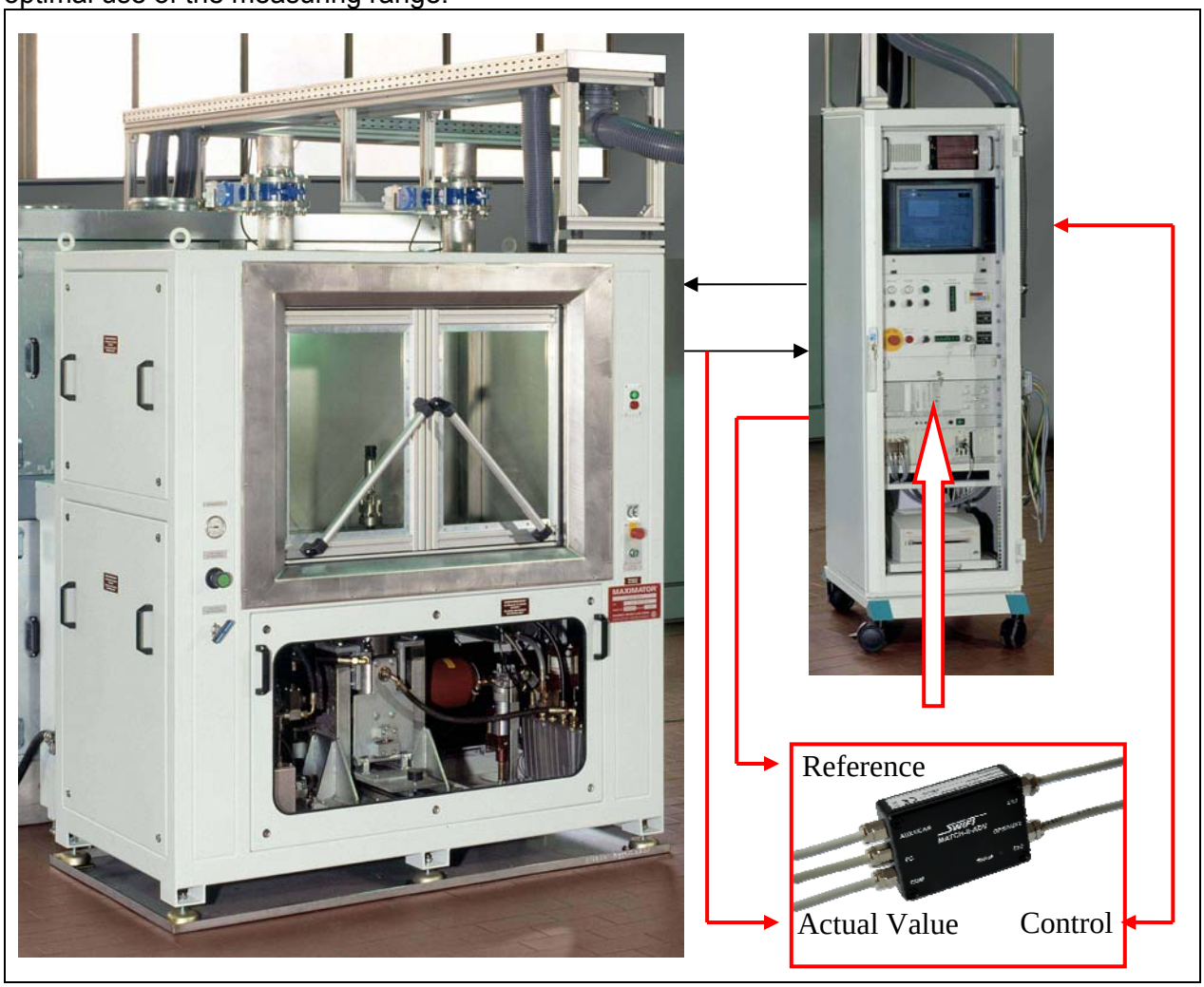
Match-II for Test Bench Monitoring

The Match-II has two measuring channels which can be connected via BNC connectors with the test bench control system. Normally, on one of the channels the reference value and on the other channel the actual value of the control sensor is recorded.
Both inputs are designed for the test bench typical voltage range of ± 10V (resp.0…10V). In addition, the measuring range can be continuously adjusted down to 0...1V.This allows optimal use of the measuring range.



The Match-II is very compact and uses very little power, therefore it can be integrated directly into the test bench control system. In order to control the recorder the available test bench PC can be used. Since the Match-II operates autonomously, there is no risk of data loss even when there is a failure of the test bench PC.

Application

The exact reproduction of the load sequences is a prerequisite for reliable fatigue testing. Therefore control systems are used, which are supposed to guarantee compliance with the reference values. Nevertheless, an additional monitoring for various reasons is useful:

- Test equipment and loop controller together represent a highly complex system, which can respond sensitively to small changes in the closed loop.
- Different influences such as aging or heating of the test specimen may affect the steady-state control accuracy in progression of the test.
- Since the loop controller and the monitoring sensor do not work independently from each other, from the perspective of quality assurance the case of control and audit function in one unit is classified as questionable.
- In the context of quality assurance, the independently collected data can be used as an evidence for the correct execution of the whole test procedure.

The Match-II with its autonomous data acquisition and analyzing capability is best suited for the supervision of servo hydraulic test benches. The device records the complete test data according to common fatigue life analysing methods (Rainflow, Range Pair Count, etc.). These data can be transmitted, visualized and archived on a PC. Due to the autonomous operation (including the data storage in the device), maximum availability and reliability is ensured.
For further processing the collected data, standard Office products such as EXCEL are used. Due to their widespread use, almost anyone can operate it and the experienced user can create his own extensions relatively easily by himself. The comparatively low price in contrast to professional visualization software and the availability of "mass" licenses in many companies ensures that the total price of the system remains attractive.

Supported test procedures

The Match-II can be used for evaluating single- and multi-level testing as well as for complex completely random load signals.
In a single level test the specimen is repeatedly exposed to load cycles of constant amplitude at a constant offset.
In a multi-level test load cycle, different amplitudes with different mean stress values are used. Usually the test signal is composed out of blocks with constant but from block to block different amplitudes.
Finally complex load signals are used which were for example gathered during real life applications and therefore represent a quite complex load sequence.
For the evaluation of a single level test assessing the amplitude level and its frequency is sufficient. This information can be read directly from the “Rage-Pair” analysis of the test. This is also true for a multi-level tests, however, the frequency in relation to the different amplitudes must be evaluated.
Although the same method is practicable for complex loads too, it is less suitable since the reference count and actual count of each amplitude must be compared. In this case a so called damage calculation can be very helpful. With the optional Damage Calculator Software, a single load index (damage value) can be calculated from the complex load cycle. The calculations are carried out according to the method of Palmgren and Miner. The resulting load indexes can easily be compared against each other.

SWIFT Gesellschaft für Messwerterfassungssysteme mbH
Am Dieburger Berg 12 D-64354 Reinheim
Tel.: +49 (0)6162 / 82086 Fax: +49 (0)6162 / 82604
info@ swift-online.de www.swift-online.de

Supported data analysis

The Match-II is an autonomous operating, directly classifying measurement system. This means the device records independently of a PC the data on its two input channels, and processes the acquired data immediately (online) according to different evaluation methods:

- ***Rainflow Counting (RF)***
- ***Range Pair Count (RP)***
- ***Level Crossing Frequency (LC)***
- ***Triggered Time Series Recording (Transient Mode, TM)***

<u>Rainflow(RF), Level Crossing(LC), Rangepair(RP)</u>

In the Rainflow method, the turning points are detected in the data stream and in the case of closed hysteresis loops stored with their maxima and minima value in a resulting so called Rainflow matrix. Turning points which have so far not formed closed hysteresis (half load cycles) are temporarily stored in the residue. To ensure high amplitude resolution, the RF-method operates with 256x256 classes, allowing an amplitude resolution of 0.4 % of the measuring range.
The Levels Crossed (LC) counting method is derived from the Rainflow matrix by means of the accompanying software. A Range Pair Count (RP) analysis can be performed too.
Both methods operate with the same high resolution of 256 classes used by the RF-method.
All results are immediately available after transmission to the test bench PC and can e.g. be transferred to Excel for further processing and documentation.
Particularly noteworthy is the fact that the data size is hardly 0.5 Mbytes (regardless of the duration of the test series). Thus the test duration is practically unlimited.

<u>Triggered Time Series (TM)</u>

In addition to the permanent acquisition of all load cycles according to the RF-method it is possible to capture and store time signals in the transient mode (TM) directly, when crossing or falling below a given threshold. In order to evaluate the pre-trigger signal history, the method has a ring memory with adjustable length from which the signal prior to the trigger event is also stored.

<u>Software-Add-on Options</u>

In addition to the standard methods mentioned above, there is a variety of other methods available as an extension. Particularly interesting for test bench applications are:

- ***Time at level (TAL) counting***
- ***Multidimensional Time at Level (TAL2D, TAL3D) counting***
- ***Damage Calculation according to Palmgren/Miner, Damage Calculator***
- ***Damage Evolution (DE)***

SWIFT Gesellschaft für Messwerterfassungssysteme mbH
Am Dieburger Berg 12 D-64354 Reinheim
Tel.: +49 (0)6162 / 82086 Fax: +49 (0)6162 / 82604
info@swift-online.de www.swift-online.de

Features

- Direct connection to the test bench via BNC-Connectors
- Two channels: reference value and actual value input
- High accuracy (0,25%) and high resolution (256 classes)
- Low data volume
- Direct counting of Rainflow cycles (RF)
- Unlimited recording duration (RF)
- Detection of unexpected signal peaks as a time signal recording, including pre- and pos-trigger
- High sampling rate (2kHz)
- Convenient Windows operating software for parameterization, data transmission, evaluation and export function for Excel
- Highest reliability and availability
- Factory calibrated, incl. calibration certificate
- DKD calibration (optional)

Applications

- Quality assurance: Proof of correct test procedure execution, exposure of test errors
- Documentation: Proof guidance towards third parties (company/subcontractor), archiving
- Failure analysis: Time series analysis of unexpected signal peaks

The following software methods which are relevant for the test bench monitoring are included in this product folio:

- Rainflow - RF
- Level Crossing - LC
- Range Pair - RP
- Transient Mode - TM
- Damage Calculator - DAMCALC
- Damage Evolution – DE
- Sequential Peaks and Throughs with Time and Master/Slave concept - SQTMS

SWIFT Gesellschaft für Messwerterfassungssysteme mbH
Am Dieburger Berg 18 D-64354 Reinheim
Tel.: +49 (0)6162 / 82086 Fax: +49 (0)6162 / 82604
info@swift-online.de www.swift-online.de

Technical Data of the MATCH-II

General

• Analogue inputs	2
• Digital inputs	2
• Central processing unit (CPU)	16Bit @ 40MHz
• Internal program memory	FLASH ROM, in-system programmable
• Data memory capacity	1,8 MByte
• Logbook	more than 16.000 entries
• Data retention	3V lithium battery
• Sensor connection	2x BNC-Connector (max. ±10V)
• Data acquisition	12Bit analogue/digital converter, 2000 samples per second each channel

Analogue Input

• Symmetrical measuring ranges	±1V to ±10V, freely adjustable by Software
• Asymmetrical measuring ranges	0V…1V to 0V…10V, freely adjustable by Software
• Measuring mistake in all areas	±0,25% (typical), ±0,5% (maximum)
• Bandwidth	>1kHz (-3dB)
• Input resistance	101kΩ ±0,2%

Digital Input

• Trigger threshold	~2,1V
• Hysteresis	~0,05V
• Input voltage range	±50V
• Input resistance	92kΩ

Software

• Rainflow (RF) counting	256 classes, more than 10^9 counts
• Range-Pair (RP) counting	256 classes, more than 10^9 counts
• Levels Crossed (LC) counting	256 classes, more than 10^9 counts
• Transient Mode(TM)	256/1024 classes

Miscellaneous

• Status check, internal	Status-LED: Stand-by / running
• PC Connection	USB/RS232

Power Supply

• Supply voltage range	6,5V to 30V
• Supply current	less than 90mA
• Reverse voltage protection	yes (up to -15V permanent, up to 30V short-term)

Ambient Conditions

• Temperature	-30°C...+65°C
• Humidity	0%...80%, not condensing

Casing

• Size	80x50x25 mm / $3^1/_8$ x 2 x 1 Inch
• Weight	170g
• Material	Aluminium
• Protection rating	IP65

SWIFT Gesellschaft für Messwerterfassungssysteme mbH
Am Diebsurner Berg 18 D-84354 Rehmalm
Tel.: +49 (0)6162 / 82086 Fax: +49 (0)6162 / 82604
info@swift-online.de www.swift-online.de