Riveting process Monitoring

STF-1 EXPERT
Auto-Compensation

- ***Allows greater part tolerances***
- ***Projection measurement***
- ***Process Controller***
- ***STFProg Tool***

BalTec
The Assembly Experts

...joining is our business!

Process Controller STF-1 EXPERT...

In the tough, competitive world of the automotive supply industry, complex riveted assemblies are particularly under pressure to reduce costs. Proof of quality is a prerequisite for maintaining the confidence of your customers. With profit margins under constant attack in this extremely competitive market, company investment in correct process machinery is critical.

In the conflict between quality objectives and control complexity, plus the ever-increasing pressure from global purchasing strategy, survival is dependent on the use of process guidance and monitoring equipment.

This is especially true with a riveted connection, where strength of material characteristics cannot be measured on the finished work piece as a geometric dimension. Here, **the Process Controller STF-1 EXPERT** controls and evaluates process factors such as the forming achieved per unit of time. This allows the best possible conclusions to be drawn regarding the strength, quality and initial state of the rivet material.

The Process Controller STF-1 EXPERT governs the **rivet project measurement*** through a second, software-implemented measuring axis and the function highlight **Auto-Compensation.*** This unique riveting process controller, with patents applied for worldwide, rivets against the rivet projection, permitting **considerably greater part pairing tolerances.**

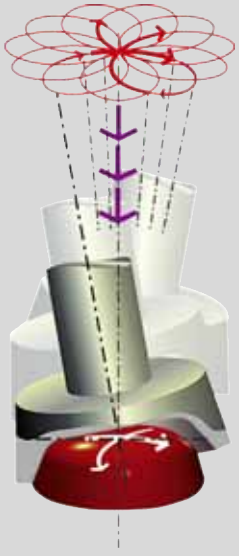
All of BalTec's past software tools for process data logging and evaluation, including **Quality Monitoring System STF-2, Single Process Data Recording**, and **Process Data Analysis**, are compatible.

*Optional, not included in basic price. This user software is activated with the purchase of "Rivet Projection Measurement" and "Auto-Compensation."

...strengthens your market position

Process Controller STF-1 EXPERT

- *Gives you the edge in pricing*
- *Profitable production with higher quality*
- *Assures quality and confidence in your riveting*
- *Reduces corrective costs and quality issues*
- *Encourages cost-efficient material procurement by accepting greater tolerances on part pairings*
- *Increases the range and efficiency of your BalTec Radial Riveting Machine*
- *STF-1 EXPERT represents the latest technology in riveting process control and monitoring called for by industry*



Process Controller STF-1 EXPERT...

Technical
Microprocessor unit for riveting process control and monitoring of BalTec Radial Riveting Machines

Operation via the riveting machine controller RC-20A:
- 64 riveting programs
- RS 232 for process data logging on a PC with BalTec software Single PDR
- Optional with PLC controller input (10 inputs, 2 outputs and analogue output 4-20 mA)

Operation via PLC:
- Communication with each of 8 digital I/O and 1 analogue output 4-20 mA
- 64 riveting programs or via RS 485 full duplex to the PLC
- Programming with BalTec software STFProgTool (Windows® based)

Interfaces, on Sub-D connectors:
- Power supply and I/O
- 2 RS 485, 1 RS 232

Functions
Verification of:
- Rivet presence, rivet position, rivet projection and rivet base. NOK = Abort riveting

Riveting process control:
- Riveting travel S (mm), riveting time T (sec) riveting force F (kN)
- Triggering the start of riveting
- Analogue output for system pressure regulator

Rivet projection measurement in operating mode (options):
- **Auto-Compensation** of the rivet projection deviation from the nominal dimension. The process guide factors S (mm) or T (sec) are calculated for optimum size in real-time on the actual rivet projection to be measured.

Process evaluation (riveting result):
Riveting start, riveting travel, riveting time, riveting force

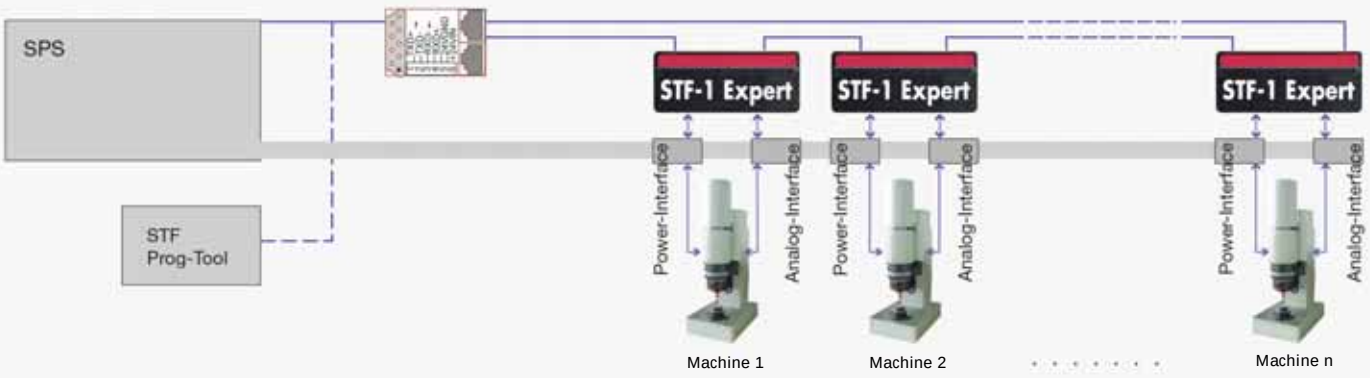
Process data display:
- numerical in the RC-20A display
- for PLC: digital as OK or NOK or numerical over RS 485
- for STFProgTool: graphic and numerical

Process data logging
- for PC software over RS 232 (BalTec Single PDR)

System configuration
- Machine type and size
- Riveting force calibration
- Automatic or manual triggering of NA (riveting spindle start)
- Rivet range
- Max. permissible run-time
- Process filter

Example of a circuit for several riveting machines

Downloading the riveting values into the process memory
Uploading the riveting result



...and the riveting machine control

*The choice is yours. Communication can be controlled through the BalTec riveting machine controller **RC-20A**, a PLC via digital I/O, or the RS 485. In the last two cases, the **STFProgTool**, a Windows® based MMI software developed by Baltec, is available.*

RC-20A Riveting machine control

Function and characteristics of the RC-20A
Illustrates the man/machine interface during manual operation.
The Process Controller utilizes the RC-20A display for the functions:
- Modes of operation: Setup, Correction, and Cycle
- Riveting mode: S, T, F and E
- **Projection Measurement, Auto-Compensation (options)**
- Status of the riveting result of all process factors

- System configuration with setup parameters
- PLC communication: 2 Inputs, 8 Outputs
- 64 riveting programs
- Process data recording for the last 100 riveting cycles
- Automatic or manual triggering of NA (riveting spindle start)
- Analogue output 4-20 mA for proportional pressure regulator

- Operator blocking function
- Safety management in the manual working area
- Control of the riveting motor and spindle valve in addition to peripheral accessories
- Password system

(MMI) STFProgTool – operating interface

STFProgTool, Windows® based application
For creating, editing and saving riveting programs when the Process Controller STF-1 EXPERT is controlled by a PLC, without use of the Baltec riveting controller RC-20A.
For programming, the riveting cycle is started with a mouse click and the process data is displayed. A maximum of 64 programs can be saved by downloading to the STF. For production operation, the PC and software is no longer required. All the programs in the STF can be selected by the PLC via digital I/O or RS 485.

PLC – plant control

Necessary functions of a PLC
- Riveting start at the riveting machine controller RC-20A
- Reading the status of the riveting over I/O

- With direct communication (without RC-20A) via digital I/O or using the RS 485 interface of the Process Controller STF-1 EXPERT

Process data can be transferred via the RS-485 directly to the PLC.

® Microsoft Corporation

AUTO-COMPENSATION of part pairing errors...

The unique and innovative Process Controller STF-1 EXPERT has achieved the solution for evaluating and dramatically reducing costs in riveting technology worldwide.

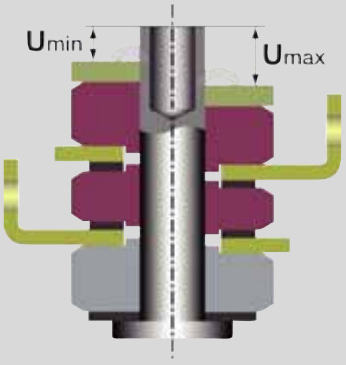
Functions in complex riveted assemblies require both consistent working riveting machines and tightly toleranced parts. The demands of quality assurance, through “quality monitoring only” equipment, very often result in a high scrap rate. This is because the equipment evaluates the completed riveting process simply in terms of OK or NOK.

This evaluation is based on the non-controlled riveting process parameters that are affected by part geometry before riveting. When the riveting process controlled parameter is consistent, the non-controlled parameters vary. This variation can cause an excessive scrap rate that can be reduced by adjusting the controlled riveting parameter for each riveting cycle.

The **Auto-Compensation** in the Process Controller STF-1 EXPERT corrects this fault in the normal process monitoring systems.

By measuring the rivet projection prior to every part pairing being riveted, the STF-1 EXPERT can calculate and compensate for the parts function by adjusting the machine controlling factors, “riveting travel” or “riveting time.” Consequently, the function of a riveted assembly is maintained, even with considerably greater part pairing tolerances.

The Auto-Compensation controls the riveting process based on each individual rivet projection!



In the illustrated riveted assembly, the unusually wide range of rivet projections “U” is the result of the additional thickness tolerance of the ceramic body, In spite of this, the parts have to be riveted with a consistently high tension in order to prevent the parts from twisting against each other. However, the limiting riveting range, to the point where the ceramic body cracks, is very small. This task is achieved with Projection Measurement and Auto-Compensation.

...with greater tolerance – to greater profits

Avoiding losses *through the reduction of NOK parts.*

The effect of Auto-Compensation is strikingly illustrated on these specimen rivets with a 2 mm projection scatter range.

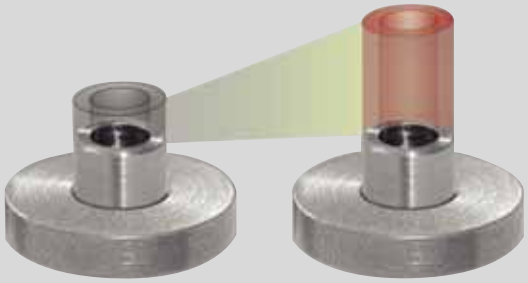
A rivet with a nominal projection of 5 mm is to be riveted to a formed head height of 2 mm. The threshold values for the projection are fixed at 4 and 6 mm.

Without Auto-Compensation
The middle rivet is to nominal dimension and is OK. The rivet to the right is over-dimensioned. Because of the constant forming travel, the riveting is not finished. The rivet at left has too little projection. Here, again, because of the constant forming travel, the edge of the form tool has intruded into the work piece and destroyed it.

Auto- Compensation active
With a compensation of 65%, the riveting improves to a formed head height of between 1.65 and 2.35 mm. The formed head diameter, appearance and strength characteristics remain virtually the same. With normally measured formed heads, the dimensions remain within tolerance.

The formed head of all three rivets formed with auto-compensation.

Cost savings *through moderate tolerance gauging and highly efficient manufacturing methods.*



- Are you producing too much scrap?
- Do you want to buy more economically?
- Are you struggling with the quality of delivered parts?
- Do you have high control costs?

Auto-Compensation gets rid of all that...
Calculate your profit:

	Example	Your calculation
Number of machines	10	
Hours per working day	16	
Working days per year	220	
Cycle time for riveting [s]	5	
Costs per rivet	0.03	
Savings potential	25%	
Rivet operations per work piece	3	
Cost of work piece	3.00	
Scrap rate/1000 off	2	
Rivet operations per year	25'344'000	
Total rivet costs	760'320	
Savings potential/year	190'080	
Saving/machine/year	19'008	
Work pieces/year	8'448'000	
Scrapped parts	16'896	
Scrap costs	50'688	
Scrap costs/machine	5'069	
Savings potential for 10 machines	**240'770**	

Your profit!

BalTec
The Assembly Experts

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