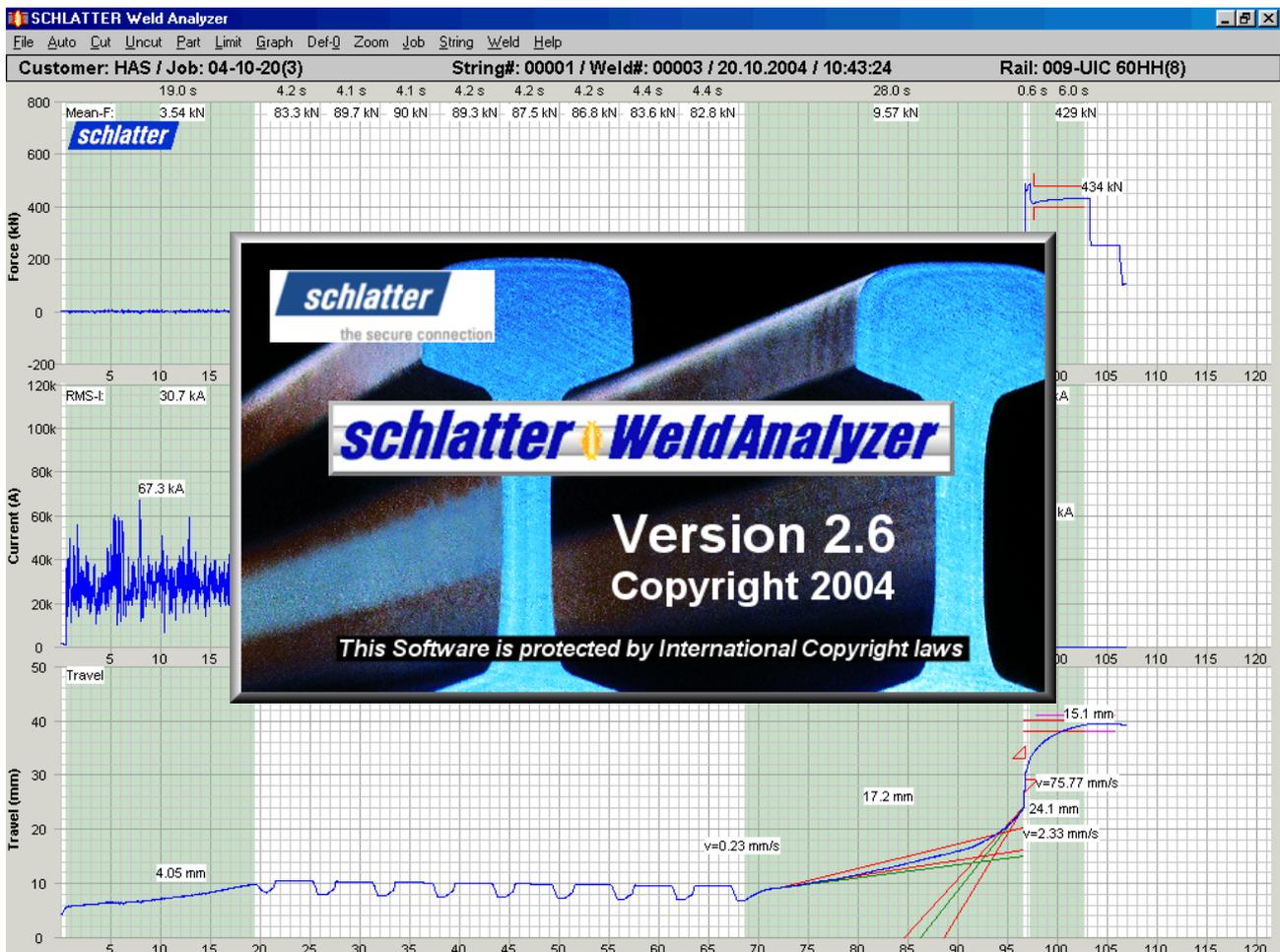


# Schlatter WeldAnalyzer



## General description and main features + Improvements compared to WeldMonitor V4.0

RB0045en WA Specification Rev2.6-1008



the secure connection



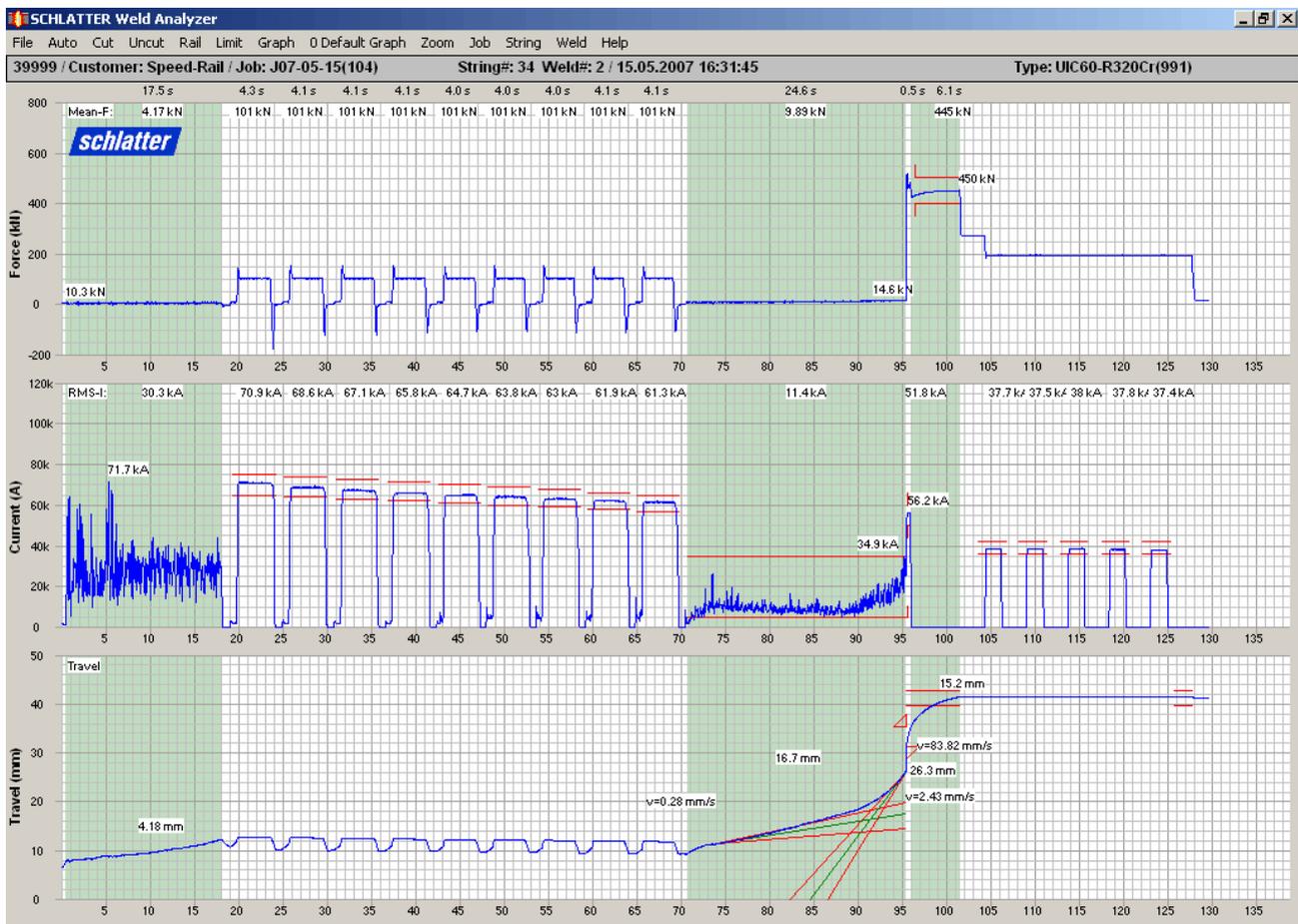
## 1. General description

The **Schlatter WeldAnalyzer** program records, analyzes and monitors the three most important parameters of a flash butt welding process and plots the information in real-time on a high resolution graphic display. The three parameters are:

- **Welding force**
- **Welding current**
- **Travel**

The program runs on state of the art personal computers in the Microsoft Windows 2000/XP environment and will adapt to any resolution at or above 800x600. The **Schlatter WeldAnalyzer** program can be operated with keyboard commands and/or a pointing device (mouse, track ball, etc.). Analogue input signals from the welder or the weld processor SWEP 06\*) are digitized and recorded with a 16-Bit resolution data acquisition board.

The program recognizes and graphically distinguishes each cycle of the weld process with different background colour shades (see figure 1).



AnalyzeScreen\_01\_En.tif

Figure 1: Graphic display of a weld with all vital weld characteristics within the specification limits

Upon completion of the weld, the weld information is compressed and saved in a so-called weld file. Header data like job ID, customer, welding date and time, welding site, machine ID, operator name, calibration settings, notes concerning the job, strings or welds, etc. are added to every weld file.

\*) SWEP 06 = Schlatter **Weld Processor** for Flash Butt Welding Processes

## 2. Main features

### 2.1 Checking for compliance to weld minimum/maximum specifications

Weld specifications to certain critical areas may be entered into the program (see figure 2). Each weld is checked for compliance to these specifications.

LimitWindow\_01\_En.png

Figure 2: Pop up window for specification limits

The applicable specification limits are:

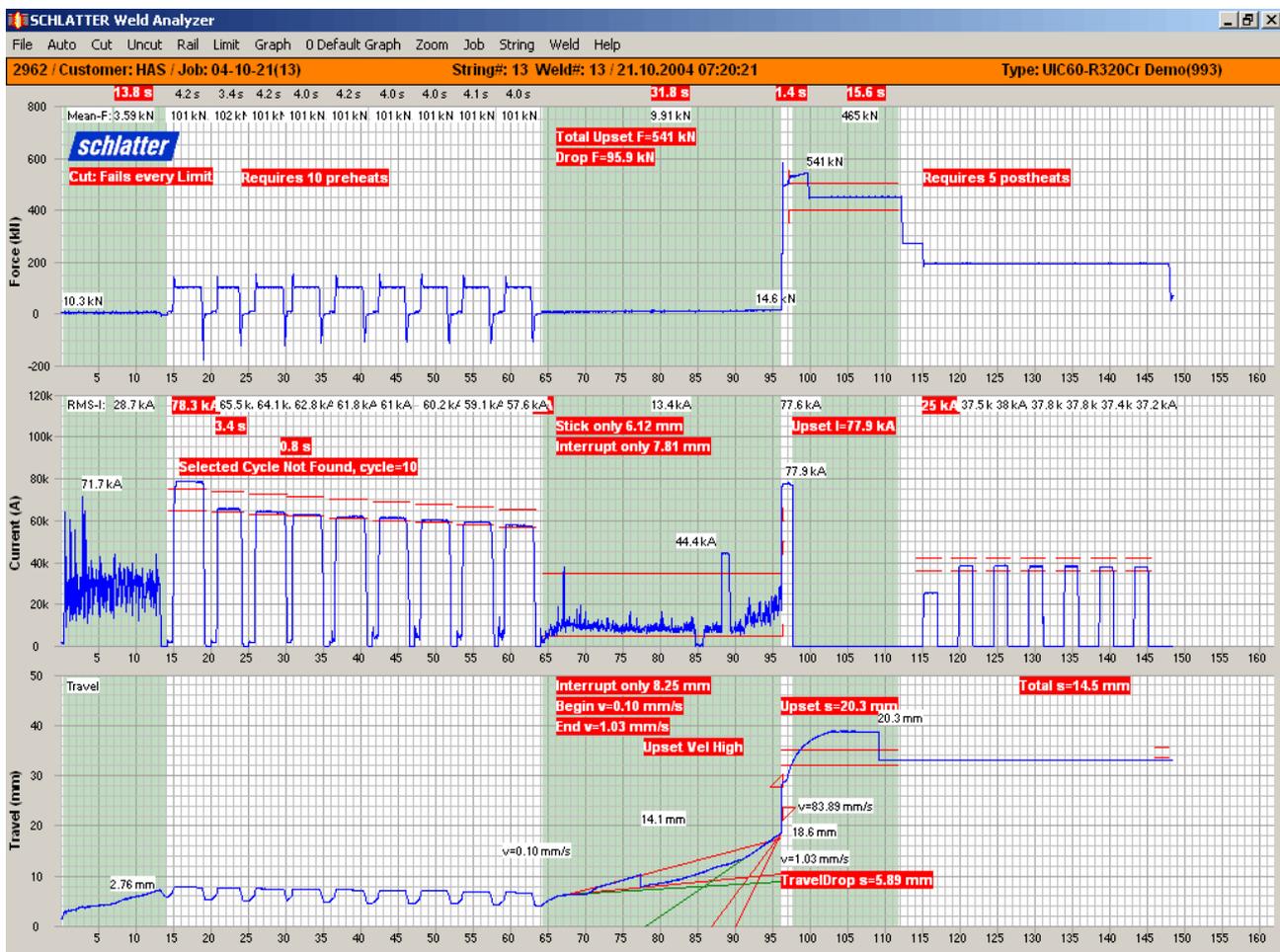
- Flash even min/max time
- Number of preheat cycles
- Preheat min/max current of all or a selectable range of cycles
- Preheat min/max current on/off time
- Final flash min/max begin velocity
- Final flash min/max end velocity
- Final flash min/max time
- Final flash current interrupt/stick
- Final flash travel interrupt
- Upset min/max force
- Upset force drop maximum
- Upset min/max current
- Upset total travel min/max

- Upset travel drop maximum
- Upset velocity
- Upset min/max current time
- Upset min/max hold time
- Number of post heat cycles
- Postheat min/max current of all or a selectable range of cycles
- Total travel or total loss of weld cycle

Every single specification limit can be enabled or disabled separately. Specification lines on the graph to indicate where the specification limits are located can be enabled or disabled (see figure 1, 2 and 3).

Critical areas of a weld found to be non-compliant are highlighted and the out of tolerance value is displayed (see figure 3). If any activated specification limit is violated, a digital output is set which can be used by the PLC for remote alarm indication, locking functions etc.

After a weld which has failed a specification limit, an inspector password is needed to unlock WeldAnalyzer for the next weld.



AnalyzeScreen\_03\_En.tif

Figure 3: Graphic display of a weld with fails every limit. Values out of tolerance are highlighted

Up to 999 sets of specification limits (see figure 2) can be stored and assigned to a specific rail /part type (see figure 4). Selecting a certain rail/part type activates the associated set of limits and via a COM-Port also the associated SWEP 06\*) program is automatically loaded.

\*) SWEP 06 = Schlatter **W**eld **P**rocessor for Flash Butt Welding Processes

Rail Select Menu						
Current Rail: 008-UIC60-R260(8)				Quench:		
Item Number	Rail Type / Part Type	Part Category	PGM # = Limit #	Pressure	Time	Delay
001	Internal		999			
002			999			
003	UIC54-R260	Rail	3			
004	UIC54-R260Mn	Rail	4			
005	UIC54-R350HT	Rail	5	2.5	40	30
006	UIC54-R320Cr	Rail	6			
007			999			
008	UIC60-R260	Rail	8			
009	UIC60-R260Mn	Rail	9			
010	UIC60-R350HT	Rail	10	2	50	35
011	UIC60-R320Cr	Rail	11			
012			999			
013			999			
014	AREA132	Rail	14			
015	AREA132-HT	Rail	15	2.5	60	40
016			999			
017	AREA136	Rail	17			
018	AREA136-HT	Rail	18	2.5	65	40
019			999			
020	Current Calibration	Calibration Rail	20			
021	Force Calibration	Rail	21			
022	Speed/Function Check	Rails with Gap >70mm	22			
023	Travel Calibration	Rails with Gap >70mm	23			
024	SWEP Calibration	Calibration Rail	24			
025	Annealing	Rail	25			
026			999			
990	UIC60-R260 Demo	Rail	990			
991	UIC60-R320Cr Demo	Rail	991			
992	UIC60-R260 Mobile-Demo	Rail	992			

PartWindow\_01\_En.tif

Figure 4: Part/Rail selection list which loads the assigned set of limits and the associated weld program

### 2.2 Aquisition data and user defined additional information

Acquisition data from the welder (welding force, current and travel as a function of time) and automatically generated data like rail/part type and associated program number, weld number, weld date and time, site, machine ID, string loss etc. can be completed with additional user information such as:

- Job identification
- Operator name (predefined drop-down list with 999 predefined names)
- Customer (drop-down list with 999 predefined customers)
- Text information (notes) concerning the current job
- Text information (notes) concerning the current string
- Text information (notes) concerning the current welding
- Rail/part temperature and ambient temperature
- Location, Gang, Activity, Track side, Mile/km Post when in-track welding

All this additional information is entered in the Auto Input Window (see figure 5), where also JobID, weld and string number, rail/part information, program number etc. applied to the next weld is displayed.

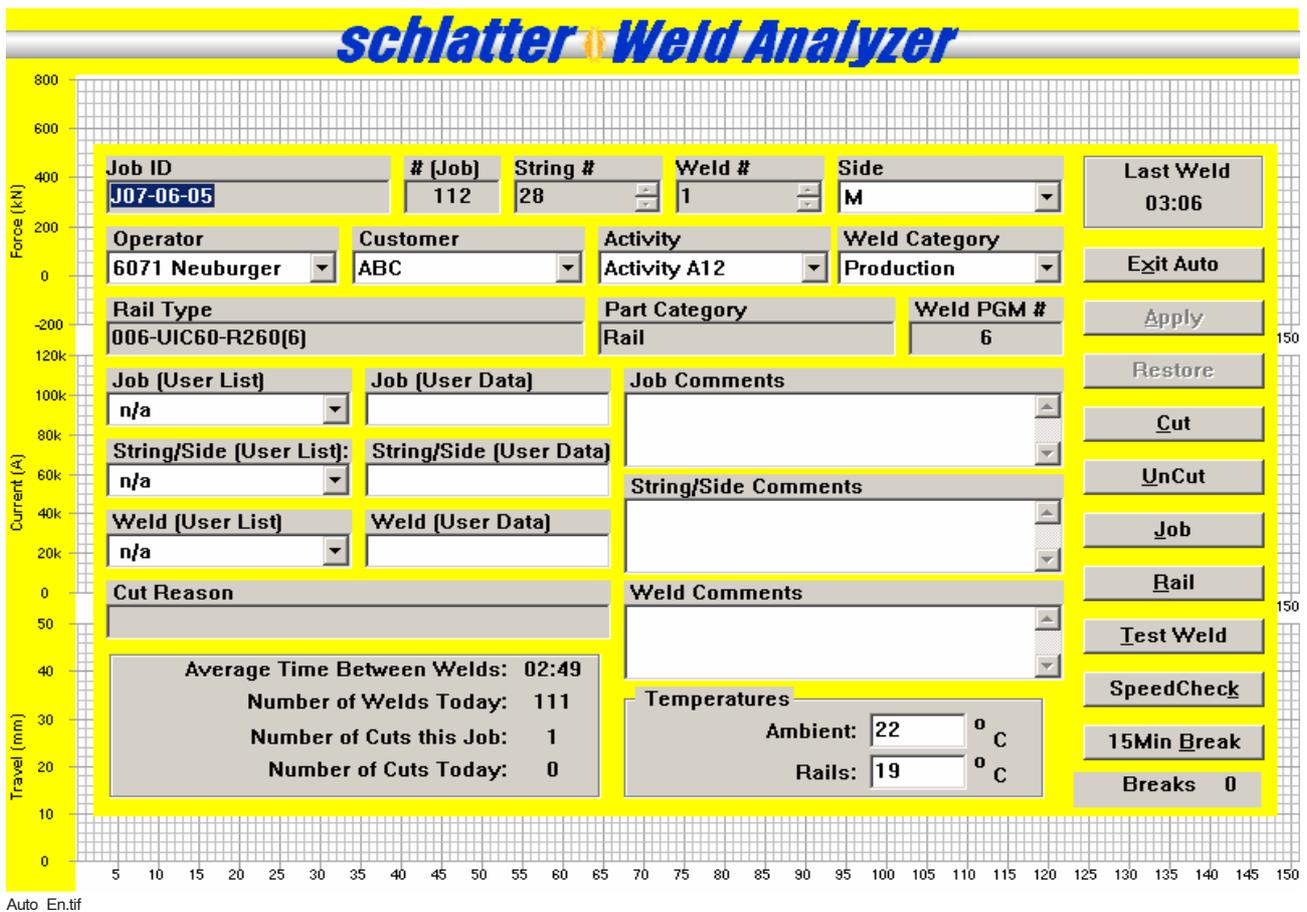


Figure 5: Auto Input Window, displayed when WeldAnalyzer is ready for recording the next Weld

For every single weld, this additional information together with the automatically generated data will be stored as the header of the acquisition data to a file. With an edit function, it is possible to edit this header data, e.g. for adding information about test results or special occurrences concerning this specific weld.

### 2.3 Data storage

Upon completion of the weld, the weld information is compressed and saved into a so-called Weld File to the primary drive. There are two types of data in the weld file: Header data and acquisition data. The acquisition data are the analogue and digital readings from the data acquisition board which were recorded during welding. The header data contains information like welding job, customer, welding date and time, welding site, machine ID, operator name, notes concerning certain jobs, strings or welds.

Also, all the necessary information about the welding machine and the calibration settings are saved to this file to ensure correct reconstruction of the acquisition data independent of a specific welding unit.

To ensure utmost data security, the weld file can be stored to a secondary drive immediately after the weld data has been written to the primary drive. The primary or secondary drive can be internal or external drives or network drives.

The weld file name is unique to each weld and contains Site/Unit name, Customer, a user specified Job-ID, Job number, String number (max. 99'999), Track side, Weld number (max. 99'999), Cut/Reweld information, Location, Rail/Part description and Cut reason.

This file name system provides a quick and easy way to select and recall files of previous welds. Long-time archiving of weld files can be performed with common back up systems to tape, CD-ROM, DVD-ROM, external hard disk, flash memory or MO-disk.

### 2.4 Graphic display of weld information

The graphic display layout (size, scale, colour, screen location, fonts) for the three weld parameters force, current and travel can be user-specifically designed. Different layout settings can be saved and easily recalled, allowing a quick replotting of the graph with a different layout (e.g. quick changing from one channel to three channel display).

For more detailed studies, a sophisticated zoom function is available.

Upon completion of a weld and after the weld is saved, the weld data is analyzed and plotted on the screen, where it will be displayed for a specified time. After this viewing period, the program automatically prepares itself for recording the next weld, allowing a touch free use of the WeldAnalyzer program. After a weld which has failed a specification limit, an inspector password is needed to proceed with the next weld.

### 2.5 Displaying a summary of weld characteristics and header data

All the characteristic values of a weld, together with the weld file header information, specification limits and compliance or non-compliance with these specifications can be displayed in a window (see figure 6). The layout of this window can be user customized.

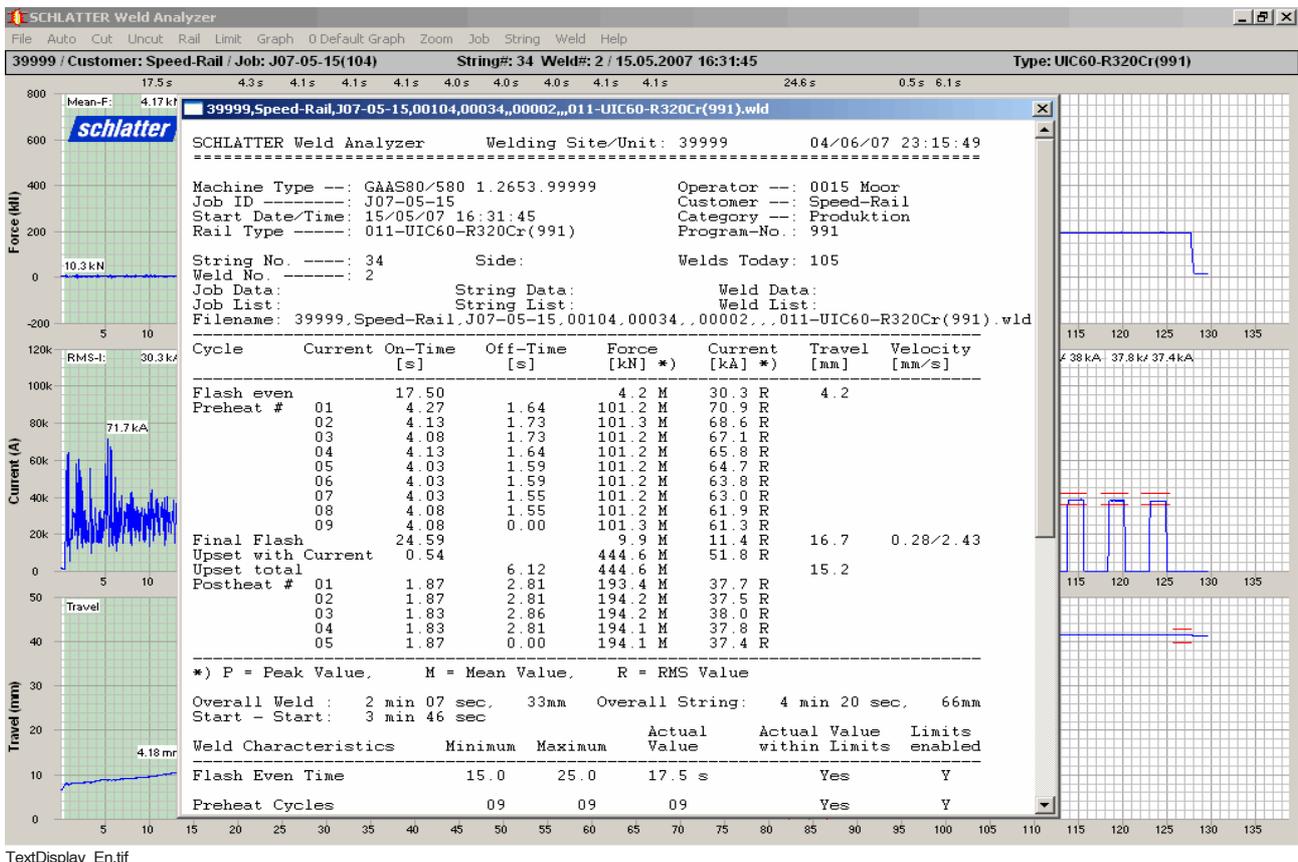


Figure 6: User customized summary of weld characteristics

## 2.6 Printing a summary of weld information

Characteristic values of a weld, together with production information, specification limits and compliance or non-compliance with these specifications can be printed automatically after completion of a weld (see figure 7). Instead of printing a report, it also can be saved into an ASCII-file to the hard disk drive. The layout of this report can be user customized. Printing a report from a previous weld can be performed manually at any time.

```

SCHLATTER Weld Analyzer      Welding Site/Unit: 2962      06/06/07 08:38:54
=====
Machine Type --: GAAS 80/580 AS1.2653.2962      Operator --: 6071 Neuburger
Job ID -----: 04-10-20                        Customer --: HAS
Start Date/Time: 20/10/04 11:43:24             Category --:
Rail Type -----: 990-UIC60-R260 Demo(990)     Program-No.: 990

String No. ----: 1          Side:                Welds Today: 3
Weld No. -----: 3
Job Data:                String Data:            Weld Data:
Job List:                String List:            Weld List:
Filename: 2962,HAS,04-10-20,00003,00001,,00003,,990-UIC60-R260 Demo(990).wld
=====
Cycle      Current On-Time   Off-Time   Force      Current   Travel   Velocity
           [s]         [s]         [kN] *)   [kA] *)   [mm]     [mm/s]
-----
Flash even          19.03                3.5 M     30.7 R     4.0
Preheat # 01      4.21      1.80     101.3 M    71.1 R
           02      4.11      1.90     101.2 M    68.8 R
           03      4.06      1.90     101.3 M    67.4 R
           04      4.16      1.85     101.3 M    66.1 R
           05      4.16      1.85     101.3 M    64.9 R
           06      4.21      1.75     101.4 M    63.7 R
           07      4.26      1.75     101.3 M    62.6 R
           08      4.31      0.00     101.3 M    61.6 R
Final Flash        28.06                9.6 M     11.4 R     17.2   0.23/2.33
Upset with Current 0.59                428.6 M   55.2 R
Upset total                5.99     428.6 M
Postheat #                **** No Post-Heats ****
=====
*) P = Peak Value,      M = Mean Value,      R = RMS Value

Overall Weld :      1 min 46 sec,      33mm      Overall String:      6 min 13 sec,      102mm
Start - Start:      3 min 12 sec

Weld Characteristics      Minimum      Maximum      Actual      Actual Value      Limits
                        Value          Value          Value      within Limits      enabled
-----
Flash Even Time          15.0         25.0         19.0 s      Yes                Y
Preheat Cycles           08           08           08          Yes                Y
Preheat Current # 01     65.0         75.0 kA      see above   Yes                Y
Preheat Current # 08     58.0         65.0 kA      see above   Yes                Y
Preheat Current On-Time  4.0          4.8 s        see above   Yes                Y
Preheat Current Off-Time 1.0          2.0 s        see above   Yes                Y
Final Flash Time         20.0         30.0         28.1 s      Yes                Y
Final Flash Interrupt    5.0          ----         ---- kA      Yes                Y
Final Flash Stick       ----         35.0         ---- kA      Yes                Y
Final Flash Travel Slip -1.0         1.0          ---- mm/s    Yes                Y
Final Flash Begin Vel   0.2          0.4          0.2 mm/s    Yes                Y
Final Flash End Vel     2.0          3.0          2.3 mm/s    Yes                Y
Upset Start Vel         50.0         90.0         80.6 mm/s    Yes                Y
Upset Current           50.0         60.0         56.5 kA      Yes                Y
Upset Force             380.0        450.0        433.7 kN     Yes                Y
Upset Force Drop        ----         50.0         0.2 kN       Yes                Y
Upset Travel            13.5         16.5         15.1 mm      Yes                Y
Upset Travel Drop       ----         0.5          0.0 mm       Yes                Y
Upset Current Time      0.5          1.0          0.6 s        Yes                Y
Upset Hold Time         4.0          7.0          6.0 s        Yes                Y
Postheat Cycles         00           00           00          Yes                Y
Postheat Current # 01   36.0         42.0 kA      see above   Yes                Y
Postheat Current # 05   36.0         42.0 kA      see above   Yes                Y
Total Travel
from Start Upset        13.5         16.5         15.3 mm      Yes                Y
=====
All Values within Specification Limits (29/05/07 12:18:05)      Yes
=====
Filename: 2962,HAS,04-10-20,00003,00001,,00003,,990-UIC60-R260 Demo(990).wld
    
```

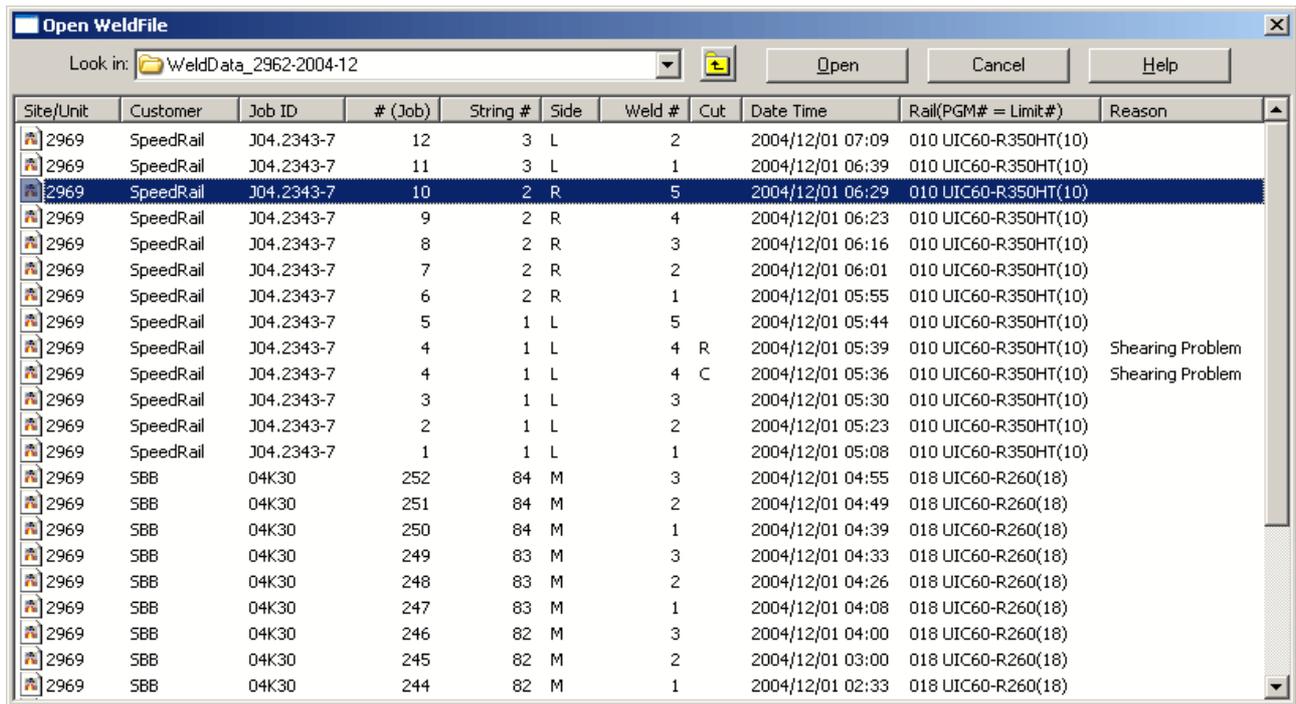
Figure 7: Printed report with characteristic values of a weld, together with additional header information and Minimum - Maximum Limits

Also the complete graph of a weld can be automatically or manually printed or saved as a BMP, PNG, TIF or PDF file.

### 2.7 Recalling and displaying previous welds

Files of previous welds are displayed in a selection list. Each line in the list represents a weld file that is located in the specified directory and shows the Site/Unit name, Customer, a user specified Job-ID, String number or Track side, Weld number, Cut/Reweld information, Location, Rail/Part description and Weld program number, Cut reason and weld date and time (see figure 8). Using the UP/DOWN keys and pressing ENTER or double-clicking to a line selects and displays the desired weld file.

Weld files can be sorted ascending or descending by any column just by clicking on the column header bar, enabling the user to quickly find a specific weld out of a large number of weld files.



Site/Unit	Customer	Job ID	# (Job)	String #	Side	Weld #	Cut	Date Time	Rail(PGM# = Limit#)	Reason
2969	SpeedRail	J04.2343-7	12	3	L	2		2004/12/01 07:09	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	11	3	L	1		2004/12/01 06:39	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	10	2	R	5		2004/12/01 06:29	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	9	2	R	4		2004/12/01 06:23	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	8	2	R	3		2004/12/01 06:16	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	7	2	R	2		2004/12/01 06:01	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	6	2	R	1		2004/12/01 05:55	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	5	1	L	5		2004/12/01 05:44	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	4	1	L	4	R	2004/12/01 05:39	010 UIC60-R350HT(10)	Shearing Problem
2969	SpeedRail	J04.2343-7	4	1	L	4	C	2004/12/01 05:36	010 UIC60-R350HT(10)	Shearing Problem
2969	SpeedRail	J04.2343-7	3	1	L	3		2004/12/01 05:30	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	2	1	L	2		2004/12/01 05:23	010 UIC60-R350HT(10)	
2969	SpeedRail	J04.2343-7	1	1	L	1		2004/12/01 05:08	010 UIC60-R350HT(10)	
2969	SBB	04K30	252	84	M	3		2004/12/01 04:55	018 UIC60-R260(18)	
2969	SBB	04K30	251	84	M	2		2004/12/01 04:49	018 UIC60-R260(18)	
2969	SBB	04K30	250	84	M	1		2004/12/01 04:39	018 UIC60-R260(18)	
2969	SBB	04K30	249	83	M	3		2004/12/01 04:33	018 UIC60-R260(18)	
2969	SBB	04K30	248	83	M	2		2004/12/01 04:26	018 UIC60-R260(18)	
2969	SBB	04K30	247	83	M	1		2004/12/01 04:08	018 UIC60-R260(18)	
2969	SBB	04K30	246	82	M	3		2004/12/01 04:00	018 UIC60-R260(18)	
2969	SBB	04K30	245	82	M	2		2004/12/01 03:00	018 UIC60-R260(18)	
2969	SBB	04K30	244	82	M	1		2004/12/01 02:33	018 UIC60-R260(18)	

OpenWeldFile\_Eng.tif

Figure 8: List of previous welds

### 2.8 Cut-out of a weld and Reweld

If a weld is found to be unacceptable and requires a cut-out and a reweld, this weld file can be recalled, marked as a **Cut** and a reason for this cut-out can be assigned to this weld file. All the settings from the weld file to be cut are pulled and used as the present weld settings. The next weld will be marked as a **Reweld** and will contain all the information from the cut weld, especially the same weld and string number as the cut weld. After the reweld is complete, the settings may resume as before the cut-out.

### 2.9 Cumulative rail loss

For each weld, the total travel is measured and automatically cumulated for the actual string or side. Changing the string number will set the cumulative rail loss total to zero. For special occurrences, e.g. cutting a weld, the cumulated rail loss can be manually corrected.

### 2.10 Operating the WeldAnalyzer program

The program is operated with common MS-WINDOWS technique with a keyboard and/or a pointing device (mouse, track ball, etc.). Important and often used commands can be launched with a single key stroke (hot key), for example:

- A** = Automatic mode (**A**cquisition mode)
- L** = Viewing and editing specification **L**imits (see figure 2)
- G** = Viewing and editing **G**raphic layout settings
- D** = Text **D**isplay of weld characteristics (see figure 6)
- O** = **O**pen (recall) of previous welds (see figure 8)
- P / R** = Select **P**art / **R**ail type (see figure 4)
- PageUp** = Display previous weld
- PageDown** = Display next weld
- etc.

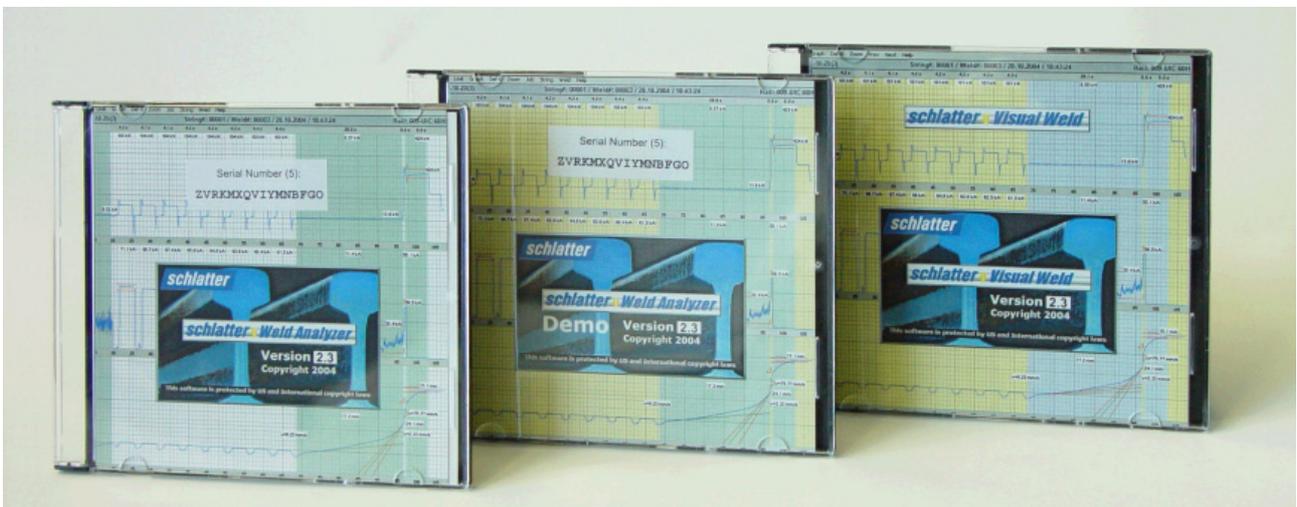
## 2.11 Data export to spread sheet or data base programs

Large numbers of selected weld files from a directory or all weld files from a number of selected directories can be automatically analyzed. User specified, characteristic values of these welds, production information, specification limits and compliance or non-compliance with these specifications are analyzed and extracted from the weld file and saved into a CSV file which can be processed with common spread sheet programs or data base programs. This way almost every statistic evaluations can be effected and production data from a large number of welds can be generated.

## 2.12 Display and analysis of weld data on any personal computer

With the additional **VisualWeld** software, weld files can be displayed and analyzed on any personal computer. Just double clicking on a weld file (file name extension is .WLD) opens and displays the weld in the same way as the user knows from **Schlatter WeldAnalyzer** program. Also the above mentioned printing and export functions are available in this additional software.

## 3. The Schlatter WeldAnalyzer System



Soft\_Weldanalyzer.jpg

Figure 9: The complete software package

The Schlatter WeldAnalyzer System consists of the following software components:

**Schlatter WeldAnalyzer** for data acquisition and analysis at the flash but welder

**Schlatter WeldAnalyzer Demo** for evaluation and training

**Schlatter VisualWeld** for viewing, analysing and printing recorded weld data at the office

## 4. Improvements compared to WeldMonitor V4.0

1. WeldAnalyzer (WA) operates with a worldwide available 16 Bit resolution PCI Data Acquisition Board from National Instruments (NI).
2. The Data Acquisition Board does not have jumpers, DIP-switches or potentiometers to be set. There are no files with calibration data necessary. The board can be replaced without any settings.
3. WeldAnalyzer runs in Windows 2000 and Windows XP environment. Compatibility with Windows NT is not tested. WA is not compatible with Windows 3.1/3.11/95/98/ME.
4. Names of Weldfiles can be as long as 255 characters (Windows standard long filenames). WeldMonitor had an 8.3 filename system.  
It has to be considered that, depending on the CD-Format, only filenames with a maximum of 64 characters (including dot and extension) are allowed when copying files to CD. Longer filenames will be truncated.
5. The long filenames do not contain coded data which needs an INI-file to get the correct information from the filename. Therefore, WeldFiles can be copied, moved and mailed without losing information. In the old 8.3 filename system of WeldMonitor, weld unit, customer, string number, weld number and cut/reweld information was coded information.
6. The filename extension is always .WLD, double-clicking on a .WLD-File opens VisualWeld programm and displays the WeldFile.
7. The maximum number of welds in a string or a job can be as much as 99'999; WeldMonitor was limited to 770 resp. 16'340 welds.
8. The maximum number of strings in a job can be as much as 99'999; WeldMonitor was limited to 3'033 strings.
9. Weld Analyzer can handle up to 999 sets of limits (sets of weld specifications) and 999 weld programs. WeldMonitor was limited to 255 sets.
10. Weld data on the Primary- and Secondary-Drive are kept consistent. When editing Weldfile header data, changes are saved to Primary- and Secondary-Drive.
11. WeldAnalyzer is able to periodically backup his own setup data and the weld specifications (limit files) to two different drives/directories.
12. WeldAnalyzer can be configured for fixed plant rail welders, mobile rail welders and for flash but welders welding other parts than rails. When not welding rails, text in menus and windows changes from 'Rail' to 'Part'.
13. WeldAnalyzer is able to apply the following additional weld specifications:
  - Preheat minimum/maximum current of all or a selectable range of cycles
  - Postheat minimum/maximum current of all or a selectable range of cycles
  - Preheat minimum/maximum current on time
  - Preheat minimum/maximum current off time
  - Total travel at the end of weld, starting from *Travel Zero*, *Start of Weld*, *Start of Flash Even* or *Start of Upset*.

14. WeldAnalyzer is able to handle welds with up to 999 preheat impulses and 999 postheat impulses. (WeldMonitor was limited to 15 impulses).
15. The setting whether monitoring a certain minimum/maximum limit is enabled or disabled can now be made independently for every set of limits, with WeldMonitor, this was a global setting for all sets of limits.
16. The reference (zero line) for monitoring upset force can now be set to 'Absolute 0 kN' or 'Mean value of force during last x mm of final flashing'. → Mobile rail welding, compensation of frictional forces.
17. The settings for the layout, scale, colour, fonts and size of the graphic display of Weldfiles is can now be done very easily in common Windows technique.
18. The time axis for the graphic display of Weldfiles can be set to a fixed value. Therefore, variations in time of different welds are displayed more obvious. Printed Weldfiles can easily be compared when lying one on top of the other.
19. All setup parameters and the analogue signal calibration procedures are password protected.
20. In WeldAnalyzer, an additional 'Weld Inspector' password can be enabled. After an 'Out of Tolerance Weld', doing the next weld has to be approved by entering this 'Weld Inspector' password.
21. WeldAnalyzer has a completely new Auto Screen (the screen which is displayed when WA is ready for recording the next weld) with a so called Auto Screen Input Window. Before the weld begins, all the information and settings for the next weld is displayed and can be changed in this Auto Screen Input Window.
22. The digital output signals 'WA is ready' and 'Last weld is out of limits' can be configured as 'Active High' or 'Active Low', to have a wire breakage proof system.
23. With the built in 'WeldExplorer' and the 'Open Weld' command, Weldfiles can be sorted ascending and descending by machine number, customer, job ID, string number, weld number, date and time, rail/part type and cut reason.
24. With the built in 'WeldExplorer', Weldfiles can be copied/cut/pasted and deleted (with password only) This copy/cut/paste/delete-functionality can only be applied to Weldfiles; other files on the computer can not be copied/cut/pasted and deleted with this tool.
25. WeldAnalyzer has a programmable SpreadSheetExport-Tool. Data from selected Weldfiles or from all Weldfiles located in one ore more selected directories including subdirectories can be extracted and saved into a CSV-File. CSV-Files can be opened with Spread Sheet and Data Base programs, for example MS-EXCEL or MS-ACCESS, where further data analysis can be performed.
26. Welds that have failed one or more specification limits are listed in an Error Log file. The Log entry can be user customized. The Error Log file can be opened processed with Spread Sheet and Data Base programs, for example MS-EXCEL or MS-ACCESS.
27. WeldAnalyzer is able to convert old WeldMonitor files into WeldAnalyzer files and saving them with long filenames. After conversion, the files can be displayed and analyzed with all the available capabilities of WA or VisualWeld program.
28. WeldAnalyzer has a single command to quickly exit WA, shut down Windows and power of the computer.





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the secure connection