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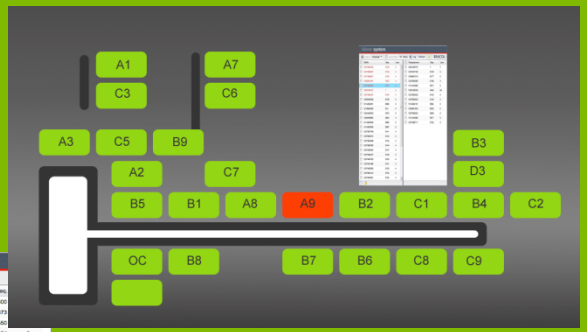
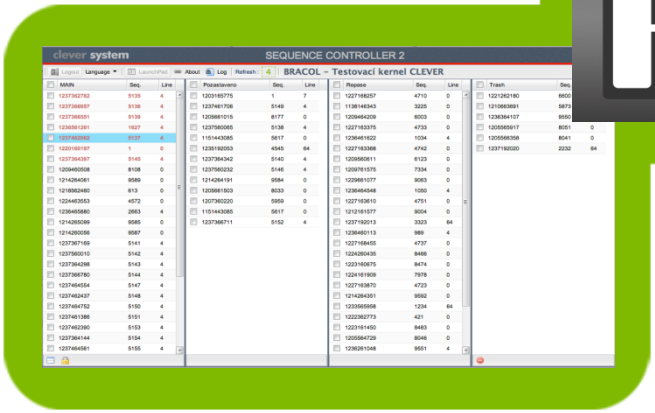
Clever System for Production Line Control





General description of Clever System

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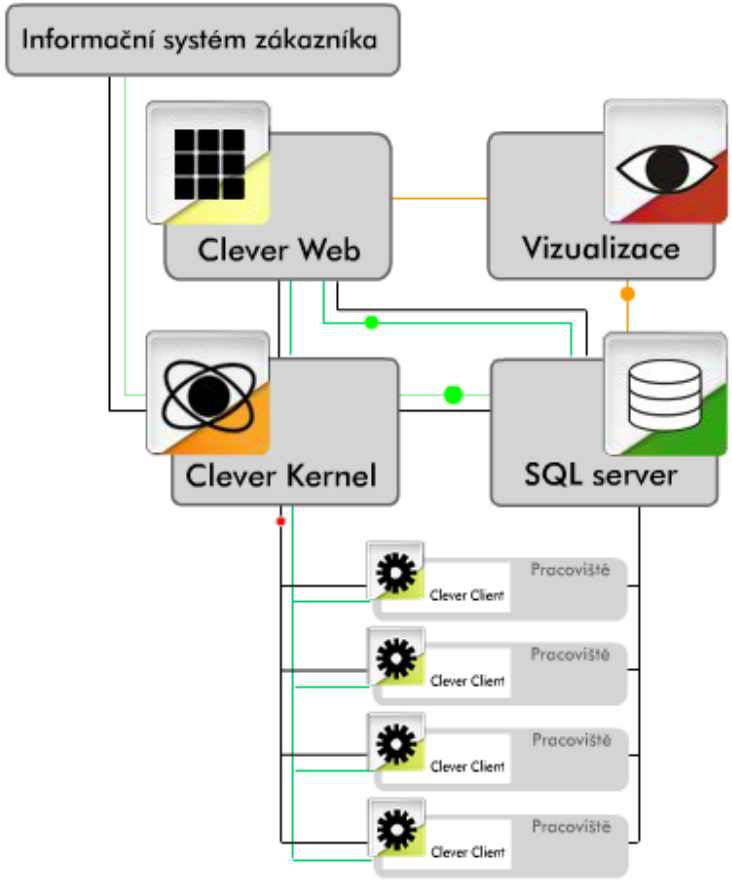
General description of Clever System

- Possibilities of Clever System
- Main functions of Clever System
- Clever System workstation Client
- Dedicated rework station
- Clever System control Kernel
- SQL server and database
- Data archiving
- Clever System WWW interface
- Configuration of the system



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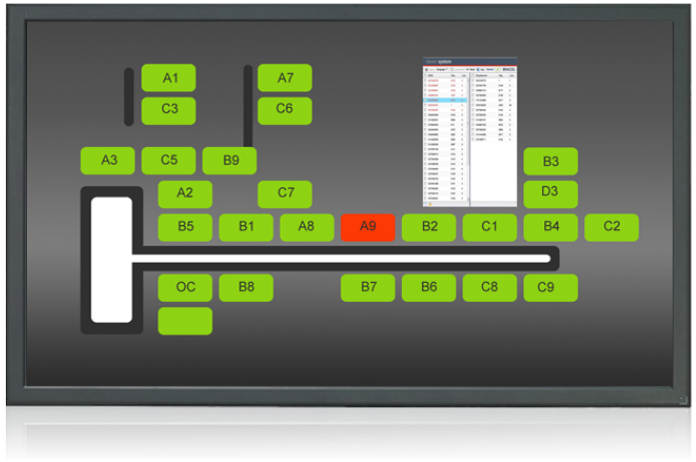
The brief description of Clever System

1. The software system Clever System is designed for a control of industrial production lines according to JITdata from a manufacturer.

2. The system controls a sequence of products on an assembly line, defines technological data for work positions and checks technological operations during the assembly.

3. The whole system is composed by specialised software modules. These modules are running on PCs on a LAN network. All technological data are processed in accordance to ISO 9000.



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3 main functions

Control function

Data are sent to modules on each work position and these modules control an assembly.

Checking function

All supervised operations on each product are checked in real time during an assembly.

Documentation function

Data are stored into an SQL database and then can be archived onto non-rewritable media (e.g. CD-R discs). A www search engine for finding the data is available.

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Possibilities of the CLEVER System

- Receiving of the product configuration data from a customer or PPS
- Distribution of the production data to workstations at assembly lines
- Checking of the product sequence at the assembly line in real time
- Different systems of product identification (bar code, holder ID, RFID, MODAS,…)
- Line conveyor control, decision points (forks), merge points
- Check of assembled parts in real time, pick-to-light and delivery points control
- Registration of serial numbers of assembled parts
- Collecting of technological data (tightening, pressing,…) and its check
- Control of technological devices (tightening machines, stock systems, camera systems…)
- Input signals processing (end switches,…)
- Complete check on each work position in real time (check if all operations were done OK)
- Data import from external systems (e-checks, safety coding,…)
- Output check for each product at the end of an assembly line and at internal check points
- Pre-assembly workstations
- Printing of product labels, build-sheets and output protocols
- Dedicated rework station
- Backward finding of the technological data, SQL data queries, export to html or csv format
- Overviews of product amounts in time periods, possibility to filter a configuration of products
- Data archiving according to ISO 9000
- Web modules for a data searching, a production check, a control of the whole system

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Language possibilities

Clever System is from its nature multilingual and is ready to run in the following languages:

- English (include the web interface)
- German (include the web interface)
- Spanish
- French
- Dutch
- Czech (include the web interface)
- Romanian
- Chinese
- Turkish

There is no problem to add any other dictionary

Our on-line support and hot line is available in English and Czech

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The workstation Client

Each workstation at a production line is equipped with the Clever Workstation Client module. All operations are authorized by an operator and stored into an SQL database with its timestamp. The following features are available and configurable:

- **Sequence check**
- **Previous workstations check**
- **Part check**
  Assembled parts are checked by its bar codes and it is possible to store serial numbers of that parts as well.
- **Poka-yoke check** (unique part check) is a special type of the part check (cabling systems,…)
- **Tightening data check and a tightening machines control**
  It is possible to collect tightening data from following machines: Atlas Copco, Georges Renault (Chicago Pneumatics), Clecon and Bosch Rexroth. Values of torque, angle and rundown angle are checked and stored. It is possible to control tightening unit – choosing tightening programs for various screws, machine blocking, reverse run control.
- **Serial numbers evidence** include a duplicity prevention and cross-station verification
- **Measurement in real time** – press sensors,…
- **Input signals** (end switches, position sensors,…)
- **Part codes storing**
  For example security codes of radios (separated secure database with a password-protected access)
- **Visual Check** – visual confirmation with an operator sign
- **Rack Part Check (Pick to light)** – part check for parts without a suitable identification (barcode). Different systems as light sensors or buttons can be used.
- **Camera inspection** – automated visual check and measurement

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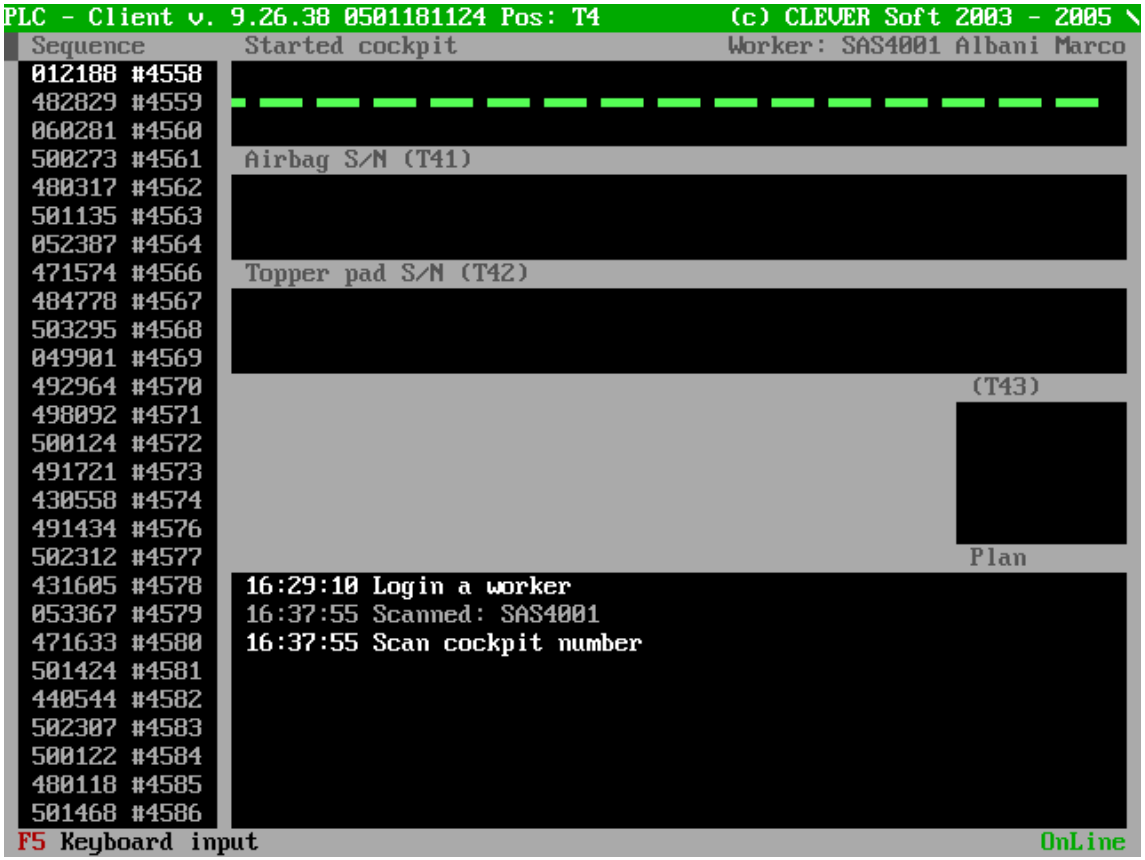
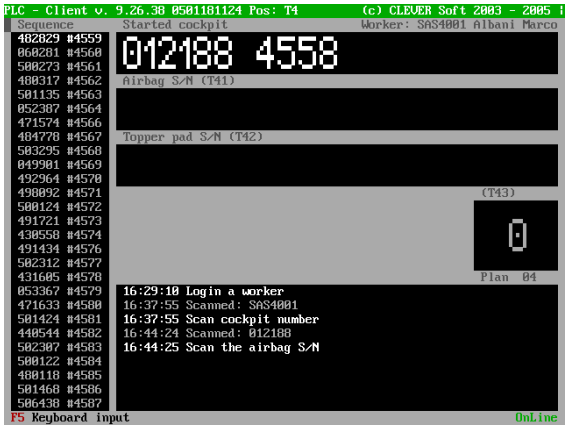
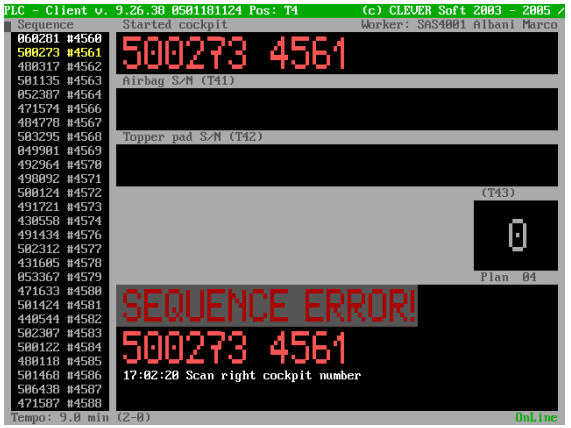
Sequence check

Correct sequence of a production
Prevents from a product skipping







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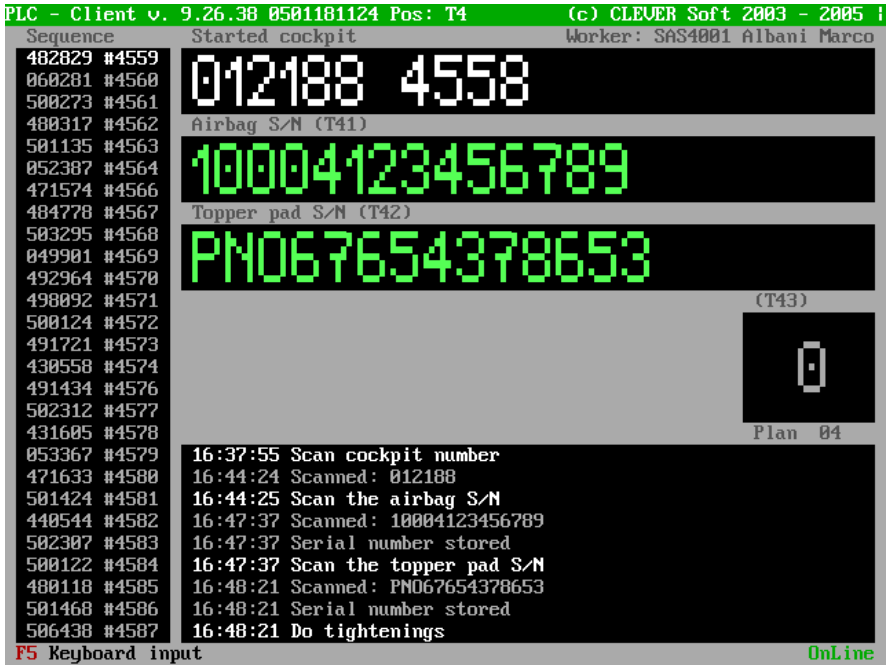
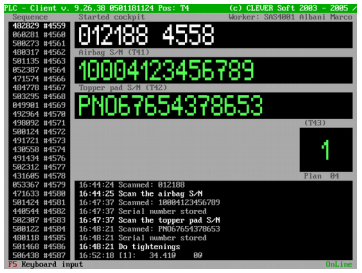
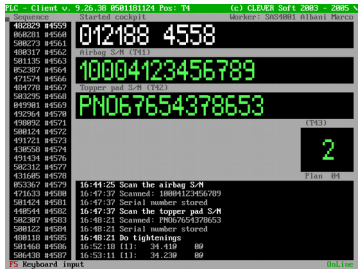
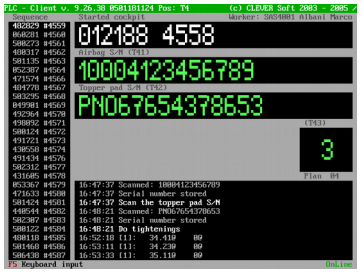
Tightening

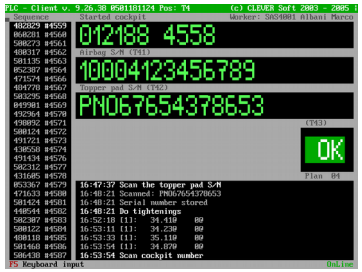
Stored values: torque, angle and rundown angle

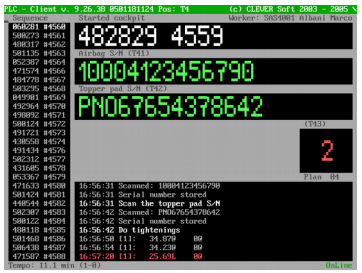


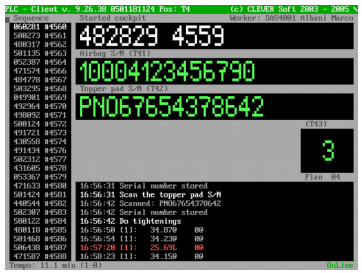












Possible tightening machines:
Atlas Copco Power Focus 2000, 3000, 4000, DS, DL
CP (Georges Renault) 5200, Cvi, CviS
Clecon-E
Bosch Rexroth TS 300, ExaConnect

Part check

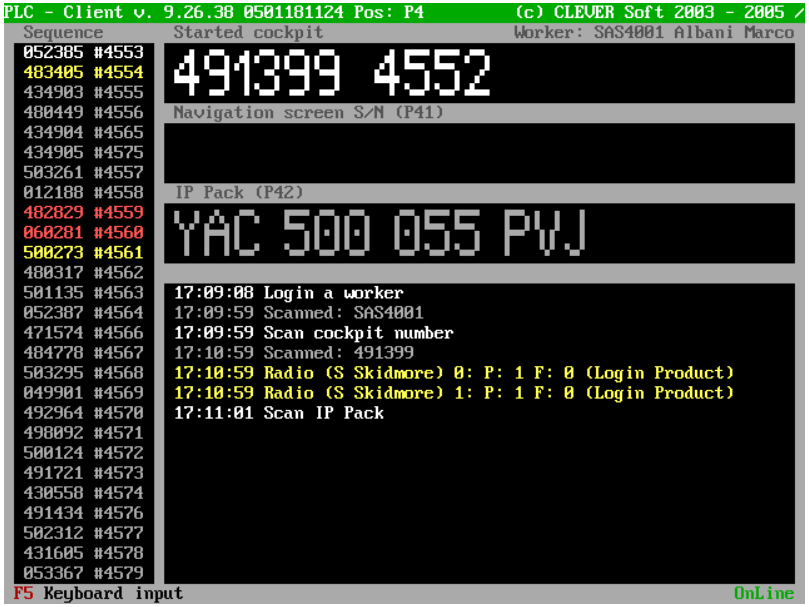
The part check data depends on:

Incoming data of a product (list of assembled parts) obtained from pps system

PartDistribution table – a conversion table between part numbers and bar codes.

The requested part type is displayed on a screen after a reading of a product ID, then the bar code of a part is scanned and compared with the requested one.

Part check


PLC - Client v. 9.26.38 0501181124 Pos: P4
(c) CLEVER Soft 2003 - 2005
Sequence
Started cockpit
Worker: SAS4001 Albani Marco
052385 #4553
483405 #4554
434903 #4555
480449 #4556
434904 #4565
434905 #4575
503261 #4557
012188 #4558
482829 #4559
060281 #4560
500273 #4561
480317 #4562
501135 #4563
052387 #4564
471574 #4566
484778 #4567
503295 #4568
049901 #4569
492964 #4570
498092 #4571
500124 #4572
491721 #4573
430558 #4574
491434 #4576
502312 #4577
431605 #4578
053367 #4579
491399 4552
Navigation screen S/N (P41)
IP Pack (P42)
YAC 500 055 PVJ
17:09:08 Login a worker
17:09:59 Scanned: SAS4001
17:09:59 Scan cockpit number
17:10:59 Scanned: 491399
17:10:59 Radio (S Skidmore) 0: P: 1 F: 0 (Login Product)
17:10:59 Radio (S Skidmore) 1: P: 1 F: 0 (Login Product)
17:11:01 Scan IP Pack
F5 Keyboard input
OnLine


PLC - Client v. 9.26.38 0501181124 Pos: P4
(c) CLEVER Soft 2003 - 2005
Sequence
Started cockpit
Worker: SAS4001 Albani Marco
483405 #4554
434903 #4555
480449 #4556
434904 #4565
434905 #4575
503261 #4557
012188 #4558
482829 #4559
060281 #4560
500273 #4561
480317 #4562
501135 #4563
052387 #4564
471574 #4566
484778 #4567
503295 #4568
049901 #4569
492964 #4570
498092 #4571
500124 #4572
491721 #4573
430558 #4574
491434 #4576
502312 #4577
431605 #4578
053367 #4579
471633 #4580
052385 4553
Navigation screen S/N (P41)
IP Pack (P42)
YAC 500 045 PVJ
INVALID PART
YAC 500 442 PVJ
17:18:18 Scan IP Pack
Tempo: 6.5 min (1-0)
OnLine

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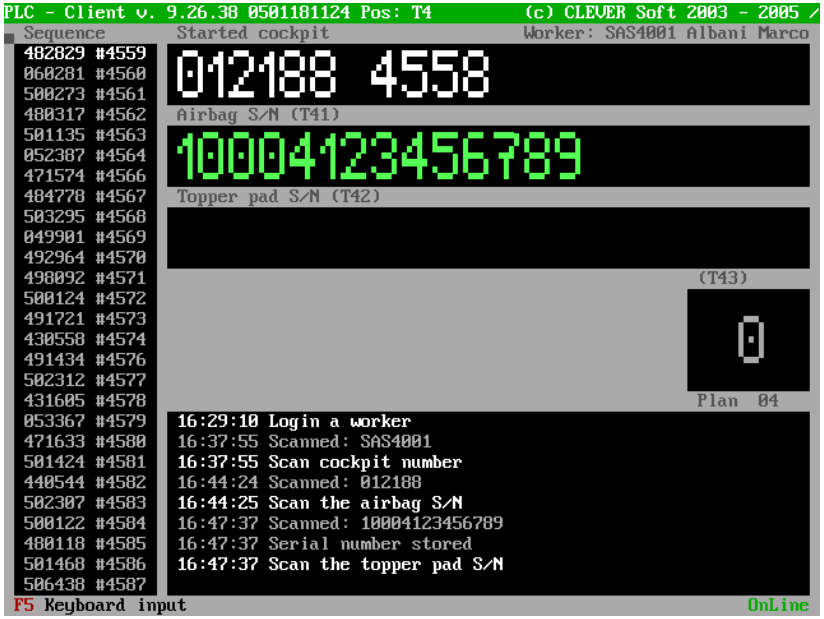
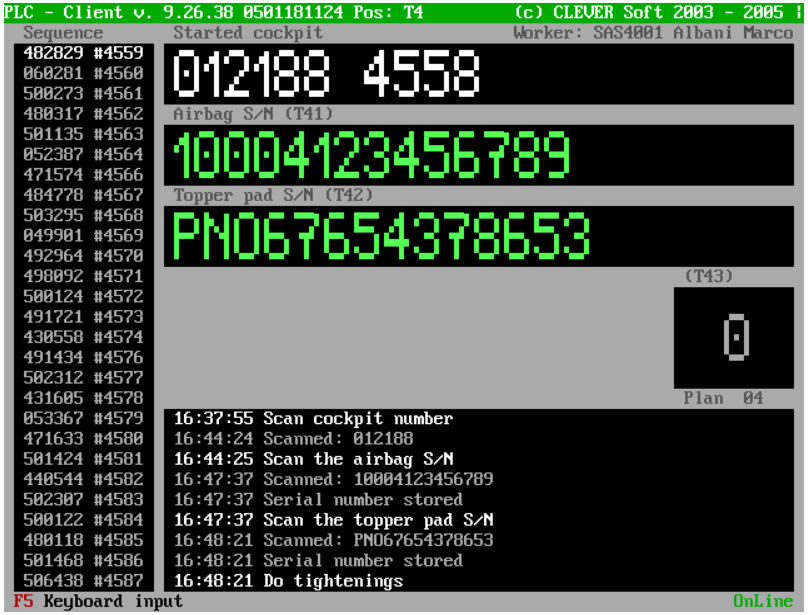
Serial number registration





CLEVER System can automatically validate the scanned bar code and eliminate not authorized bar codes.

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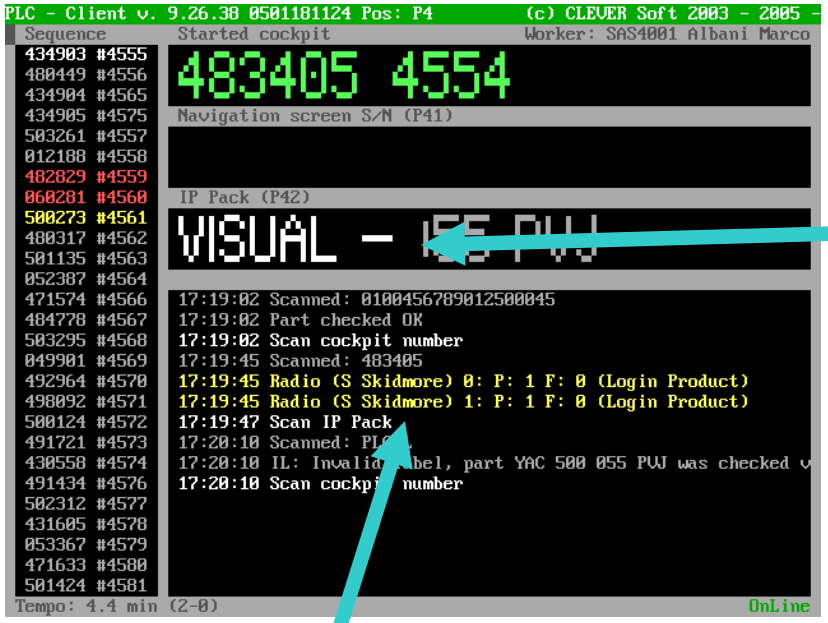
Non standard situations



Yellow messages: missing operations on previous workstations. Internal self check with operators

CLEVER System – Invalid label

This code skips the serial number

Usage:
When label with a serial number is destroyed or unreadable.

Workstation client control is done by a set of control bar codes.
Each responsible person can have different bar codes with his ID inside the code. A keyboard is not used on most of client stations.

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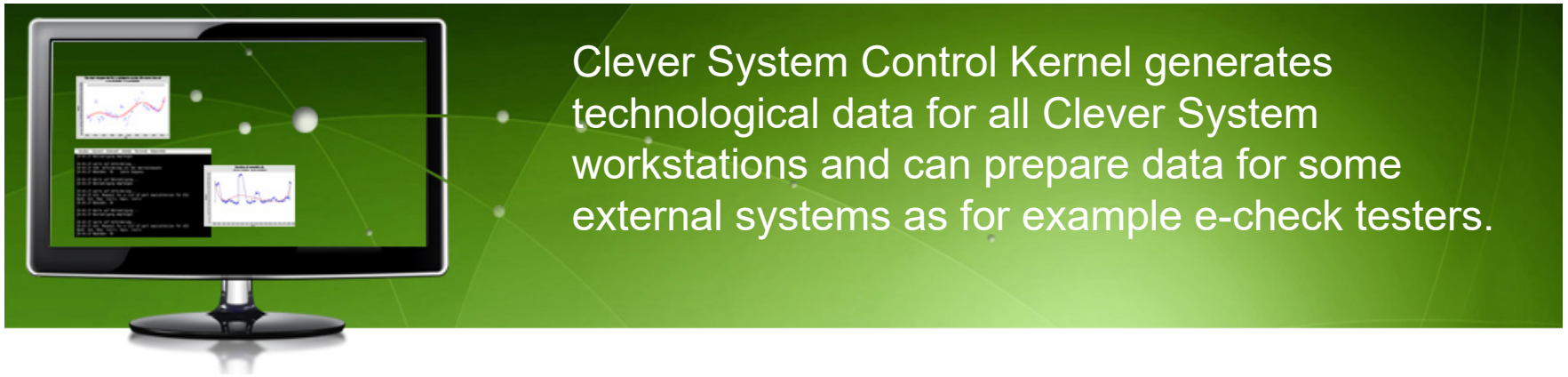
Clever System Control Kernel

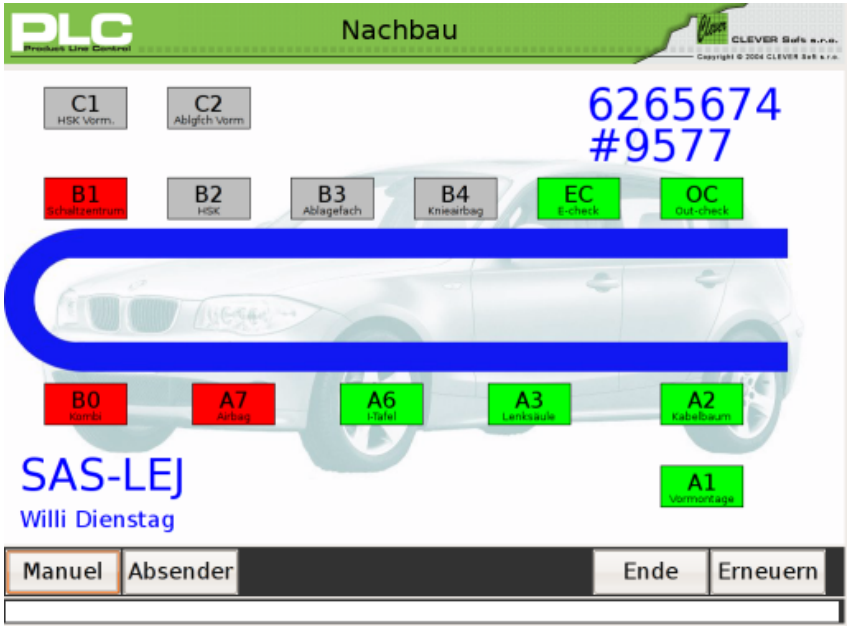
Clever System Control Kernel enables the communication with other Clever System modules at an assembly line and provides an access to a technological and status database.

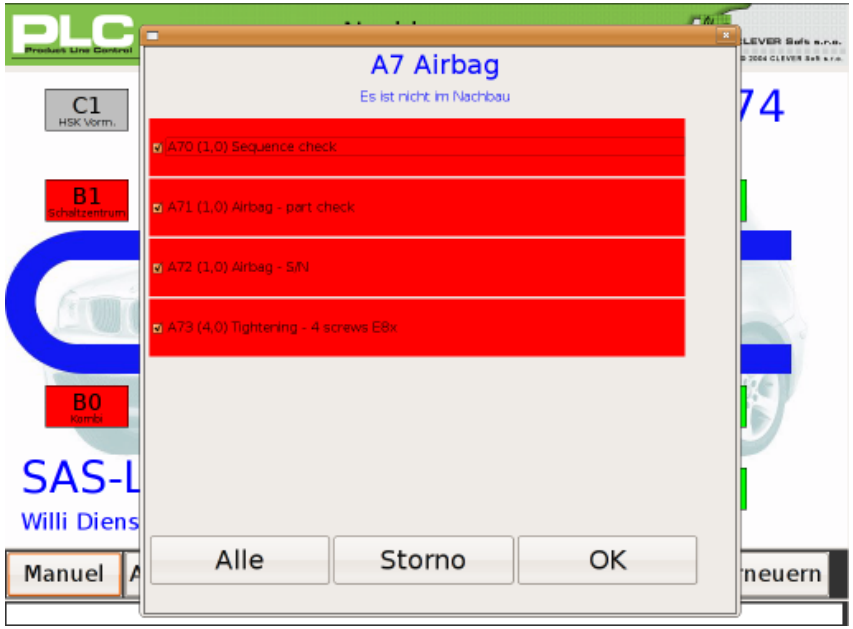


Clever System Control Kernel generates technological data for all Clever System workstations and can prepare data for some external systems as for example e-check testers.

This module is not necessary on some small production lines, where client workstations can work standalone.

Dedicated rework station





A dedicated rework station can substitute any workstation at the assembly line. There is displayed the layout of an assembly line with workstations depending on each reworked product. Any of workstation operation can be selected for a rework procedure.

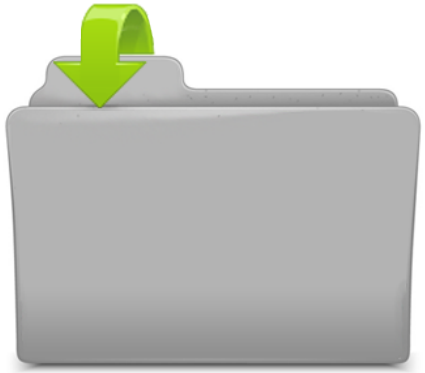
SQL Server

All technological data are safety stored into SQL database where it is easy to search and archive the data.

MySQL SQL server is used. Data are stored in one database with several tables. The specifications of cockpits and assembly times (data receiving time, start of an assembly) are stored in configuration table (SQLProductCfgTable).

Records of each technological operation at each assembly position is stored into the operation table (SQLProductTable).

Data archiving



All technological data are automatically archived from SQL database into *.paf files (Plc Archive File) by a software module plc_arch.
These text files are copied to a customer file server and then it is possible to record them to non-rewritable discs (CD-R discs).

Text files *.paf are possible to use for data import into another external systems, data statistics, central database, etc.

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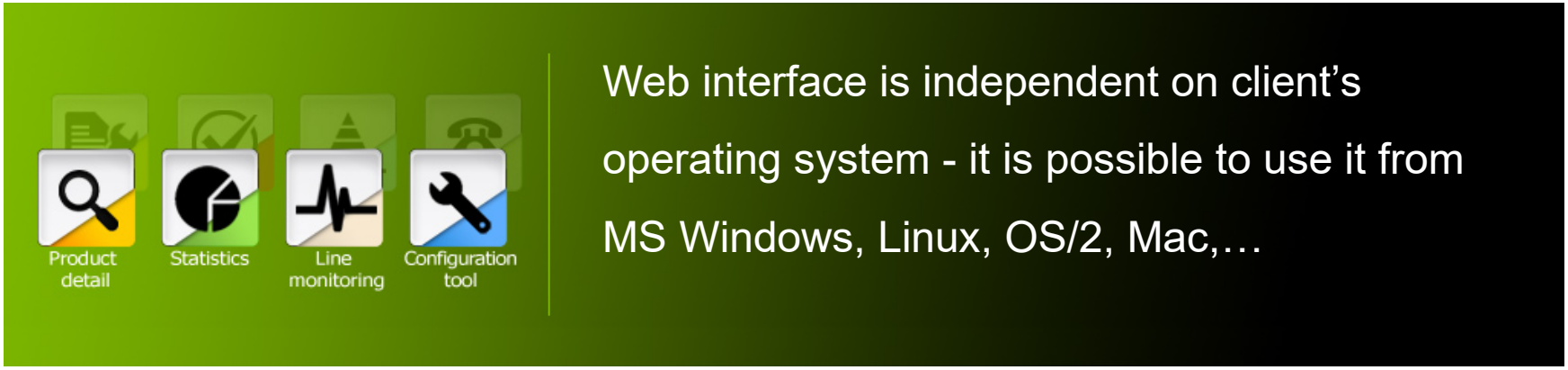
Clever System - Web interface

The data stored in an SQL database are accessible via Web interface. This interface enables searching for the technological data of products, overview of products in a time period, overview of assembled parts by their serial numbers and much other.



Full user management system is available. It provides detailed system of access rights and privileges for all users of Clever System web applications.

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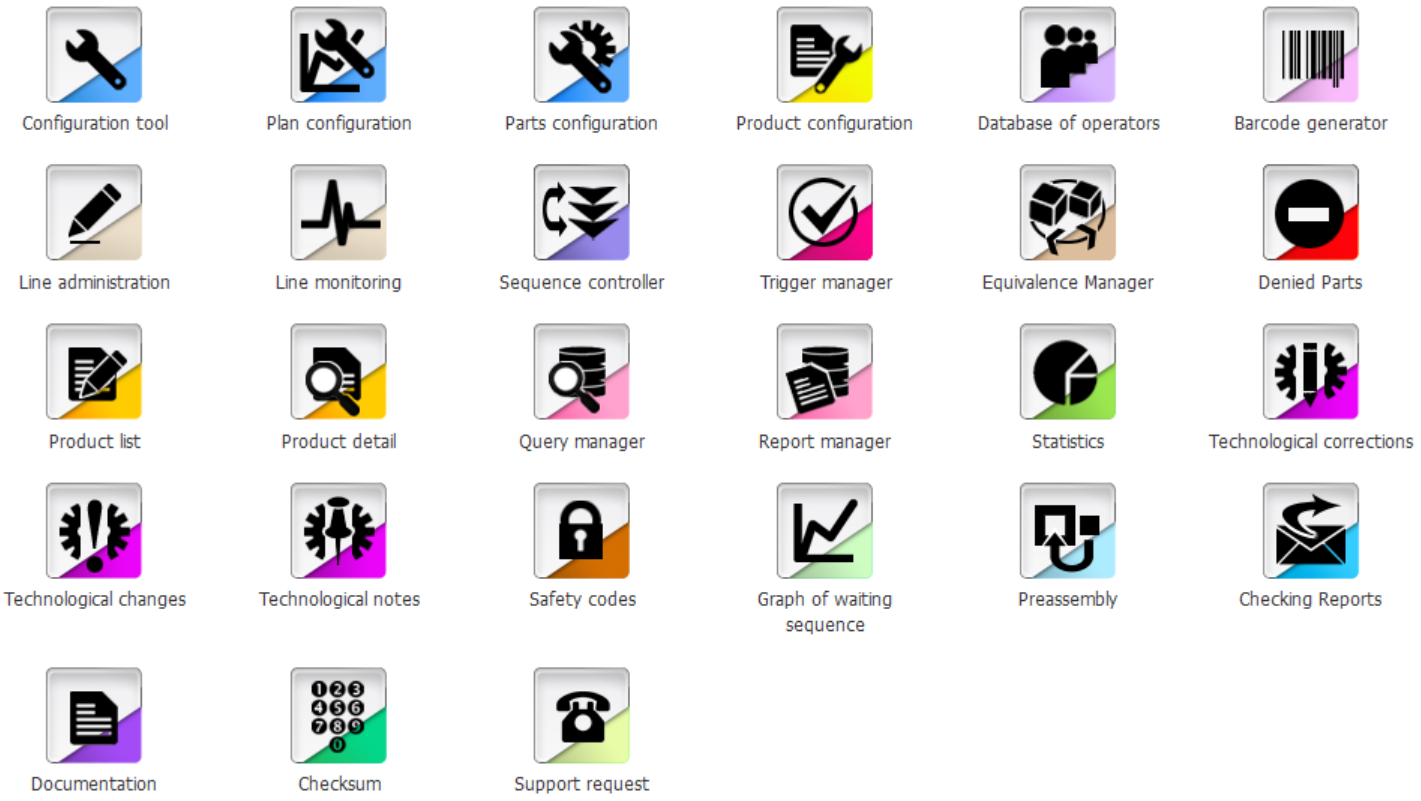
Clever System Web interface (cont.)

CLEVER System Web interface is a modular system. It contains modules as the following:



Clever System Web interface (cont.)

System configuration

- Configuration tool - Configuration of a whole systém
- Plan configuration - Configuration of planned operations
- Parts configuration - Configuration of assembled parts
- Product configuration
- Database of operators - Database of operators and their access to workstations
- Barcode generator - Creating of control barcodes for workstations

Clever System Web interface (cont.)

System CONTROL

- Line administration
- Line monitoring
- Sequence controller - Manager of an assembly sequence
- Trigger manager
- Equivalence Manager - Enables an usage of equivalent parts during an assembly
- Denied Parts - Manager for denied parts

Clever System Web interface (cont.)

SQL data treatement

- Product list - Overview of assembled products
- Product detail - Details of product assembly
- SQL Query manager - Searching and viewing of SQL data
- Report manager - Access to SQL reports
- Production statistics – Andon systems
- Technological corrections - Records of technological corrections

Clever System Web interface (cont.)

SQL data treatement

- Technological changes - Documentation of technological changes
- Technological notes - Technological notes
- Safety codes
- Graph of waiting sequence - Graph and statistics of waiting sequence, other time analysis
- Preassembly
- Checking Reports - Manager for a control of sending of checking reports

Clever System Web interface (cont.)

Other modules

- Documentation
- Check sum - Checksum calculation
- Support request

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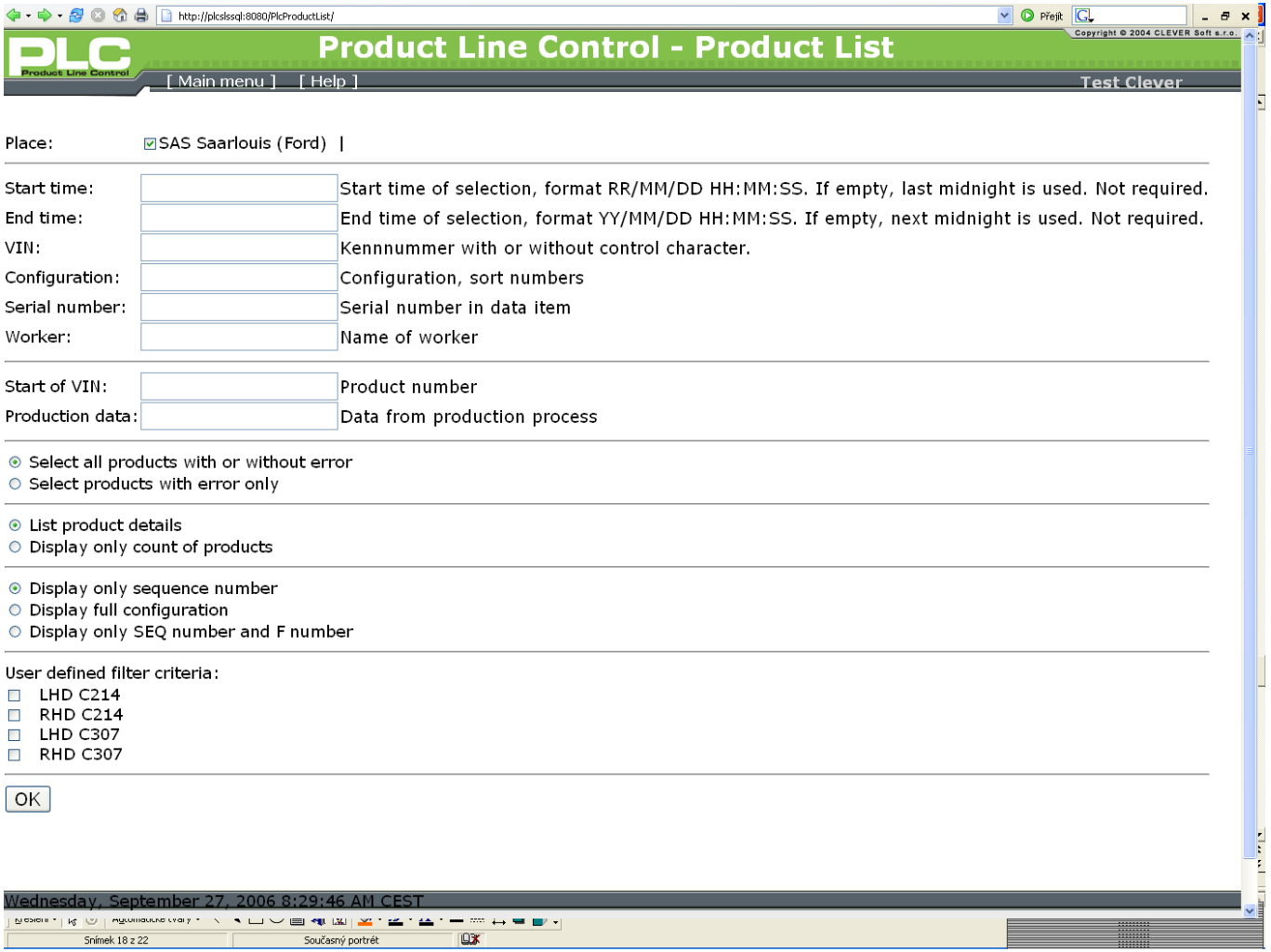
Web interface – selection criteria



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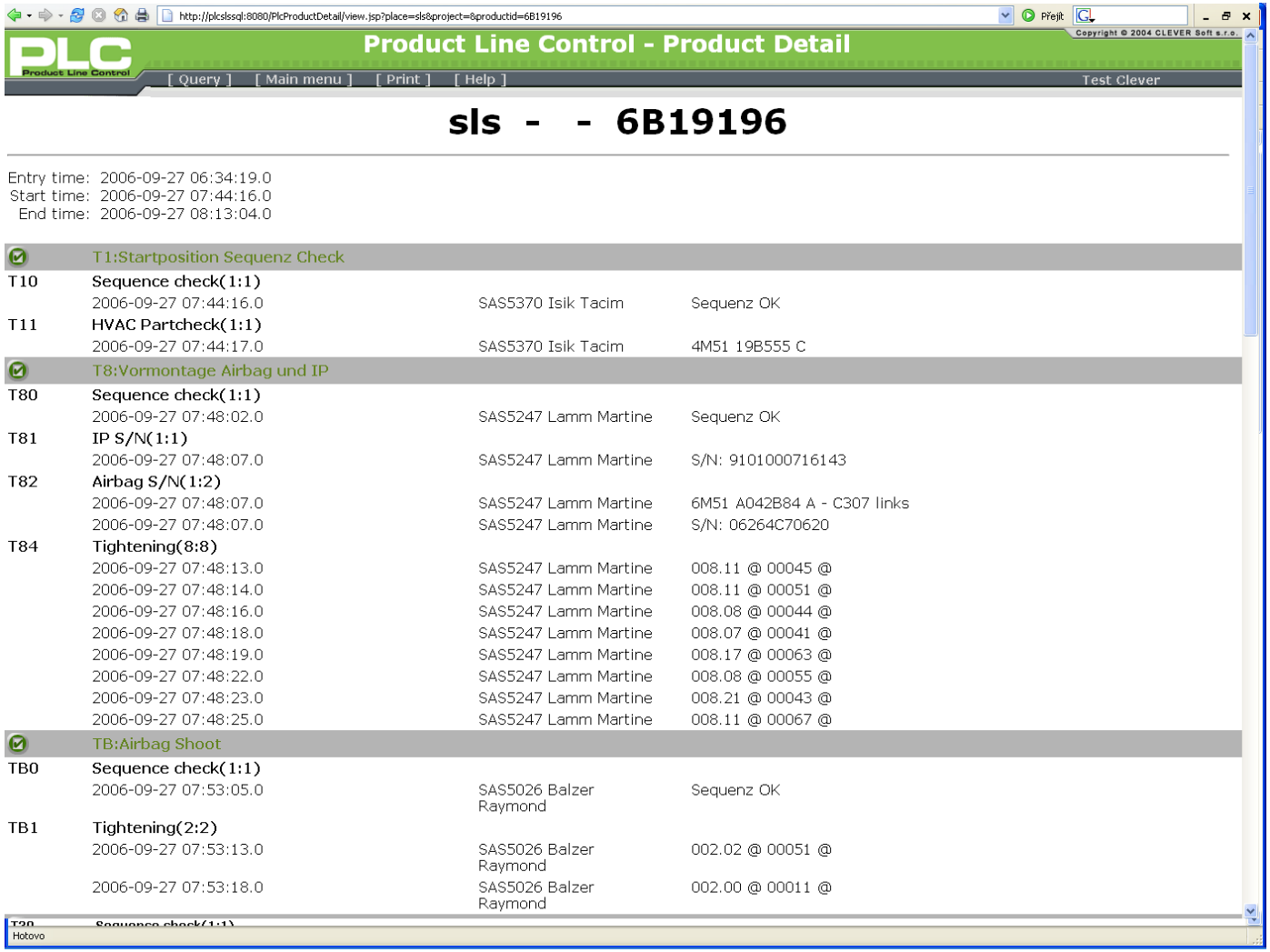
Sample of product detail



http://plcslssql:8080/PlcProductDetail/view.jsp?place=sls&project=&productid=6B19196

Product Line Control - Product Detail

Copyright © 2004 CLEVER Soft s.r.o.

[Query] [Main menu] [Print] [Help] Test Clever

sls - - 6B19196

Entry time: 2006-09-27 06:34:19.0
Start time: 2006-09-27 07:44:16.0
End time: 2006-09-27 08:13:04.0

	T1:Startposition Sequenz Check		
T10	Sequence check(1:1)		
	2006-09-27 07:44:16.0	SAS5370 Isik Tacim	Sequenz OK
T11	HVAC Partcheck(1:1)		
	2006-09-27 07:44:17.0	SAS5370 Isik Tacim	4M51 19B555 C
	T8:Vormontage Airbag und IP		
T80	Sequence check(1:1)		
	2006-09-27 07:48:02.0	SAS5247 Lamm Martine	Sequenz OK
T81	IP S/N(1:1)		
	2006-09-27 07:48:07.0	SAS5247 Lamm Martine	S/N: 9101000716143
T82	Airbag S/N(1:2)		
	2006-09-27 07:48:07.0	SAS5247 Lamm Martine	6M51 A042B84 A - C307 links
	2006-09-27 07:48:07.0	SAS5247 Lamm Martine	S/N: 06264C70620
T84	Tightening(8:8)		
	2006-09-27 07:48:13.0	SAS5247 Lamm Martine	008.11 @ 00045 @
	2006-09-27 07:48:14.0	SAS5247 Lamm Martine	008.11 @ 00051 @
	2006-09-27 07:48:16.0	SAS5247 Lamm Martine	008.08 @ 00044 @
	2006-09-27 07:48:18.0	SAS5247 Lamm Martine	008.07 @ 00041 @
	2006-09-27 07:48:19.0	SAS5247 Lamm Martine	008.17 @ 00063 @
	2006-09-27 07:48:22.0	SAS5247 Lamm Martine	008.08 @ 00055 @
	2006-09-27 07:48:23.0	SAS5247 Lamm Martine	008.21 @ 00043 @
	2006-09-27 07:48:25.0	SAS5247 Lamm Martine	008.11 @ 00067 @
	TB:Airbag Shoot		
TB0	Sequence check(1:1)		
	2006-09-27 07:53:05.0	SAS5026 Balzer Raymond	Sequenz OK
TB1	Tightening(2:2)		
	2006-09-27 07:53:13.0	SAS5026 Balzer Raymond	002.02 @ 00051 @
	2006-09-27 07:53:18.0	SAS5026 Balzer Raymond	002.00 @ 00011 @

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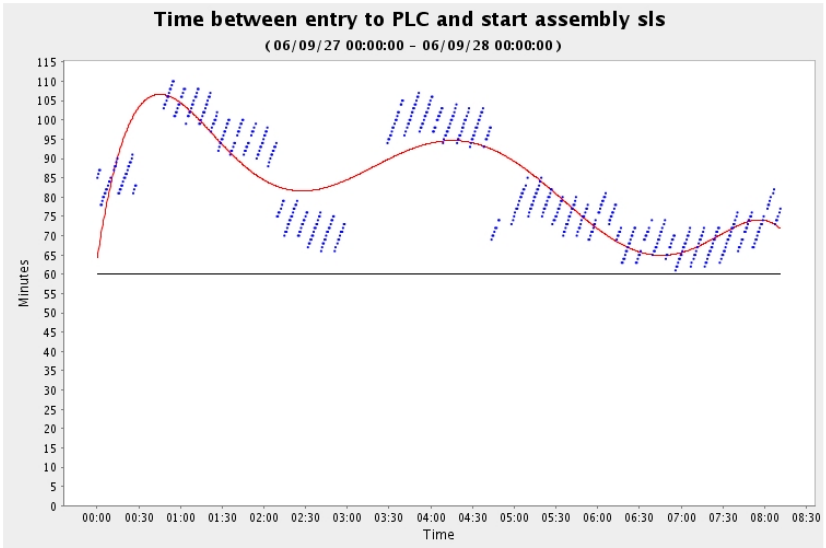
http://plcslssql:8080/PlcProductEntryGraph/view.jsp

Graph of waiting products

PLC Product Line Control

[Query] [Main menu] [Print] [Help]

Test Clever



VIN	Entry time	Time difference	Start time	Time difference	End time	Time difference	Buffered
6B20423	06/09/26 22:34:19	+ 85	06/09/27 00:00:15	+ 23	06/09/27 00:23:55	(109)	117
6B17152	06/09/26 22:34:19	+ 86	06/09/27 00:00:55	+ 23	06/09/27 00:24:54	(110)	116
6B20112	06/09/26 22:34:19	+ 87	06/09/27 00:01:34	+ 23	06/09/27 00:24:59	(110)	115
6B20905	06/09/26 22:34:19	+ 87	06/09/27 00:02:07	+ 23	06/09/27 00:25:56	(111)	114
6B20091	06/09/26 22:44:19	+ 78	06/09/27 00:02:44	+ 23	06/09/27 00:26:24	(102)	113
6B19983	06/09/26 22:44:19	+ 78	06/09/27 00:03:18	+ 23	06/09/27 00:27:13	(102)	112
6B20439	06/09/26 22:44:19	+ 79	06/09/27 00:03:51	+ 23	06/09/27 00:27:17	(102)	111
6B20703	06/09/26 22:44:19	+ 80	06/09/27 00:04:19	+ 43	06/09/27 00:47:30	(123)	110
6B20191	06/09/26 22:44:19	+ 80	06/09/27 00:04:53	+ 43	06/09/27 00:48:35	(124)	123
6B20021	06/09/26 22:44:19	+ 81	06/09/27 00:05:30	+ 43	06/09/27 00:48:38	(124)	122
6B20477	06/09/26 22:44:19	+ 81	06/09/27 00:06:01	+ 43	06/09/27 00:49:38	(125)	121
6B20841	06/09/26 22:44:19	+ 82	06/09/27 00:06:30	+ 44	06/09/27 00:50:40	(126)	120
6B20026	06/09/26 22:44:19	+ 82	06/09/27 00:07:05	+ 43	06/09/27 00:50:52	(126)	119
6B24172	06/09/26 22:44:19	+ 83	06/09/27 00:07:55	+ 43	06/09/27 00:51:38	(127)	118
6B19517	06/09/26 22:44:19	+ 84	06/09/27 00:08:41	+ 43	06/09/27 00:52:09	(127)	117
6B22406	06/09/26 22:44:19	+ 84	06/09/27 00:09:11	+ 43	06/09/27 00:53:07	(128)	116
6B20053	06/09/26 22:44:19	+ 85	06/09/27 00:09:50	+ 43	06/09/27 00:53:29	(129)	115
6B20095	06/09/26 22:44:19	+ 87	06/09/27 00:12:10	+ 42	06/09/27 00:54:25	(130)	114
6B17100	06/09/26 22:44:19	+ 88	06/09/27 00:12:49	+ 41	06/09/27 00:54:31	(130)	113

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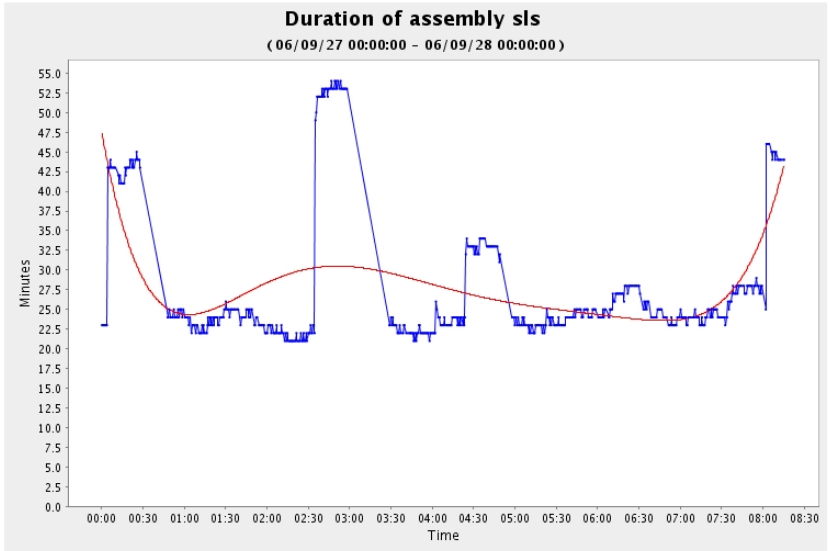
http://plcslssql:8080/PlcProductEntryGraph/view.jsp

Graph of waiting products

PLC Product Line Control

[Query] [Main menu] [Print] [Help]

Test Clever



VIN	Entry time	Time difference	Start time	Time difference	End time	Time difference	Buffered
6B20423	06/09/26 22:34:19	+ 85	06/09/27 00:00:15	+ 23	06/09/27 00:23:55	(109)	117
6B17152	06/09/26 22:34:19	+ 86	06/09/27 00:00:55	+ 23	06/09/27 00:24:54	(110)	116
6B20112	06/09/26 22:34:19	+ 87	06/09/27 00:01:34	+ 23	06/09/27 00:24:59	(110)	115
6B20905	06/09/26 22:34:19	+ 87	06/09/27 00:02:07	+ 23	06/09/27 00:25:56	(111)	114
6B20091	06/09/26 22:44:19	+ 78	06/09/27 00:02:44	+ 23	06/09/27 00:26:24	(102)	113
6B19983	06/09/26 22:44:19	+ 78	06/09/27 00:03:18	+ 23	06/09/27 00:27:13	(102)	112
6B20439	06/09/26 22:44:19	+ 79	06/09/27 00:03:51	+ 23	06/09/27 00:27:17	(102)	111
6B20703	06/09/26 22:44:19	+ 80	06/09/27 00:04:19	+ 43	06/09/27 00:47:30	(123)	110
6B20191	06/09/26 22:44:19	+ 80	06/09/27 00:04:53	+ 43	06/09/27 00:48:35	(124)	123
6B20021	06/09/26 22:44:19	+ 81	06/09/27 00:05:30	+ 43	06/09/27 00:48:38	(124)	122
6B20477	06/09/26 22:44:19	+ 81	06/09/27 00:06:01	+ 43	06/09/27 00:49:38	(125)	121
6B20841	06/09/26 22:44:19	+ 82	06/09/27 00:06:30	+ 44	06/09/27 00:50:40	(126)	120
6B20026	06/09/26 22:44:19	+ 82	06/09/27 00:07:05	+ 43	06/09/27 00:50:52	(126)	119
6B24172	06/09/26 22:44:19	+ 83	06/09/27 00:07:55	+ 43	06/09/27 00:51:38	(127)	118
6B19517	06/09/26 22:44:19	+ 84	06/09/27 00:08:41	+ 43	06/09/27 00:52:09	(127)	117
6B22406	06/09/26 22:44:19	+ 84	06/09/27 00:09:11	+ 43	06/09/27 00:53:07	(128)	116
6B20053	06/09/26 22:44:19	+ 85	06/09/27 00:09:50	+ 43	06/09/27 00:53:29	(129)	115
6B20095	06/09/26 22:44:19	+ 87	06/09/27 00:12:10	+ 42	06/09/27 00:54:25	(130)	114
6B17199	06/09/26 22:44:19	+ 88	06/09/27 00:12:49	+ 41	06/09/27 00:54:31	(130)	113

Položek: 1314, nepřečteno: 5

Doručení pošty Chyba - klepněte sem.

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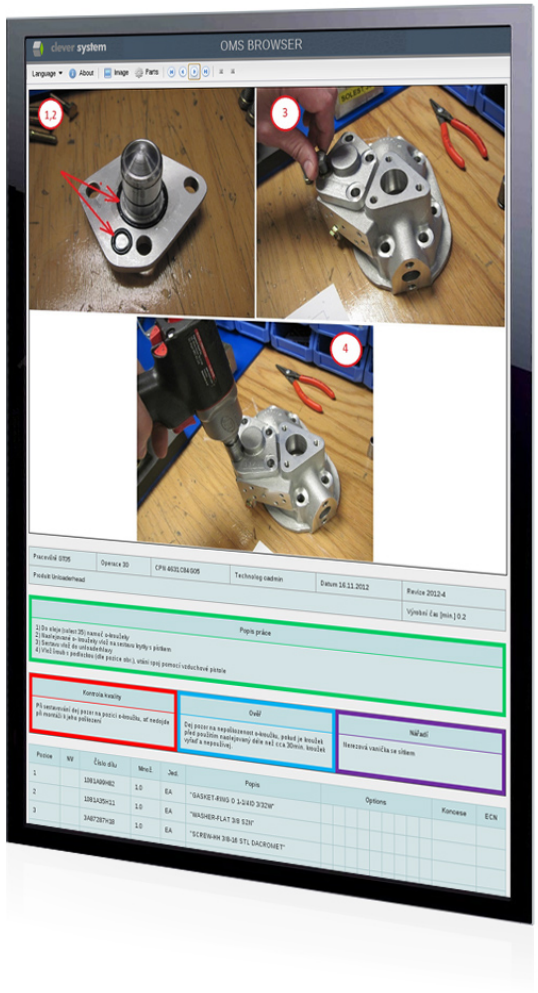
Operational Method Sheets

This application is designed for a management of operational method sheets placed on workstations. It enables an assignment of bill of material to operations defined on workplaces.
A documented history of revisions is available as well.
A database of tools used on workplaces is handled by this application.



Outputs:

- An electronic operational method sheet on a workstation screen.
- PDF file available for a printing.
- Technologists are notified by an e-mail about changes in the bill of material.

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Configuration of Clever System

All software modules are configured by configuration files. It is possible to edit these text files with common text editors.

A user-friendly configuration tool (cct) is available as well.

All PCs with Clever System system support a remote access via IP protocol. It enables remote configuration with responsible person or our support.

The production on workstations doesn't need to be interrupted during configuration changes.

No MS Windows licenses are required.

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