From the Reporting Matrix to the Automated Acquisition of Knowledge

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In order to use the full potential of the Q-DAS CAMERA® Concept, you have to apply the tools of the M-QIS Engine. They offer the web applications and automatisms for creating reports and presenting results.

This article helps to support a well-structured installation of the Q-DAS® Reporting System including as few non-value-added services as possible. The term

Reporting-Matrix

is based on this claim.

The Reporting System is one of the main components of the Management Quality Information System (M-QIS). It is often applied to the offline control loop. The system is opposed to the Operator Quality Information System (O-QIS) illustrating the real-time control loop which is close to the process. However, these differences provide the opportunity to obtain a comprehensive overview reaching far beyond the single production processes. This helps you finding out about different relations and correlations.

A Reporting System is set up during the implementation of the Q-DAS CAMERA® Concept. You mostly install it after configuring the data recording stations (procella®, O-QIS, Upload). In the meantime, users gain experience in evaluating and reporting data manually by using qs-STAT® or destra®.

This kind of orientation phase often leads to the definition of clear tasks helping you specify an automatism for reports. Each company generally uses control loops whose efficiency rises as the automatic provision of information in the form of reports increases.

General Preliminary Considerations

The available qs-STAT® options for the evaluation and graphical display of data combined with a time-saving automatism offer various opportunities and possible applications. However, this advantage may turn into a disadvantage. What seemed to be clear and well-arranged might become confusing when reaching the installation and maturation phase. However, this is not supposed to happen at all. At this stage, we want to keep things clear and keep track of the information we provide.

You laid the foundation for these advantageous opportunities in the production and quality planning process; now it is necessary to transfer them. The existing structures of the company provide some good starting points for this task.

A well-structured approach makes the installation easier and you will create the documentation for later expansions or "succeeding generations" at the same time without really noticing it. You have already set the right course in the collecting and assessing phase of the CAMERA Concept (O-QIS, AQDEF data format and database structure).

Now, you may access the K-field structures in order to use specific information, such as reasons for test, workshops, characteristic classes, etc., as filter criteria. It is reasonable to analyze an established control loop of the company since the people working on the loop will be "grateful recipients" of automated reports.

Use the following phrase as a guideline:

"Only provide the required information with a sufficient level of detail to the right recipient."

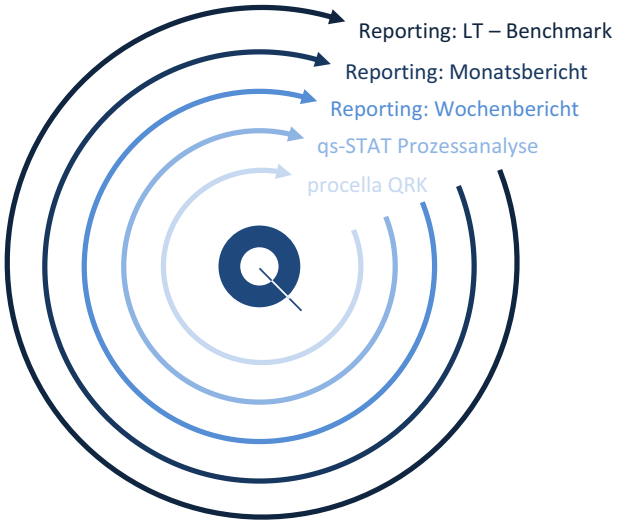
The overdisclosure of information quickly leads to a dwindling acceptance of the system. Only the right recipient is able to use the information and take the respective measures, i.e. to control processes.

The level of detail rises as the hierarchy level decreases – from the "green smiley" for the management to a "list of bad smileys" including all bad characteristics for the production manager to suitable control charts for the machine operator.

The generation of reports can also be staggered. You may use monthly/quarterly benchmark reports but also daily lists always indicating what went wrong.

You have to define how the recorded data are transferred based on the respective situation on site. A PDF file stored on a server will be useless if the recipient does not know it was stored there or if the recipient cannot access it.

The following diagram is based on this principle.



Specific Preliminary Considerations

Ask yourself the following questions and the answers will help you creating a Reporting Matrix easily. From case to case the examples given below also provide some answers showing the difference to a real-time control loop as illustrated by O-QIS or as evaluated by qs-STAT® or destra® on request.

List of Questions

1. **Why**?
   a. What is the target?
      (Report, regulation, support, documentation, etc.)
   b. Which control loop do you want to support or start?
      (Big vs. small // real-time vs. offline)
2. **Who** shall receive the information (reports)?
   a. What is the hierarchy (plant management, head of manufacturing division, production manager, master etc.)?
   b. Which unit (location, cost center, line, workshop, etc.)?
3. **How** do you want to transfer / provide reports (information)?
   a. "Pop-up" window, horn, signal light, … (tasks of O-QIS)
   b. PDF in file storage
   c. E-mail
   d. "On demand" (task of qs-STAT®/destra®)
4. **When** do you want to create reports (information)?
   a. As soon as the "alarm" (task of O-QIS) occurs in the real-time control loop
   b. Always at a certain time
   c. For documentation purposes before deleting original values
5. **How** often (interval)?
   a. Daily (8:00 AM on Tuesdays)
   b. Monthly (on the third day of the month), etc.
6. **What** triggers the generation of a report?
   a. Event (requirements are not met)
   b. Time (cyclical)
   c. A concrete suspicion (on demand by using qs-STAT®/destra®)
7. **Which** period do you want to observe?
   a. Interval corresponds to the respective period
   b. Interval does not correspond to the respective period (e.g. weekly report about the data recorded during the last 90 days)
8. **Which** data should be analyzed?
   a. Filter at all levels
   b. Only data such as auxiliary characteristics, erroneous measurements, adjustment parts, etc.
9. **Which** statistics do you want to display?
   a. Violations of specification limits
   b. QCC alarms
   c. Process capabilities
   d. Part evaluations
10. **How** do you want to process the data?
    a. Separately (e.g. per machine, batch, order, etc.)
    b. Combined (e.g. per type of variant, product, type of characteristic, e.g. diameter of 20 mm ±0,1 for all types per production machine)
    c. Division criteria for data compression/results
    d. Compressed (e.g. per month and quarter)
    e. From a process or product perspective
11. **How** meaningful is the statistic and can you calculate it based on these data?
12. **How** much data do you need for a reasonable display of values/results? (What are the alternatives?)
    a. A daily evaluation of the Cpk value based on four measured values does not make sense…
    b. Monthly evaluations including 85,000 measured values per characteristic are hard to understand and interpret in the value chart…
13. **Which** changes in the data flow are necessary?
    a. Converter adjustments
    b. Relocating contents during the upload
14. **What** is the report supposed to look like?
    a. Reference to parts, characteristics and values
    b. Which graphics and output points?
    c. Benchmarks, evaluation results, etc.
    d. Filters in summary graphics (e.g. hiding specific information based on the overall evaluation result or certain characteristic classes)
    e. Display of trends included in results (capabilities, etc.)
15. **Where** do you want to store reports?
    a. On the file server by using a specified naming convention (e.g. K-fields, selection name, date, etc. as a part of the respective name of folders or files).
    b. On the servers of the respective department
    c. …

The answers to these questions clearly define the demands and make requirements tangible. True to the slogan "writing is a more precise way of thinking" you will obtain an overview facilitating the definition of the required settings for the Reporting System considerably.

Examples

Some examples help you understand the theory behind it. The following examples provide some tasks and describe how to realize these tasks in a possible Reporting Matrix.

0) Real-time process control

O-QIS helps to control the process directly at the production machine.

1) Report of the previous day for the masters of a manufacturing cell

The responsible masters conduct a work day review which shall be supported by a list showing the value charts, QCC or histograms per characteristic (=process) of the production processes. This kind of report will include all values recorded during the last 24 hours.

2) Problem cases occurring in hall 5 during the last week prepared for the weekly meeting

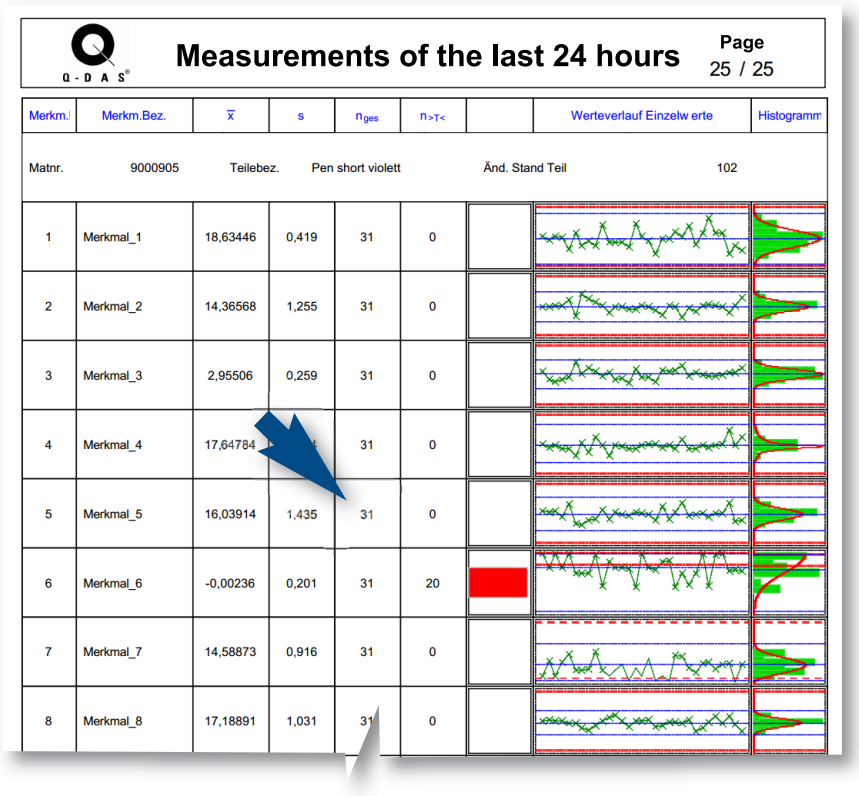
Processes whose values are outside the tolerance (or any other limit violations) appear on the agenda for the production meeting on Tuesday at 10 am. The aim is to decide on medium-term corrective actions (e.g. maintenance of tools or machines). So it is helpful to gain an overview of last week's situation.

3) Monthly report for the head of the manufacturing division

In order to detect medium-term and long-term changes in the process performance, the head of the manufacturing division needs an overview of the last months including a list of problems (insufficient capability) occurring during the last month.

4) Quarterly report for the plant manager

The plant manager rather controls for and thinks about the long term. So he needs the quarterly evaluation of the last and current year or the annual evaluation of the last three years. These reports have to include information about the entire production site but also information about the single shop floors.



Q-DAS®

Measurements of the last 24 hours

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Merkm.	Merkm.Bez.	$\bar{x}$	s	n_{ges}	$n_{>T<}$		Werteverlauf Einzelw erte	Histogramm
Matnr.	9000905	Teilebez.	Pen short violett		Änd. Stand Teil	102		
1	Merkmal_1	18,63446	0,419	31	0			
2	Merkmal_2	14,36568	1,255	31	0			
3	Merkmal_3	2,95506	0,259	31	0			
4	Merkmal_4	17,64784		31	0			
5	Merkmal_5	16,03914	1,435	31	0			
6	Merkmal_6	-0,00236	0,201	31	20			
7	Merkmal_7	14,58873	0,916	31	0			
8	Merkmal_8	17,18891	1,031	31	0			

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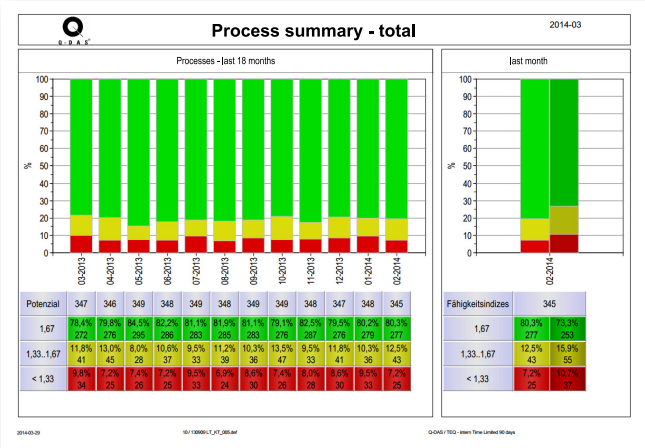
„Recycling“

While discussing the Reporting Matrix you will notice soon that some components like filters, queries, report allocations and division allocations can be interwoven for the storage of results and report templates.

As an example, the queries may define the title of the PDF file, the respective storage folder and the file name. At the same time you might have the option to perform a Reporting job including several queries and only one report template.



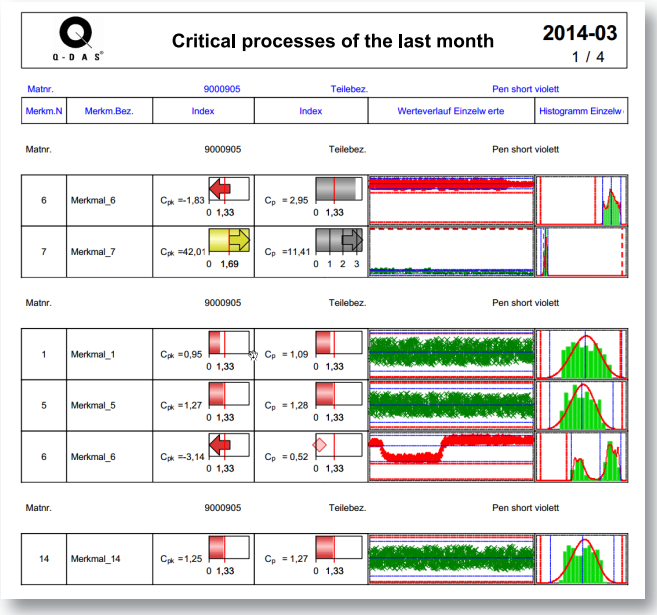
Special Types of Reports

Reports including several sections (layouts)

The combination of several kinds of display (different graphics, tables, control charts, etc.) and levels of detail in a report help users to focus on a specific task.

As an example, a monthly process report might consist of two sections

- Cover sheet: Development of capability indices during the last 18 months is displayed in a benchmark graphic
- Higher level of detail: Each characteristic assessed to be not capable during the last month is displayed in a value chart (hopefully this section only contains few pages)



Reports for “special occasions“

During the start-up phase of a new product you sometimes need some temporary special evaluations. In contrast to the procedure described before (filter by structures and hierarchies) you may also filter out products or machines directly and output them according to your requirements.

Why?					
...	control cycle	"Q-table"	Production meeting		
...	Reporting level	1.	2.	(Monthly) **Compression**	
...	title of the report?	**Report of the previous day**	**Weekly report**	---	**Monthly rep**
Which data?					
...	from the database (*.udl)?	Subgroup_data.udl	Subgroup_data.udl	Subgroup_data.udl	
...	should be analyzed?	All characteristics	Characteristics violating rules during the last week	All characteristics	All chara
...	filter by K-fields?	K1092 = 12 / K1092 = 14 / K1092 = 22	K1101 = H3 / K1101 = H5	K1100 = manufacturing	
...	reason for test?	SPC, initial part	SPC, initial part	SPC, initial part	
...	period?	Values recorded during the last 24 hours	Values recorded during the last 90 days	All values recorded during the past 2 months, without exception	
...	should be compressed?	---	---	---	
...	how do you want to compress data?	---		Monthly	
...	how do you want to sort them?	---	By time	---	By t
...	should be changed?	During the upload for old converter (K1053 ->			
...	should be filtered out / reduced?	---	Measurement errors (events)	Measurement errors (events)	
Which statistics?					
...	do you want to display?	Number of tolerance violations	"Bad smiley"	---	
...	how do you want to display statistics?	List	List	---	List / capabiliti mo
...	how do you calculate which	"SPC evaluation strategy"	"SPC evaluation strategy"	"SPC evaluation strategy"	"SPC evaluat
...	which module do you use?	Process Capability Analysis	Process Capability Analysis	Process Capability Analysis	Long-term
Which kind of display?					
...	referring to parts, characteristics, ...	New page per part, 15 characteristics per page	Header per part, 25 characteristics per page	---	Capability o months di
...	graphics	List of characteristics/statistics with QCC, histogram	List of characteristics/statistics with QCC, histogram	---	Statistics with
...	developments over time	-"-	---	---	Mor
...	all characteristics, evaluation n.o.k.?	All characteristics	Characteristics n.o.k.	---	

You can find this example under www.q-das.de/temp/ReportingMatrix.xls

Forecast

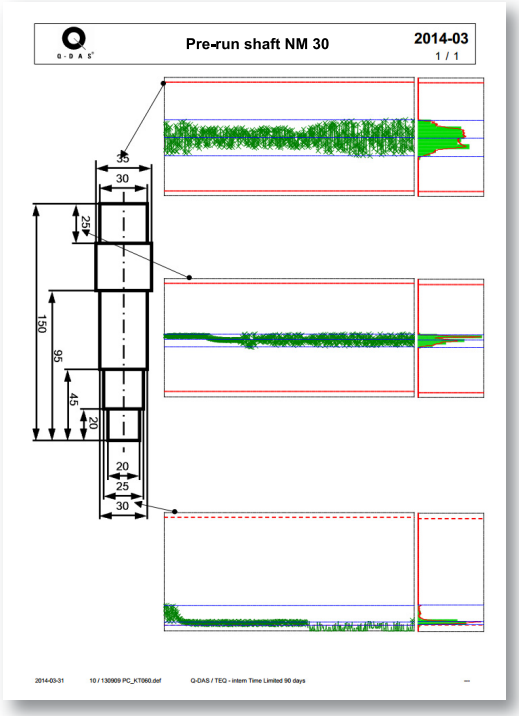
Starting working with a Reporting Matrix in order to become acquainted with M-QIS in a well-structured way has proved to be best practice and will still provide many advantages. Together with the K-field list this document illustrates your CAMERA Concept.

Please consider that the (successful) application of the CAMERA Concept over time will develop structures characterized by the following common aspects

- Common standardization (sometimes including clearly distinguished variants)
- Consistent application of K-fields (measuring machines, procella®, Reporting System, archiving)
- Q-DAS® tools connected to existing control loops

Since the CAMERA Concept consists of different modules, you may implement it step by step. Enhancements will adapt easily to the overall concept.

What still remains is the overview the Reporting Matrix provides.



Manufacturing meeting			Management
3.		(Quarterly) **Compression**	4.
ort (section 1)	**Monthly report (section 2)**	---	**Quarterly report**
Subgroup_data.udl		All *.udl's of this division	All *.udl's of this division
cteristics	Characteristics violating rules	All characteristics	All characteristics
K1100 = manufacturing		---	---
SPC, initial part, product audit		SPC, initial part, prototyping	SPC, initial part, prototyping
Results of the last 9 months		All values recorded during the last 2 quarters, without exception	Results of the last 8 quarters
---		---	---
---		Quarterly	
ime	By time	---	Over time
---		---	---
---		Measurement errors (events)	---
Process capability		---	Process capability
es over the past nths	Characteristics statistics	---	
ion strategy"	"SPC evaluation strategy"	"SPC evaluation strategy"	"SPC evaluation strategy"
n Analysis	Long-term Analysis	Process Capability Analysis	Long-term Analysis
ver the past 9 splayed per	Header per part, 25 characteristics per page	---	
n C-value chart	List of characteristics/statistics with QCC, histogram	---	Benchmarks
nthly	---	---	Quarterly
	Characteristics n.o.k.	---	