HKS-Prozesstechnik GmbH

Welding Monitoring
Automatic Quality Assurance
Calibration
Welding analysis
Welding Fault Detection
WeldQAS – basics and system technology

1. Determination, tasks and impact
2. What is the difference between WELDQAS and other monitoring systems?
3. Documentation, statistics and optimisation of welding equipment
4. Administration of the jobs
5. Data management, archive management
6. Sensors and calibration
7. Fault detection by means of examples
Our products guarantee

• optimal adjustment to various applications in welding such as: manufacturing, quality assurance and research,

• adaptability to any specific welding technology

• simple handling

• robustness specifically adapted to welding environments.
## Product range

<table>
<thead>
<tr>
<th>Main</th>
<th>Product</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welding data monitoring</td>
<td>WeldQAS</td>
<td>System for the monitoring, visualization and documentation of industrial welding processes</td>
</tr>
<tr>
<td>Welding data documentation</td>
<td>WeldScanner</td>
<td>Mobile, durable system for the measurement, recording and calibration of the most important welding data, also for hand welding usable</td>
</tr>
<tr>
<td>Welding data analysis</td>
<td>WeldAnalyst</td>
<td>Software-system for the high dynamic analysis of welding processes</td>
</tr>
</tbody>
</table>
WeldQAS
Monitoring system for industrial welding production
WeldQAS is an automatic monitor, controller and recorder for the arc welding (MIG/MAG, TIG, submerged arc welding, plasma jet welding etc.),

- it allows automatic welding supervision,
- it works on the bases of the recording of the welding parameters during welding, without any changing to the welding torch head,
- it is based on a new technology of digital high-resolution data recording and intelligent process data computing in a signal processor (ASP - Advanced Signal Processing), and
- it allows a substantially improvement and detection of welding faults.

Automated welding processes require automated checking quality control
1. **Tasks and Impact**

**Tasks of the WeldQAS**

### Supervise

**Sort / out**

- 100 per cent check of the demanded welding engineering parameter through the running production
- Prevents defective welds due to false functions in the welding device or non authorized interventions

### Fault detection and avoidance

- Quick and competent fault detection, because sporadic mistakes from the welding data can be clearly assigned
- Use of the arc as a quality sensor

### Documentation

**Data recording**

- Documentation and reporting of the observance of the welding parameters of every weld
- Archiving of the manufacturing data for the whole life span of the product
1. **Tasks and Impact**

**Function**

- **Measuring of the welding parameter**
  - current and voltage
  - Wire feed
  - Gas flow rate

- **Measuring of the thermal field (option)**

**WeldQAS**

**Welding monitoring system**

- **Documentation**
  - presentation and analysis functions

- **Monitoring**
  - of the welding process
  - tolerance bands for warnings and faults

- **Fault detection**
  - automatically “not-ok” rejection
  - faulty parts throughout the production process
  - error output for marked parts, selection, automatic alarm
1. **Tasks and Impact**

**Equipment**

- integrated network function
- USB-keyboard in addition
- simple using via wheel
- no hard disk and CPU-fan
- operating system WIN XP embedded
- integrated error outputs and program inputs
1. **Tasks and Impact**

**Equipment**

---

**µQAS**

- Robust standard device in compact dimensions (255x165x155mm)
- 6.6 inch TFT-Display
- Ring buffer for approx. 10,000 seams
- µQAS 1K - for monitoring of one welding torch
- µQAS 2K - for monitoring of two welding torches

**QAS-V5**

- Robust device with higher computing power
- Dimensions (360 x245x155mm)
- 12.1 inch TFT-display
- Ring buffer for approx. 20,000 seams
- Particularly suitable for software to visualisation of parts (part manager)
- QAS V5 2K – for monitoring of two welding torches
1. Tasks and impact

Measuring transducers for all welding technologies

- Directly connection of the sensors to the WeldQAS ASP is possible
- All sensors are calibrated and have a calibrating certificate
- HKS-sensors are independent of the welding equipment

<table>
<thead>
<tr>
<th>Process sensor</th>
<th>Gas flow sensor</th>
<th>Wire feed sensor</th>
<th>Compact sensor</th>
</tr>
</thead>
<tbody>
<tr>
<td>measures welding current and welding voltage</td>
<td>measures the gas flow rate</td>
<td>measures the wire feed speed</td>
<td>measures welding current, welding voltage, wire feed speed and gas flow rate</td>
</tr>
</tbody>
</table>
1. **Tasks and Impact**  
**Impact of the WeldQAS**

**ASP (Advanced Signal Processing) – our new generation**

**Basis:** Welding faults cause changes in the arc which are reflected in the welding parameters

**Impact of the ASP technology**

- Measurement of the welding parameters with 50 kHz (every 0.00002 second)
- Compression of the values by means of signal processor to process characteristics with intelligent algorithms
- Comparison with reference curves during welding
- Inquiry of divergent vectors as a quality mark
- Immediate visualisation and output of defects with bad quality marks
In a stable welding production to maintain high standards the measurable welding parameters (welding current, welding voltage) fluctuates in stable samples. Changes differing from it indicate problems.

The WeldQAS takes into account these "natural fluctuations" and judges divergent changes of this with a note in the area of 1 to 7. This is proportional to the size and temporal duration of the fluctuations.

- **welding current**
- **Welding voltage**
- **Gas flow rate**

Permitted tolerance and temporal duration of the variations for every parameter

**Quality mark**

1,5

A good mark shows that all parameters were within the permitted tolerances. Trends can be recognized easily.
2. The difference between WeldQAS and other monitoring systems

Reference as an envelope

Monitoring by fixed borders
(fade-out of the start time and end time)
for not time fixed processes

Monitoring by envelopes
Pioneering online-fault detection

Every checking program contains warn margins and error margins and time margins for all measurement categories

For every weld a specific reference can be laid out.
2. **The difference between WeldQAS and other monitoring systems**

**Automatically statistical learning methods**

Most time the use of such systems needs the inquiry and attitude of operating supervision limits.

WeldQAS is the only system, which offers an automatic learning to the regular production parallel.

The signals are evaluated statistically and abnormal courses excluded automatically.

The monitoring limits (faults) were learned from the course of many welds represented above automatically.
2. The difference between WeldQAS and other monitoring systems

Pioneering Fault Detection - PFD

Patented technology – online analysis of the arc dynamik

The PFD – Technology

Is based on an evaluation of a process index. It recognises the low differences in welding current and welding voltage at irregularities during the welding e.g.

- weld seam besides the joint,
- pores, holes, lacks of adhesion, penetration defects
- influence of gas and wire
2. **The difference between WeldQAS and other monitoring systems**

**Pioneering Fault Detection - PFD**

**The process index is**

- Calculated online only from the high-speed trace of current and voltage
- Widely independent of the welding current
- Doesn’t need automatically learned patterns

**The result is**

- A reference value for the monitoring of the automatic production and
- A indicator for the analysis of the arc
3. Documentation, statistics and optimisation

Documentation

Every welding documents automatically:
- when,
- with which welding equipment,
- which part, which instruction (optional),
- which welding parameter (average value and time dependent),
- which monitoring result was achieved.

The documentation is carried out in a database.
3. Documentation, statistics and optimisation

Listing of all welding seams into tabular form

- **WHITE**: Welding all right
- **YELLOW**: Welding in the area of warn margins
- **RED**: Welding has reached the tolerance limit
3. Documentation, statistics and optimisation

Documentation of the result of a welding seam
3. Documentation, statistics and optimisation

Filtering of all welds from a part

Example: all welds of the part 3-211-28 B

- number of the seem (1-13)
- executing robot
3. Documentation, statistics and optimisation

Statistical result representation
4. Administration of the jobs
Recording several welds as a job

All welding seams a robot execute as a cycle always returning, are a ("his") job.

The job makes possible the immediate combination of the results of a job with regard to:

- the executed welding number,
- problems of the quality of individual welds,
- the complete welding time
- simplify the sorting of not identified parts
4. Administration of the jobs
Complete and universal documentation

Demonstration of all jobs of a robot

all welds of this special job

faulty weld of this special job
5. Data- and archive management

Data management

The data is saved in a relational database (interbase /firebird).

The data manager can manipulate data (delete, copy, move, generate lists).
5. Data- and archive management

Archive management

The archive manager:

- sorts out data in a partial database (monthly, weekly, daily),
- stores this into lists produced automatically incl. time of the data,
- deletes the evacuated data from the main database.
6. Calibration of the sensors

Every sensor is adjusted and calibrated on delivery. The factors of the adjustment are stored in a file in accordance with the serial number of the sensor (e.g. 12568881st sif). This file must newly be memorised and dialled at exchange of a sensor.

In accordance with the calibrating guideline a new calibration should be carried out every year (at the latest every two years).
7. Examples of use
7. Examples of use
MIG – soldering Ignition faults (Audi)

• Faults at the ignition cause a temporal moving of the welding process and with that a clear overstepping of the tolerance limits.

• Faults at the ignition usually cause after-work

• Igniting faults are always recognized.

Ignition faults
7. Examples of use

Weld faults while MIG - soldering

- Typical seam faults are holes or missing connection at the edges of the holes.

- If the faults are caused by changes of the process parameters, (e.g. by wear on the nozzles or problems at the wire feed) a clear identification by the QAS – system is carried out.
7. Examples of use
Converter production (Daimler Chrysler)
7. Examples of use
Transverse control arm (Volkswagen)

MAG welding process
Welding current: 270 A
Welding speed: 100 cm/min
3 mm in 0.3 sec.!!!
7. Examples of use

Rear axle (Daimler Chrysler)

- 64 MIG/MAG-robots weld at one detail
  82 seams with 8413 mm length
- 4000 parts per day
- Archiving of welding details for 15 years

Complete quality monitoring and fault detection
7. Examples of use
Rocket tanks for Ariane EADS

- high quality TIG welding
- 100% documentation and fault detection
- tool for managing of WPS / WPAR
7. Examples of use

Process optimisation

Example of a process optimized badly

Two robots which shall respectively weld the same seam at two workpieces were programmed dissimilarly.

Although the seams are visually almost identical, they have different fusion penetrations.

Our QAS monitoring system recognizes this dissimilar programming of the robots.
7. **Examples of use**

*Optimization by means of documentation while MIG – soldering (1)*

Changes of the welding parameters or programmes are recognized as well as changes of the electrical values caused by replacement of the current nozzle, change of the mass connection etc.

- Differences in the current course by change of the start parameters
- Volatile change of the current average value by change of the contact nozzle
7. **Examples of use**

*Optimization by means of documentation while MIG – soldering (2)*

By a statistical analyses fluctuations and trends can be recognized (because of e.g. wear).

Quality marks of an unstable process Ø 2,9

Quality marks of an stable process Ø 2,0
With the QAS-system HKS has more than one hundred applications per year worldwide
We eye your Welding Quality

Thank you for your interest.

For further assistance please do not hesitate to contact us:

Tel: +49 345 68309 – 29
email: sales@hks-prozesstechnik.de
www.hks-prozesstechnik.de