



# PCS8000 Digital Controller

Ultra-High-Speed & High Resolution Versatile Digital Controller



## walter+bai ag Testing Machines



walter+bai ag Testing Machines supplies a wide range of material testing machines and systems for the safety and quality of materials, industrial products and buildings.

Mechanical testing is carried out in many industrial sectors, such as the automotive and aircraft industry, metal industry, plastic and rubber industry, the chemical industry, construction industry, bio mechanics as well as at institutes and universities. Serving these sectors for more than 45 years, w+b benefits from the company's extensive experience in producing material testing systems and equipment to meet this wide range of applications. Due to our considerable engineering capabilities we are able to offer not only standard testing machines but also customized solutions or complete installations for physical testing laboratories world-wide. To ensure you obtain the maximum rewards from your investment, our accredited calibration laboratory guarantees that excellent after-sale service and verification facilities are available for your installation.

### Profile

We are renowned for the production of high quality systems. Due to our continuous research and development policy as well as actively collaborating with our customers and suppliers we have always maintained the very high product standard ever since the company was founded in 1970 by Armin Walter and Alfred Bai in Löhningen - Switzerland. The sales, design and manufacturing divisions associated with testing machines has grown due to the constant interaction with a multitude of clients and the systematic realisation of their requirements. Our product range has been steadily expanded and our service sector activities extended to meet growing demands. The unique position of w+b in the field of material testing machines can be attributed to the fact that their specialised know-how related to materials testing is being constantly updated whilst offering custom designed products and services. A well qualified and highly motivated staff coupled with an efficient organisational structure forms the backbone of w+b upon which you can depend for know-how, competence and reliable performance.

### «Specific testing tasks demand appropriate testing equipment!»

This is our motto. Therefore, besides our standard range of testing machines, we have developed an extensive number of customized testing machines for static and dynamic material and component testing.

w+b Testing Machines are the pacemaker for trendsetting technologies. They are a prerequisite for the safety and quality of materials, industrial products and buildings.

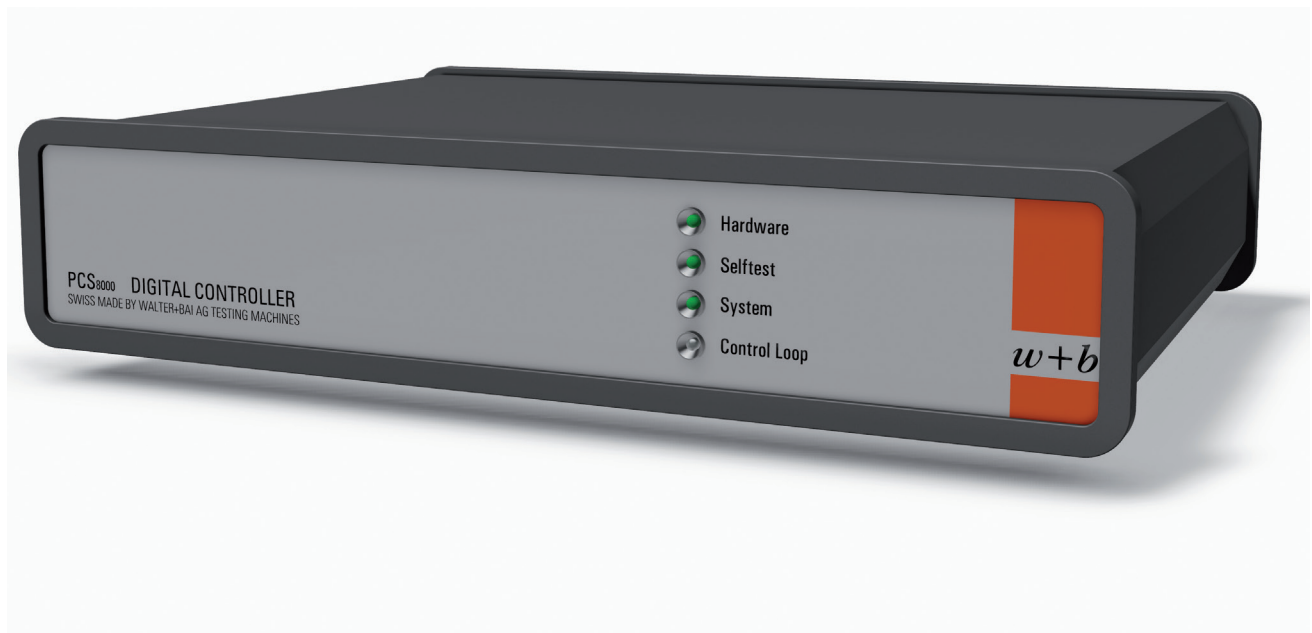
### Our Products and Services

- Manufacturing of materials testing machines and systems
- Customer specific testing systems
- Servohydraulic and electromechanical, static and dynamic testing machines
- Digital measuring and control systems and testing software
- Hydraulic power packs
- Static and dynamic actuator testing systems
- Accessories and fixtures for component testing
- Testing machines for construction materials
- Modernisation of existing testing machines
- Maintenance and calibration of material testing machines
- Project management and technical consulting

## Ultra-High-Speed & High Resolution Digital Controller PCS8000

This modular & versatile fully digital controller represents the latest generation of ultra-high-speed & high-resolution controller for the full spectrum of applications ranging from materials and component tests to complex multi-axis (multi-channel) simulation.

The PCS8000 can control everything from monotonic electromechanical testing machines to electrodynamic or servohydraulic systems, single channel actuators to multi-channel test stands.



This controller is the 4th generation of the multi-channel PCS digital controller family with consequent enhancement and continuous implementation of customers inputs and feedbacks and hundredfold successful installations across the globe.

The PCS8000 ultra-high-speed 14.4 kHz closed loop control and data acquisition rate on all channels combined with 24 bit high resolution transducer conditioning rate achieved by 64 bit processor running at 1 GHz.

As control channels available are any connected inputs as well as virtual (calculated) channels that might open many new opportunities to your application. The versatile concept of the PCS8000 is based on latest technology and supports applications with virtually no limits.

The PCS8000 is highly modular and allows an easy extension of control channels or hook-up of existing PCS8000 controllers to a multi-channel control system.

The controllers are reliable built for the harsh industrial operation, flexible, feature-rich and simple to use. They integrate perfectly into the w+b suite of Dion7 Software Family.

this controller is the foundation of a powerful and scalable testing environment of any laboratories.

# w+b Materials Testing Systems

## Total Flexibility

The **PCS8000** controller has been designed for flexibility. Its modular and state-of-the-art design is perfectly suitable from static and dynamic materials testing up to complex, multi-channel applications in the field of component tests and simulation. Each **PCS8000** controller has on-board amplifier and can easily be fitted with additional 12 plug-in AC, DC or digital transducer conditioner modules to serve your expanding needs. One digital transducer input is always available on-board. Intelligent conditioner modules and transducer connectors provide an automatic module and transducer recognition and reading. Additional configurable digital inputs and outputs are available for monitoring and controlling of external events. The user does not have to pay for modules he does not need. At any time the controller can be extended up to a full-featured multi-channel control system by simply adding modules and/or controllers. A wide range of hardware and software options are available.

## Powerful Data Acquisition

The controller can be equipped with modules to accurately measure up to 13 sensor signals for stroke, force, elongation, etc. All common sensor types and input ranges are supported. The intelligent sensor system automatically detects the type of sensor, its serial number, operating range as well as coefficients for linearization and calibration. Each sensor signal will be converted into a high-resolution high-speed digital data stream, which is available within the controller, the host PC's testing software and even within other **PCS8000** controllers in a multi-controller setup. That also means that a controller's sensor capability can be extended by importing other controller's sensor signals over a 200 MBit/s real-time data link. Such data streams are referred to as external streams. Even more, the **PCS8000** controller can also deliver data streams for physical quantities that can not be measured. The user is free to program mathematical expressions to transform and combine measured data and parameters into so-called virtual data streams, which can be used just like measured or external data streams. Mathematical expressions requiring extensive computation power can be implemented as so-called math streams. They behave just like virtual data streams but are updated at a lower rate in order to reduce processing load. The internal synthesizers and the controllers produce additional data streams. They are absolutely equivalent to internal, external and virtual streams. All data streams within a controller or within a multi-controller system are strictly synchronized and processed in real-time. The sample and data rate always remains constant even if you add sensors and/or data streams. Apart from the data streams the controller also reads up to 12 isolated digital inputs and drives up to 8 isolated digital outputs. These signals can be used to trigger events and hence are available to the user as well.

## Events and Triggers

Each **PCS8000** controller permanently supervises all his data streams including internal, external and virtual streams as well as math streams. For each data sample it adjusts positive and negative drag indicators as needed and checks user-defined upper and lower thresholds on all streams. On top of that the controller constantly monitors lots of operation and safety conditions like control states, user interactions, digital inputs and outputs, range checkings, hardware health, overflow and overrun events, emergency stops, etc. Whenever the machine leaves its safe operating domain the built-in system supervisor interferes and stops that action in a controlled or user-programmable way. All of these supervising activities may trigger so-called events. For example, data streams immediately issue an event when they reach a user-defined upper or lower threshold. The same happens when a sensor reaches its stress limit or when a digital output changes its state due to some user program or user command. Such events will be reported to the host PC's testing software to tell the user that a certain condition has been met. In a factory- or user-programmed testing sequence, events can also be used to move to the next testing phase, for conditional transitions, to synchronize multiple control loops, etc. Accordingly, events and triggers

are a very powerful instrument for programming test sequences and for over-all safety. Therefore a large number of individual events are available.

## Outputs

The **PCS8000** digital controller is ready to drive all common types of hydraulic valves including 2-stage and 3-stage valves. Its current output can deliver up to  $\pm 300$  mA. An additional voltage output with a standard  $\pm 10$  V span is also integrated and may be used to drive an external motor amplifier or any other actuator. A 24 V supply is provided to the user. It may be useful to operate small external devices, like door locks, specialized preamplifiers etc. The supply output is protected with a self-recovering electronic fuse.

The **PCS8000** series provides a number of isolated digital outputs to interact with external equipment. For example a simple electric heating may be turned on and off and by measuring the temperature over one of the data acquisition streams a temperature control loop can easily be implemented. Low noise analog output modules are available as well. They can be used exactly like sensor modules.

Each of the modules outputs up to four different data streams. Every one of the data streams can be sent to an analog output including virtual and external streams.

The analog output voltage span is  $\pm 10$  V. The user can tell the controller to zoom any signal window into the  $\pm 10$  V range. For example, when measuring a stroke range of 50 to 60 mm, the user can set 50 mm to -10 V and 60 mm to +10 V. This way the analog output span covers the entire range of interest perfectly.

## State of the Art Control

The **PCS8000** includes a whole bunch of different control algorithms. The user can choose and configure the one that suits him best. Conventional PID control is available but also self-optimizing strategies based on adaptive control. The user can switch from one control



# w+b Materials Testing Systems

algorithm to another on the fly without having to reboot or reconfigure the entire system. This feature is also available within sequencer programs. Among the well-known family of single PID controllers PID and PIDT are implemented. They all include anti-windup protection and configurable output limiting. PIDT uses a differential response limiting which is useful when feedback measurements are noisy for some reason. A combined stroke-force control method, called PIDM for mixed control, is also provided. In this mode stroke is being controlled but the force is kept within user supplied limits. As the force increases the system switches over softly from stroke to force control. This is particularly useful when setting up delicate samples. The PIDM strategy is fully parameterized.

Therefore the user can adjust this very convenient control method exactly to his particular needs. Furthermore the PCS8000 system is equipped with two PID based peak control algorithms. A peak controller is an adaptive strategy to ensure that peak values of a periodic output function remain constant and reach the desired value. This is extremely helpful in cases where a periodic output function suffers from severe distortions, for example due to disturbance from the mechanical setup or when the probe changes its state and hence its behaviour during the test.

A conventional PID controller fails under such circumstances. The self-adjusting peak controllers can cope with such situations very well. The latest generation of adaptive controllers also included in the PCS8000 even go further. In the background they constantly measure the transfer behaviour of the entire control loop. Based on the results they are able to automatically improve the control performance. There are two typical scenarios for using these algorithms:

1. During an initial training phase the controller quickly adjusts its internal states. At the end of the training the states are frozen. From then on the optimized controller is ready for testing.
2. Testing starts with a neutral or conservative initial setup of the adaptive states. During the test the adaptive controller softly adjusts its internal states to optimize the total performance. When the probe or some other component within the control loop starts to change its behavior the adaptive controller follows and compensates for the drift. Of course all sorts of mixed scenarios are at hand. The PCS8000 trimming function allows the user to hand-optimize almost every control parameters by turning the hand-wheel on the remote control or by using buttons on the host PC's testing program while observing at the same time how the machine changes its behavior. This feature is also available for synthesizer parameters.

## Synthesizer

The PCS8000 series include a highly sophisticated multi-generator synthesizer to feed the controller with the desired signal. The synthesizer's three generators create ramps, sine waves, trapezoids, triangles, haversines, and many more. Even sampled curves can be downloaded to the controller and reproduced there. The user can individually turn generators on and off or choose their function and parameters.

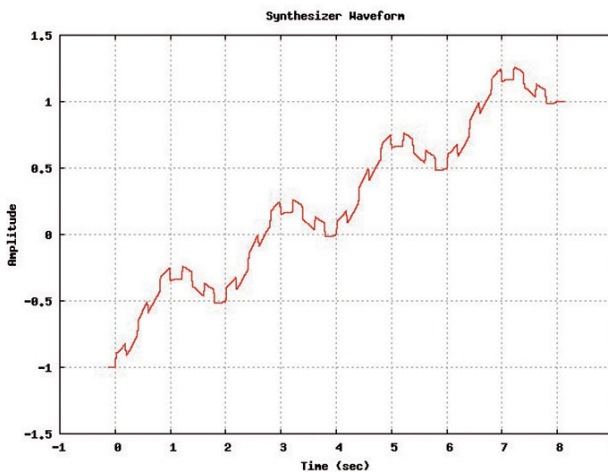
The synthesizer output signal is the superposition of all generator outputs. Hence possible output signals are, for example, a simple sine wave or a trapezoid wave, a triangle with a square wave on top, or a ramp with superposed haversine and rectangle. Such an example is shown in the figure below.

Parameter trimming is available as with control parameters. For example the user can adjust a generator's frequency or amplitude by using the hand-wheel. He can do that while the testing machine is in operation. So he can immediately observe how the frequency or amplitude change and what the effects are. The synthesizer output is just another data stream within the controller. Therefore it has the same features and can be used exactly the same way as internal, external and virtual data streams. An additional but similar generator is used to provide the dither signal added to the controller output in order to overcome the drive's friction. All generators can issue special event triggers like having reached the end of a the waveform or a specified number of wave

cycles, etc.

## Sequencer Programs

The PCS8000 controllers are able to perform entire test procedures autonomously. To this end, a simple scripting language has been implemented. Complete scripts for a lot of different typical tasks are available from w+b. However, the user can write his own scripts according to his particular needs. A graphical PC-software is available



superimposed ramp, haversine and rectangular functions.

to support scripting. Through scripts the user has access to data streams, math streams, events, digital inputs and outputs, etc. By using them he can create his own variables and new virtual data streams. Within a script the user can program, start and stop the synthesizer and change control loop. Furthermore, within a script the controller can send data to the host PC or receive values from there. Events and user programmable conditions play an important role in scripts as well. Conditional branching, synchronization, a transition to the next phase of a testing sequence can be based on events or conditions. Hence most control structures commonly known from other programming languages are possible. A rich selection of mathematical functions are available. The user can download a sequencer program to the controller on the fly and execute it immediately. Before starting the program, the controller performs a syntax check. An erroneous program can not start. A program with a deadlock will be terminated. Sequencer programs are very useful for small recurring tasks as well. For example to setup a probe a small program driving the machine into its setup position, then waiting until the user confirms clamping of the probe and finally moving the machine into the ready position may be very helpful.

## Multi-Channel Testing

Multiple controllers can be combined easily to a multi-channel testing system with strictly synchronized data sampling and closely linked control and supervising functions.

A testing sequence can start simultaneously on all controllers and target functions from the local synthesizers maintain in a fixed phase relation during operation.

## Multifunctional Remote Control Hand Set with Touch-Screen

The Remote Control Hand Set with LCD Touch-Screen offers convenient Test Set-up and Operation of the Test System. The remote control is fully programmable which makes it extremely versatile. According to the application the unit offers functionality beyond the common preassigned ones for advanced operational comfort.

The Remote Control can be located on the working table or mounted on the load frame. The Digital Display can be rotated 180° whatever is preferred cable bottom-down or upwards.

The remote control unit comply with the CE safety standards for material testing applications. Accordingly the unit offers the hardware key to activate the set up mode with reduced piston or crosshead speed as simple software limitation is not as just limiting of piston speed is accepted for systems with speeds above 1200mm/min.



From Single to Mult-Channel Testing

The remote control is used in connection with one **PCS8000** for single channel control application as well as for mult-channel configurations where multiple **PCS8000** are involved.

### Some Functions:

- Display of up to three (3) channels (example Force / Piston Stroke / Strain)
- Zeroing of control and measurement channels
- Piston or Crosshead Movement via trimmfunction
- Adjustable piston or crosshead speed
- Unclamping of movable crossheads with crosshead positioning
- Opening and closing of hydraulic, pneumatic or motorized grips
- Display brightness adjustment
- Rotation of display
- Integrated Emergency STOP
- Key-Switch to activate the setting mode according to the new CE Machine directive for testing machines or actuators.

## PCS8000 Specification

### Technology

- x86\_64 processor running at 1 GHz
- Memory 1 GB RAM, 4 GB CFast flash
- Signal processing IEEE 64 bit double precision floating point data representation.

### Data Streams

- Sensor inputs up to 13 streams
- Virtual streams up to 32 streams
- External streams up to 16 streams
- Exportable streams up to 16 streams
- Math streams up to 16 streams
- Synthesizer 1 stream
- Dither 1 stream
- Controller output 1 stream
- All data streams are available within the controller and on the host PC application software.

### Measured Input Streams

- Inputs up to 13 measured high resolution high speed input data streams.
- Analog formats support for direct connection of DMS, LVDT and DC sensors.
- Digital formats: quadrature encoder with RS-422 or TTL level, SSI with RS-422, sine with programmable interpolation and input level.
- Sample & hold simultaneous sampling of all input data streams.
- Sample rate 8/10/12/14 kHz on all inputs.
- Resolution 24 bit on all inputs. Internal representation in IEEE 64 bit double precision floating point.
- Configuration of the intelligent sensor detection includes sensor type, operating range, linearization and calibration coefficients, etc.

### Virtual Data Streams

- Data type IEEE 64 bit double precision floating point.
- On the fly definition by supplied mathematical expression including data stream values, constants, etc.
- Functions: add, subtract, multiply, divide, power, exponential, root, logarithm, sine, cosine, tangent, etc.
- Data rate at full controller rate.

### Math Streams

- Data type IEEE 64 bit double precision floating point.
- On the fly definition by supplied mathematical expression including data stream values, constants, etc.
- Functions: add, subtract, multiply, divide, power, exponential, root, logarithm, sine, cosine, tangent, etc.
- Update rate at 80 Hz.

### Synthesizer

- Generators: one ramp generator, two generators for periodic functions.
- Waveforms: any combinations of ramp, sine, haversine, rectangle, trapezoid, triangle, saw, arbitrary.
- Trimming: manual parameter trimming by hand wheel or host PC program.
- Frequency: 0.001 to 3000 Hz.

### Dither

- Waveforms: sine, haversine, rectangle, trapezoid, triangle, saw, arbitrary.
- Frequency: 0.001 to 3000 Hz.

### Control System

- Source: Every data stream including virtual and external streams can be selected as input to the control system.
- Optimization: optimization by the user or self-optimization, depending on the type of control method used.
- Trimming: manual parameter trimming by hand wheel or host PC program.
- PID type: All PID type controllers have anti-windup protection and output limiting.

- PID controller: user-adjustable Kp, Ti and Td parameters.
- PIDT controller: PID with additional, user-adjustable T1 parameter to limit differential gain.
- PIDM controller: combined stroke and force PIDT controller. Additional parameters are balance and f99 defining the transition from pure stroke to pure force control.
- Peak controller: a PIDT based adaptive controller that maintains peak values of periodic output functions.
- PIDV controller: A velocity mode PID controller with several hydraulic and drive specific extensions: leakage and drift compensation, DC correction, residual error correction, automatic peak adaption, non-linear friction compensation, correction for asymmetric drive behaviour
- Interactive learning controller: adaptive controller for difficult, periodic functions
- Position- and velocity controller for built-in AC-Motor servo power amplifier (option)

### Sequencer

- Event driven program interface for automated test sequences.
- Functions: Handling of local variables, usage of all data streams, loops, conditional and unconditional branches, conditional and unconditional jumps, control loop management, internal and external synchronization, actions, switching of digital outputs, etc.

### Auxiliary Inputs and Outputs

- Digital in: 12 isolated inputs.
- Digital out: 12 isolated relays outputs.
- Analog out: Optional modules of up to 4 analog outputs,  $\pm 10$  V.
- Serial RS-485 interface to external devices like conditioning cabinet, etc. USB for future options.
- Status display: 4 status LED's.

### System Interfaces

- Remote control: hand wheel, 6 keys, LED's.
- Ethernet: used to connect host PC over a dedicated network.
- High speed link: real-time data stream exchange between multiple controllers.
- Display Standard VGA
- Keyboard USB or touch screen

### Power Supply

- Input voltage 100 to 240 VAC. 50 to 60 Hz.
- Input current Maximum 2 A (8 A with built-in servo power amplifier)

### Dimensions Desktop

- Width 430 mm (16.9 in).
- Height 100 mm (3.9 in).
- Depth 270 mm (10.6 in).
- Color RAL 9010.
- Stackable up to 8.

### Environment

- Temperature 0-45 °C.
- Humidity 10-85 % (rel), non-condensing.

### Standards

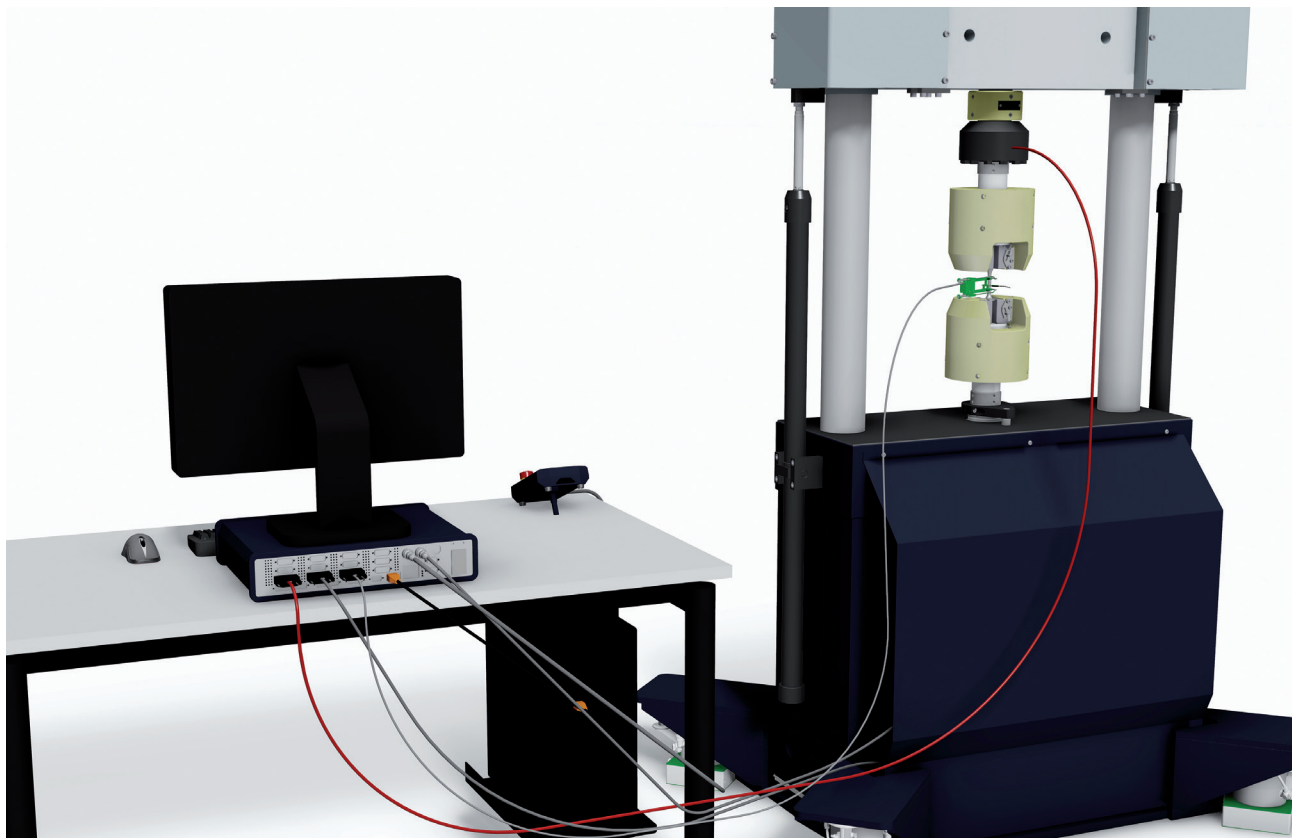
- EMC (CE conformity)
- Safety

## Single-Channel Applications

The PCS8000 is designed for both cyclic fatigue and static testing applications. The controller is easy to install to any test machine or test rig.

The controller supports servohydraulic, electrodynamic, electromechanical and pneumatic actuators and drive systems and provides excellent control loops in force, displacement, strain, acceleration or any external mode including virtual / calculated command values.

It is the ideal choice for any test labs that need flexible and efficient operation from static materials testing, to sub-assemblies to components to structural testing.





# w+b Materials Testing Systems

Over a special high-speed data link the controllers can exchange data streams and events. During a testing sequence the different controllers are able to synchronize their local programs. Raising a multi-controller setup is easy. The user only has to establish the high-speed link with standard cables and he has to connect the controllers to an ethernet switch. One of the controllers has to be defined as a master the others will be slaves. From then on the master manages initialization, and communication among the system.



## For closed loop control of more than one actuator (servohydraulic or electromechanical) in one test set-up

Multiple PCS8000 digital controllers can be configured to a multi-channel (Master & Slave) control system. The test programming will be made in the DION7FPI application software.

Multiple PCS8000 controllers may be combined to form a multichannel setup. Such a system will be able to control a set of hydraulic or electromechanical drivers synchronously. Data acquisition and control loops are strictly synchronized throughout the entire multichannel system. By means of sequencer programs, mutual dependencies and synchronized flows are realizable. Using real-time data exchange allows one controller to operate with data from another one. In a multichannel setup there's always one controller, working as the master. It handles the communication to the host PC and delivers the master clock for the whole system. All further controllers work in slave mode.

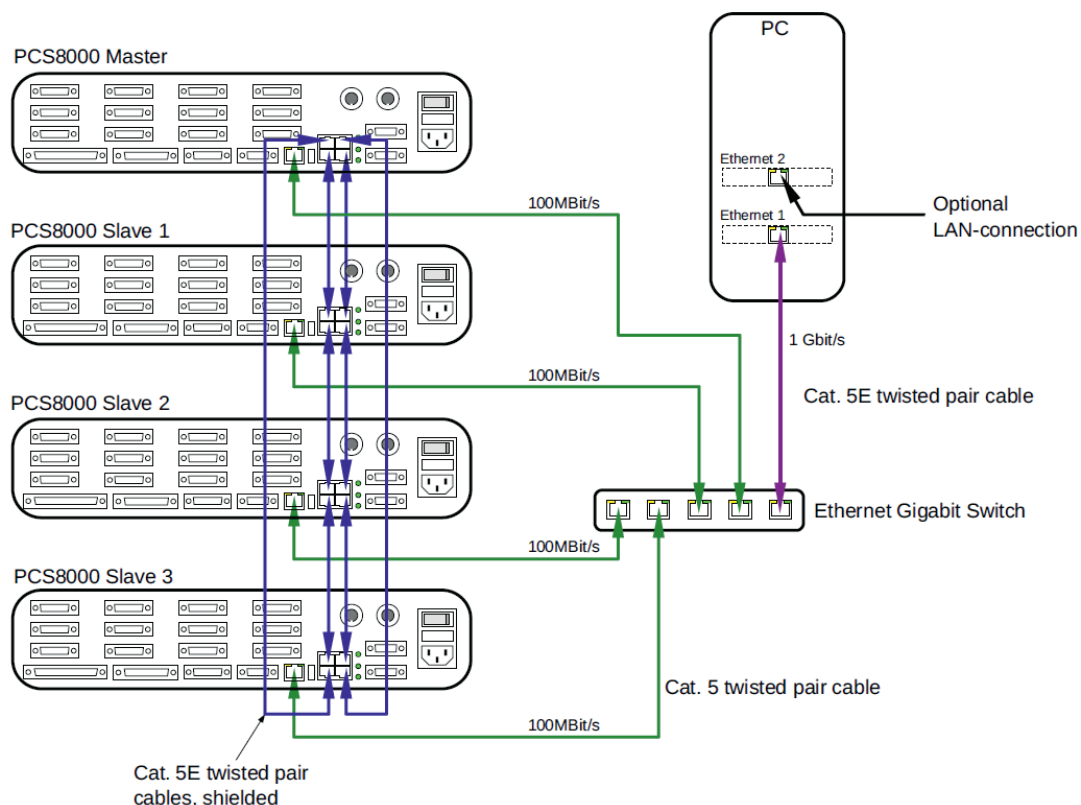
### For a multi-channel control system the following components are needed:

- Number of digital controllers corresponding to number of actuators that needs to be controlled (control-channels)
- One (1) remote control handset (digital handwheel) with emergency button
- One (1) Computer (PC)
- One (1) application software licence
- One (1) Ethernet Gigabit Switch
- Cable set

### Example for a 4-Channel Control System Ultra-High-Speed, Expandable Four-Channel High Resolution Digital Material Testing Control System PCS8000-T4

#### Basic scope of supply consisting of:

- Three (4 pce) PCS8000 Controllers
- One remote control handset with touchscreen and emergency button
- 12 digital outputs and 8 digital inputs
- Set of connecting cables
- One (1) Ethernet Gigabit Switch

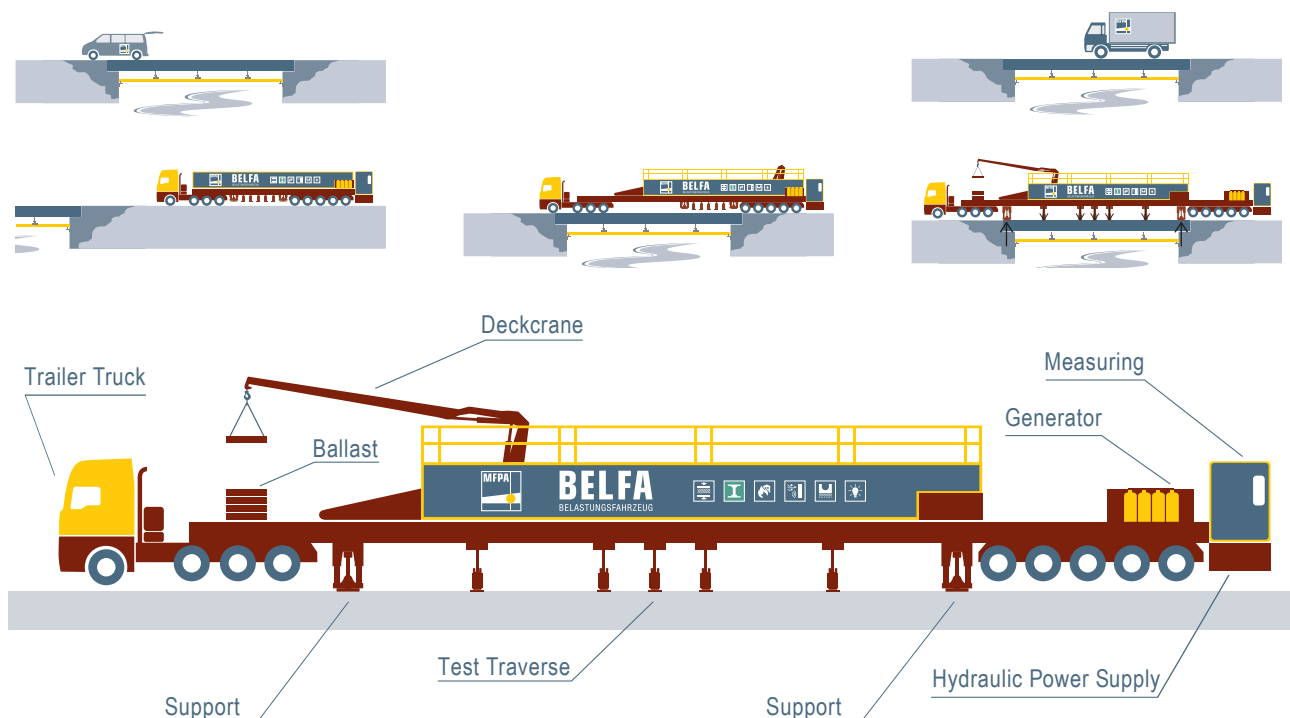


## Case Study: A Slightly Different Task for PCS8000 Multi-Chanel Digital Controller

A special Vehicle (BELFA) owned and operated by MFPA Leipzig, Germany, provides reliable values about the load bearing capacity of bridges. The measurements deliver objective state information about the condition of the bridge used as a criterion to decide if the building has to be demolished, repaired or reinforced.



Once a bridge is equipped with measurement sensors and the BELFA is placed at position, load is applied on the bridge through the actuators integrated in BELFA. These actuators are closed loop controlled through Ultra-High-Speed- & Resolution Digital Material Testing Control System PCS8000 and DION7 application software. The controller provides fully programmable flexibility and allows to control the actuators in load or displacement / deformation model.



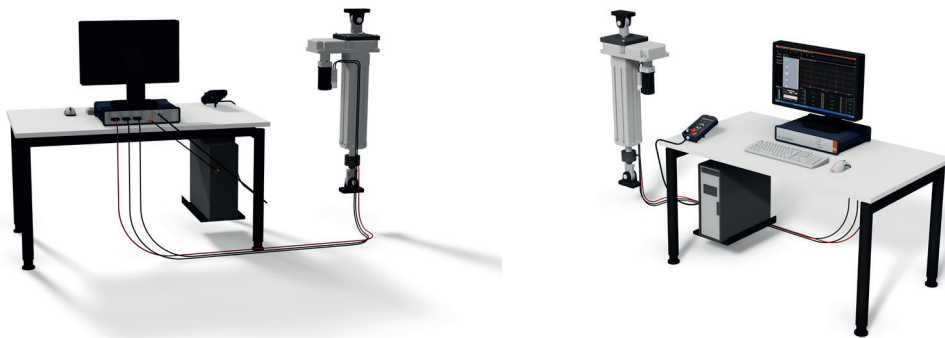
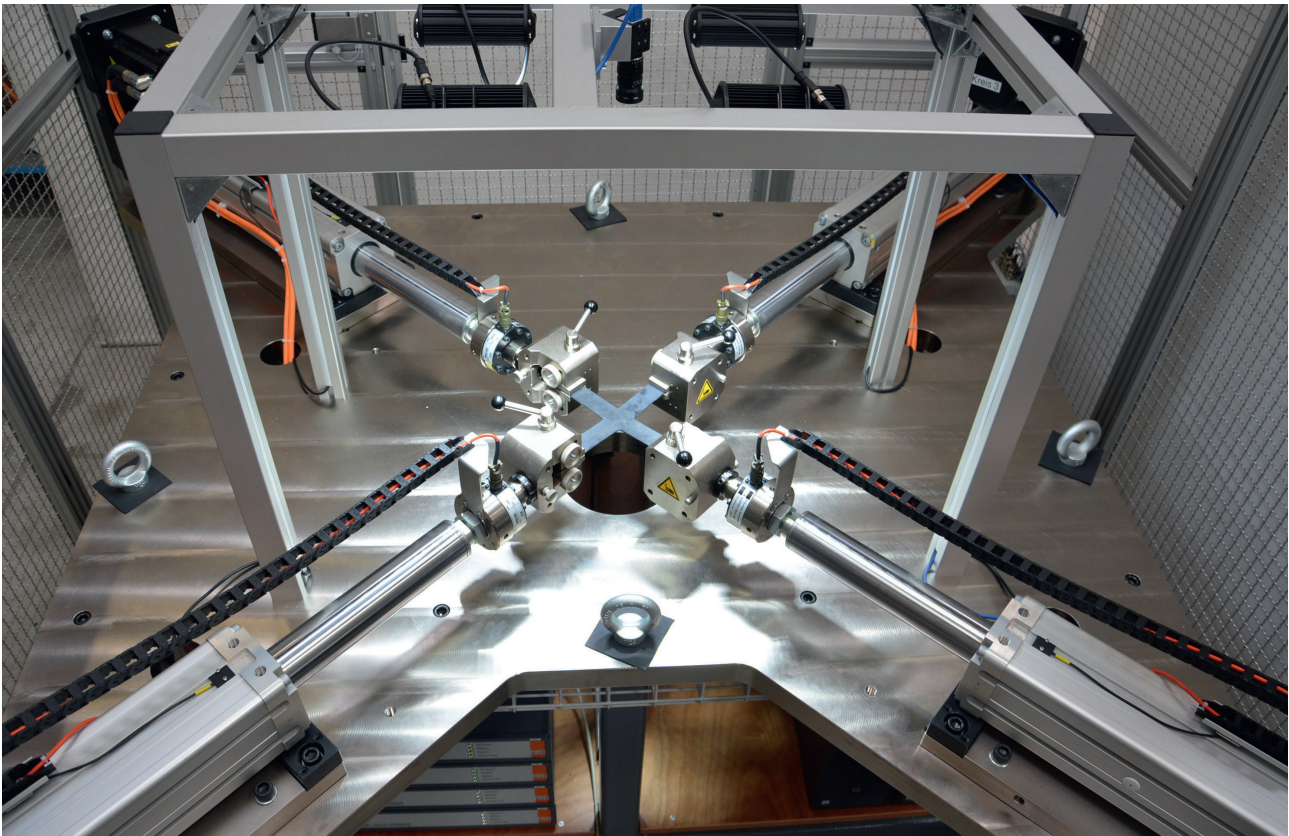
## Internal Power Amplifier Module for AC Servo-Motors

The **PCS8000** digital controller is available with integrated servo drive for maintenance-free AC synchronous motors.

It supports drives in the power range from 200 W to 1.4 kW with resolver and a thermal winding protection (PTC). The power amplifier module can be added into the housing of the **PCS8000** controller. It is fully integrated into the existing control structure. Apart from the servomotor, no external components are required.

The servo controller is controlled by a 32-bit microcontroller, which communicates with the **PCS8000**. The close-loop-control rate is 8000 Hz (8 kHz) and the data-acquisition rate is available up to 14400 Hz (14.4 kHz).

The number of pole pairs of the motor, the maximum current, as well as other motor and controller parameters are configured via **PCS8000**. The temperature of the amplifier is constantly monitored as a protective function. The internal power amplifier module is also woven into the safety concept of the **PCS8000**: The power module is electrically isolated, via emergency button the engine is switched off. To suppress circuit feedbacks the servo amplifier is equipped with a PFC (Power Factor Corrector).



### Safety

The **PCS8000** supports a clamp lock and door lock function, safety door feedback, inputs for limit switches, and drive enable, drive ready signals. The behavior of the controller in case of jeopardy is user-programmable. In a multi-controller setup the emergency stop is automatically daisy chained through all controllers. If activated, the entire system stops simultaneously. Additionally each controller permanently supervises its operating condition. Faults, errors or dangerous situations will be detected. In case of a severe condition the controller will disabled itself for safety. In other cases, like driving into a limit switch or stressing a sensor beyond its specifications, the behavior is again user-programmable. At every time the controller reflects its state on the four front panel lamps. They indicate the hardware health state, the result of an automatically performed self-test, the readiness of the entire system (including multiple controllers) and whether the control loop is active or not. With that the user is perfectly informed about the system's soundness.

## External Amplifierbox for cable lengths up to 100 meter

The external amplifier-box is to be used when sensors (especially strain gauges) are mounted far from the digital controller and therefor require long cables, which are prone to low signal quality.

Materials or Component Testing requires high accuracy measurement of force, deformation or other physical channels. In measuring technology the effects of the cable on the measurement must be considered. There are different effects of significance that needs to be considered as for example effect on the sensitivity due to voltage drops over the cable length, effect on the thermal span characteristics due to the change of cable resistance with temperature or interfering (high-frequency) signals. Further each long (measuring) cables needs adequate precaution against mechanical damage and cable break.

The external amplifier-box amplifies and converts (digitize) the analogue measuring signals (for example from the strain gage load cell, LVDT piston stroke transducer or analogue extensometers) locally into digital signals.

From the external amplifier-box only one connecting cable (up to 100 m length) to the PCS8000 digital controller is needed that simplify the installation.

Each amplifier-box allows to connect up to three sensors and additional the servovalve. Up to four (4) external amplifier-boxes can be connected to one PCS8000 controller.

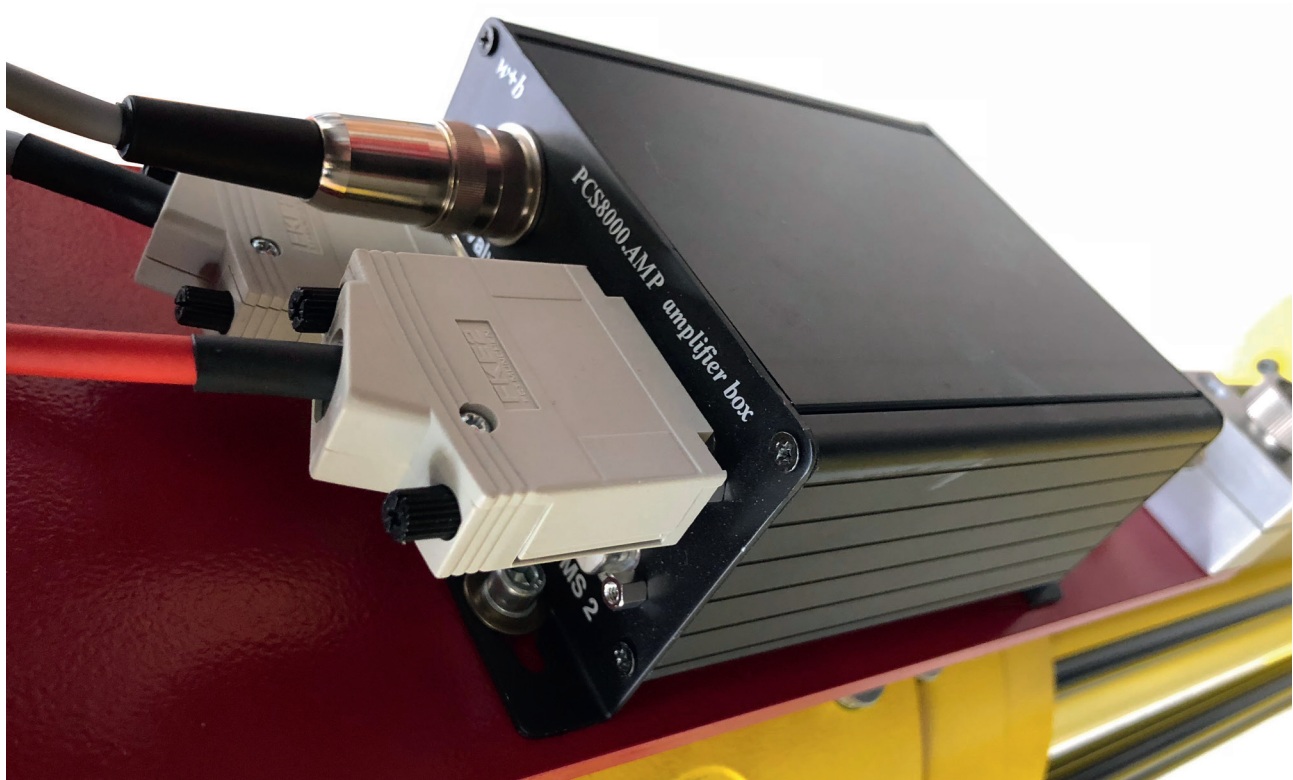
The three integrated amplifier cards are suitable for DC, Strain-Gauge, LVDT or Digital Signals.

Input Card 1: For DC or Strain-Gauge Sensor

Input Card 2: For DC or Strain-Gauge Sensor

Input Card 3: for LVDT or Encoder (SSI) Sensor

Connecting cable from the external amplifier-box to the digital controller PCS8000.



Remark:

The maximum allowed length of the cable is 100m. The cable must not be interrupted. Extensions or interconnections are forbidden.

The real permissible cable length can be less than 100m, depending on the current consumption of the attached servo valve. It can be calculated as follows

$$l_{\max} = \frac{23.3V - U_{\min}}{27\text{m}\Omega/\text{m} * (I_{\text{valve}} + 0.28\text{ A})} \quad \text{respective } l_{\text{valve}} = \frac{23.3V - U_{\min} - 0.28\text{ A}}{27\text{m}\Omega/\text{m} * l_{\text{cable}}}$$

$U_{\min}$ : minimal permitted operating voltage of the servo valve ( $\geq 18V$ )!

$I_{\text{valve}}$ : Operating current of the servo valve

The calculation assumes the following operating mode:

2x strain gauges 300  $\Omega$ , 50 mA for external encoder

Example:  $U_{\min} = 20V$ ;  $I_{\text{valve}} = 1.5\text{ A}$ ;  $l_{\max} = \frac{23.3V - 20V}{27\text{m}\Omega/\text{m} * 1.78\text{ A}} = 69\text{ meter}$

**Service Manifold Control Module** for direct operation over PCS8000 Controller. Thanks to this function, no additional electrical control board or SPC is needed. This module simplify the installation, offers a maximum of flexibility in the future in extending and minimizing interference-prone

# w+b Materials Testing Systems

cable connections.

In case of an emergency stop an electrical security connection between Controller and Service Manifold takes part scope of supply.

This option is available to all w+b hydraulic service manifolds (HSM). Several HSM's from other producers are also available.

If this option shall be used in combination with hydraulic service manifolds from any other producer than w+b please inform about producer, model number and send us the hydraulic and electrical drawings of it.

## Hydraulic Grip Control Module

for direct control of hydraulic grips via **PCS8000** Controller / **Dion7** Software

Thanks to this function, no additional electrical control board or SPC is needed.

This module simplifies the installation, offers a maximum of flexibility and minimizes interference-prone cable connections. This module supports hydraulic wedge, parallel or non-shift grips.

It also supports grips with automatic clamping force incensement controlled via a proportional valve. The hydraulic grip control module has been designed to comply with safety requirements. It is integrated into the safety circuit in order to ensure a safe shutdown in an emergency case.

**Hydraulic Crosshead Control Module** for direct movable crossheads operation over **PCS8000** Controller / **Dion7** Software.

Thanks to this function, no additional electrical control board or SPC is needed.

This module simplifies the installation, offers a maximum of flexibility and minimizes



interference-prone cable connections. This module supports movable crossheads of servohydraulic machines machine with or without hydraulic unclamping and lift via hydraulic cylinders. The hydraulic crosshead control module has been designed to comply with safety requirements. It is integrated into the safety circuit in order to ensure a safe shutdown in an emergency case.

## Interface to DION7 Application Software

Software packages **DION7** for static / monotonic, creep or relaxation, low cycle fatigue, fracture toughness, fatigue-crack-growth, high cycle fatigue to complex multi-axial, multi-channel tests and fully-automatic test systems in the field of materials and component tests and simulation.

The Dion Software Packages are result of 30 years of enhancements with continuous implementation of customers input and feedback.

This application software has many advantages to offer in the field of materials & components testing. Control and evaluation has never been as user-friendly as it is now when using the **DION7** application software.

The **DION7** Software Family consists of modules and applications used to run standard tests for materials testing, simple-to-use fatigue tests, free programmable single-to-multi-channel tests for components or structures testing as well as analysing and reporting tools.

**DION7** supports a variety of different devices, including electromechanical testing machines or actuators, servohydraulic test systems or servo-hydraulic actuators, electrodynamic systems, pneumatic drives as well as Eurotherm drives and controllers used in environmental chambers, high temperature furnaces or inductive heating systems.







### Real Time Testing with DION7 & PCS8000

Test programs which are run from **DION7** application software are sent first via interpreter to the **PCS8000** controller(s). The digital controller(s) runs the test direct and independent and sends the data acquisition data to the application software for data acquisition. The advantage is, that the controller is able to react much quicker to program steps, events (for example appeal of a limit) etc. that makes the test control real-time and much safer. Intervention during the test via **DION7** application is provided to adjust limits or change test parameters. For visualization, evaluation and storage the data transfer from **PCS8000** to **Dion7** application software is via high-speed-Ethernet.

### DION7EASY Application Software

The Name is Program! This package offers the Easy-to-operate intuitive and highly visual environment to run single to synchronized multi-channel tests. In many industries and laboratories simple durability tests are performed in the field of materials or component testing.

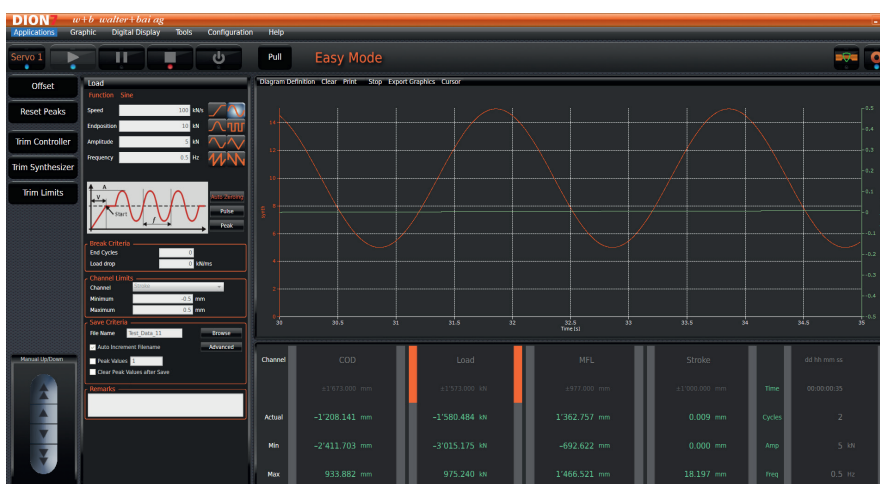
The **DION7EASY** is the easiest, clearest and most intuitive application software on the market for those who run a single function test in closed loop force, displacement, deformation or external mode mode. As data acquisition and control channels are all connected transducers available.

Tests can be defined and run with operation as hold , ramp , sine wave  (alternating load or pulsating load), haversine, triangle , rectangle , sawtooth  or pulse functions.



Additional break, stop, limits and save criteria can be defined. All needed inputs are done in one input mask what makes this module extremely user-friendly and offers you both rapid and productive testing. Operators are quick instructed and trained without any specific knowledge.

All needed inputs are done in one input mask what makes this module extremely user-friendly and offers you both rapid and productive testing. Select the waveform, select the break criteria and set-up the data logging and saving and be ready to run a tests immediately. The clear structured screen mask offers the test graph with selectable axis, digital displays of the channels including actual value and upper/lower peak-values, a cycle counter, set-value of the frequency and amplitude of the control channel as well as test duration. For easy test set-up the control field for actuator or crosshead movement is available to simplify the operation.



## DION7FPI (FPI - Free Programmable Interface)

This package offers the Flexible-multi-step environment designed to run everything from simple ramps to dynamic & fatigue single to complex multi-axial materials, component and simulation tests. DION7FPI is highly visual software that delivers flexibility, functionality combined with intelligent features.

FPI stands for Free Programmable Interface. It offers the possibility to create and run very specific and individual test procedures. Creating and editing such a test procedure is made graphically using a flowchart editor. Therefore, the user does not require knowledge about programming or scripting languages. Only a basic understanding about logical processes is necessary.

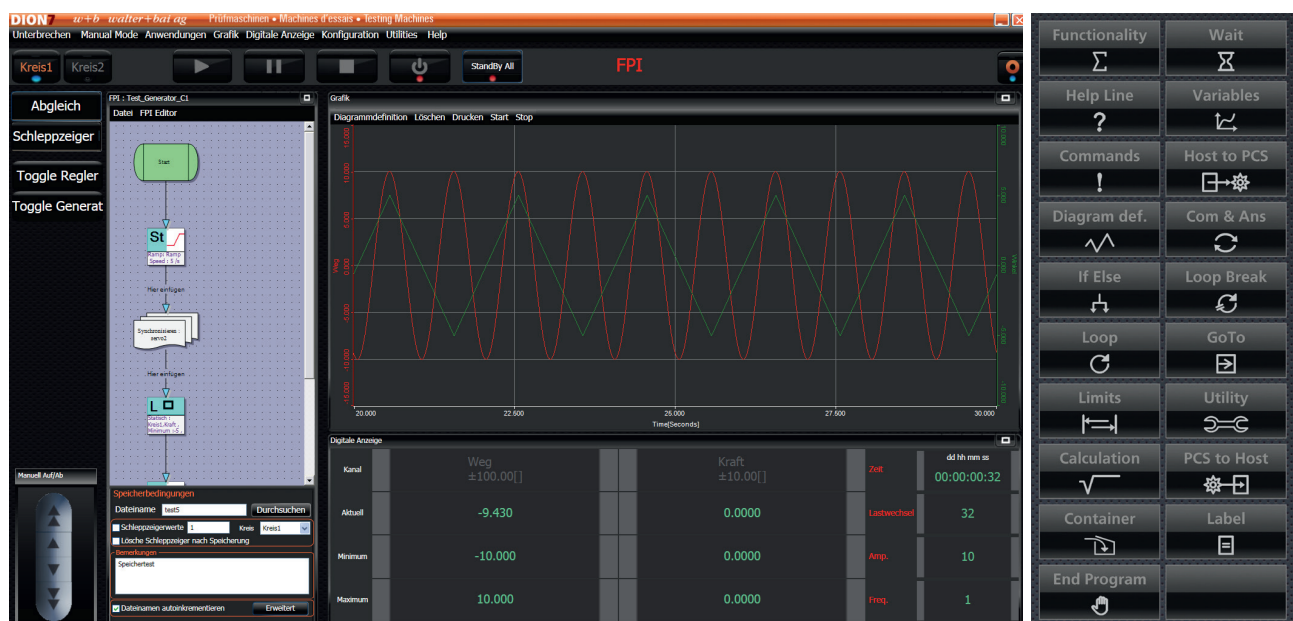
DION7FPI consist of two environments: The test environment and the development environment. As the name suggests, the test environment is used to run test procedures and in the development environment, the test procedures are created, edited and stored.

When the user starts a test, the loaded FPI-program will be translated into a language that the controller understands. After that, it will be sent to the controller and started. The program runs on the controller autonomically. The advantage is that the controller can react on events (such as exceeding limits) more quickly and more precisely and does not have to wait on any processes of the host computer. The main task of the host computer is to collect and store data.

## The Test Environment provides the Runtime View

Logical structured with clear screen mask provides a comprehensive view of the test in progress. Proving test graph(s) with selectable axis, digital displays of the channels including actual value and upper/lower peak-values, a cycle counter, set-value of the frequency and amplitude of the control channel as well as test duration.

For easy test set-up the control field for actuator or crosshead movement is available to simplify the operation.



Test Controls Buttons are consistently located on the top of the screen. This simple test control buttons provide start, stop, finish of test and pause functions of the test.



The clear structured, free programmable graphical matrix (flowchart) allows the logical step-by-step test programming by easy-to-select functions including waveforms, control & data acquisition (logging), synchronisations and phase control, step sequencing, inputs & outputs, events, end-of-test criteria and monitoring.

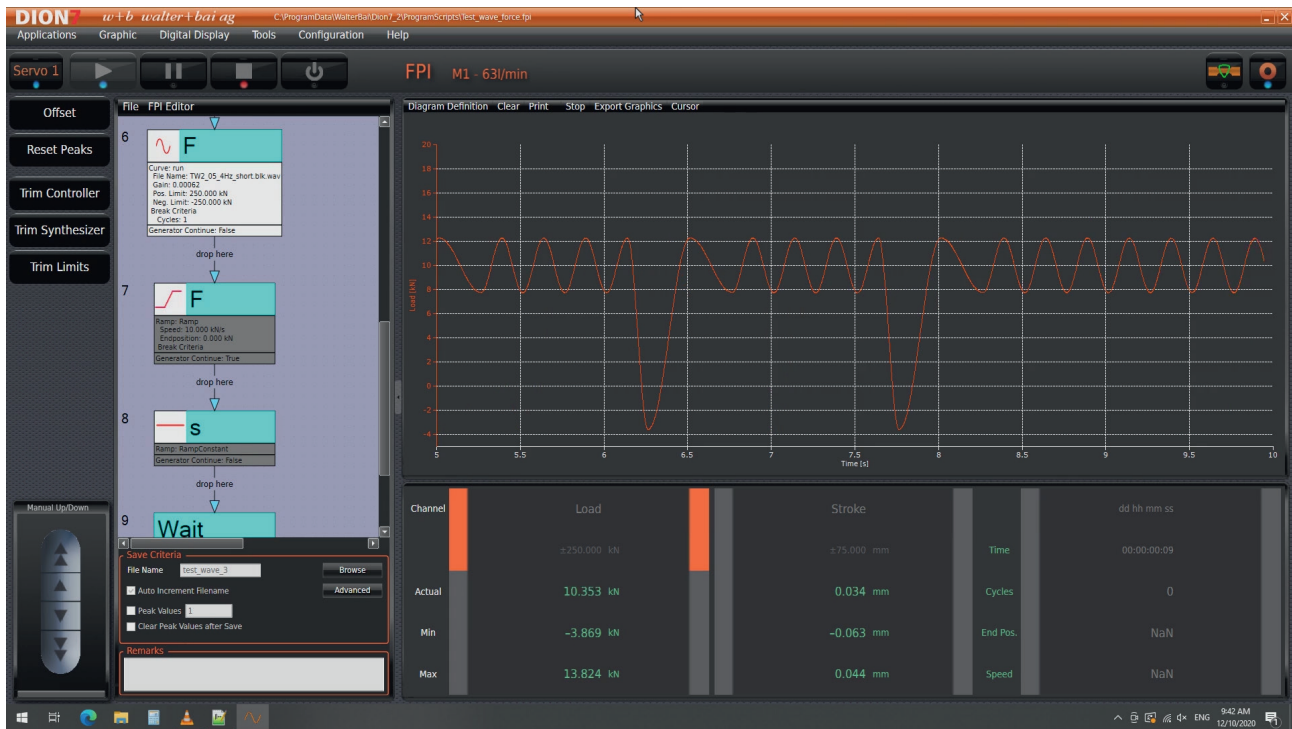
This ultimate flexibility makes Dion7FPI to a real powerful multipurpose software allowing you to design tests as you image and need them.

The graphical flow chart editor does not require knowledge about programming or scripting languages that allows an intuitive creating or editing of tests.

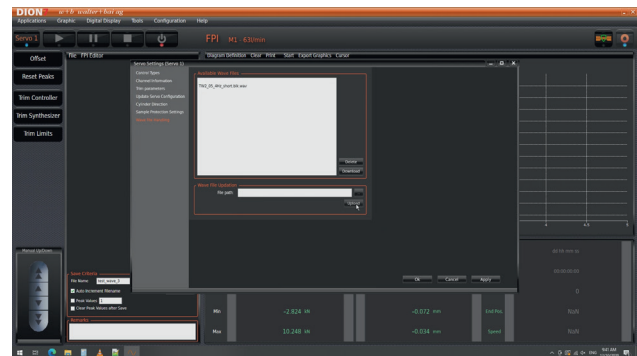
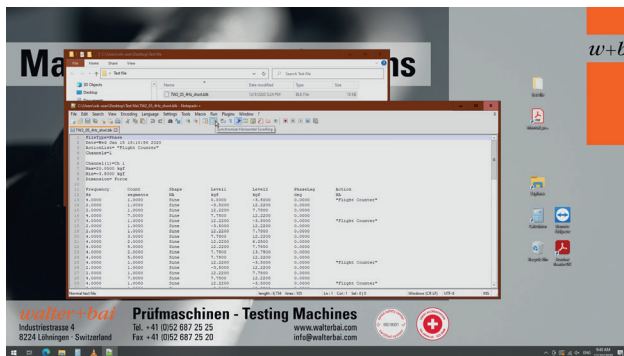


## Time History Replay from Files

Simulated or recorded time history data can be replayed in either load, strain or stroke control in the testing machine in combination with **DION7** and **PCS8000** Software.



The procedure2wav.exe converts a time history file to a corresponding wav file playable in the Testing Machine with PCS8000 controller with **DION7FPI** Software.




Additionally, the procedure2wav.exe writes a text file containing information about source and destination of conversion, gain value required to play the wav file in PCS8000 and duration of the created wav file.


For easy handling without having to use a command line the time history file can be dragged over the program icon (procedure2wav.exe) on the desktop and dropped there. The converted wav and the information file are created in the folder the procedure file is located.

The wave file then can be selected and uploaded in the **DION7FPI** Software program and run on the testing machine.

## Flexibility through an electronic data sheet in the transducer

The PCS8000 features an intelligent transducer plug system featuring an incorporated electronic data sheet that will be automatically recognized and read by the digital controller. The characteristics as electronic label, specifying sensor type, operating range, coefficients for linearization, transducer calibration etc. are stored in the form of an electronic data sheet. Once the transducer is connected to the amplifier card of the PCS8000 the information will be read and imported. It gives the laboratory the flexibility to connect and transducer with electronic data sheet to any available PCS8000 controller in the laboratory without quick plug and play installation and without the need of execute a calibration of verification procedure.

 <b>±10 VDC Measuring Amplifier PCS8000.DC - No 81-0002-000</b> Sensor Conditioning Module for ±10 VDC Signals Analogue input signal of ±10V of direct current, used for extensometers, displacement transducers and all other devices that work with 10V. A system plug (item 81-0006-000) with 15 pins is required.		
Resolution		24 Bit
Sample rate		14'400 Hz
Linearity error		typ. 0.001%
Input	Type	Differential DC Not galvanically isolated
	Ranges	±10, 5, 2.5, 1.25 V
	Max. input voltage	±11 V (100% Excitation)
	Common mode range	±10 V
	Impedance	100 kΩ
	Gain error	typ. 0.15%
	Noise (input referred at 20Hz bandwidth)	typ. 26µV <sub>pp</sub>
	SNR (Bandwidth: 20Hz, Range: 10V)	typ. 127 dB
Output voltage	Ranges	1, 2.5, 5, 10 V max. 100 mA
	Precision	typ. 0.1%
Supervision	Parameter	Bridge voltage
	Behavior	Emergency stop, Standby, Setup-mode, Message only None
Size		84 x 55 mm (without connector)

 <b>Strain-Gauge Measuring Amplifier PCS8000.DMS - No 81-0003-000</b> Sensor Conditioning Module for Strain-Gage Signals Analogue input signal from Strain-Gage Transducers, employed mostly for strain gauges, extensometers, load cells. A system plug (item 81-0006-000) with 15 pins is required.		
Resolution		24 Bit
Sample rate		14'400 Hz
Linearity error		typ. 0.001%
Input	Type	Differential DC Not galvanically isolated
	Ranges	±0.5, 1, 2, 4, 8 mV/V
	Max. input voltage	±104 mV (100% Deviation)
	Common mode range	±10 V
	Impedance	100 MΩ
	Gain error	typ. 0.2%
	Noise (input referred at 20Hz bandwidth)	typ. 0.35 µV <sub>pp</sub>
	"SNR (Bandwidth: 20Hz, Range: 4mV/V)"	typ. 117 dB
Bridge voltage output	Ranges	1, 2.5, 5, 10 V max. 100 mA
	Gain error	typ. 0.1%
Supervision	Parameter	Bridge voltage Bridge current: Alert threshold: ≤3mA Open inputs
	Behaviour	Emergency stop, Standby, Setup-mode, Message only None"
Size		84 x 55 mm (without connector)



### Measuring Amplifier PCS8000.LVDT - No 81-0004-000

Sensor Conditioning Module for Linear Variable Differential Transformers (LVDT)

Analogue input signal from LVDT-sensor, employed mostly for extensometers, displacement transducers. A system plug (item 81-0006-000) with 15 pins is required.

Resolution		24 Bit
Sample rate		14'400 Hz
Linearity error		typ. 0.008%
Input	Type	Differential DC, not galvanically isolated
	Ranges	80, 160, 320, 640 mV/V
	Impedance	200 k $\Omega$ (Version 2) 1 M $\Omega$ (Version 3)
	Gain error	typ. 0.15%
	Noise (input referred at 20Hz bandwidth, range 80mV/V)	typ. 6.5 $\mu$ V <sub>pp</sub> /V (Version 2) typ. 0.8 $\mu$ V <sub>pp</sub> /V (Version 3)
	SNR (Bandwidth: 20Hz, Range: 80mV/V)	typ. 99 dB (Version 2) typ. 116 dB (Version 3)
Excitation	Ranges	1, 2.5, 5, 10 V / max. 100 mA
	Precision	Sinus, typ. 3 V <sub>rms</sub> , 5 kHz, max. 50mA
Supervision	Parameter	Excitation current: Alert threshold: $\leq$ 1.3mA available at Version 3 only)
	Behaviour	Emergency stop, Standby, Setup-mode, Message only None
Size		84 x 55 mm (without connector)



### Measuring Amplifier PCS8000.ENCOD for Digital Inputs - No 81-0012-000

For digital input signal from all digital devices such as, displacement transducers, angular digital displacement transducers (ADT), MFL-extensometers (other extensometers are mostly analogue) and others. A system plug (item 81-0006-000) with 15 pins is required.

Digital quadrature encoder input	Type	RS422 (symmetrical) TTL (5V)
	Input impedance	150 $\Omega$ @ RS422 10k $\Omega$ @ TTL (pullup)
	Frequency limit	5 MHz
SSI input	Word width	8 ... 32 Bit
	Encoding	Binär / Binary, Gray
	Transfer- clock	250 / 500 / 750 / 1000 kHz
	Reduction of readout rate	1 ... 10
	Connection	RS422 (symmetrical)
	Virtual resolution (overrun handling)	64 Bit
Sensor supplies		5V, 200mA max. / 24V, 100mA max.



### $\pm$ 10 VDC Analogue Output Module PCS8000.AOUT for four (4) Outputs - No 81-0005-000

This module provides 4 analogue output signals of  $\pm$ 10V used for delivery of any signals from testing machine to external system. A system plug (with 15 pins is required).

Digital quadrature encoder input	Type	16 Bit
Sample rate		14'400 Hz
Linearity error		typ. $\pm$ 1 LSB
Outputs (4 channels)	Type	Differential DC Not galvanically isolated
	Isolation voltage	1kV
	Range	$\pm$ 11.5 V max. 10mA pro per channel
	Impedance	typ. 0.5 $\Omega$
	Recommended load	> 5k $\Omega$
Frequency range		0 ... 1500 Hz
Offset		< 1mV
Error		< 0.1%
Noise		< 1 LSB
Size		84 x 55 mm (without connector)



## System Plug PCS8000.SENS with EEPROM for Analogue VDC, Strain-Gauge, LVDT or Digital Signal

The system plugs PCS8000.SENS (item number 81-0006-000) is for connecting sensors and measuring signals to the amplifier cards for Strain Gauge, VDC, LVDT, or Digital Signals.

The system plug features an integrated memory (16kBitEEPROM), what allows to store all necessary data as calibrations data of connected sensor.

Once a sensor is configured and calibrated, it can be used on each controller PCS-8000 without any kind of additional settings.

### Technical data

- Connector D-Sub 15-pin
- Memory EEPROM 16 kBit
- Size of optional available resistance Minimelf MM0204



## System Plug PCS8000.ENC with EEPROM for Digital Sensors without Interpolation

The system plugs PCS8000.ENC (item number 81-0008-000) is for connecting of digital quadrature encoder and SSI-Encoder to the PCS8000 On-Board-Module (Sensor Conditioning Module).

This system plug supports RS422- and TTL-Signals for quadrature encoder and only RS422 for SSI-Encoder.

The system plug features an integrated memory (16kBitEEPROM), what allows to store all necessary data as calibrations data of connected sensor. Once a sensor is configured and calibrated, it can be used on each controller PCS-8000 without any kind of additional settings.

### Technical data

- Connector D-Sub 25-pin
- Memory EEPROM 16 kBit



## System Plug PCS8000.ENC1 with EEPROM for Digital Sensors without Interpolation

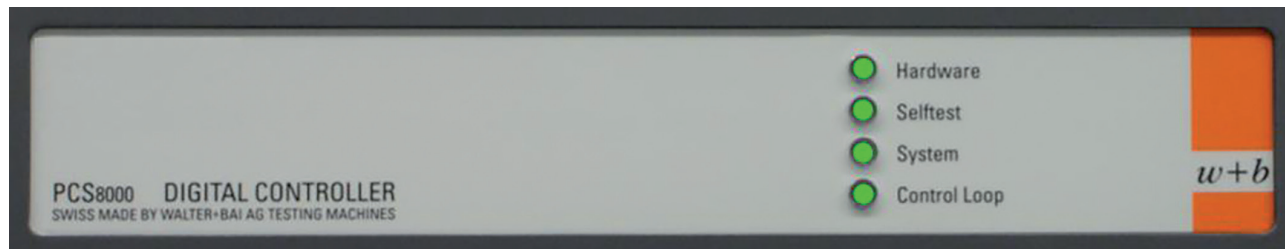
The system plugs PCS8000.ENC1 essentially corresponds to system plug PCS8000.ENC and is needed to connect sensors on the on-board-module. The system plug PCS8000.ENC1 is configured with interpolator chip what allows to connect an quadrature encoder with sinus/cosinus-signals.

### Technical data

- Connector D-Sub 25-pin
- Memory EEPROM 16 kBit
- Quadrature encoder input for sinus signals 1Vpp
- Max. input frequency 340 kHz
- Interpolation factors 20 / 25 / 40 / 50 / 80 / 100 / 160 / 200

## Controller Self-Test & Status Information

The front panel of the controller contains four LED's for visualizing the system state.



### LED Hardware

**Red:**

Immediately after power up: System is booting, HW will be initialized → OK.

**In running state:**

A fatal error occurred, system has been disabled → Error, turn off the controller.

**Red Blinking:**

The SW has detected an error and disabled the device → Error, turn off the controller.

**Green:**

Normal Operation

### LED Selftest

**Off:**

After power up: No selftest has been performed yet.

**Red:**

The selftest failed → **Error**. As long as the selftest fails, the system doesn't get ready.

Possible causes:

- A measuring module is broken.
- Temperature limit exceeded (if enabled).
- Highspeed link malfunction (might be a cabling problem, only in multichannel setup)

**Yellow:**

The selftest is running.

**Green:**

The selftest succeeded, normal operation → **OK**.

### LED System

**Red:**

The system is not ready → **Error**.

Possible causes:

- The system is still booting
- The selftest failed
- Invalid configuration (possibly by selecting an invalid control channel)
- In multichannel setup only:
  - Master: not enough or no slaves have connected so far
  - Highspeed link is interrupted
  - Slave: Emergency stop loop is open

**Red/Green alternating:**

Master only: Emergency stop loop open

**Green:**

Normal operation → **OK** (Standby or Ready state)

### LED Control Loop

**Off:**

- The control loop is disabled.
- The drive enablecontact is open.
- The system is in Standby state (as far as all other LED's are green).

**Green:**

The control loop is enabled. The drive enablecontact is closed. The system is in Setup state.

**Green blinking with**

**System LED green:**

As above, with sequencer program running. The system is in Program state.

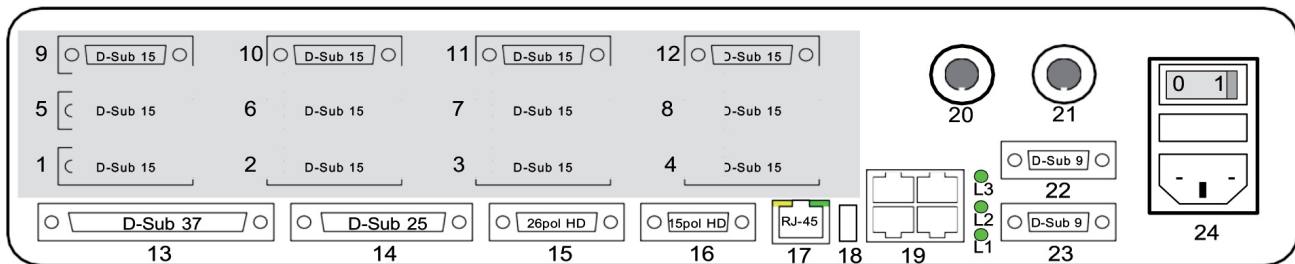
(Remark: In a multichannel setup this LED is blinking synchronously on all controllers).

**Green blinking with**  
**System LED Red/Green**  
**alternating:**

Fade state:

- Transition from enabled to disabled control loop.
- The drive enablecontact is already open, however, the control loop is still enabled.
- After a certain time – which can be set in the system configuration – the system automatically changes to Standby mode and disables the control loop.

## Back panel



No. 1 - 12:	Module connector	DSub15 F/M
No. 13:	Digital input/output	DSub37 F
No. 14:	Input for quadrature encoder (digital/sinusoidal) and SSI sensor	DSub25 F
No. 15:	Control and supervision signals, some duplicated signals from digital input/output	DSub26HD F
No. 16:	Monitor VGA	DSub15HD F
No. 17:	Network, Ethernet 100BaseTX	RJ45
No. 18:	USB 2.0	USB
No. 19:	Highspeed link	RJ45
No. 20:	Remote control	Binder Serie 680, 12 Pol
No. 21:	Servo valve and control voltage output	Binder Serie 680, 7 Pol
No. 22:	RS232	DSub9 F
No. 23:	RS422, RS485	DSub9 M
No. 24:	Line input with 2 fuses 2AT and main switch	-

### Description of LED's

The connector 17 (RJ45) contains a green and a yellow LED. At the right side of connector 19, there are three builtin green LED's (L1, L2, L3). Below is a description of the meaning:

- L1: **Green:** Turned on in case of a valid signal on the link (PLL locked).  
Must be on in case of a multichannel setup. (Always on in case of a singlechannel setup.)
- L2: **Green:** Turned on if the highspeed link is connected and the emergency stop loop is closed.  
Must be on in case of normal mode and multichannel setup at master and slave.
- L3: **Green:** Turned on if the emergency stop circuit is closed.  
Must be on in case of normal mode at the master only.

#### 17 (Ethernet)

**Yellow:** Blinking upon data transmission  
Must be on in case of normal mode at the master only.

**Green:** Turned on in case of active link (connected network on both sides and available connection on ethernet link layer).  
Must be on in normal mode.

## Easy Installation of modules

The installation of a new module is simple. After removing the controller cover:

1. Hold the module at a slight angle and put it through the back panel first with its DSub connector.
2. Push the module with light pressure into the socket. The module must remain in a horizontal position.
3. Attach the plastic threaded sleeves and tighten them slightly. Attach the two screws at the DSub connector. Close the controller cover again.

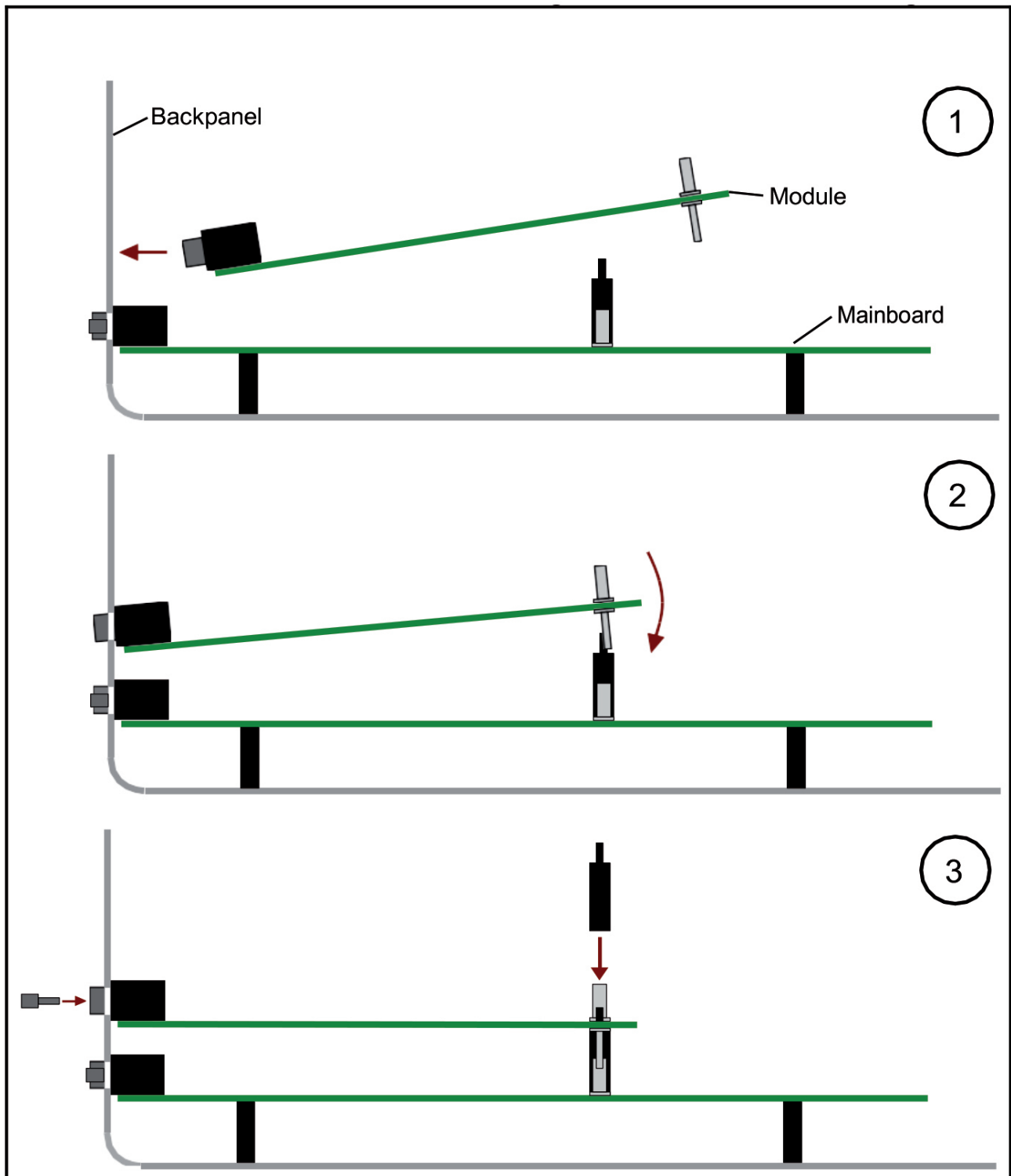


Figure: Installation of modules

## w+b After Sales Service

w+b and our network of factory trained support points providing after sale solutions of your high-quality w+b test systems. We are dedicated and have the experience to support our customers from installation throughout the entire life cycle to ensure you will reap the maximum benefit of your test system.



### Over 45 Years of Experience

- Customers choose w+b because we meet your specific testing needs with optimum testing solutions.
- But there is more. After choosing a testing system from w+b it means that this is the starting point of a long-term partnership with us.
- Our network of experienced support and qualified engineers provides you an optimum after sale support to make sure you get the most from your investment.
- Due to this target, w+b continue to invest in hiring and training service engineers or local representatives.
- To cut cost of field service a full staff of application engineers is available for telephone support, which is free for as long as you own your system.
- Our large stock of spare parts from the most w+b equipment helps you to minimise the shut down time in case of problems.
- w+b test systems are designed for hard and long term use. With the w+b service and support, you'll be sure to reap the maximum benefit of your systems throughout their entire life cycle.

### Instruction Manual

For us a reliable support starts with a proper instruction manual. To each system we deliver a complete users manual including information about safety, system installation, machine setup, technical drawings of testing structure, hydraulic and electric drawings with part legend, soft and hardware manuals, maintenance information a.s.o. Due to we give the fully information to our clients and in connection with our experienced telephone support more than 90% of all shut downs can be solved by telephone.

### Installation and Warranty

Our Field Service Engineers are available to install and commission your system upon delivery. All our Field Service Engineers are factory trained to complete the installation in a timely manner, to ensure the system operates to specification and to commission the system. All new w+b products carry a factory warranty.

### Customer Training

It is essential that our clients can use the full potential of our testing systems. This requires that the system works properly and that system operators are thoroughly trained in its operation. The instruction provided by our Engineer at the time of commissioning, enables our personnel to operate a system competently. Continued training ensures that new staff are brought up to speed on installed systems, that existing operators retain their skills and that occasional users retain the skills necessary to operate the system. We offer a wide array of regularly scheduled system training courses at our facilities or at your site.

### Hardware & Software Support

To make sure your investment lasts as long as possible even if your requirements change, our Soft- and Hardware engineers or local representatives will provide you advice on how you can benefit from our steady developing in soft and hardware. This will guarantee you, that your system maintain at peak performance. Through planned service visits for preventative maintenance and calibration any potential system problems are identified and resolved thereby avoiding unnecessary machine downtime.

### Calibration

Our calibration laboratory is accredited according to the latest ISO EN IEC 17025 (formerly EN 45001) standard. The calibration and verification of your material testing machines is part of our service capability. Our Field Service Engineers are not only trained to complete maintenance and calibration service on w+b machines, they also can do it on other testing machines in a timely manner. The calibration certificate will prove the verification of your system with ISO 9001 a.s.o standards.



### Application Service

We can provide test methods, report templates or graphic presentations precisely to your specification, developed within w+b standard software packages. Our application experts have many years experience in materials testing applications and will work with your representative to meet your requirements.



## Maintenance and Calibration of Your Material Testing Installations through the w+b Accredited Calibration Laboratory

The maintenance and service work on your material test equipment is executed by our specialists with highest attention. With the experience of 45 years! Highly precise computer-aided calibration equipment guarantees a calibration according to the latest standards.

Our calibration laboratory is certified according to ISO/IEC 17025 which is recognised through the Multilateral Agreement (MLA) for EA - European Cooperation for Accreditation.

The maintenance and calibration through one hand by our specialists with many years of experience assure a reliable execution.

Your savings: no extra costs for an additional calibration by a further official calibration institute, since we are an accredited calibration laboratory.

We calibrate your test equipment independently of type and manufacturer. We offer excellent conditions as well as appointed dates.

The accreditation according to ISO/IEC 17025 is recognised through all signatories of the EA (European Cooperation for Accreditation) multilateral agreement of calibration. With over 40 years of experience! Please do not hesitate to ask for a quote!



**SCS 0068**

### We are accredited Calibration Laboratory for:

- Force - Tension, Compression
- Pressure
- Length - Displacement, Deformation
- Hardness
- Energy - Impact Tester





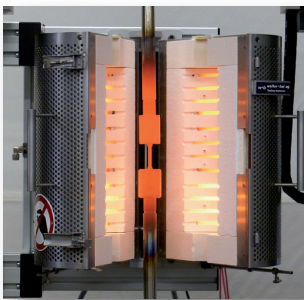
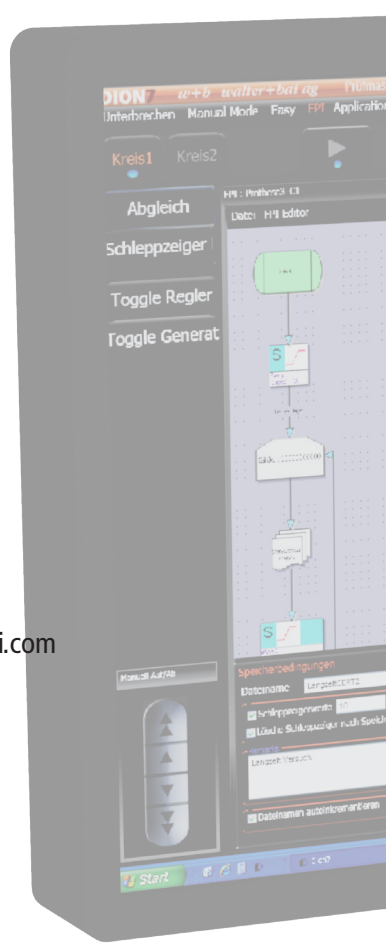
*walter+bai*

**walter + bai ag  
Testing Machines**

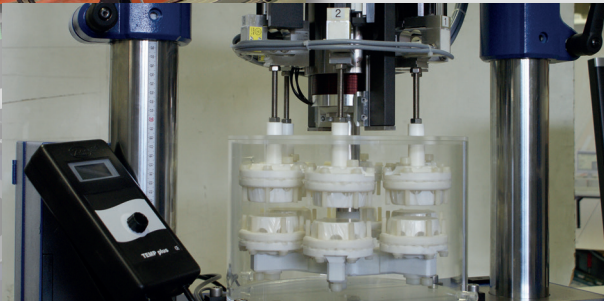
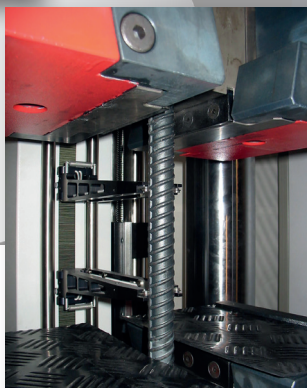
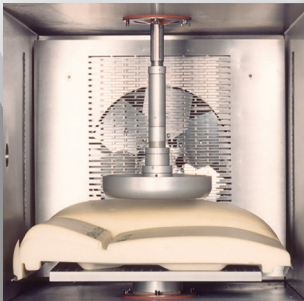
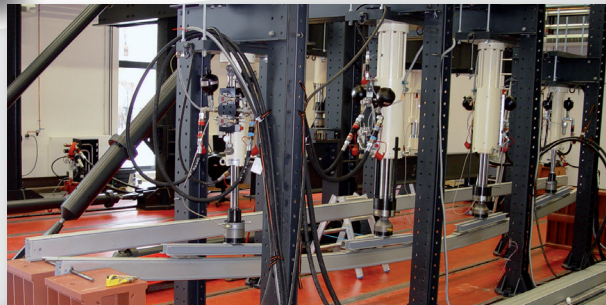
Industriestrasse 4  
8224 Löhningen · Switzerland

Tel. +41 (0)52 687 25 25  
Fax +41 (0)52 687 25 20

info@walterbai.com · www.walterbai.com



- Static Universal Testing Machines, Electromechanically or Servohydraulically driven
- Dynamic Multipurpose Testing Systems for Advanced Material and Component Testing
- Torsion, Rotary Bending, Impact Pendulum Testing Machines
- Hydrostatic Pressure Testing Systems
- Customer Specific Testing Machines, Modernisation of Existing Testing Machines



- Accessories for Material Testing, incl. Digital Controllers, Application Software, Hydraulic Power Supply, Grips and Fixtures, Extensometers, Furnaces and Climatic Chambers, a.s.o.
- After-Sale Service at Customers Laboratory
- Calibration of Material Testing Machines

PCS8000 DIGITAL CONTROLLER  
 SWISS MADE BY WALTER + BAI  
 S:\Prospektblätter w+b\02 Anwendungen\_Übersichten etc. ab 2016\02 Brochures\PCS-8000\_Digital Controller\PCS-8000\_E