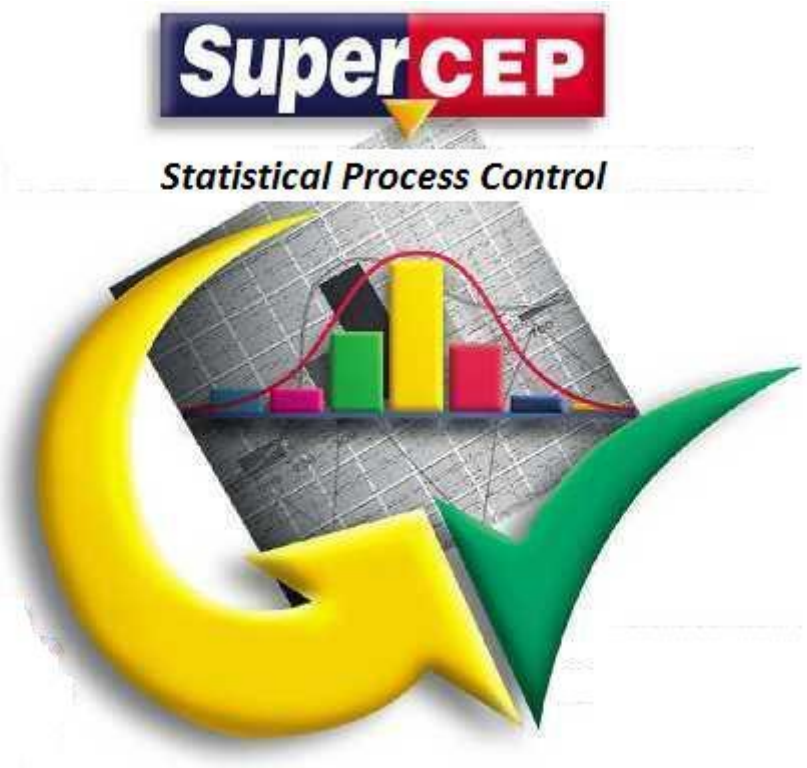

*Super*SPC 2016

USER'S MANUAL

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Note: The contents of SuperCEP are being constantly improved; therefore, this printed handbook will remain from time to time slightly outdated. The online help and the SCLOG.TXT file contain the most updated information.

1. PRESENTATION

Statistical Process Control is a collection of tools of great usefulness for the analysis of data obtained through measurements or specific observations on the characteristics of raw materials, manufacturing processes, finished goods, services and administrative processes. The workers' participation in this quality functions is important. The benefits obtained from the implantation of this type of control are necessarily reflected in an increase of productivity, costs reduction, constant improvement of product quality and greater client satisfaction.

The **Statistical Process Control System *Super*CEP® 2016** was created considering the importance of Statistical Process Control in modern organizations and the need for the people responsible to anticipate and speed the response time to quality problems.

The integral utilization of this kind of techniques demands registering, storing, processing and analyzing great amounts of data. With this idea in mind and the need to rapidly obtain well presented and reliable results, we designed this Statistical Process Control System **SuperCEP® 2016** for stand alone PC's and networks.

The system has a Sample Data Record Sheet that allows users to enter, edit, delete, select, filter, transform, consult and report the information obtained from inspections or quality tests. SuperCEP offers the following statistical quality analysis techniques:

Descriptive Statistics
Frequencies Histograms
Normality Studies.
Process Capability Analysis
Net Weight or Volume Audits
Whisker Box Charts
Pareto Charts
Variables Control Charts
Attributes Control Charts
Exponentially Moving Average Chart
Highs and Lows Charts
Rainbow Charts
Group Charts
Lot Variables Acceptance Samplings
Lot Attributes Acceptance Samplings
Scatter Diagrams
Quality Certificates
Data Reports
Non-Conformities Report
Process Log Report

***Super*CEP® 2016** presents a series of competitive advantages for the user, since it elaborates the statistical analysis of the information obtained in productive processes, services or quality improvement programs, as well as in other industrial activities, in order to have quantitative elements for decision-making and to verify the veracity of the processes capacity.

When the operator uses SuperCEP he finds that the implementation of SPC does not burden his daily work, since the verification sheet or inspection format is presented to him on the screen much in the same way it would on paper. He inputs variables or attributes data from his process or product inspection and SuperCEP does the rest. The user does not have to learn complicated instructions or key combinations, only to capture the data that is being solicited to him, just like using paper and pencil, but more quickly and with the possibility of making Reports, Certificates, present a log record, to have process information when he wishes, print any type of available chart, carry out data filtering and stratification, etc., all of this right after the information is generated.

***Super*CEP® 2016** is a tool of great help in any operational or transactional area whose processes need to be verified inside a quality management system. Some examples of the needs that can be covered are:

Management Responsibility

- **Customer focus.** Determination of customer requirements; enhance customer satisfaction.
- **Management review.** Review the Quality Management System at planned intervals; suitability, adequacy, effectiveness; opportunities for improvement; input; output.

Resource Management

- **Human resources**. Evaluate competent personnel; training and effectiveness of training.
- **Work environment.** Monitor work environment.

Product Realization

- **Customer related processes.** Evaluation of the ability of the organization to meet customer's requirements.
- **Design and development.** Verification that the design outputs meet the requirements of the input elements. Validation that the product or service meet the intended use and established needs. Evaluation, verification and validation of the effects of design changes.
- **Purchasing.** Assure conformance of purchased product; type and extent of control; evaluate and select suppliers; re-evaluation; records; purchasing information (approval of product, procedures, processes, equipment, qualification of personnel, QMS requirements); verification of purchased product.
- **Production and service provision.** Plan and carry out production and service provision; controlled conditions; information; work instructions; equipment; gages; inspection; release, delivery, post-delivery; special processes; identification and traceability; customer property; preservation of product.
- **Control of monitoring and measuring devices.** Assure that process monitoring and measurement is consistent with requirements. Evaluate previous results in case of non-conformance.

Measurement, analysis and improvement

- **Monitoring and measurement.** Monitor customers' perception regarding organization's ability to consistently meet requirements; methods; conduct internal audits; monitor and measure processes; monitor and measure products.
- **Control of nonconforming product.** Nonconforming product is identified and controlled; defined controls and related responsibilities and authorities; documented procedure; action to eliminate detected nonconformities; authorized concession; actions to preclude use (if nonconformities are not corrected); records.
- **Analysis of data.** Determine, collect, analyze data; demonstrate suitability and effectiveness; evaluate where continual improvement can be made; including: customer satisfaction, product conformity, characteristics and trends of processes and products; opportunities for prevention; suppliers.
- **Improvement.** Continually improve effectiveness; by use of policy, objectives, audits, data analysis, corrective and preventive actions, management review; corrective actions; preventive actions.

This system is aimed to any company or industry that wishes to assure and to control the quality of its products, services and processes.

It is also very useful for those companies interested in exporting national products, which will have to show statistical evidence of the fact that they comply with the specifications and standards required by the international market including the requisites for electronic records security imposed by FDA CFR-21.

Also ***Super*CEP® 2016** is an excellent support for the activities related to the obtainment and maintenance of the ISO-9001 procedures.

The system is completely in English (other languages versions available) and very simple to operate.

The recommended procedure to obtain the best results with the system is to consult the information in this manual in the order that is shown below:

Installation and start up

Enter data in the tutorial examples.

Charts and Reports on the tutorial examples.

Configuration of your own real life example.

Enter real data.

Charts and Reports on real data.

If you have any doubts about how the system is administered it will be necessary to consult chapters 4 Data Entry and 5 Configuration. The only way to exploit ***Super*CEP® 2016** to its 100% is to study this handbook in its entirety.

Finally, if after consulting the content of this handbook, the information is not sufficient for obtaining a wished chart or report, or if you have some suggestion to improve or enrich the handbook or the system, please call your distributor or the manufacturer:

Free Technical Support.

Telephone: (52) 55-5445-5390 and 91

Web site: www.supercep.mx

E-mail: fabricadigital@prodigy.net.mx
soporte@supercep.com.mx

2. STATISTICAL PROCESS CONTROL.

Below we intend to give a short explanation about Statistical Process Control and each one of the tools available in the system, as well as their application to productive processes and Quality Management.

1. Concepts.
2. Control Charts.
3. Other Sequential Charts.
4. Process Capability Studies.
5. Pareto Charts.
6. Acceptance Sampling.
7. Linear Regression.

2.1 Concepts

Quality improvement is essential to increase client satisfaction, increase sales, preserve employment and to raise the living standards of society.

One of the main obstacles for improving quality is the constant presence of variations in processes and its consequences on outcoming products or services. But, what is variation? In the same way that no two persons are never exactly alike, two manufactured parts or two services delivered are never exactly the same, There will always be a variation in size, weight, conformance or delivery time of the material, part, assembly or service. The difference can be very small or difficult to measure but it will always exist. This is called Variability.

Excessive variation is the cause of a great deal of quality problems. We must possess tools that allow us to exhibit, react, control and prevent excessive variations.

Statistical Process Control methods are very important to quality improvement since it has been demonstrated that is a very simple and inexpensive way to detect, analyze and control excessive variation.

For most people, statistics seem very difficult or complicated, but for us it is no more than a clever way of using numbers to our advantage for helping us make objective decisions based on facts to reduce the number of problems in the operation of any process and in the realization of any product or service. The use of statistics is necessary because it is a mathematical tool designed to deal with large amounts of numbers of incomplete and imperfect nature just as the ones obtained from industrial and commercial scale processes.

Before approaching the statistical tools that ***Super*CEP®** offers, we should understand what it means to be in "Statistical Control". It is said that a process is in Statistical Control when the variations or deviations from its average value cannot be linked to special causes and when the magnitude of these variations remains constant in the short and long-term. If the variations that arise are caused only by common and chance causes, the process is said to be under Statistical Control. A process is said to be "out of statistical control" if special causes of variation arise. Stating that a process is in Statistical Control is equivalent to saying that it is in a natural stability state.

In practice, how can one distinguish between a special cause and a natural or common cause? A special cause will not necessarily indicate a defective product. On the other hand, the exclusive existence of a system of common causes does not necessarily leads to a process conforming to specifications. What fundamentally matters at this moment is to verify the consistency and stability of the process independently of the way the product or service meets or not the stated specification.

For the purpose of analysis and improvement of the process we can think of common or natural causes as the sum or system of all those forces that act upon our process and have relatively small and random effects. Even the most perfect and stable process, natural or artificial, shows certain routine variations of random nature that we must acknowledge as an inseparable part of it and that we call natural variability or noise. On the other hand, a process might present extraordinary variations known as signals that might indicate the presence of special or non-random causes that have appeared and are acting upon our process.

To make a decision on the stability of a process it will be useful to be able to delimit between natural variability or noise and special variability or signals. Control Charts are built using these limits.

In terms of the control charts we can say that for a process to be in control, all the points should fall within the Control Limits and they should be scattered at random with respect to the Central Line with no runs, cycles or adhesion to limits.

After recording data in our inspection format and having obtained a chart, the first question that we should answer is: *Is the process in statistical control?* We could ask the same question in different terms: Is the process free of special causes of variation? Or, the realization of the product or service has been under a stable and consistent set of circumstances?

For answering this question, we should seek evidence of extreme variations, deviations and trends. The presence of any indication of a special cause must guarantee an investigation of the process. The absence of these signs gives us the security that our data correctly represent the current maximum possibilities of the process.

Only when our data come from of a system of common causes, we can think that it is justified to compare the results of the process with the conditions imposed by the specifications.

2.2 Control Charts

Some people are surprised when they learn that two apparently identical parts, made under carefully controlled conditions, of the same source of raw material and manufactured only with a difference in seconds by the same machine and operator, could be different in many aspects.

In reality, any manufacturing process, even the most reliable, is characterized by certain degree of variability that it is of random nature and cannot be eliminated completely. Services and administrative processes are no exception.

When the variability present in a production or service process is limited to natural or random variation, it is said that the process is **Under Statistic Control.**

This condition is reached investigating and eliminating all the causes that originate variations of other kinds, as are those which can be due to poorly trained workers, low quality raw materials, improper machine adjustments, lack of control of ambient conditions, overused parts, tools wear, unclear instructions, etc.

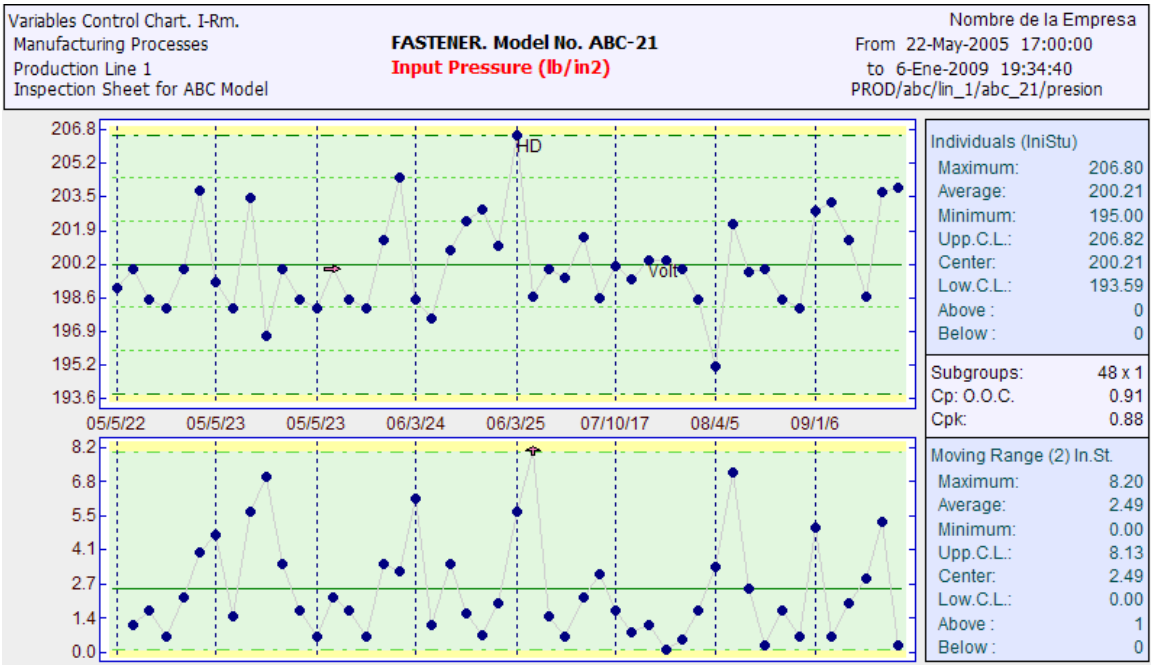
As any manufacturing or service processes rarely are free of this type of influences, it is important to have some systematical method for detecting the notable deviations from the state of statistical control, when these factors appear or earlier if it is possible. It is mainly for this purpose for which control charts are employed.

A control chart consists of a central line that corresponds to the average in which the process is operating and two lines corresponding to the upper and lower control limits.

These limits are chosen in such a way that the values that fall outside them should be interpreted as indications of a control fault, which means excessive variation or process instability. These limits should not be confused with specification limits, which were chosen, by the customer or designer to fulfill an arbitrary purpose.

Marking the results obtained from samples taken periodically in frequent intervals, it is possible to verify, by means of this chart, if the process is under control or if in the process has appeared some special cause of problems as those previously indicated.

When an obtained point falls outside of the control limits, we seek a possible fault, but still if the points remain within limits, the appearance of a trend or systematic irregularity can serve as notice of the fact that some action should be taken to avoid more serious problems.



The ability to "read" or "interpret" a control chart and to determine justly what corrective action must be taken, is a matter of objectivity, experience and good judgment of the process owners.

There are several types of control charts that can be built. If you obtain data for a quality characteristic that can be measured and expressed in numbers, generally you use control charts for central trend and variability, since the quality of a product frequently can be summarized in terms of these two quantities.

The sequence of decisions and necessary activities regarding the use of a control chart for any quality characteristic will typically include many of the following steps:

1. Decisions preparatory to the control charts.

- Purpose of the Charts. The objective is to complement and improve the ability of operators and supervisors of analyzing the process for the purpose of:
    - Establishing or changing specifications or in determining whether a given process can meet specifications. Establishing or changing production procedures either by elimination of assignable causes of variation or fundamental changes in production methods. Establishing or changing inspection and acceptance procedures.
    - Provide a basis for current decisions during production as to when to hunt for causes of variation and take action intended to correct them and when to leave a process alone.
    - Provide a basis for current decisions on acceptance or rejections of manufactured or purchased product.
    - Disclose opportunities for continuous improvement and cost savings.

- Choice of the Variable. An easy to sample and measure variable not always justifies the use of a control chart. It is important, specially at the beginning, to select variables that offer the greatest prospects of reducing or preventing costs that supervision and management will readily accept as being real.

- Decision on the Basis of Subgrouping. The key idea behind the success of control charts is the division of observations into ***rational subgroups***. This requires the use of the right criteria suited to the type of process and the purpose of the control chart. Generally speaking subgroups should

be selected in a way that makes each subgroup as homogeneous as possible and that gives the maximum opportunity for variation from one subgroup to another.

- Decision on the Size and Frequency of Subgroups. Because the essential idea of the control chart is to select subgroups in a way that gives minimum opportunity for variation within a subgroup, it is desirable that subgroups be as small as possible. On statistical grounds, a size of four is sufficient for the distribution of means to be nearly normal. The larger the subgroup size, the narrower the control limits on charts for means and the easier it is to detect small variations. No general rules may be laid down for frequency of subgroups but in the initial use of a control chart for analyzing a process, it may be desirable to take more frequent samples and, later on, the frequency can be reduced as the process becomes more stable. If the cost of measurements is high, the sampling frequency must be balanced with the expected benefits.

- Setting up the Forms for Recording the Data. For learning and sensitizing purposes it can be interesting to have operators work their first charts with paper and pencil, although the routine use of computers is more efficient because human errors are reduced and there is more time left for analysis. Any form used needs plenty space for remarks and annotations regarding the context that might give clues to the causes of any out-of-control points.

- Determining the Method of Measurement. The quality of the data obtained from the measurement system (instruments, operators, methods) must be formally assured before any attempt is made to extract valid conclusions from the control charts elaborated with this data.

2. Starting the Control Charts.

- Making and Recording the Measurements. It should always be remembered that the information given by the control chart is influenced by variations in the measurement process as well as by variations in the quality characteristic. Measurement and recording errors should be avoided to the maximum extent possible. Data must be time-stamped to preserve its sequence. Annotations should be made of any occurrences that might help find special causes in case necessary.

- Calculation of subgroup statistics. Depending on the type of chart it will be necessary to calculate the mean, range, standard deviation or some other statistic for each subgroup. The relevant formulas will be presented later on.

- Plotting the charts. Although not compulsory, the general practice is to present the means and ranges (X-R) chart before the variability chart (R or S). Vertical scales are used for statistical measures and the horizontal scale is used for subgroup numbers, lot numbers or dates. Each point represents the statistic for the subgroup. Points may be connected but some authors do not recommend it to avoid resemblance with a trend chart. Points on the chart should be kept plotted up to date preferably by the process operators because the potential benefit of using the chart depends to a great extent on the agility of the decision-making it enables.

3. Determining the trial control limits.

- Decision on required number of subgroups before control limits are calculated. On statistical grounds it is desirable that control limits be based on at least 25 subgroups. Preliminary calculations of control limits can be made from the first 8 or 10 subgroups, with subsequent modification of limits as more subgroups are obtained. It must be understood that the fewer the subgroups used, the less assurance that this basis for action is sound..

- Calculation of trial limits. In all cases control limits extend 3 standard deviations on each side of the average values of the location and variability statistics. This space represents a good balance between the two types of errors one can make using the charts to determine the stability of a process: the error of searching for a problem when there is none and the error of letting the process run when a problem really exists. We wil list later on the methods that statistical theory gives us to estimate the standard deviation for each chart.

- Plotting the central lines and limits on the charts. Conventionally a solid horizontal line is drawn to represent the central limit at the aveage of the means, ranges or standard deviations charts.

On both sides of this line the upper and lower control limits are drawn with a dashed horizontal line. On the ranges and standard deviations charts the lower control limit are not drawn if the computed value is zaro or less. It will be useful to draw lighter iines to horizontally divide de 1, 2 and 3 standard deviations zones between the central line and each limit.

4. Drawing preliminary conclusions from the charts.

- Indication of control or lack of control. Lack of control is indicated by points falling outside the control limits. The computational design of the control limits offers great confidence that a common cause system will seldom be responsible for points falling outside control limits. In contrast to this; when all points fall inside the control limits we can only say that it pays to act as if no assignable causes of variation are present. Still it is necessary to search for runs or patterns that might point to assignable causes of variation. For this purpose there are a series of rules or tests based on the number of points that can be expected on each zone of the chart if the process were subjected exclusively to a common cause system. The following situations suggest the need to searh for assignable causes of a possible process shift:

    - 2 out of 3 succesive points are on the zone between 2 and 3 standard deviations.
    - 7 succesive points going up or down.
    - 8 succesive points outside the 1 standard deviation zone on both sides of the central line.
    - 4 out of 5 succesive points outside the 1 standard deviation zone on the same side of the central line.
    - 15 succesive points inside the 1 standard deviation zone on both sides of the central line.
    - 14 alternating successive points.
    - 7 succesive points are on the same side of the centra line..
    - 10 out of 11 succesive points are on the same side of the central line.
    - 12 out of 14 succesive points are on the same side of the central line.
    - 14 out of 17 succesive points are on the same side of the central line.
    - 16 out of 20 succesive points are on the same side of the central line.

- Interpretation of process in control. With evidence from the control chart that a process is in control, we are in a position to judge what is necessary to permit the manufacture of product that meets the specifications for the quality characteristic charted. If specifications are met then it will suffice to maintain the state of the process to assure the quality of the product or service. If specifications are not met then it will be necessary to profoundly modify the process itself to reduce common variation or to better the centering of it with respect to the target specification.

- Interpretation of process lacking statistical control. When the control chart indicates lack of statistical control the obvious step is to hunt for the assignable causes of variation and try to correct them. The process centering and dispersion cannot be used to compare with specification limits because the process is not stable nor predictable. It is possible though to recalculate limits eliminating out-of-control points on the charts to predict where ought the process average and limits to be if a controlled state could be achieved. This way it can be known in advance whether or not profound process changes are necessary anyway to meet specification limits.

5. Continuing to use the charts.

- Revision of Central Lines and Control Limits. The trial control limits served the purpose of determining whether past operations were in control. The continuing use of the control chart, with each out-of-control point used as a possible basis for hunting for an assignable cause of variation and taking action to eliminate that cause, may require revised limits. Eventually, as more data accumulate, the limits will need to be reviewed to make them more precise or simply because there have been fundamental changes in the process that have modified the common-cause system of variation.

- Use of the Control Charts for Action on the Process. In continuing the use of the control charts, there may be three different kinds of action on the process as follows: 1) action to remove assignable causes of variation that are brought to attention by out-of-control points, 2) action to

establish the process average and 3) action to establish the process dispersion. Once a process is brought into control with a satisfactory average and dispersion, a purpose of the control chart is to help continue this state of affairs.

- Control Charts for Variables in relation to Acceptance Inspection. There are useful techniques for acceptance sampling and inspection, but it is well established that an overall decision with respect to the acceptance or rejection of a manufacturing process often is superior to a series of unrelated decisions regarding acceptance or rejection of separate lots of products. Control charts may give evidence that a process is in statistical control with satisfactory centering and dispersion which means the product is being made right the first time.

- Use of the charts for action on the specification. The basis of all specification limits should be the prospective use of the part or product for which the limits are specified. Ideally, all specification limits should be exactly right from the standpoint of what is really needed. Many specification limits are made tighter than really necessary, often because no time or effort has been given to finding out what is necessary. In most cases there is no one right value of specification limits which can be settled independently of cost factors involved; these cost factors cannot be properly judged without information regarding the capabilities of the manufacturing process such as is given by the control chart. Sometimes the appropriate conclusion from the control chart is to change the specification.

2.2.1 Control Charts for variables

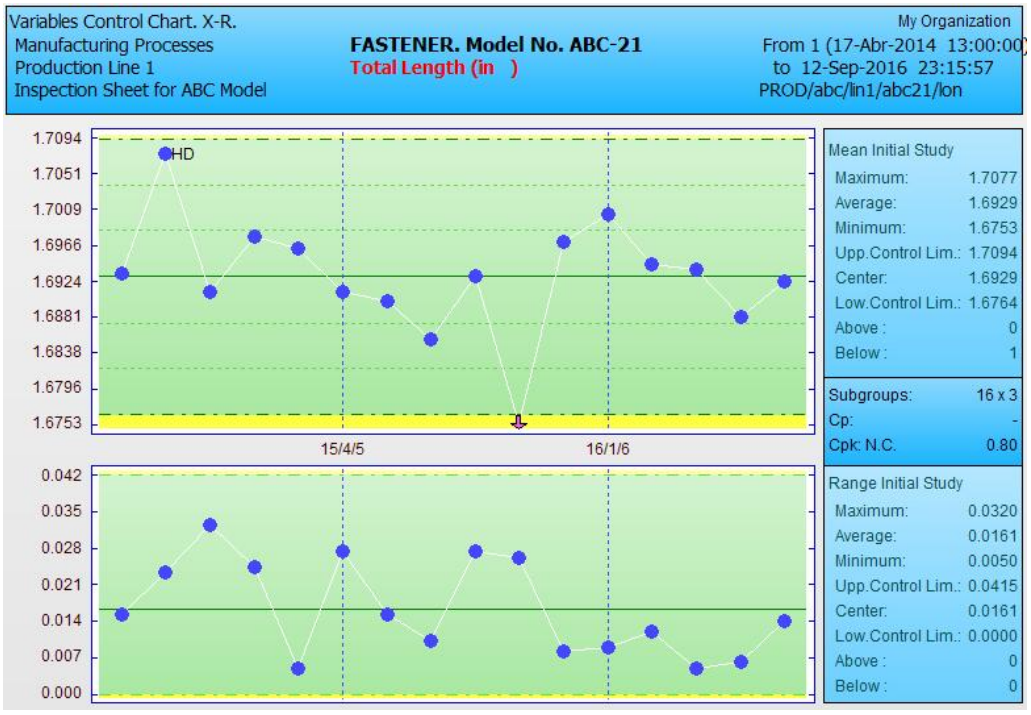
***Super*CEP** offers the following charts for Variables:

- X - R Chart (Means and Ranges)
- X - S Chart (Means and Standard Deviations)
- I - mR (Individuals and Moving Ranges)
- X – mR – R (Means, Moving Ranges and Ranges)
- EWMA - R (Exponentially Weighted Moving Averages and Ranges)

2.2.1.1 Means and Ranges Chart ($\overline{X} - R$)

The X-R chart, which is the traditional and fundamental tool of statistical process control, consists of two graphs, one for the Means (X) that will help us control process centering and the other for Ranges (R) that will help us control its variability.

Means and Ranges are obtained from subgroups of samples of constant size taken from the process at regular intervals of time or production units. Usually subgroup sizes are chosen between 4 and 5. Each data point on the Means graph is the average of the samples in one subgroup. Each point on the Ranges chart is the difference between the highest and lowest value in the subgroup. Control limits are calculated from the average Range and they delimit a 3 standard deviations zone around the process average.



Necessary formulas for the central line and control limits are:

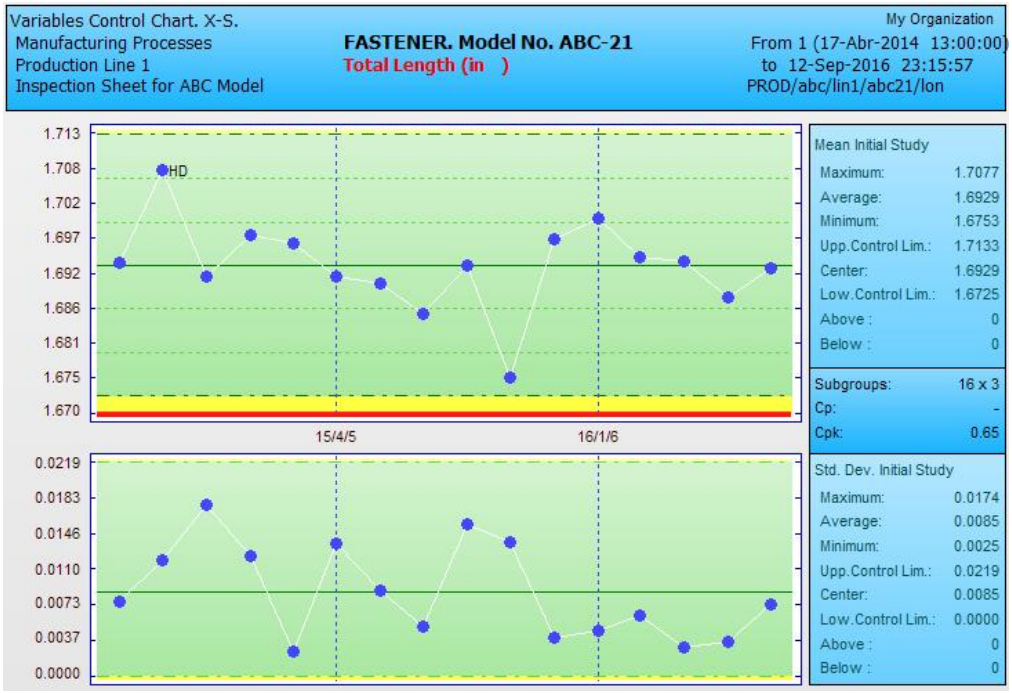
Graph	Limit	Definition	Estimate
Means	Upper	$\overline{\overline{X}} + 3\sigma_{\overline{X}}$	$\overline{\overline{X}} + A_2\overline{R}$
	Central	$\overline{\overline{X}}$	$\overline{\overline{X}}$
	Lower	$\overline{\overline{X}} - 3\sigma_{\overline{X}}$	$\overline{\overline{X}} - A_2\overline{R}$
Ranges	Upper	$\overline{R} + 3\sigma_R$	$D_4\overline{R}$
	Central	$\overline{R}$	$\overline{R}$
	Lower	$\overline{R} - 3\sigma_R$	$D_3\overline{R}$

Estimators vary with subgroup size n:

n	A2	D3	D4	n	A2	D3	D4
2	1.8806	0.0000	3.2670	21	0.1733	0.4254	1.5746
3	1.0231	0.0000	2.5740	22	0.1675	0.4347	1.5653
4	0.7285	0.0000	2.2820	23	0.1621	0.4438	1.5562
5	0.5768	0.0000	2.1140	24	0.1572	0.4530	1.5470
6	0.4833	0.0000	2.0040	25	0.1526	0.4602	1.5398
7	0.4193	0.0760	1.9240	30	0.1341	0.4830	1.5170
8	0.3726	0.1360	1.8640	35	0.1204	0.5016	1.4984
9	0.3367	0.1840	1.8160	40	0.1098	0.5162	1.4838
10	0.3082	0.2230	1.7770	45	0.1013	0.5277	1.4723
11	0.2851	0.2560	1.7440	50	0.0943	0.5372	1.4628
12	0.2658	0.2830	1.7170	55	0.0885	0.5453	1.4547
13	0.2494	0.3070	1.6930	60	0.0838	0.5512	1.4488
14	0.2353	0.3280	1.6720	65	0.0796	0.5582	1.4418
15	0.2231	0.3470	1.6530	70	0.0759	0.5670	1.4330
16	0.2123	0.3630	1.6370	75	0.0726	0.5787	1.4213
17	0.2028	0.3780	1.6220	80	0.0696	0.5943	1.4057
18	0.1943	0.3910	1.6080	85	0.0668	0.6152	1.3848
19	0.1866	0.4030	1.5970	90	0.0642	0.6426	1.3574
20	0.1796	0.4150	1.5850	95	0.0619	0.6781	1.3219
				100	0.0597	0.7231	1.2769

2.2.1.2 Means and Standard Deviations Chart ($\overline{X} - S$)

Each point of the Means chart is the average of the samples of a subgroup. Each point of the Deviations chart is the internal standard deviation of each subgroup. The control limits are calculated from the average standard Deviation and delimit a zone of 3 standard deviations on each side of the average.



Necessary formulas for the central line and control limits are:

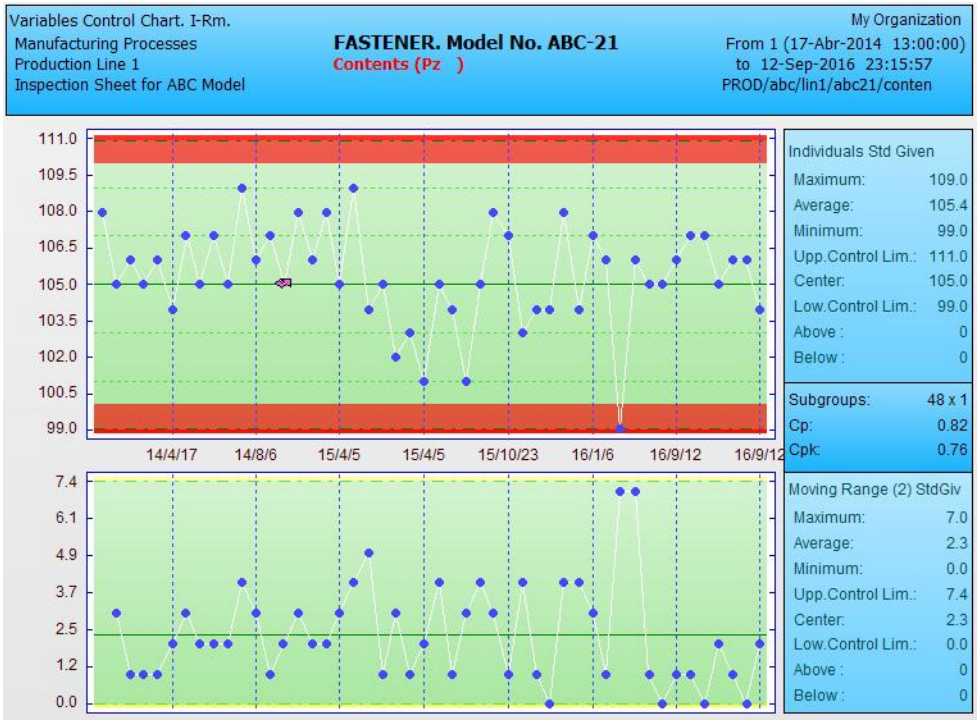
Graph	Limit	Definition	Estimator
Means	Upper	$\overline{\overline{X}} + 3\sigma_{\overline{X}}$	$\overline{\overline{X}} + A_1\overline{S}$
	Central	$\overline{\overline{X}}$	$\overline{\overline{X}}$
	Lower	$\overline{\overline{X}} - 3\sigma_{\overline{X}}$	$\overline{\overline{X}} - A_1\overline{S}$
Deviations	Upper	$\overline{S} + 3\sigma_S$	$B_4\overline{S}$
	Central	$\overline{S}$	$\overline{S}$
	Lower	$\overline{S} - 3\sigma_S$	$B_3\overline{S}$

Estimators vary with subgroup size n:

n	A1	B3	B4	n	A1	B3	B4
2	3.7599	0.0000	3.2664	21	0.6792	0.5231	1.4769
3	2.3937	0.0000	2.5682	22	0.6625	0.5354	1.4646
4	1.8799	0.0000	2.2659	23	0.6469	0.5458	1.4542
5	1.5959	0.0000	2.0895	24	0.6324	0.5561	1.4439
6	1.4100	0.0300	1.9700	25	0.6188	0.5638	1.4362
7	1.2766	0.1176	1.8824	30	0.5619	0.6039	1.3961
8	1.1750	0.1850	1.8150	35	0.5183	0.6342	1.3658
9	1.0942	0.2395	1.7605	40	0.4835	0.6604	1.3396
10	1.0282	0.2830	1.7170	45	0.4549	0.6767	1.3233
11	0.9726	0.3219	1.6781	50	0.4308	0.6953	1.3047
12	0.9253	0.3529	1.6471	55	0.4086	0.8744	1.1256
13	0.8842	0.3818	1.6182	60	0.3912	0.8277	1.1723
14	0.8482	0.4064	1.5936	65	0.3759	0.7964	1.2036
15	0.8162	0.4281	1.5719	70	0.3622	0.7729	1.2271
16	0.7876	0.4487	1.5513	75	0.3499	0.7544	1.2456
17	0.7618	0.4655	1.5345	80	0.3388	0.7393	1.2607
18	0.7384	0.4810	1.5190	85	0.3287	0.7267	1.2733
19	0.7170	0.4964	1.5036	90	0.3194	0.7159	1.2841
20	0.6974	0.5094	1.4906	95	0.3109	0.7066	1.2934
				100	0.3030	0.6985	1.3015

2.2.1.3 Individuals and Moving Ranges Chart ($PI - Rm$)

The control chart of individual points and mobile ranges can be used for characteristics whose individual samples are normally distributed. On the I chart each point represents an individual value. In the mR chart each point is the difference between the current sample and the previous sample.

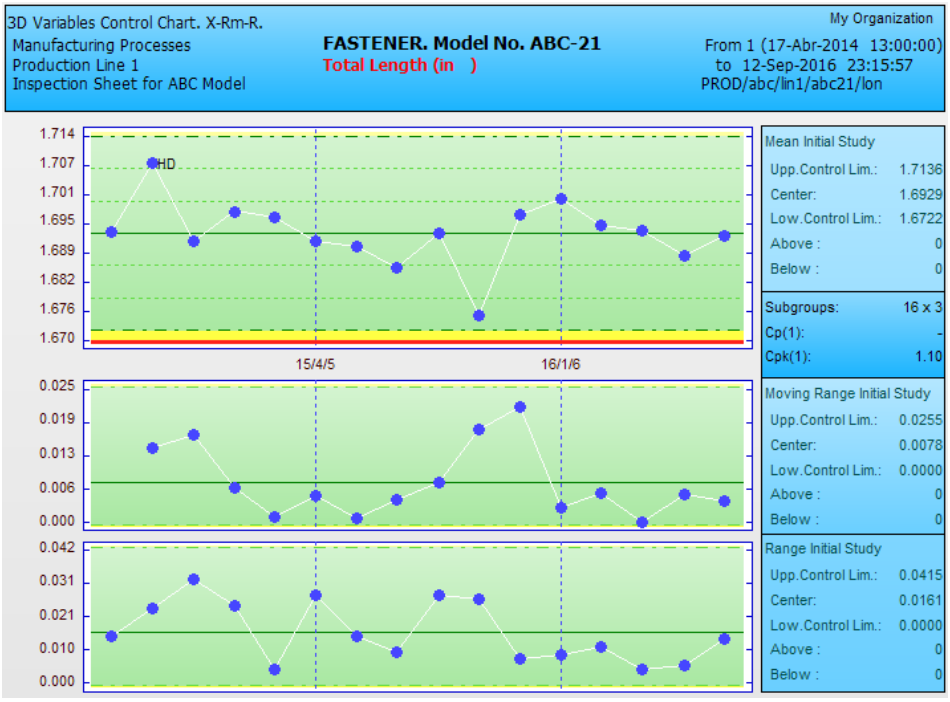


Necessary formulas for the central line and control limits are:

Graph	Limit	Definition	Estimator
Individuals	Upper	$\overline{PI}+3\sigma_{PI}$	$\overline{PI}+2.6596\overline{Rm}$
	Central	$\overline{PI}$	$\overline{PI}$
	Lower	$\overline{PI}-3\sigma_{PI}$	$\overline{PI}-2.6596\overline{Rm}$
Moving Range	Upper	$\overline{Rm}+3\sigma_{Rm}$	$3.267\overline{Rm}$
	Central	$\overline{Rm}$	$\overline{Rm}$
	Lower	$\overline{Rm}-3\sigma_{Rm}$	0.0

2.2.1.4 Means, Moving Ranges and Ranges ($\overline{X}-Rm-R$ or 3D)

Statistical independence between samples in each subgroup is one the most important requisites for a control chart to work properly, but also one of the most frequently ignored. Many times several measures of the same characteristic on the same sample are taken and these repetitions are integrated into subgroups charting its mean and range values. The lack of independence of these repetitions usually generates out-of-control charts. The 3D chart was designed to avoid this problem. The same means, moving ranges and ranges charts that we already know are presented with one difference: subgroups averages are taken as individuals on the moving range chart and for the calculation of limits on the means chart. This adaptation renders more realistic natural limits.



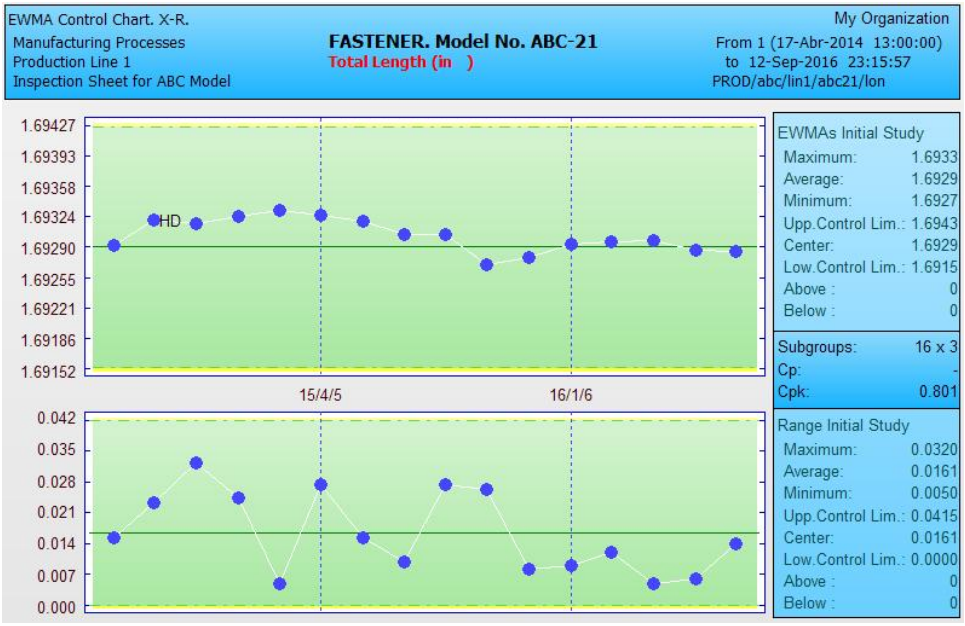
Necessary formulas for the central line and control limits are:

Graph	Limit	Definition	Estimator
Means	Upper	$\overline{\overline{X}} + 3\sigma_{\overline{X}}$	$\overline{\overline{X}} + 2.6596\overline{Rm}$
	Central	$\overline{\overline{X}}$	$\overline{\overline{X}}$
	Lower	$\overline{\overline{X}} - 3\sigma_{\overline{X}}$	$\overline{\overline{X}} - 2.6596\overline{Rm}$
Moving Range	Upper	$\overline{Rm} + 3\sigma_{Rm}$	$3.267\overline{Rm}$
	Central	$\overline{Rm}$	$\overline{Rm}$
	Lower	$\overline{Rm} - 3\sigma_{Rm}$	0.0
Ranges	Upper	$\overline{R} + 3\sigma_R$	$D_4\overline{R}$
	Central	$\overline{R}$	$\overline{R}$
	Lower	$\overline{R} - 3\sigma_R$	$D_3\overline{R}$

2.2.1.5 Exponentially Weighted Moving Averages and Ranges Chart (EWMA–R or mR)

The Exponential Moving Averages chart is an alternative to the Means or Individuals chart that can be used in processes where we want to investigate constant and small shifts in the process mean in the order of 0.5 to 2.0 sigma. Each point on the graph is geometrically weighted with all older data in a way that better represents small constant shifts sacrifying the sensibility for large sudden shifts. A weighting factor

(lambda) is chosen between 0.05 and 1.0 to inversely affect how much “smoothing” is obtained. Common chosen values fall between 0.2 and 0.4. Raw individual or grouped data can be used. The Ranges chart does not change.



Necessary formulas for the central line and control limits are:

Graph	Limit	Definition
Means	Upper	$\overline{\overline{X}} + \frac{\kappa \overline{R}}{d_2 \sqrt{n}} \sqrt{\frac{\lambda}{2-\lambda}}$
	Central	$\overline{\overline{X}}$
	Lower	$\overline{\overline{X}} - \frac{\kappa \overline{R}}{d_2 \sqrt{n}} \sqrt{\frac{\lambda}{2-\lambda}}$

Estimator d2 varies with subgroup size n:

n	d2	n	d2	n	d2	n	d2
		11	3.1730	21	3.7780	55	4.5720
2	1.1280	12	3.2580	22	3.8190	60	4.6220
3	1.6930	13	3.3360	23	3.8580	65	4.6720
4	2.0590	14	3.4070	24	3.8950	70	4.7220
5	2.3260	15	3.4720	25	3.9310	75	4.7720
6	2.5340	16	3.5320	30	4.0855	80	4.8220
7	2.7040	17	3.5880	35	4.2134	85	4.8720
8	2.8470	18	3.6400	40	4.3220	90	4.9220
9	2.9700	19	3.6890	45	4.4151	95	4.9720
10	3.0780	20	3.7350	50	4.4982	100	5.0220

Kappa factor varies with lambda:

lambda	kappa
0.05	2.49
0.10	2.70
0.20	2.86
0.30	2.93
0.40	2.96
0.50	2.98
0.75	3.00
1.00	3.00

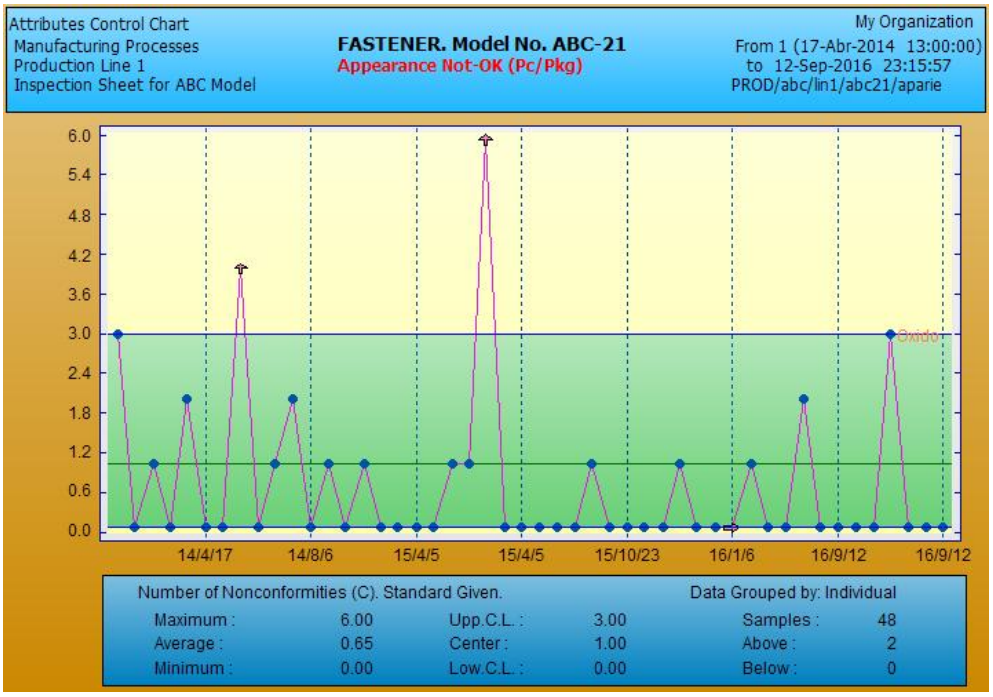
2.2.2 Control Charts for Attributes

When a quality characteristic can only be evaluated as accepted or rejected or qualified with a subjective scale then an analysis by attributes is necessary. The defective fraction chart or number of defects chart are used in this situations. The system handles the following Control Charts by Attributes:

- C Chart (Number of defects)
- U Chart (Number of defects per unit)
- P Chart (Defective fraction)
- NP Chart (Number of defectives)

2.2.2.1 Non-conformities chart (c).

Each point on the graph is the number of defects found in a sample, a lot, a period's production or any other constant-size opportunity area. Control limits border a 3 standard deviations probability zone around the mean so the interpretation of out-of-limits points is similar to the variables charts.

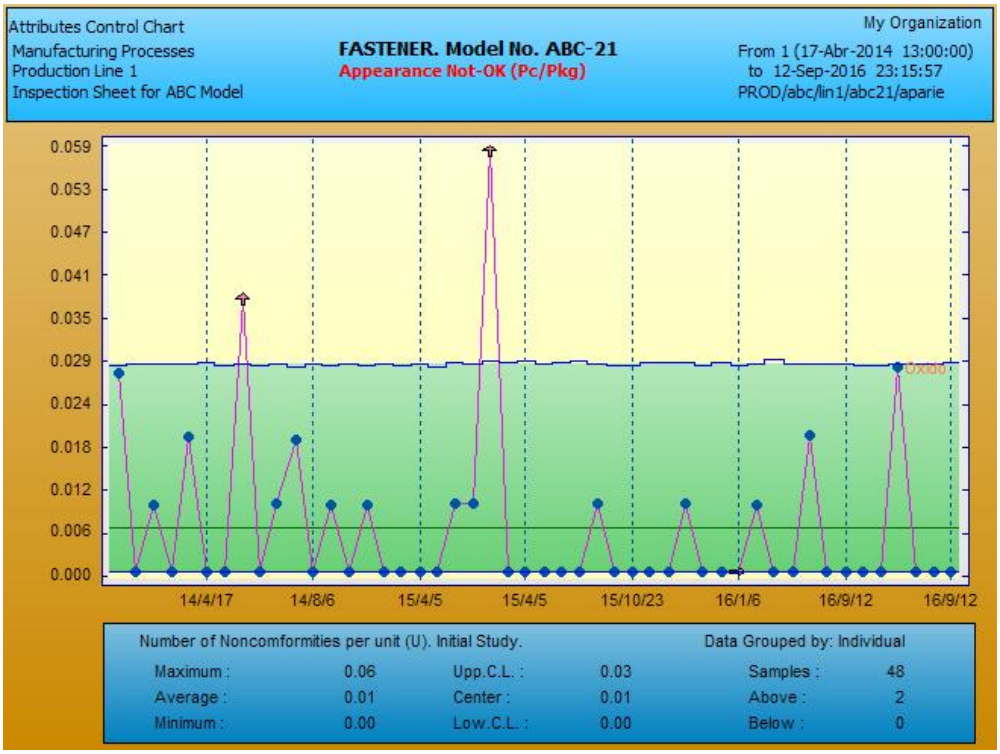


Necessary formulas for the central line and control limits are:

Limit	Definition	Estimator
Upper	$\bar{c}+3\sigma_{\bar{c}}$	$\bar{c}+3\sqrt{\bar{c}}$
Central	$\bar{c}$	$\bar{c}$
Lowerr	$\bar{c}-3\sigma_{\bar{c}}$	$\bar{c}-3\sqrt{\bar{c}}$

2.2.2.2 Non-conformities per Unit Chart (u).

Each point on the graph represents the quotient between the number of defects found in a sample, lot, period's production or any other opportunity area and its size, which might not be constant. Control limits are interpreted as usual except that they will vary from point to point according to the inverse of the opportunity area size.

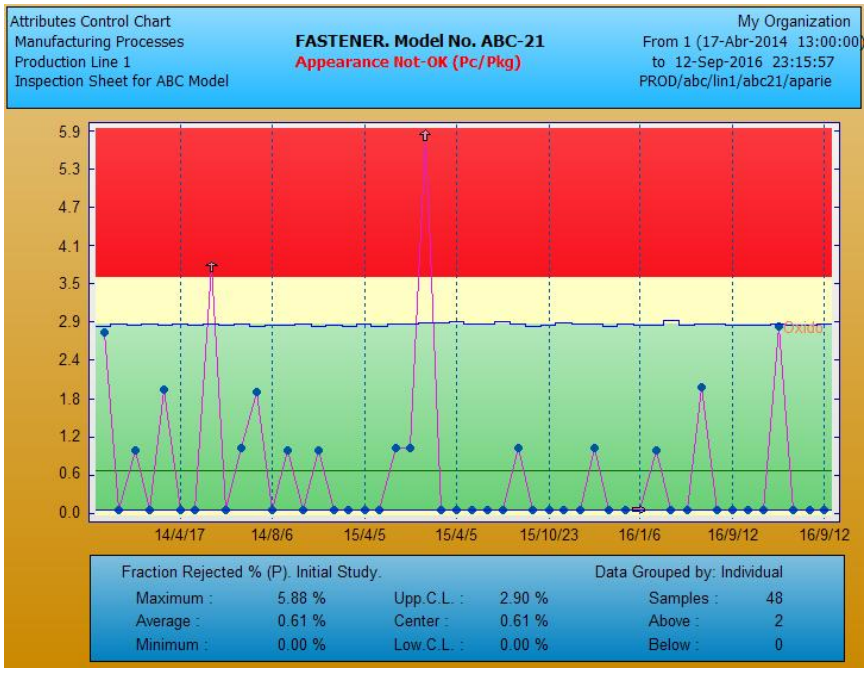


Necessary formulas for the central line and control limits are:

Limit	Definition	Estimator
Upper	$\bar{u}+3\sigma_{\bar{u}}$	$\bar{u}+3\sqrt{\bar{u}/n}$
Central	$\bar{u}$	$\bar{u}$
Lower	$\bar{u}-3\sigma_{\bar{u}}$	$\bar{u}-3\sqrt{\bar{u}/n}$

2.2.2.3 Non-Conforming Fraction Chart (p).

Each point on the graph represents the percentage of the number of non-conforming units (with each rejected unit having one or more defects) in the sample, lot, period's production or any other opportunity area, which might not be of constant size. Control limits are interpreted as usual except that they will vary from point to point according to the inverse of the opportunity area size.

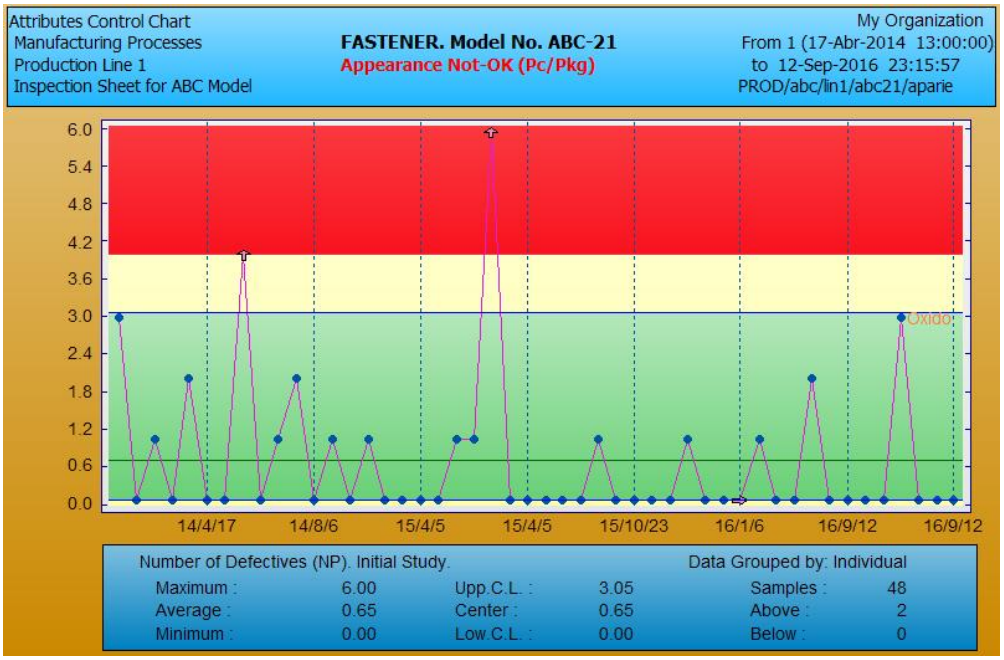


Necessary formulas for the central line and control limits are:

Limit	Definition	Estimator
Upper	$\overline{p}+3\sigma_{\hat{p}}$	$\overline{p}+3\sqrt{\overline{p}(1-\overline{p})/n}$
Central	$\overline{p}$	$\overline{p}$
Lower	$\overline{p}-3\sigma_{\hat{p}}$	$\overline{p}-3\sqrt{\overline{p}(1-\overline{p})/n}$

2.2.2.4 Non-Conforming units Chart (np).

Each point on the graph is the number of non-conforming elements (each rejected unit may have one or more non-conformities) found in a sample, lot, period's production or any other opportunity area of constant size. Control limits border a 3 standard deviations probability zone around the mean so the interpretation of out-of-limits points is similar to the variables charts.



Necessary formulas for the central line and control limits are:

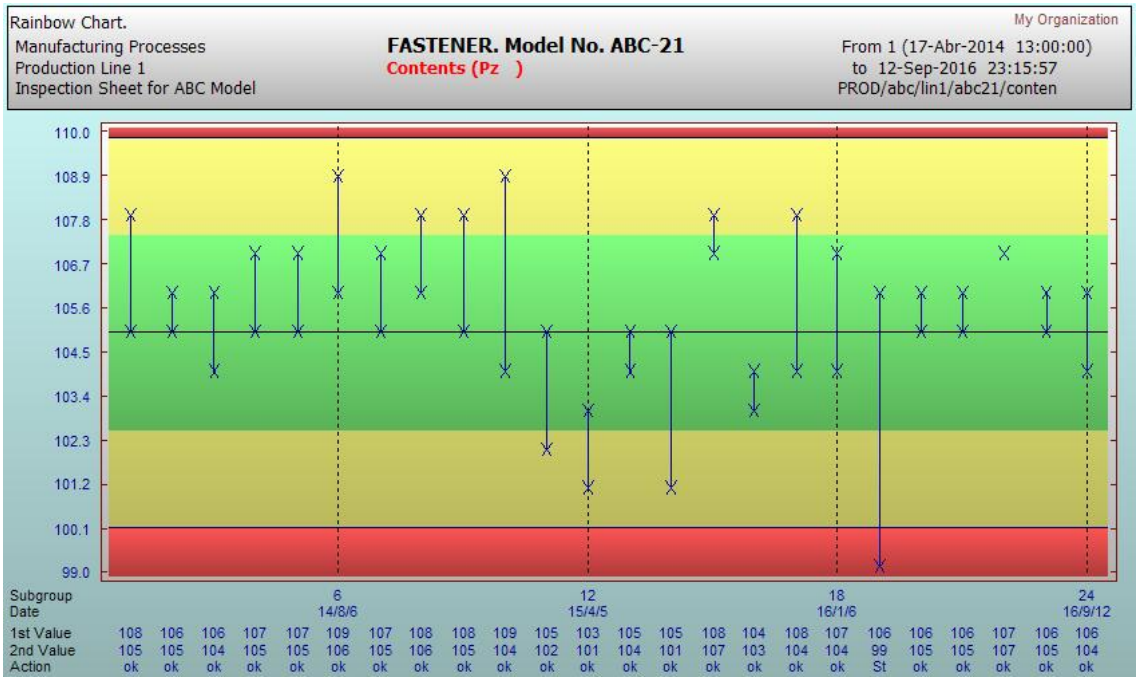
Limit	Definition	Estimator
Upper	$\overline{np}+3\sigma_{np}$	$\overline{np}+3\sqrt{\overline{np}(1-\overline{p})}$
Central	$\overline{np}$	$\overline{np}$
Lower	$\overline{np}-3\sigma_{np}$	$\overline{np}-3\sqrt{\overline{np}(1-\overline{p})}$

2.3 Other Sequential Charts

2.3.1 Rainbow Chart

It is a practical tool for in-line process control. It is recommended because it is especially effective controlling processes with frequent set-ups, adjustments and tooling changes.

Comparing it with the X-R chart it has some attractive characteristicss like the small subgroup sizes allowed (usually 2 samples every 30 minutes) and the fact that no calculations are needed. This allows operators and tooling personnel to use them in an effective manner with little training.



Another advantage is that the Rainbow chart shows samples directly charted against specification limits instead of control limits, which is the case with control charts like X-R.

To use this chart the process must show some statistical properties:

- The probability distribution of the process must approximate a normal distribution.
- The process must be in a state of statistical control.
- The process must be centered very close to the nominal specification value (half-way between upper and lower specification limits).
- The process must have a potential capacity index (Cp) of at least 1.33.

If these conditions are met, 5 color areas are drawn in the following way:

Upper Red.	Above the upper specification limit.
Upper Yellow.	Between 75% of tolerance and upper specification limit.
Green.	Between 25% and 75% of tolerance.
Lower Yellow.	Between 25% of tolerance and lower specification limit.
Lower Red.	Below the lower specification limit.

The usage routine is as follows:

1. After a set-up, adjustment or tooling change, inspection is a 100% until 5 consecutive measures fall on the green zone.

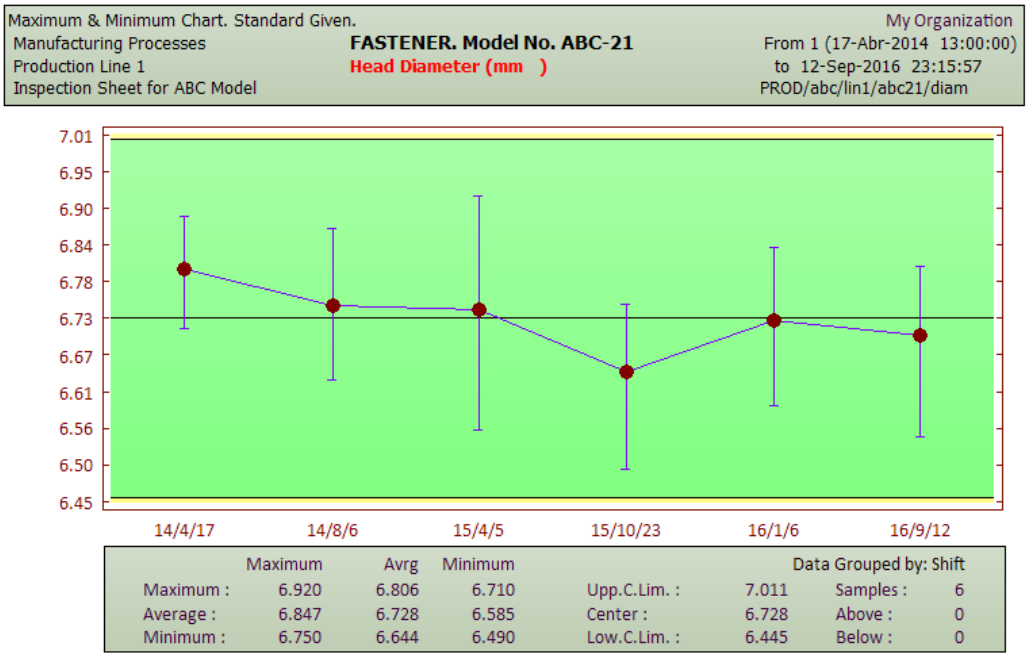
2. Having 5 measures on the green zone sampling inspection begins.
3. Initially 2 samples are taken at 30 minutes intervals and both measures from the subgroup are recorded.
4. Actions are taken based on which color zones both measures fall on:

Situation	Action
Both points on the green zone. One point on the green zone and the other on any yellow zone.	Continue without change.
Both points on the same yellow zone. One point on the red zone and the other on any zone of the same side of the nominal target.	Adjust and enter 100% inspection until finding 5 consecutive measures on the green zone.
One point on the red zone and the other on any zone on the other side of the nominal target. Both points on opposite yellow zones.	Stop the operation and ask for supervision.

5. Samples with values on the red zone are to be handled according to non-conforming product procedures.
6. Based on process control needs, reduction of inspection frequency can be justified after having 25 subgroups with all its measures on the green zone.

2.3.2 Maximum and Minimum Chart

Similar to the Means control chart this graph show the average of each subgroup and also the lowest and highest value with an I bar. Subgroups are not necessarily made up of constant size samples but instead they encompass a constant period's samples. The central line is the average of the means of all subgroups, while control limits are calculated for each period from the range. This chart is useful for comparing extreme values with specification limits.



2.3.3 Group Chart

When forming the subgroups for a control chart, mixing samples from different currents of a process is a common mistake. This frequently happens when the same machine has distinct positions, cavities, injectors, molds, dies, etc.

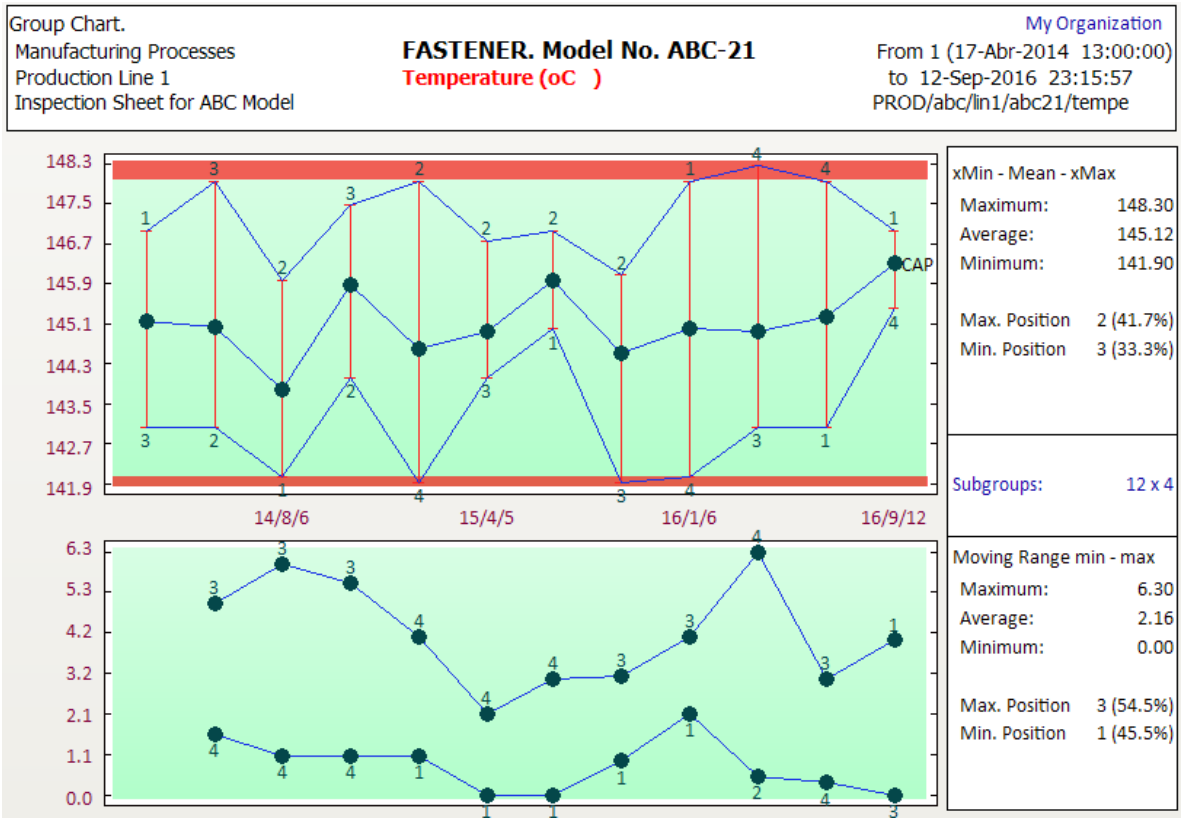
In fact, each one of these elements usually behaves as a relatively independent process with its own average and standard deviation and therefore collecting product samples from all of them into one subgroup will mask the signals of instability losing the ability to detect them. If one wants to avoid this mistake, the practical problem arises of how the control chart of each element can be analyzed without having to spend too much time and effort.

The Group chart can be used to detect which elements or positions deserve a closer analysis with a control chart.

On a Group chart, extreme upper and lower samples from a fixed period of time are shown with a label identifying its origin. This permits saying, for example, that mold number 5 is delivering the most deviated samples most of the time.

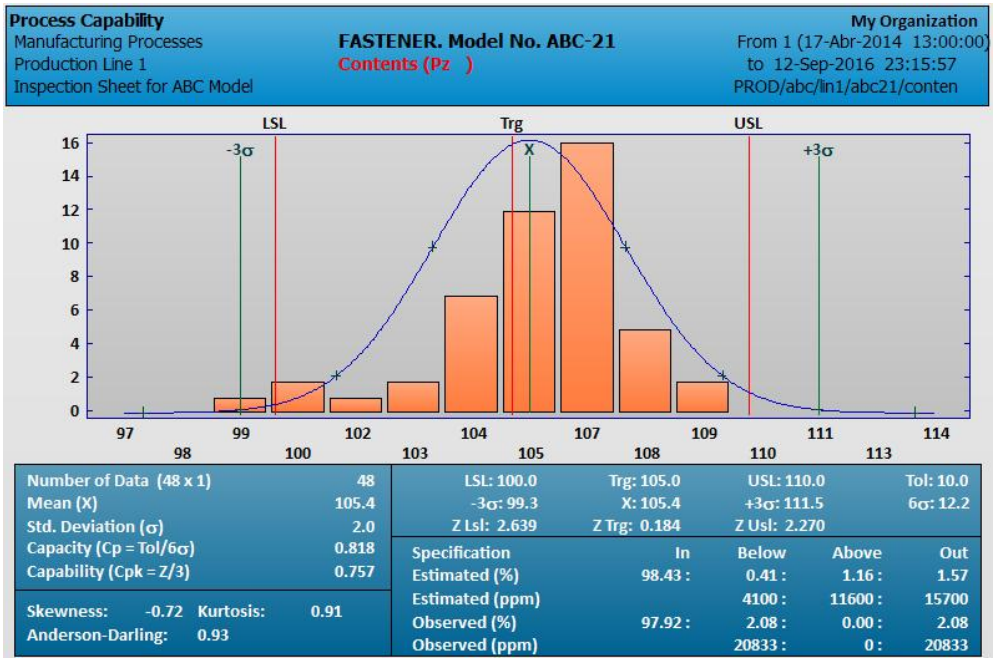
The highest and lowest moving ranges between successive periods are labeled on a second chart.

Due to its nature this graph does not lend itself to the calculation of control limits but it is useful as a guide to initiate other analysis.



2.4 Process Capability Study.

The tabulation or gathering of the number of times in which a certain measurement of the quality characteristic or variable to analyze appears, for any product that is being examined is known as a Frequencies Histogram. The tabulation or data ranking is represented putting on the vertical axis the frequency in which the data occur, and on the horizontal axis the values of the characteristic that is being measured; these values are represented in small numerical intervals almost always defined by the user, called class intervals.



Commonly, in the referred Histogram, the corresponding values of the target mean of all the population are also shown, as well as the values for the upper and lower specification limits.

The process capacity or Cp is defined as the relationship between the specification limits or tolerance and the total variability of the process given by the calculation of the standard deviation.

Mathematically it is expressed in the following form:

$$Cp = \frac{\text{Upper Specification - Lower Specification}}{\text{6 times the standard deviation}}$$

Example:

Upper Specification Limit: 5.00 % humidity
Lower Specification Limit: 3.00 % humidity
Process Standard Deviation: 0.40 %
(Calculated with data obtained from last month)

Substituting these values in the formula gives the following result:

$$Cp = \frac{5.0 - 3.0}{6 \times 0.40} = 0.83$$

The denominator is greater than the numerator resulting in a value smaller than 1.0. This means that the process has greater variability than what the specification allows.

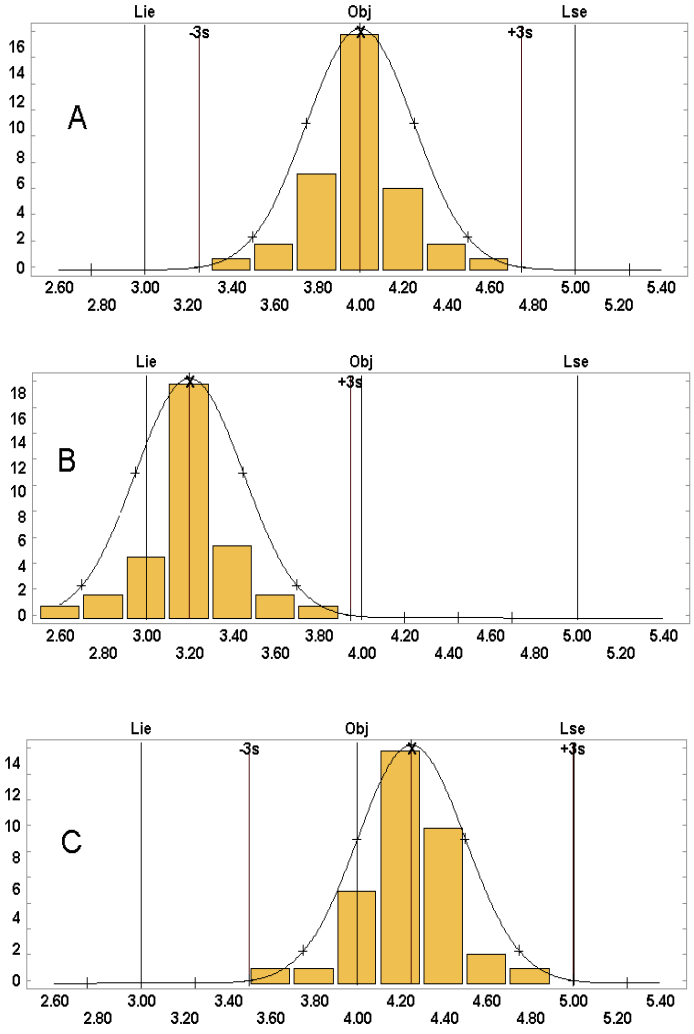
Now, corrective action is taken on one of the common causes to reduce the variability and then the new standard deviation of the process is equal to 0.25%, therefore we have a new value for Cp:

$$Cp = \frac{5 - 3}{6 \times 0.25} = 1.333$$

This indicates that the variability of the humidity that the process gives is less than that of the established tolerance; therefore the process has the potential capacity of fulfilling the specification.

As it's seen, the Cp index permits to qualify the variability of products and processes, being greater the capacity of complying with the specification, when the Cp value is greater.

You must realize that for calculating the value of Cp it has been assumed that the average value of the distribution always coincides with the center of the specification, but in reality there will be situations, as those of the cases "B" or "C" of the following figure, where the average of the distribution does not coincide with the center of the specification.



It is evident that in case "B" there are more values outside of specification and in the "C" case, though in smaller quantity, the distribution shows that the values also tend to be outside the upper limit of the

specification; however, according to the Cp formula, in all "A", "B" and "C" cases, the numerical value would be 1.33.

To consider this situation, we use a more meaningful index that takes into account the position of the center of the distribution with respect to that of the specification, that we call Process Capability (Cpk). Mathematically it is expressed as:

$$Cpk\ usl = \frac{\text{Upper Specification} - \text{Mean}}{\text{3 times the standard deviation}} = \frac{LSE - X}{3 \cdot s}$$

$$Cpk\ lsl = \frac{\text{Mean} - \text{Lower Specification}}{\text{3 times the standard deviation}} = \frac{X - LIE}{3 \cdot s}$$

From the obtained values, we take into account the smaller one.

$$Cpk = Min\ (Cpk\ lsl, Cpk\ usl)$$

Applying the formula to case "A" case in which the distribution average = 4.0 we have:

$$Cpk\ usl = \frac{5-4}{3 \times 0.25} = 1.333 \qquad Cpk\ lsl = \frac{4 - 3}{3 \times 0.25} = 1.333$$

In this case, the distribution mean coincides with the center of the specified limits, therefore the values of Cpk usl, Cpk lsl and Cp are equal and therefore Cpk is equal also.

In the"B" case, where the average distribution = 3.2, we have:

$$Cpk\ usl = \frac{5 - 3.2}{3 \times 0.25} = 2.4 \qquad Cpk\ lsl = \frac{3.2 - 3}{3 \times 0.25} = 0.267$$

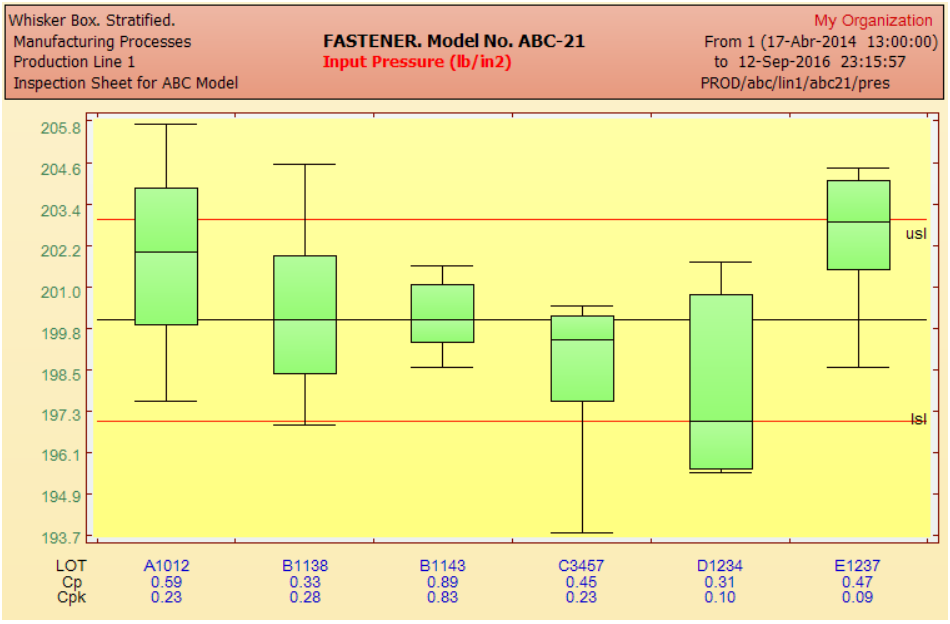
In this case, to use only the value of Cpk usl would make the process look perfect, but the value of Cpk lsl = 0.267, which is the value that will be taken as Cpk, is very low, which indicates that most of the data is outside the lower limit, something which can be noticed in the previous figure.

In the "C" case the average of the distribution = 4.25 and therefore:

$$Cpk\ usl = \frac{5 - 4.25}{3 \times 0.25} = 1.0 \qquad Cpk\ lsl = \frac{4.25 - 3}{3 \times 0.25} = 1.666$$

In this case, there are no problems with the lower limit, but on the other hand, the value of Cpk usl indicates that it is on the exact frontier of the specified upper limit.

The foregoing permits to conclude that higher Cpk values mean smaller variability and closer distribution mean and target value, yielding higher probability of complying with the conditions specified for a given process or product, that is, greater Cpk means greater quality.

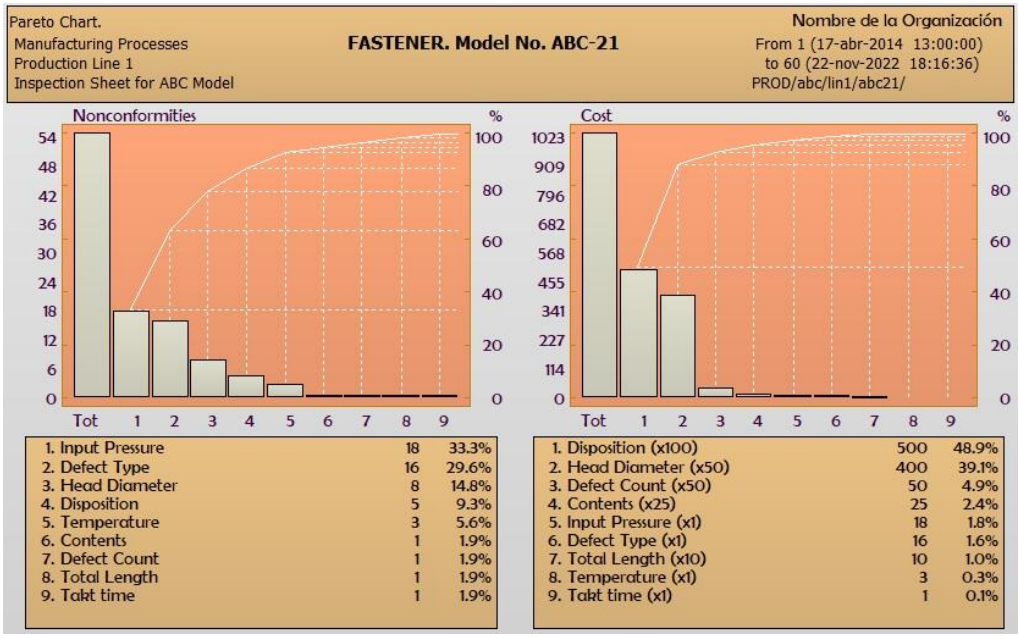


2. 5 Pareto Chart.

In productive processes there are many factors that should be improved and these, at the same time, consist of several small problems, therefore on some occasions it is difficult to know which ones should be attacked first and what road to follow to solve them.

The Pareto chart is a tool that sorts by order of importance, the negative impact of the non conforming characteristics that are measured on a given process or product, either by frequencies of defects or found contingencies or by its cost or value that they impinge on the process.

Systematic elaboration of these charts permits us to observe the evolution of the improvements accomplished on the productive processes.



2.6 Acceptance Sampling of Lots.

Manufactured goods are sent to customers in batches that vary in size from a few up to many thousands of individual objects. Ideally, each batch would not contain any defective object, but in practice it is quite rare to find this case.

Recognizing the fact that some defective objects have been sent, even supposing that the batch may have been a hundred percent surveyed, many consumers demand evidence based on careful inspection, of the fact that the portion of defective items in each batch will not be excessive.

A frequently employed method and a very effective one to give this kind of evidence is that of samples inspection, in which the samples are selected from each batch before shipment (or before consumer acceptance) and a decision is made based on this sample to accept or reject the whole batch. A batch can be accepted even though it contains some defective units. The agreement between producer and consumer will establish some form of compensation to the consumer for these rejections.

The rejection of a batch does not mean that it has to be destroyed, but simply that it should be subdued to a strict inspection to eliminate all the defective parts.

As this cost is not negligible at all (some times is as high as the production cost and sometimes greater) it will not always be convenient to check all the pieces of a batch. Consequently, the inspection for acceptance implies as a rule the use of samples; more specifically, a random sample is selected from each batch and the batch will be accepted if the number of defective items found in the sample does not exceed a given acceptance number.

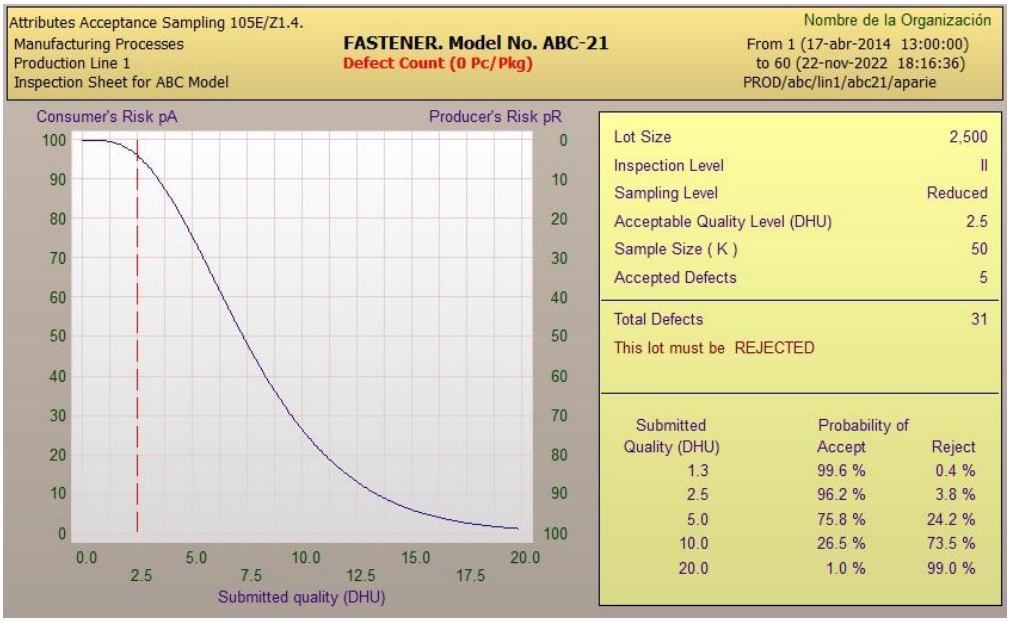
For lot acceptance sampling ***Super*CEP** uses the inspection standards by attributes MIL-STD-105E / ANSI-Z1.4 and MIL-STD-1916 and the inspection standards by variables MIL-STD-414, ANSI-Z1.9 y MIL-STD-1916.

2.6.1 MIL-STD-105E / ANSI-Z1.4

ACCEPTABLE QUALITY LEVEL (AQL). The level of acceptable quality (AQL) is defined as the maximum defective percentage (or the maximum number of defects per hundred units) that, for inspection sampling purposes, can be considered satisfactory as an average of the process. In MIL -STD-105 E / ANSI-Z1.4, the values of AQL of 10 or less are expressed as defective percentage or as defects per hundred units; those above 10, are expressed only per hundred units.

INSPECTION LEVELS AND STAGES. These concepts determine the size of the sample to inspect. The system allows choosing between the 4 special levels and the 3 general levels under single sampling in Normal, Tightened and Reduced sampling stages. Special levels of inspection are applied to very reliable suppliers that only need small samples to decide acceptance of the lot. General levels 1 and 2 are recommended at the beginning of a system of lot sampling. Finally, inspection level 3 is suggested for less reliable suppliers which have had difficulties meeting required specifications in the near past and need to submit bigger samples form the lots to decide acceptance.

Finally, the **Sampling Plan**, that is the combination of lot size, inspection level, inspection stage and AQL determine the acceptance Number c which limits the maximum number of non-conforming items that can be found in the sample to accept the whole lot.

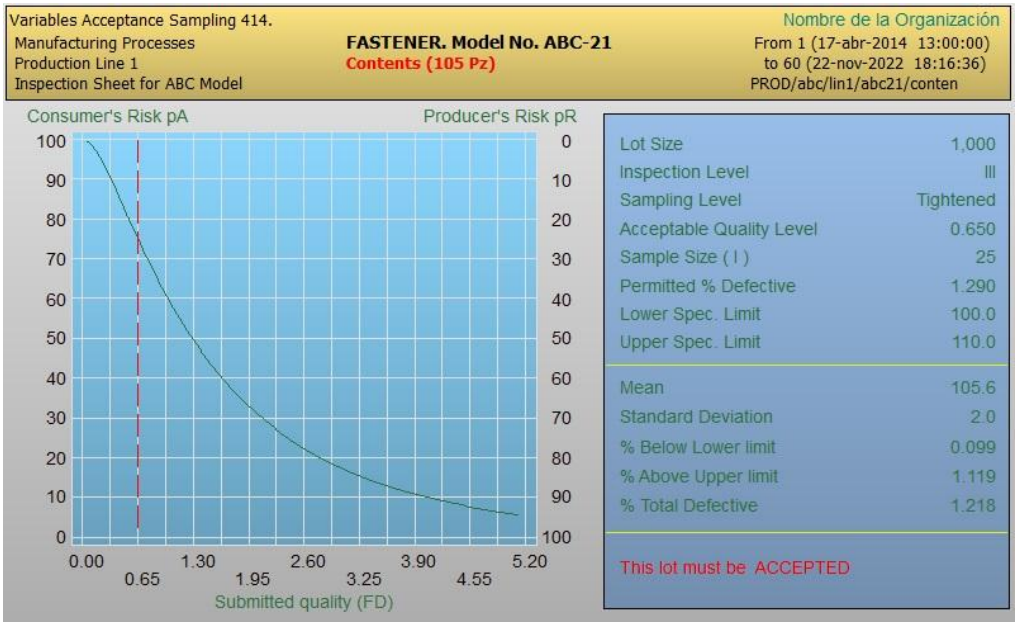


2.6.2 MIL-STD-414

The standard by variables has similarities with the standard by attributes. Like the standard by attributes, the sampling plans are catalogued by AQL, inspection level and lot size.

The definition of AQL is different from that found in the MIL-STD-105D. In MIL-STD-414, the level of acceptable quality, AQL, is defined as a nominal value expressed in terms of defective percentage specified for only one quality characteristic.

There are five inspection levels ranging from I to V (1 to 5). Level 1 is the least rigorous and level 5 the most rigorous. The acceptance criteria are taken from the master tables B-3 and B-4 for bilateral and unilateral specifications Form 2 of the Normal, Tightened and Reduced inspection stages based on unknown variability.



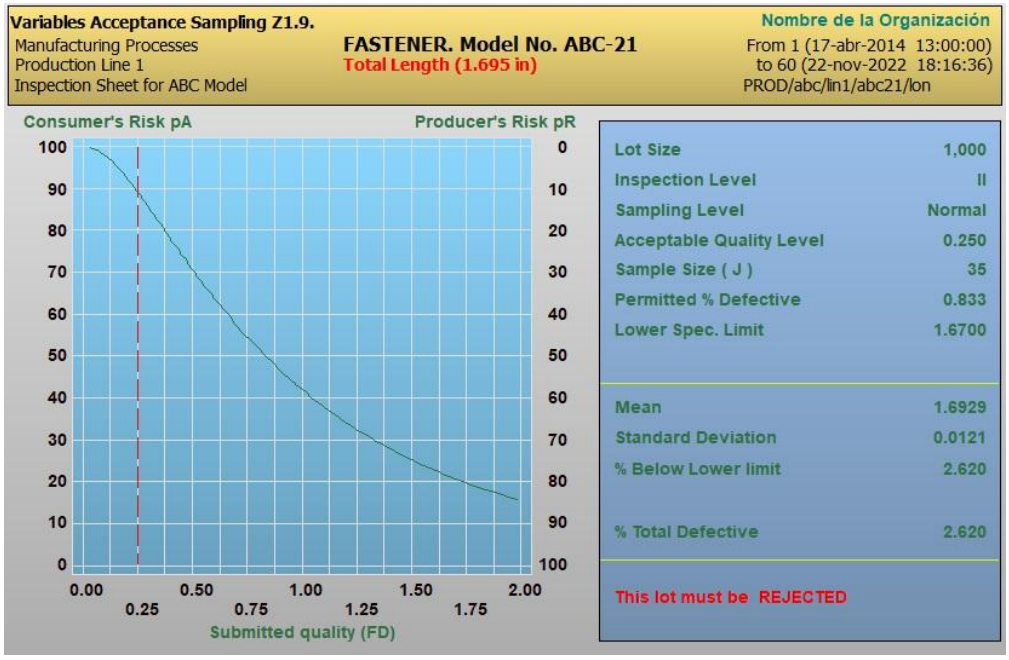
When this type of sampling is applied for the first time we begin with inspection level 4 unless other one is specified. Level 1 is applied to unreliable suppliers, therefore we would have to inspect the largest possible sample to decide if the lot is accepted or rejected.

Example:

Lot size	5000
Inspection Level	1
Code Letter	G
Aceptable Quality Level (AQL)	1.0
Sample size	15
% Non-conformance allowed	3.05
Mean	18.00
Lower specification limit	17.50
Upper specification limit	18.22
Standard deviation (s)	0.21
Estimate % above USL	2.31
Estimate % below LSL	0.42
Estimate % Total non-conforming	2.73
The lot must be	**ACCEPTED**

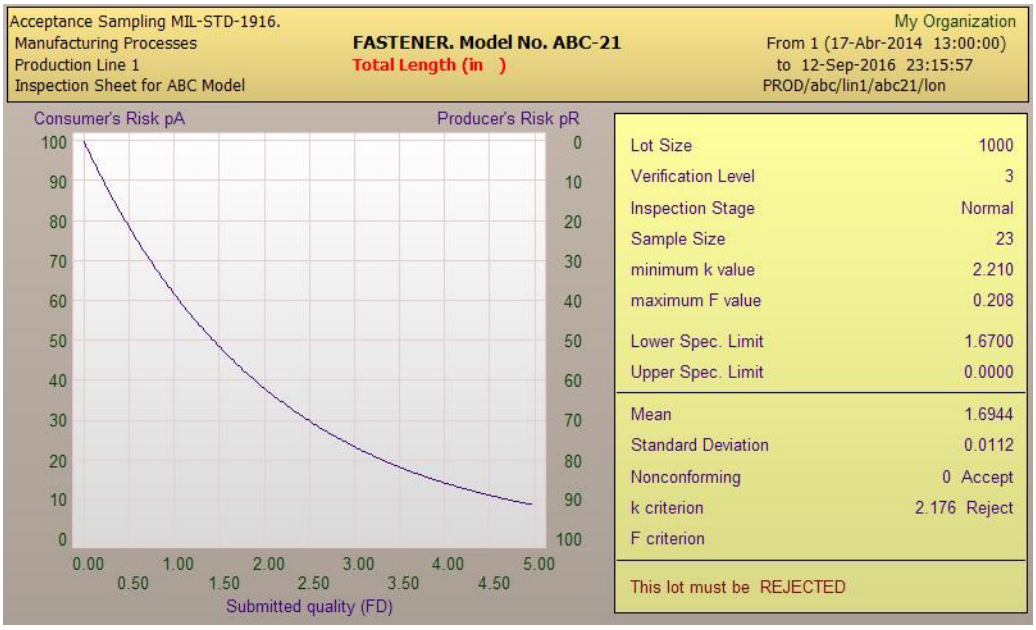
2.6.3 ANSI Z1.9

The 2003 version is similar to MIL-STD-414 with some adjustments to the names of Inspection Levels, Lot Sizes, Sample Size codes and M critical values.



2.6.4 MIL-STD-1916

Replaces previous military standards radically eliminating the concept of AQL. There are 7 verification levels with its corresponding tightened and reduced inspection stages. For attributes inspection all acceptance numbers are c = 0. For variables inspection, the k and F tables give similar error risks to the equivalent attributes levels but with smaller sample sizes.



The new standard emphasizes prevention thru SPC as a better way to quality assurance and proposes the use of acceptance sampling as a last resort.

2.7 LINEAR REGRESSION

Through this technique it is possible to determine if a variable is correlated with some other or if they vary independently. This is of importance when investigating the reaction or behavior of a variable upon modifying another. When two or more variables are related it is possible to design indirect inspection systems that could be more economic and practical than the direct measurement of the variable of interest.

What is sought is a polynomial of order 1 or order 2 that provides the best fit on the pairs of data obtained in sampling under statistical control. The coefficients of the first-order polynomial are obtained directly by the least squares method. The results are reported in the form:

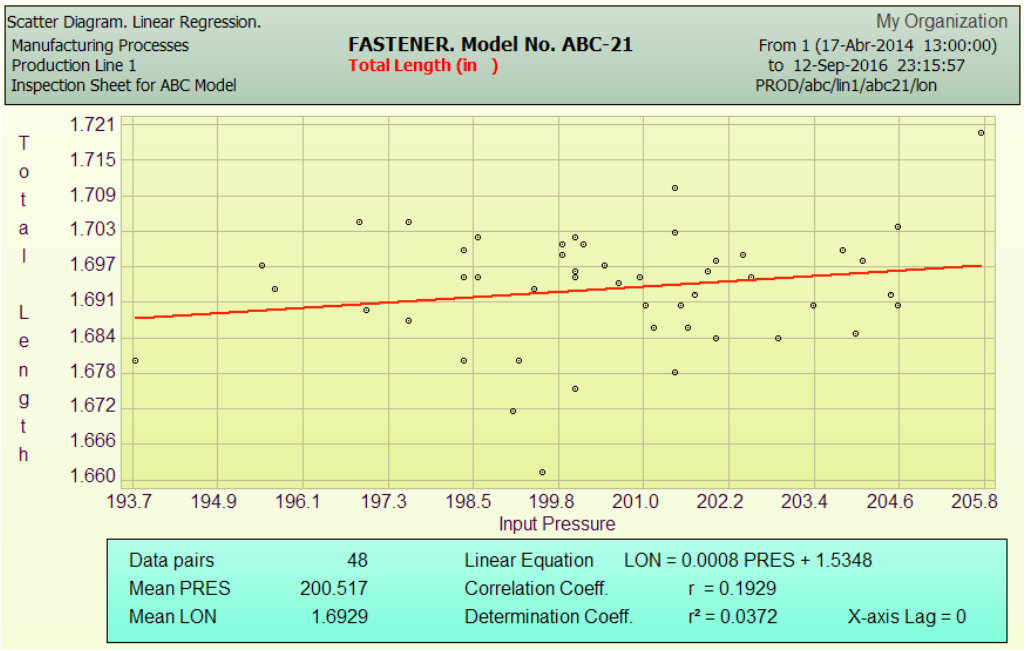
$$y = f(x) = mx + b$$

where the function is that of a straight line with slope “m” and intercept “b”.

To obtain the coefficients of the second order polynomial, an algorithm of operations on a 3x3 matrix obtained from the data is used to obtain a result of the form:

$$y = a0 + a1(x) + a2(x^2)$$

It is possible to calculate the determination coefficient "r^2" that is a measure of how well the "y" values can be predicted from the "x" values using the discovered function. In practice this coefficient should be greater than 0.8 to expect close predictions.



If "x" and "y" are cause and effect related, then it could be necessary to unsync the formation of value pairs to account for the time it takes the cause to produce its effect. This technique can be useful also in the research of cycles within a data series pairing with data points from previous periods (autocorrelation). If periodicity exists then the values of the r coefficient will reach a maximum for certain values of the delay which are multiples of the cycle amplitude.

The system can look for non-linear correlation of 2 variables transforming one or both of them with a formula. For example to obtain a correlation of the type

$$y = f(\log x)$$

the x characteristic is transformed obtaining its logarithm and using this result instead of the original values.

3. INSTALLATION AND START-UP.

3.1 Hardware and Operating System Requirements

The following are the minimum hardware and software requirements to adequately run the system:

- Intel Core Proccesor or compatible @ 1.6 Ghz.
- 32 or 64 bits Windows Operating System (Server 2003 R2, 7, 8 or 10)
- 2.0 Gigabytes of RAM.
- XVGA color monitor (1024x768) or better.
- 500 Megabytes of Hard Disk storage available.
- 100 Mbps Ethernet connection.
- Mouse and Keyboard or Touchscreen
- Graphics Printer

3.2 Local installation on a PC.

To install the system on a PC follow the next instructions:

1. Login as an Administrator and close all Windows applications.

2. Put the original CD in the drive. If the computer does not have a CD drive you can access a shared drive in your local network or copy the contents of the CD to a shared folder or flash memory or download the installation files from the Internet (read on).

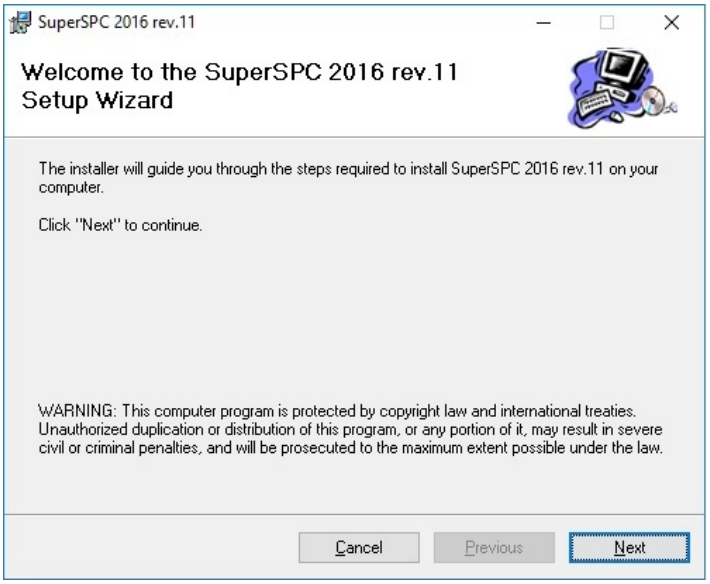
3. Click on the Start button in the Windows Task bar and then click on My PC. Navigate to the **\SuperCEP 2016** folder on the CD or shared resource that contain the installation files and double click on the **SuperSPC2016.msi** file.

   Note: The software will automatically install for all current and future users of the PC (ALLUSERS=1). If you wish to install only for the current user then you should open the Run dialog in the windows Start button and write the command MSIEXEC /i e:\Supercep2016\SuperSPC2016.msi ALLUSERS="".

4. The Windows Installer will start. This program is a component of your Windows Operating System.

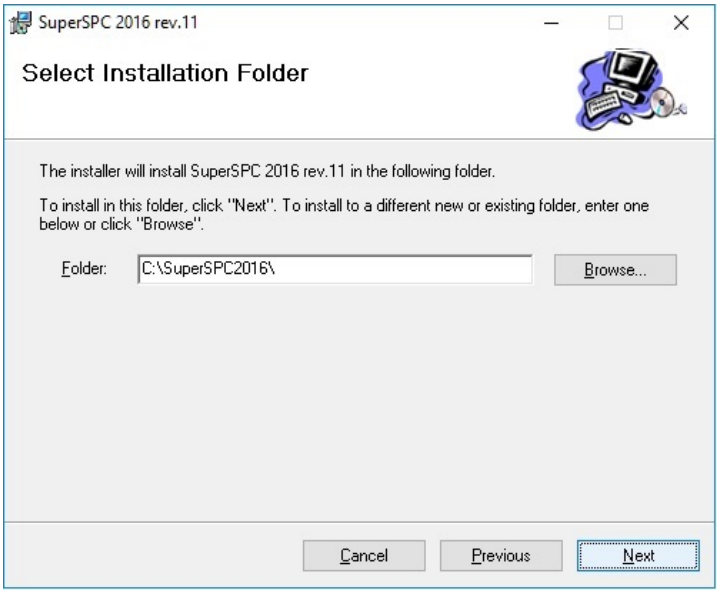
   Important: If you get some error message related to MDAC (Microsoft Data Access Components), please run the file MDAC_TYP.EXE, which is found on the original CD. This executable will install version 2.5 SP3 of these components. Retry from step 3.

5. After a few seconds the following dialog will show:



6. Click on the Next button.

7. You can confirm the installation to the folder **C:\SuperSPC2016**. If you wish to install to a different disk or folder, click on **Examine...** and select the new target path. Anytime after installation the database location can be changed with the menu option **Configure Database Location**.



Important: The program should not be installed in the root folder or in the Program Files folder.

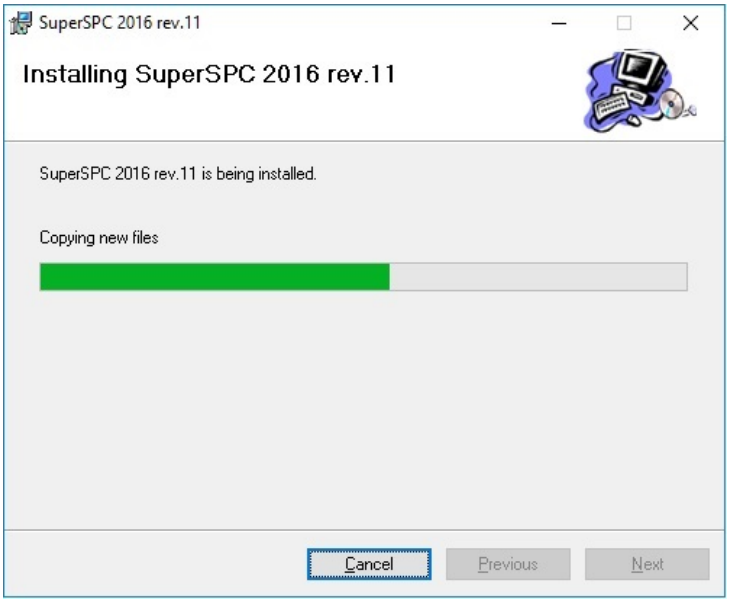
Important: If you are using any older version of SuperSPC do not select the same folder for the new installation or they will stop working. Although the 2016 version can coexist with older versions in the same PC (as long as they are installed on different folders), databases are neither forward nor backward compatible, therefore each version should keep their own databases.

Important: It is always recommended to install on a new or empty folder. If you had previously installed version 2016 on the computer, the installer program will prompt you to uninstall and then install again. If there is a useful configuration database in your system, make a backup copy of the ***SCEP2016.MDB*** *file before uninstalling, even though this file will not be deleted nor the data folders created by the system.*

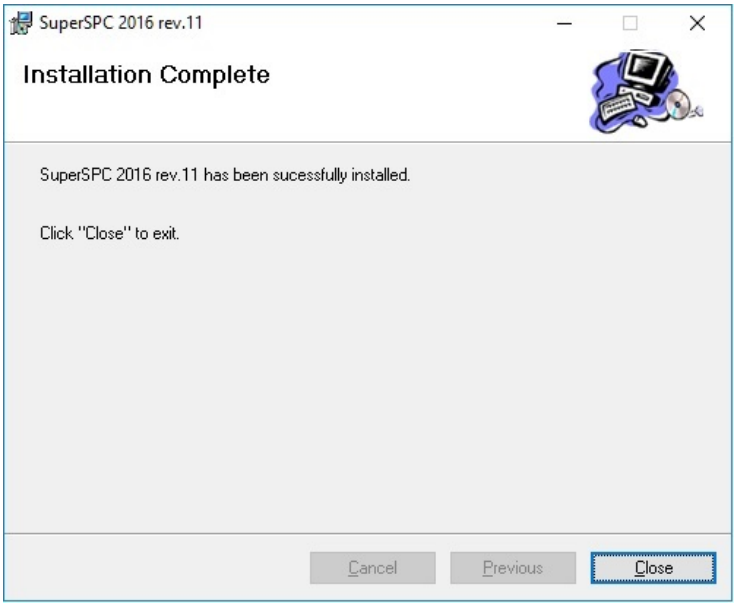
Please write down any other configuration settings like color or printer preferences to re-establish them manually after reinstallation because the installer will reset them. After reinstalling, restore the ***SCEP2016.MDB*** *file, run* ***REPAIR2016.EXE*** *and click the* ***Repair MDB*** *button. Before executing the reinstalled program for the first time, delete the file PATHINIT.IAU.*

8. Confirm the installation of SuperSPC v. 2016 clicking on Next.

9. The installer will do what is necessary to copy and register the system in Windows.



10. Finally a shortcut icon will be created on the desktop and a message announcing the success of the installation will appear.



11. On Windows Vista, 7 or 8 some additional steps are necessary.

    When running the program you will see Status: EXPIRED and no Installation # number.

    1. Close SuperSPC
    2. Find the application *Computer\Disk C\SuperSPC2016\Scep2016.exe*
    3. Right click and select *Properties*
    4. Select the *Compatibility* tab
    5. In the Privileges frame check *Run as an Administrator*
    6. Click *OK*
    7. SuperSPC will now run normally showing Status: EVALUATION and the Installation # number (if already personalized).

    This procedure needs to be performed only once and can be reverted after the software license is registered.

12. If your computer does not have a Crystal Reports 9 or higher viewer you must install it from the original CD with the CR9RT.MSI file. The process is very similar to the one just described.

If the installer reports an error please verify if your system meets the following requirements:

a) Administrative permission to install software.
b) Minimum hardware requirements, specially enough RAM and hard disk space.
c) No other application, screen saver, toolbar or antivirus open.

3.3 Downloading the program from the Internet

SuperSPC® is being constantly improved. If your user license is at the free update period, then you can download the most recent revision from, http://www.supercep.mx/SuperCEP/download2016.htm

There you will find the installer package **SuperSPC2016.msi**. Save it to your PC and run it. Then follow the directions as explained before.

3.4 Personalization.

When you purchase ***SuperSPC®*** you receive a personalization file that contains necessary information to validate your user license:

Organization Name
Serial Number
License quantity
Purchase date

After installing the software you must copy the SCCOMPA.IAU file to the IAU subfolder inside the installation folder on your PC to be able to use the system without limitations.

If the message "This demonstration only accepts 125 samples" appears when capturing data then you have not personalized your system and you should copy the SCCOMPA.IAU file as described.

3.5 Installation on a Network.

Important: To use the system beyond the evaluation period on more than one computer of the same organization it is necessary to have additional user licenses or an open user license. For more information please contact your authorized distributor.

3.5.1 Placing the executable files.

There are three possibilities to access the main program (SCEP2016.exe):

a) Run from a local folder. It is the default method and the shortcuts to the program are configured this way after installation. Each PC has its own copy of the program, auxiliary files, library components and dependencies. The advantages of this method are faster program loading and the independence of separate PC based settings like colors, fonts and graphics preferences. Local loading does not limit the possibility to connect to a shared database or data server (read ahead). The main drawback is that when it is necessary or desirable to update the software it will have to be reinstalled on every PC.

b) Run from a network location. It has the main advantage that it simplifies the installation of revisions because only the installation at the network location has to be updated. *Important: At first, the system needs to be installed locally on every computer where it is intended to run even though later it will be redirected to run from a server in the network.* After the default installation the shortcuts should be manually redirected to the network location. To help users avoid running a possibly outdated local copy of the program it is recommended to delete or rename (do not uninstall) the local copies of SCEP2016.exe.

c) Run from an application server. The system runs effectively inside application server environments like Remote Desktop Services and Citrix. The implementation details and performance warranties should be obtained from the servers suppliers.

3.5.2 Placing the MS Access (Jet) compatible Database.

The system includes all necessary components of the Jet 4.0 database engine which makes it compatible with Microsoft Access 2000 or later MDB files (MS Office or Access not required).

There is a main Configuration database (SCEP2016.MDB file) that gives access to a set of mdb files that the system creates one by one when there is a demand for a data sheet with a new combination of inspection format, machine and product.

There are two options for the location of these databases:

a) Each user has its own database. It is the default option because, after installation, the system points to a local database with example configurations and files.

Warning: Since Windows Vista it is not a good practice to keep database files under the \Program Files system folder because the operating system usually will try to block writing operations.

b) All users will share the same database. In this case a shared location in the network should be selected and every copy of the program should point to this location. This setting is done on the main menu bar in Configuration Database Location (read section 5.3).

Windows users should have read, write, create and delete permissions over the network shared folder that hosts the database files.

If you wish, you can create more than one database using different shared folders. To access them you must duplicate the [JET4] section in the IAU \ SCDIREC.IAU file by modifying the path to the folder. The system will detect that there is more than one database and will ask you which base to use at the start of each session.

3.5.3 Connection to a SQL Database Server.

If the PC has access to SQL Server you can place your databases there enabling the option at the main menu Configuration Database Location (read section 5.3).

Initially it will be necessary to create in SQL Server the main configuration database SCEP2016 and the samples database SCEP2016DATA. Both must accept a user (eg supercep) with password PASSWORD and administrator rights. If you wish to use a stronger password, ask your Support Contact to activate one of up to 15 characters. To create and initialize the database tables, we recommend using the migration tool *Convert from previous versions* that comes with your system. Select de MDB -> SQL tab and enter the connection information of your server. The user must have database creation privileges. If the User name is left blank, then the connection will be attempted through Windows Authentication. The date format must match the locale of the SQL Server. For more details read the Database Appendix later on. *Technical Note: For communication with MS SQL Server, your server must have the latest Microsoft OLE DB Driver for SQL Server (MSOLEDBSQL) installed.*

As you open new data sheets, the system will create new data tables inside SCEP2016DATA database. There are up to three tables for each combination of inspection Format_Machine_Process. The table Datos_ is for inspection data, the table Log_ keeps a log of records modifications and deletions and the table Audit_ keeps a copy of deleted records.

If you have datasheets from previous versions, first convert them to the current version in MDB Jet format (read section 3.7) before running the migration tool to SQL Server.

If the database of the previous version was already SQL then it is only necessary to add new fields with the options of the SQL -> SQL tab.

If you want to have separate databases for different business areas, you can create them with distinct names inside SQL Server, for example SPCSite2 and SPCSite2DATA would be valid names for the main configuration and inspection data databases respectively. Remember to configure the new name (in this case SPCSite2) in the field Initial Catalog in the main menu Configuration Database Location. If you want users without permission to configure the Location to access them, you can choose to duplicate the [SQLSERVER] section in the IAU \ SCDIREC.IAU file by modifying the names of the server and / or the database. The system will detect that there is more than one possible connection and ask which one to use at the start of each session.

3.5.4 Reduce data traffic on the Network.

SuperCEP data files can contain large amounts of records. By default, when a data sheet is opened, the system requests all the records in the table, causing that sometimes the waiting times are too long for the users (approximately 10 seconds for every 100,000 records). It is possible to avoid this delay by establishing a limit number of records or a deadline for submission on the data sheet. Do the following:

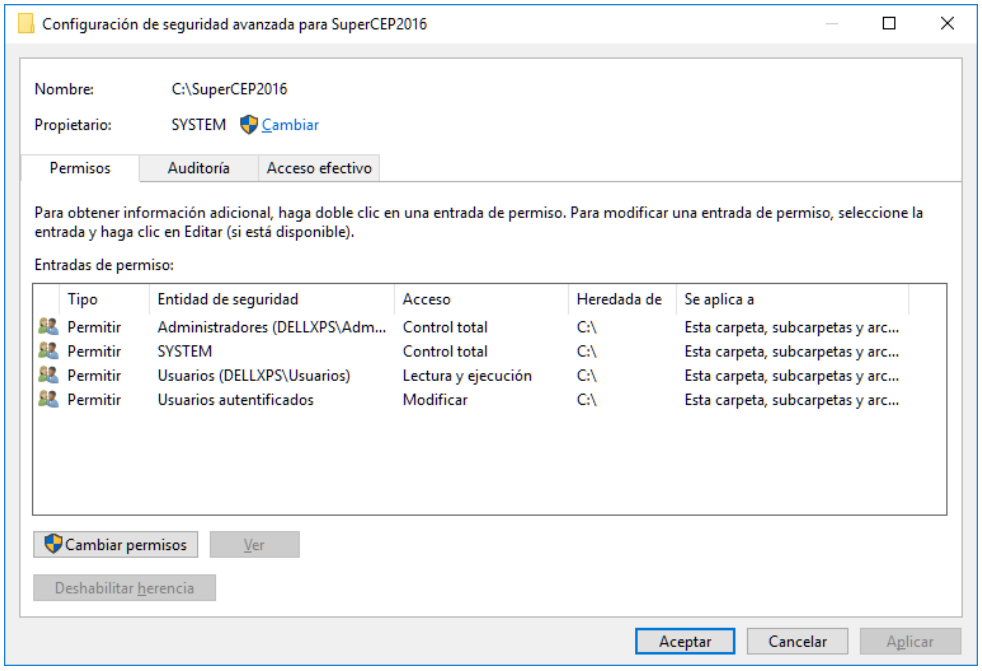
- With Notepad create the LastRows.IAU file in the \SuperSPC2016\IAU folder.
- On the first line write a date in yyyy-mm-dd format or a limit number of records.
- In the second line write the word END.
- Reopen the Data Sheet.

Although SuperCEP will only present the records with dates equal to or later than the indicated or the limit number of the most recent records, the Charts and Reports can still include previous data if requested by date in the Selection window (see section 6.3).

3.6 Security and Users Privileges.

In order to operate correctly, ***Super*CEP®** requires that Windows users have all the permissions (Full Control) over the local folder where it was installed and, if applicable, over the shared database folder in the network. Make sure that these permissions are inherited to all the contents of files and subfolders (child

objects). So that the information of the system can be effectively shared also it is due to avoid that the files created by a user are marked by Windows as private.



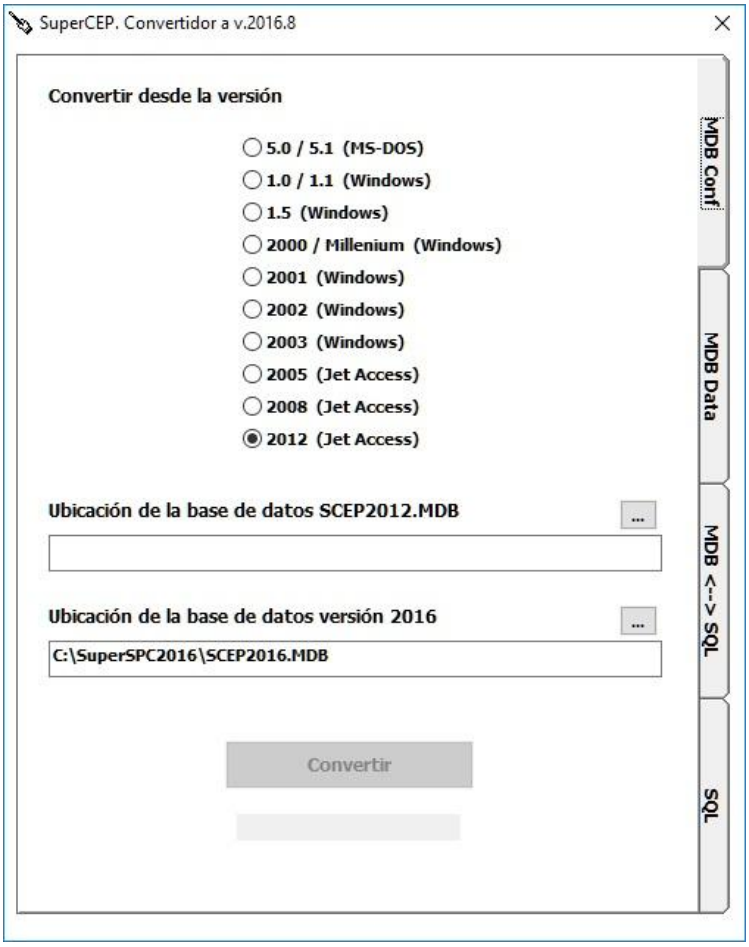
3.7 Data migration from previous versions.

If you are a user of previous versions of ***SuperSPC®*** and wish to continue to use your main configuration and inspection data, it is necessary to run once the Previous Versions Converter program (CONV2016.exe) found in the SuperSPC 2016 program group.

If you are going to use SQL Server to store your data you must first convert it from the previous to the current version in Jet format and then migrate it to the server. Read section 3.5.3.

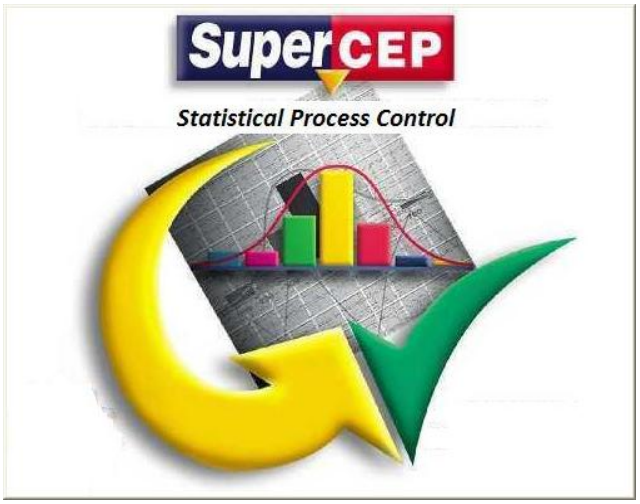
Your previous software version number is found on the main window's title bar of your older system. The location of the previous databases will vary according to the version number and whether it was placed locally or shared on the network.

This converter only updates the main configuration database (SCEP2016.MDB). The other databases corresponding to inspection data are recognized as older and converted automatically at the moment they are opened for the first time with the new version. It is recommended to copy all inspection data subfolders from the previous location to the new location instead of converting them directly from the old location, this is to maintain the possibility to open these older databases with the original version they were created. *Important: In case you are migrating from version 2000 or Millennium it is necessary that all database folders be copied to a folder named MILLENIUM before opening them for the first time.*



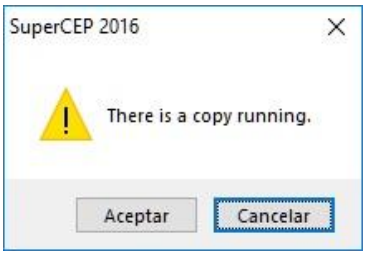
3.8 Entry to the system.

To enter, double-click on the SuperSPC icon or use Windows Explorer to locate the executable file SCEP2016.EXE and run it.



Wait for 5 seconds, press any key or click on the front page to make it disappear.

If the message “A copy is already running” shows, press Cancel if you do not want a second copy of the program to load.



If you press OK, the system will attempt to use an additional license, which might provoke the message “The maximum number of licenses has been reached” on limited licenses installations. You can easily switch from one copy to the other clicking on the windows task bar or pressing the <Alt><Tab> keyboard combination.

After the front page disappears you will see the registration dialog window.

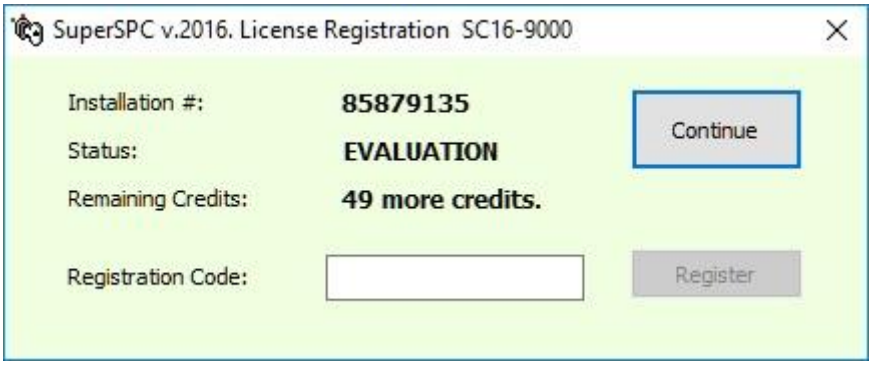
3.9 Registration Form and Copyright Protection.

SuperSPC® employs a registration system to protect your investment by guaranteeing that only the lawful licensees are able to use it after the evaluation period.

On every computer the software is installed you will get a different installation number that you must register. If you do not see the installation number it means you have not copied the license personalization file. Read section 3.4.

Note: The following procedures may not be necessary if you received a new personalization file for annual maintenance for a previously registered device. In this case the registration key will be generated automatically.

Please fill out and sign the registration form at the back of the User License that came with your User’s Manual and fax it to Ms. Selene Amador at telephone number (55)-5445-5390 to 92 in Mexico City. You can also e-mail an image of the filled format to selene.amador@prodigy.net.mx . A registration code will be given to you so you can operate the system without any limitation. Enter the 8-character registration code, press Register and then Continue.



If you manage a larger network installation, it will make sense to automate the entry of registration codes on each PC. Use the windows Notepad to create the file SCEPCLAREG.TXT in the same shared folder where the main configuration database is found (SCEP2016.MDB). In this file create one row for each license you want to register. Each row should have the installation number and its corresponding registration code with the following format:

“12345678”, ”A1B2C3D4”

Upon entering the system at each unregistered PC it will look up its number in this file and register automatically.

It is also possible to move a registered license from one PC to another:

1. Install the system on the new computer.
2. Personalize the system on the new computer.
3. Carefully note the 8-digit Installation # of the new computer.
4. On the original computer type this number in the Target Installation field and press Move.
5. You will be asked for a password. Enter the Target Installation number again.
6. Write down the 8 letter and/or number key to register the system on the new computer.
7. Enter the Code obtained in the Registration Code field of the new computer and press Register.

The system will be Registered in the new computer and Expired in the original computer. This transfer of license can be done as many times as required.

While the installation is not registered, the system will operate during 50 sessions clicking on the Continue button. After that, the label EXPIRED is shown. If your PC has Windows Vista or later and SuperSPC expires without showing the installation number, use the Program Compatibility Wizard to set the option Run with Administrator privileges for SCEP2016.EXE (read section 3.2).

3.10 Keyboard usage

The program design allows for the use of the keyboard to introduce data in the input or configuration fields and to navigate the data sheet with the arrows and pagers. To give commands and select options the mouse left button is used preferably, though the keyboard can also be used. The mouse and the keyboard should be used in a combination that is the most efficient for you.

Most system windows can be closed clicking on the Control button located in their upper right corner. To end the application the combination <Alt-F4> can also be used.

The <Alt-Tab> combination switches to another open application without closing the current application.

Keyboard guide:

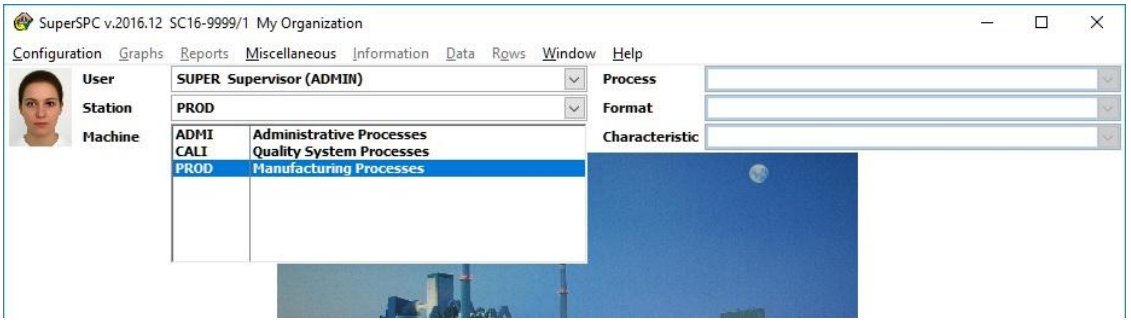
Choose in List box	< Initial letters> <Enter>
Select in List box	<Shift - Horizontal Arrows>
Delete in List box	<Backspace> or <Del>
Click Button	<Enter>
Change focus of Button or Field in Dialogue	<Tab> or <Shift-Tab>
Change of Column	<Enter> or <Horizontal Arrows>
Change of Row	< Vertical Arrows> or <PgUp> or <PgDn>
Access to Log notes	<Tab>
Return to data sheet from log notes	<Shift-Tab>
Shortcut to a Menu Option	<Alt - underlined Letter>
Indirect access to a Menu Option	<Alt> <Horizontal Arrows> <Enter>
Exit a Menu	<Esc>
Access to a window control	<Alt - Space>
Access to chart buttons	<Tab> or <Shift-Tab>
Return to previous window	<Alt-F6>
Close window	<Alt-F4>

Though it is not mandatory, it is recommended to operate the system entering the information in CAPITAL LETTERS to avoid confusion with element codes. See the Configuration chapter.

3.11 The Main Menu

The Main menu is located at the first row of the system's main window just below the title bar.

Some menu options will be disabled depending on the rights of the logged user or the part of the system that is being used.



The menu consists of the following options:

- **C**onfiguration **ALT-C**: Access to general configuration options and to the database that will store all definitions of the elements of statistical process control. Consult chapter 5.
- **G**raphs **ALT-G**: Permits the elaboration of the charts authorized for the current user and pertinent to the current characteristic. Consult chapter 6.
- **R**eports **ALT-R**: Permits the elaboration of the reports authorized for the current user. Consult chapter 7.
- Miscellaneous **ALT-V**: Access to communication utilities, data entry options and external programs.
- **I**nformation **ALT-I**: Direct access to documents associated with a column of the inspection format. Consult Chapter 5 in the Product Characteristics section.
- **D**ata **ALT-D**: Permits to import, export and backup sample data. Consult Chapter 4.
- R**o**ws **ALT-O**: Maintenance options for the sample data of the inspection format. Consult Chapter 4.
- **W**indows **ALT-W**: Permits to organize different active chart windows on the screen.
- **H**elp **ALT-H** or **F1**: On line help screen of this handbook and Support Contact information.

Additionally you can configure links to other programs by editing the MENU.IAU file. You can put these links on the Main menu or on the Graphs, Reports or Miscellaneous menus. Write the link title, the name and complete path of the external program under the corresponding section and the word PATH or NOPATH if you wish or not to send a command line containing the identification codes of the data sheet and current characteristic to the linked program.

4. DATA INPUT.

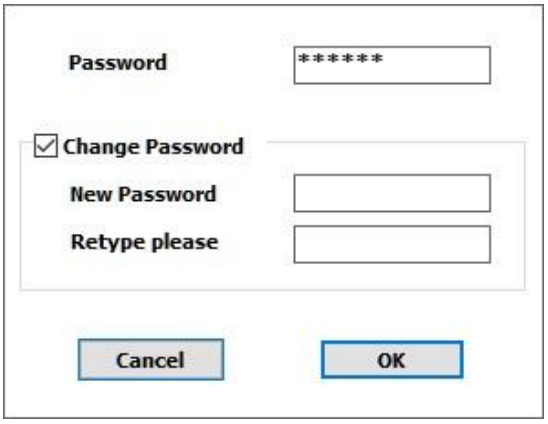
Important: If the system reports a 3709 error "Invalid operation.... closed connection" it means that the database was not found at the location defined in the system. This location is set when the program is installed but can be modified at menu option Configuration Database Location. This problem can also be solved by reinstalling the system or by editing with Notepad the text file IAU\SCDIREC.IAU which contains either the access path to the folder where the main configuration and inspection data databases reside or the access parameters to the database server. The system can handle different databases at different locations.

4.1 Selecting the User

Each person that requires using the system must have a registered code. The user configuration defines the rights and capacities of each person within the system.

Use the mouse to select a user on the list box or type the user code (for example SUPER) and press Enter.

Important: If at this point the Users list box is empty you will not be able to enter the system. Still you can run the Database Configuration module typing SCEP2016.EXE PASSWORD at the Windows Start Run dialog. Type the database general password, create a new user and assign him to at least one station.



All users have the possibility to change their password as many times as required by another that meets the requirements defined in Access Security (see section 5.5).

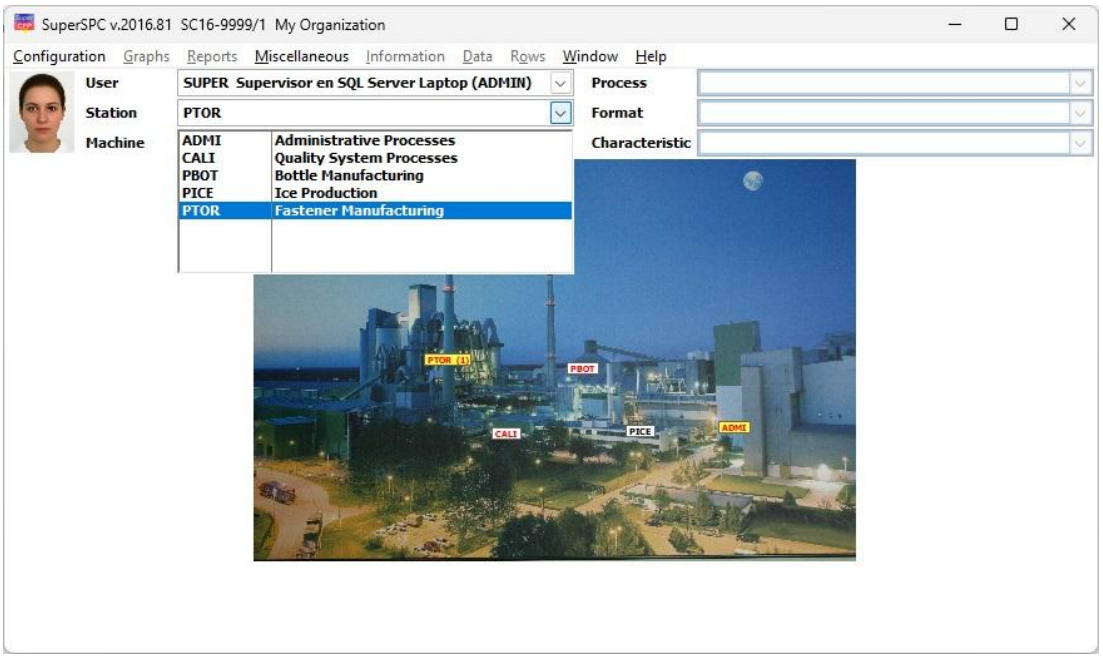
If this is indicated in the Access Security module, the users will have to modify their password every certain number of days. Additionally, the account may be blocked if a certain number of consecutive access attempts are failed. Administrators may be notified of the blocking by email.

Once access is achieved, a reception to the system image is displayed. This image can be replaced with any other in BMP, JPG or GIF format replacing the file Image\RECEPCION.JPG. Another way of replacing the image is by enabling the Configuration Map Edit option, opening any folder where your images are found, selecting one and dragging and dropping it over the previous image. SuperSPC will copy the image to the folder indicated in the SCDIREC.IAU file.

4.2 Selecting the Station

The Station term is used as synonymous of Area or Department. Depending on the user, the system will display a window with the different stations to which he is assigned. Also, a map is shown that can be configured to show the layout of the different stations in the organization (see section 4.19). To change this image you must replace the PLANT.JPG file by any other file in BMP or JPG format. The location of the Stations within the plant map can be modified dragging and dropping the labels with the mouse. For this it is necessary that the User has the Config. Map right and the Configuration Edit Map menu option activated.

To enter a Station use the mouse in the list box, type the code and press Enter or click on the label on the map. If the user is not related to any station, the stations list box will appear empty. In this case select a user with rights to configure, enter the configuration module and connect a station to the user. Leave the configuration module and select the user again to display its new stations list.

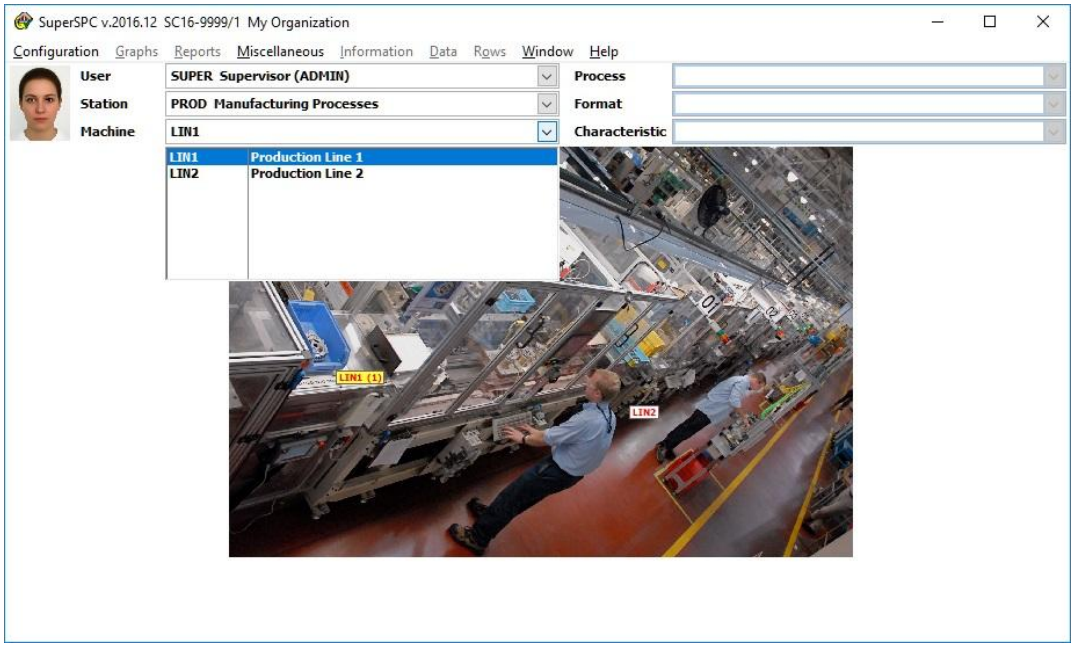


4.3 Selecting the Machine

The Machine term is used as synonymous of Production Line, Equipment, Work Place or Department. The system displays in the list box and on the map the different machines that are found inside a station. The disposition of each machine is shown with a color code (read section 4.17). The image that appears as a map is configured in the Map field of the Stations catalogue. The location of the Machines within the Station map can be modified dragging and dropping the labels with the mouse. For this it is necessary that the User has the Config. Map right and the Configuration Edit Map menu option activated.

Select it or type the machine code on the list box or click on the map over the desired machine.

If the list box is blank, configure at least one machine for the current station.

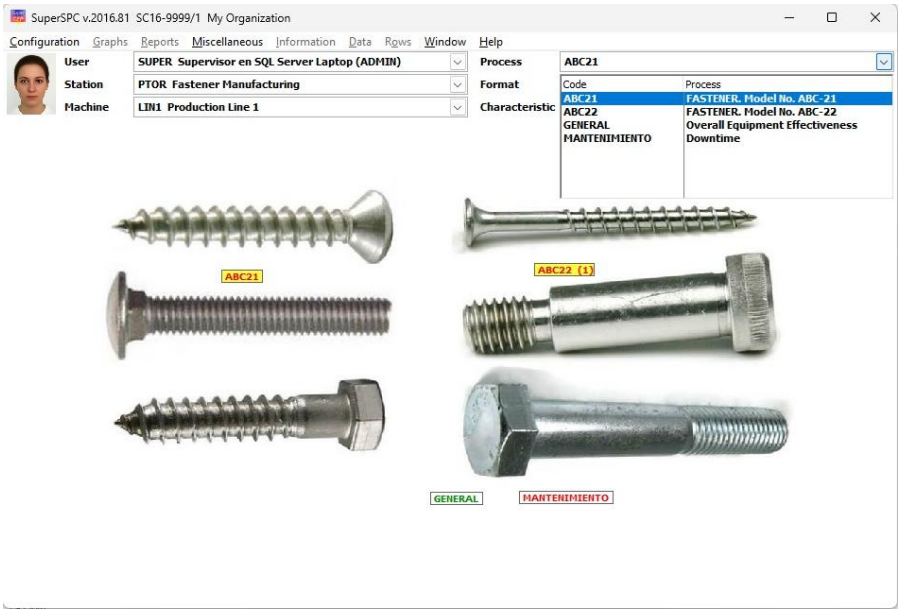


4.4 Selecting the Product

The system displays on the list box and in the map the different products or processes for the machine. The image that appears as a map is configured in the Map field of the Machines catalogue. The disposition of each product is shown with a color code (read section 4.19). The location of the Products within the Machine map can be modified dragging and dropping the labels with the mouse. For this it is necessary that the User has the Config. Map right and the Configuration Edit Map menu option activated.

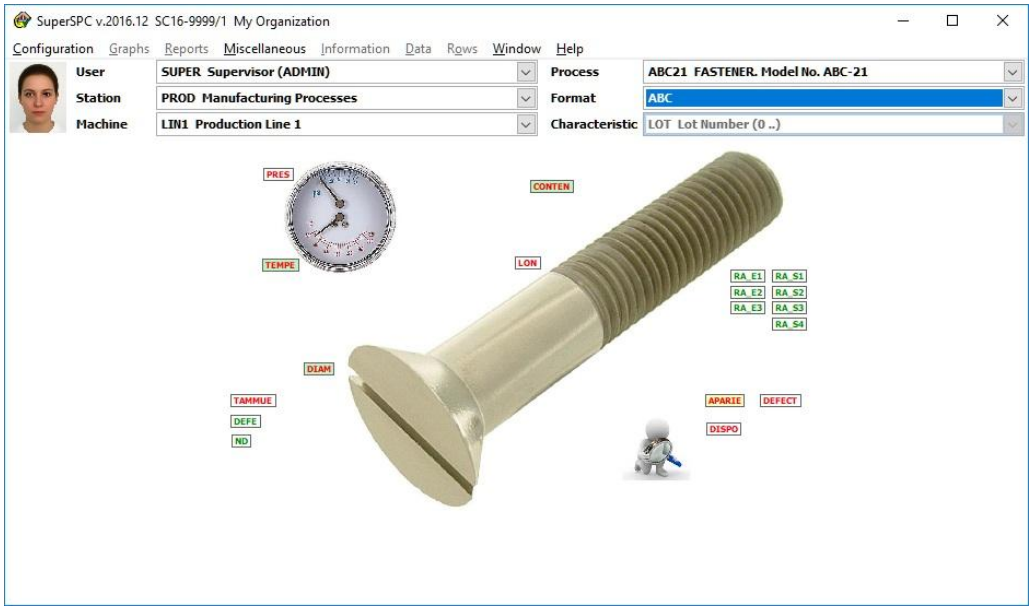
If the list box is blank, configure at least one product for the current machine.

Select or type the product code on the list box or click on the map over the desired product.



4.5 Selecting the Format

A format holds the different measured or surveyed characteristics of a process or product. Different formats can be configured for the same product according to the type of test accomplished.



The system displays on the list box the different applicable formats for the product. In the map the characteristics of each format are shown. The disposition of each characteristic is labeled with a color code (read section 4.19). The image that appears as a map is configured in the Products catalogue Map field. The location of the Characteristics within the map of the Product or Process can be modified dragging and dropping the labels with the mouse. For this it is necessary that the User has activated the Config. Map right and the Configuration Map Edit menu option.

If the list box is blank, configure at least one format for the current product.

Type the format code or select it with the mouse on the list box or on the map.

4.6 Opening the Data Sheet

Once the User, Station, Machine, Product and Format are selected, the program locates the Inspection Data file and presents it on the screen.

Important: If you receive the message Repair MDB, it is because the database is not updated with respect to your program. Exit the program and execute REPAIR2016.EXE. Press the Repair MDB button. Try to open the data sheet again.

In this point you can have the following situations:

1. The data sheet has never been used and will be created for the first time.

2. The data sheet has been used in a previous version that requires automatic conversion.

3. The data sheet has been used, but it has suffered structure changes, meaning that a characteristic has been incorporated, eliminated or relocated. The existing file will proceed to a reconfiguration. The process takes a time proportional to the amount of existing data.

4. The file has been used before and has not suffered structure changes since then.

The activated file will be displayed in the form of matrix in the central part of the screen.

4.7 Data Sheet Description

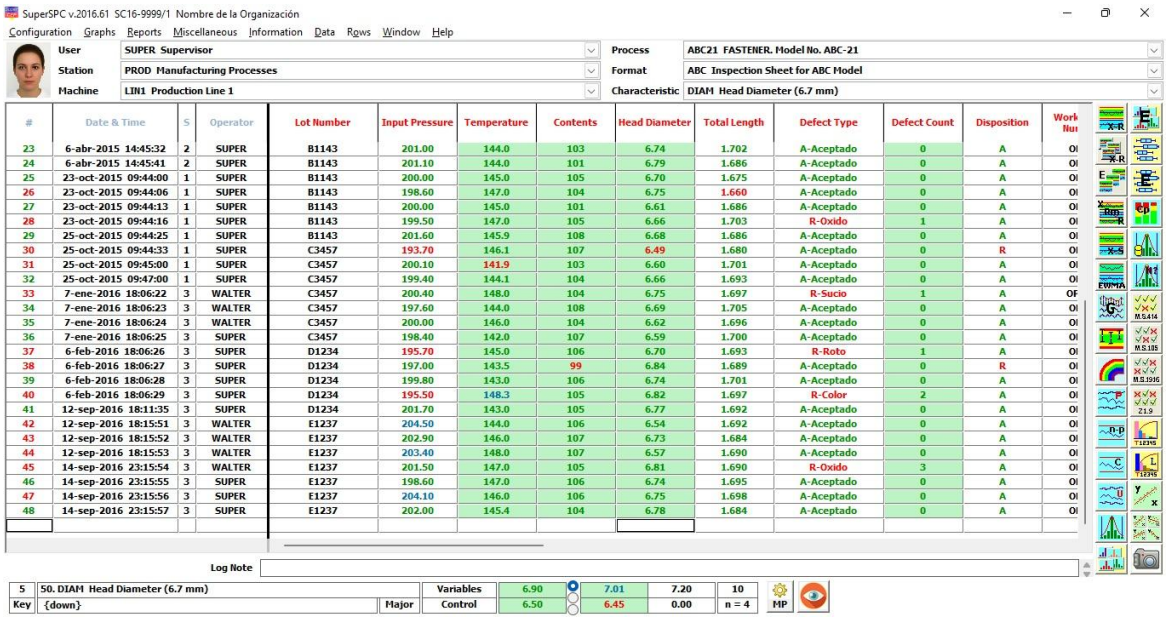
Each Machine/Product/Format combination has a corresponding data sheet that is created physically the first time the combination is selected. The columns that make up each sheet are determined by the existing definition of each particular Format Characteristics table of the Configuration module. A sheet can contain a maximum of 250 columns and 999,999 rows. The quantity of data sheets is not limited.

In the tabular data sheet, each row will represent a sample (identified with progressive number, date, hour, shift and operator) and each column will represent a characteristic of that sample.

The first four columns are fixed at the beginning; that is to say, they cannot be modified and normally are filled automatically:

1. Sample **c**onsecutive number.
2. Sample acquisition date and time (d/m/yyyy hh:mm:ss format).
3. Corresponding shift.
4. Code of the user that inspects the sample.

The date and time are obtained from the calendar-clock of the computer. The shift is displayed according to the scheduled configuration for each shift.



Cursor movement within the sheet is achieved using the arrows and pagers of the keyboard (do not use the tabulator) or putting the pointer of the mouse on a cell and clicking. When the number of columns and/or rows exceeds the capacity of the screen, scroll bars appear with an interior button which permits the positioning on any zone of the sheet. It is not possible to put the cursor beyond the last row.

The header of each column shows the description of the characteristic to control. The colors Red, Yellow and Green indicate that, according to the Control Plan, it is time for a new sample, there are less than 3 minutes for it or the sample is still valid, respectively. When changing columns, their configuration parameters are displayed at the bottom of the screen. To edit or add any of these parameters, go to the Product and Machine Characteristics table of the Configuration module.

The data shown at the bottom are:

- Column number.
- Column position, characteristic description, target value and measurement unit.
- Input type (Keyboard, Connection or Formula).
- Calculation formula or automatic input connection.
- Type of statistical analysis (Variable, Attribute, Disposition or Not to Analyze).
- Control Stage (Initial Study or Control)
- Specification Limits.
- Control Limits.
- Data input Limits.
- Critical Category (Minor, Major or Critical).
- Size of the statistical subgroup.
- Configuration shortcut button.
- Visual data entry button.

4.8 Data input

Data can be introduced directly or received automatically from a measurement instrument and will be registered in the cell that has the cursor. Also indirect measurements can be obtained through calculation columns.

Important: The functions that are explained in this section require that the user have the Input, Erase and Vertical Movement rights activated.

In the columns with Variable or Attribute analysis type the sheet accepts numerical values of up to 9 characters including the decimal point (use the point or the comma according to the regional configuration for Windows). Do not use exponential notation. In columns with Disposition analysis type you can type up to 9 characters beginning with an A for accepting or with an R to reject. In the columns Not to Analyze you can type any character. If the column is of type Disposition or Not to Analyze, and was configured with Width = 2, up to 14 characters can be accepted or up to 30 characters with Width = 3.

The cursor movement after introducing a datum is obtained pressing <Enter>. The cursor will be displaced to the right or downward depending on the Down checkbox in the Product Characteristic configuration.

When the captured number provokes a sound and disappears is because it is not accepted by the system due to the fact that the input limits hinder the introduction of absurd data far from the specification. These limits can be consulted and modified in the Product Characteristic table of the Configuration module.

The identification data (date/time, shift and operator) as well as the columns with free input type appear in black foreground color.

Upon capturing the first datum of a row, it becomes automatically identified with Date, Time, Shift and Operator. The shift is obtained using the time of day. The schedule can be edited using the Configuration Shift Edit option from the main menu.

The automatic identification of each sample (row) can be modified manually using the Misc Edit Date Time menu option. The only limitation for changing the date and time is that the chronological order of the samples must be observed. If for any reason the samples are not ordered by date and time, leave the data sheet, re-enter again and then use the Row Renumber option.

If the sheet does not accept or alters data with decimal point, it is because in some versions of Windows the decimal separator is a comma instead of a point (.), such as it is used in Europe and some countries of South America. To amend this situation select Misc Control Panel from the menu and choose the International or Regional icon.

In columns of type Don't Analyse within existing records, the F6 key introduces the current Date and Time.

DATA INPUT FROM A MEASUREMENT INSTRUMENT CONNECTION

To receive data on a column directly from a measurement instrument it is necessary to configure it as Connection Input Type. To input the data, place the cursor on the appropriate cell and press de data send button of your instrument. The correct reception of data depends on the connection being well configured according to the hardware communication parameters and data format of your instrument or measurement equipment. For more information read chapter 5 about the configuration of Product Characteristics.

If you plan to massively collect data from one or more measurement instruments or even other monitoring software applications it can be more convenient to use some of the included data acquisition accessories available explained on the chapter about Data Acquisition Modules (MAD).

4.9 Color Codes

Sample data are shown in green when they are within the specification and in red or blue otherwise. Sample data in black color are labels that do not need to be analyzed statistically.

If the quality characteristic is at the control stage (read section 5.3.12), cells are shown with a green background if the value falls within the statistical control limits of the centering control chart (X or I) and the variability control chart (R or S) or with a yellow background otherwise. In case the column is declared for grouped data (subgroup size greater than 1), if a subgroup average is out of control limits, only the individuals falling outside the limits are shown with a yellow background. Therefore an individual value on a green background does not necessarily indicate that the mean and range of the subgroup it belongs to is within control limits.

The sample or row numbers are color coded according to the following situations of the current record:

Green Foreground	All characteristics of the current record are within specifications.
Red Foreground	One or more characteristics of the current record are out of specifications.
White Background	All characteristics at control stage are within statistical limits of the means, individuals or ranges charts.
Light Yellow Background	One or more characteristics at control stage of the current record fall beyond statistical control limits of the centering chart (means X o individuals I).
Yellow Background	One or more characteristics at control stage of the current record fall beyond statistical control limits of the variability chart (ranges R o deviations S).
Deep Yellow Background	One or more characteristics at control stage of the current record fall beyond statistical control limits in both centering and variability charts.

The sample or row number color code when the point is out of control limits on the variability chart, updates every 20 minutes or when the user re-enters the data sheet. All other color updates are instantaneous.

If you have been configured as a Supervisor of the product or process in question, you will see these colors also in the Date/Time, Shift and Operator columns indicating that you have not supervised these samples. To supervise the samples click on any of these fields.

Note: These colors can be modified. Read chapter 5.7.

4.10. Log Notes

Each sample or row accepts a log note, commentary or observation. Place the mouse pointer and click on the field that is located immediately below the columns. It is possible to show these log notes on control charts enclosing a text fragment between parenthesis (). If the commentary is only applicable to some of the characteristics, type @ and the characteristic code before the commentary. The available space to type log notes is of 1000 characters per row. To save the note and return to the data sheet click on any cell.

4.11. Visual data entry.

Pressing this button displays the image corresponding to the Process / Product along with a capture field for each column of the format located in the position determined by the configuration explained in section 4.5. The movement between these fields is with <TAB> / <Enter> and <Shift> + <TAB> and the sequence corresponds to the position of the columns in the Data Sheet. When advancing from the last capture field, the Data Sheet is prepared to receive a new record. The input types by Keyboard, Instrument Connection or by Formula and the Specification, Control and Capture Limits, work in each field as they were configured for the cells of the Data Sheet. The data entered in these fields are copied immediately to the Data Sheet and are registered in the database. The typeface of the fields can be modified and is saved for future sessions.

4.12. Saving data

In this system it is not necessary to save the sample data captured in the sheet, since each one is recorded automatically. However it is always advisable to close the program before turning off the computer power or not using the computer for a long time.

Important: For efficiency reasons, SuperSPC only updates the database when the cursor changes rows or when the data sheet is properly closed. If you input or modify a value at any row but do not move the cursor to another one, then the changes will not be committed to the database, charts or reports. This is why, it is recommended to always advance the cursor to the next row immediately after entering one sample.

4.13. Recalculating formula columns

SuperSPC recalculates the cells from formula columns each time that one its factors changes or when the cursor travels vertically through the column. Nonetheless, if there has been a change of the formula definition and there are a lot of samples that need to be recalculated it will be better to use the Rows Recalculate menu option to update the results automatically.

4.14. Delete and Insert

To erase an individual cell, type a space and then press <Enter>.

Note: Even users without permission to delete will be able to do so in individual cells if a time window is configured for it. See Chap. 5.1.3.

To delete one or more rows, select Rows Delete and indicate the range to be deleted. You can selectively delete rows using an SQL Filter. For more information consult section 6.3.1 Filters.

Important: Any deletions are executed immediately therefore they can't be undone.

Note: For Audit Trail purposes, the system stores a copy of all previous values and deletions with a log record of the user and the time stamp when these changes occurred. If the system is enabled to comply with Electronic Records Security, a justification will be requested each time a data is deleted or modified.

If you have deleted a great amount of data you can compact and optimize the database with the REPAIR2016.EXE utility.

To delete a column you should eliminate it from the format structure at the Format Characteristics table in the Configuration module. It is important to note that upon modifying the structure of a Format, all the products that use that Format will be modified. The columns will not be eliminated physically but will be kept hidden from the users.

To insert one or more rows, first place the cursor on the insertion point and then select Row Insert to indicate the number of lines to be inserted. This functionality can be completely disabled copying a NoInsertRows.iau file in folder IAU. The content of this file is not relevant.

To insert a column add it to the structure at Format Characteristics in the Configuration module. This will affect all the data sheets of the products that use that Format.

4.15. Sorting Data

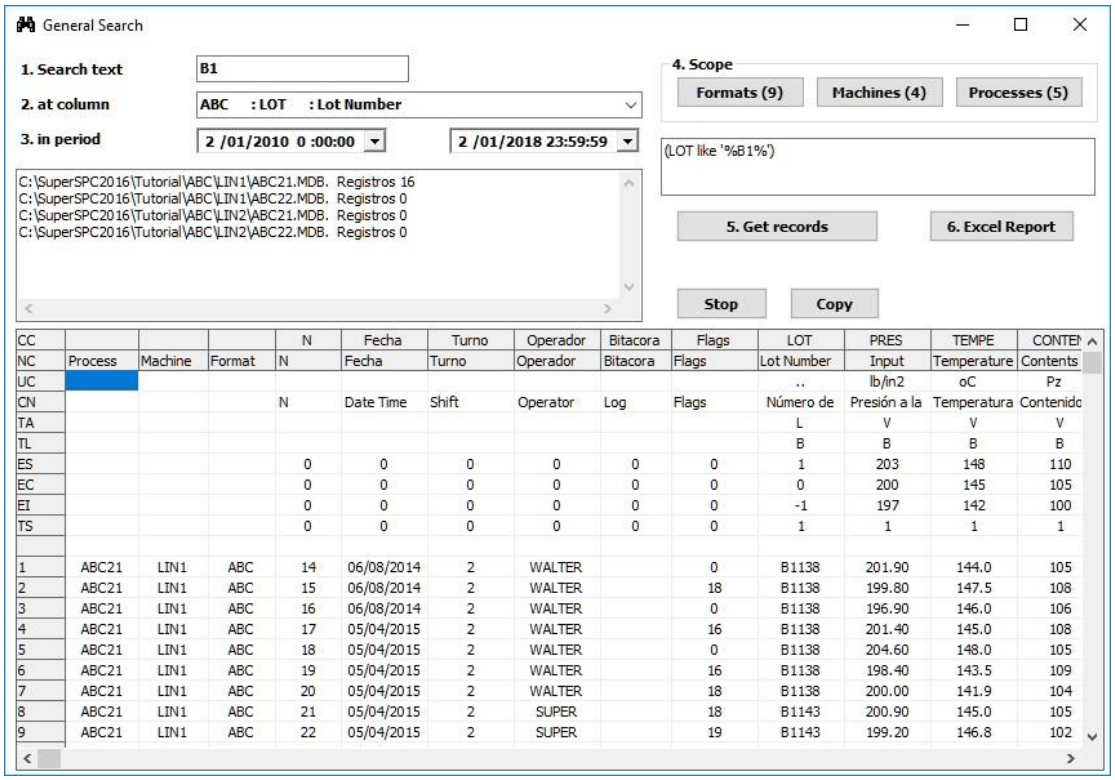
SuperCEP charts and reports only operate correctly with samples ordered by date and time, therefore each time you enter a Data Sheet the system sorts it automatically. In exceptional cases this can cause disordered sample numbers. Use Row Renumber to amend this situation. This option is disabled if your system enforces the Electronic Records Security directives to maintain the traceability of the Audit Records.

4.16. Data Search

In the Data menu, the *Search this Column* option allows to locate numeric or alphabetic data in a column of the current data sheet. The *Search all Columns* option allows you to do it in all columns of the current data sheet.

The Search in the Database option allows you to do it in a column in the selected scope of Dates, Formats, Machines and Processes. With the Advanced Filter field you can extend the search to more than one

column and/or condition using SQL sentences. The resulting data set, or a part of it, together with its statistics can be copied to be pasted in other applications. It is also possible to present the information in a report designed in MS Excel according to the instructions in chapter A.2.



CC				N	Fecha	Turno	Operador	Bitacora	Flags	LOT	PRES	TEMPE	CONTEN
NC	Process	Machine	Format	N	Fecha	Turno	Operador	Bitacora	Flags	Lot Number	Input	Temperature	Contents
UC										..	lb/in2	oC	Pz
CN				N	Date Time	Shift	Operator	Log	Flags	Número de	Presión a la	Temperatura	Contenido
TA										L	V	V	V
TL										B	B	B	B
ES				0	0	0	0	0	0	1	203	148	110
EC				0	0	0	0	0	0	0	200	145	105
EI				0	0	0	0	0	0	-1	197	142	100
TS				0	0	0	0	0	0	1	1	1	1
1	ABC21	LIN1	ABC	14	06/08/2014	2	WALTER		0	B1138	201.90	144.0	105
2	ABC21	LIN1	ABC	15	06/08/2014	2	WALTER		18	B1138	199.80	147.5	108
3	ABC21	LIN1	ABC	16	06/08/2014	2	WALTER		0	B1138	196.90	146.0	106
4	ABC21	LIN1	ABC	17	05/04/2015	2	WALTER		16	B1138	201.40	145.0	108
5	ABC21	LIN1	ABC	18	05/04/2015	2	WALTER		0	B1138	204.60	148.0	105
6	ABC21	LIN1	ABC	19	05/04/2015	2	WALTER		16	B1138	198.40	143.5	109
7	ABC21	LIN1	ABC	20	05/04/2015	2	WALTER		18	B1138	200.00	141.9	104
8	ABC21	LIN1	ABC	21	05/04/2015	2	SUPER		18	B1143	200.90	145.0	105
9	ABC21	LIN1	ABC	22	05/04/2015	2	SUPER		19	B1143	199.20	146.8	102

4.17. Data Export and Import

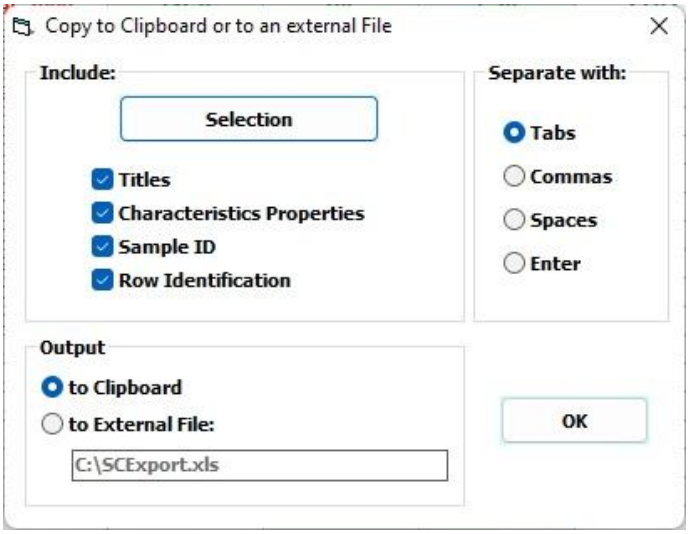
It is possible to capture data transporting it from other applications (import). The import procedure using the Windows Clipboard follows:

- Enter the application of the original data.
- Select the data that you wish to transport.
- Copy your selection to the Clipboard with Edit Copy.
- Enter SuperSPC.
- Place the cursor on the insertion cell.
- Select the Data Paste from the Clipboard menu.
- Check that correct information to be pasted appears in the textbox.
- Click Paste.

The insertion point can be placed at the end of the sheet or on any intermediate row. In this last case the imported data will be overwritten on the previous one.

SuperSPC data can also be annexed from files located in other folders or disks. Use the Data File Import menu for this purpose. Specify the location and date range of the data to import. The Browse button lets you know how many files can be imported.

The data export process from SuperCEP can use the Windows Clipboard or a disk file. Select the Data Copy to Clipboard or External File menu options, indicate the type of separator (most Windows applications can read data tables separated by TABs or COMMAs), the rows range, the columns selection and the name of the output file in disk with its extension according to the application that is going to receive the data (.xlsx for Excel, .doc for Word, etc.)



You can copy the content of a column to other column of a different data sheet. To do this, use the Data Copy and Data Paste options in the main menu. If the file that receives the information is empty, the necessary rows are created. When the file already contains information, then the new data is inserted in its position corresponding to the date and time of each sample.

4.18. Data backup

To make a backup of the data sheet use the Data Backup option. The backup can be made on any removable media (USB disk, memory card, etc.) or on a local or network hard disk. The backup is limited to the current data sheet and to the available space in the backup media. This type of backup has the advantage that it can be read directly without the need of restoring it to the original disk changing only the path to the inspection data access in Configure Database Location.

The configuration database is stored in the SCEP2016.MDB file. This file must be manually backed up regularly.

If you need a massive backup of your data, use some backup tool and include the programs folder and configuration and inspection data folder.

4.19. Supervision

SuperSPC implements a supervision mechanism to allow the medium and higher ranks of the organization fast navigation from the more general to the more specific information about those quality characteristics that might be giving trouble at a particular moment.

The mechanism works in the following way:

The supervisor enters the system and he sees a map with the different stations he has access to. Each label is color-coded in a similar way to that explained in section 4.9:

Green Foreground	All characteristics of all products accessible from this station are within **specifications**.
Red Foreground	One or more characteristics of one or more products or processes accessible from the station are out of **specification**.
White Background	All characteristics on the control stage of all products and processes accessible from this station are within statistical limits on their **centering** and **variability** charts.
Light Yellow Background	One or more characteristics at control stage of one or more products and processes accessible from the station are out of statistical limits on their **centering** chart (means X or individuals I).

Yellow Background	One or more characteristics at control stage of one or more products and processes accessible from the station are out of statistical limits on their **variability** chart (ranges R or deviations S).
Deep Yellow Background	One or more characteristics at control stage of one or more products and processes accessible from the station are out of statistical limits on their **centering** and **variability** charts.

Note: These colors can be modified. See chapter 5.7.

When the supervisor chooses a station, the map changes to show the machines or departments associated with it. The color of each label indicate if there are products or processes realized in those machines with quality characteristics with recent problems on specifications or statistical control.

In the same manner when the supervisor selects a machine or department the color labels of its products and processes are displayed.

Finally, when the product is selected, the labels of all the quality characteristics defined for the product or process are shown and from the color code it can be known which of them are having recent trouble.

Label colors are updated when users modify and close the data sheets and cover only the data from the day corresponding to the oldest modification made in the session.

If the user is a supervisor, he can see next to the label a number indicating the amount of products or processes with recent data out of specification or out of statistical control that he has not yet checked out. With this indication the supervisor can follow those labels with numbers to reach the specific sample characteristic that caused the message. To check out the problem sample it suffices to click on its identification columns (n, date/time, shift or operator).

For a user to be considered a process supervisor he has to be declared as such at the product characteristics configuration (see section 5.3.12).

5. CONFIGURATION

This menu groups the options to personalize the system operation.

5.1 Database. Why is the need to Configure?

Configuration consists of the definition of a logical structure that will enable SuperSPC to identify and label each data point it receives. The system will be able to decide if the datum is accepted or not, who is the operator that inputs it, to which process and machine it belongs, if it is in or out of specification limits, etc.

Configuration is one of the most important activities within the system. It will have to be accomplished by all the personnel that is directly involved with the Process Control carried out in any company; as for example: the quality control supervisors, productivity, manufacturing, warehouse, materials control, quality assurance, etc.

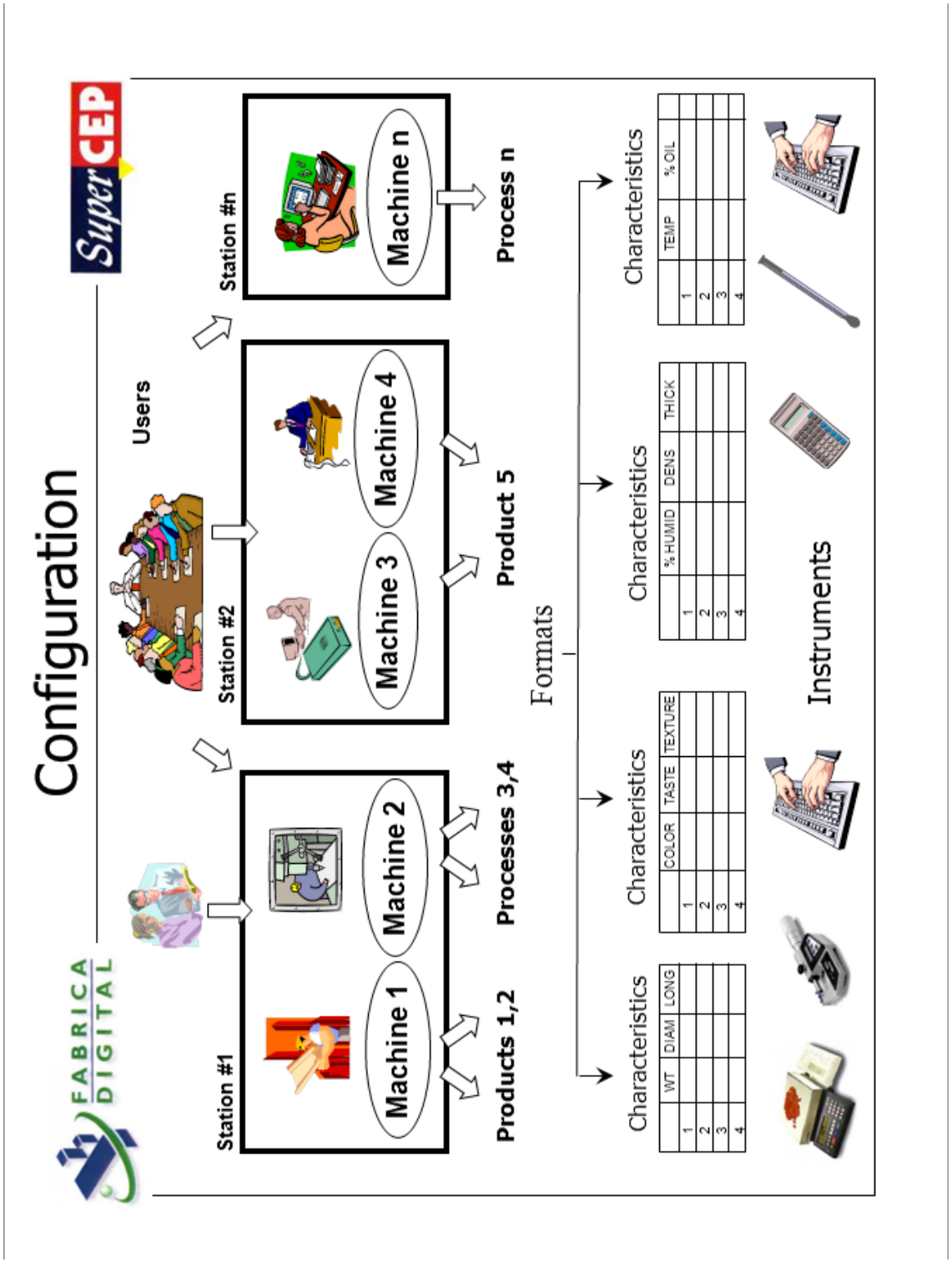
This activity encompasses all the areas, processes, stations, machines, products, characteristics, measurement instruments, etc.; that intervene in the statistical analysis that is intended to be carried out with SuperSPC.

To use the system, it is first necessary to configure it to later be able to incorporate the sample data of all those characteristics that require control. To configure means to plan and to define the precise location and identification that each sample datum that arrives to the system will have. The effort invested in this initial configuration is fully compensated by the timesavings, ease of use and secure routine operation.

All those elements as products, materials, processes, etc, should be registered with their characteristics or variables that are going to be measured and inspected. Also, you will have to register those users that will operate the system with their access levels, and incorporate the technical data of the variables to be measured, such as: definition of the type of statistical analysis to be made by attributes or by variables, the batch size or subgroup size, the specification limits, etc. Finally, it is important to mention that in order to trace the origin of data more accurately, you have the option to tell the system what production line, machine, work area and suppliers the data comes from.

Before starting to configure, you should gather all the necessary information that match as closely as possible the configuration of your workplace. Once all the information is gathered, we proceed to input it into the Configuration tables.

We must emphasize that on the care and order that we apply on the configuration depends the ease that the operators will perceive using the system, and though it is hard work, it has to be carried out only once and the rest will be only operation.


Configuration
SuperCEP
FABRICA DIGITAL
Users
Station #1
Machine 1
Machine 2
Products 1,2
Processes 3,4
Station #2
Machine 3
Machine 4
Product 5
Station #n
Machine n
Process n
Formats
Characteristics
WT
DIAM
LONG
Characteristics
COLOR
TASTE
TEXTURE
Characteristics
% HUMID
DENS
THICK
Characteristics
TEMP
% OIL
Instruments

5.1.1 Configuration Elements

The system requires maintaining a set of lists or catalogs where the elements with which the structure of the database is built are defined. These elements are related to each other to form said structure.

CATALOGS

USERS. They are the people that require access to the system. They will need a registered code and password in this catalogue to work in the system. The access level to the system facilities (querying, editing, printing, etc.) for each user is given here. At least one of the users will be responsible for controlling the access of the others.

STATIONS. A station is a physical work area where the product, material, component, etc., is manufactured and inspected. Each station receives a unique code (For example: PLANT, incoming MATERIALs, INYECtion, PRESSes, ASSEMBLY, SERVICE, etc.).

MACHINES. All the production lines, machines or departments, responsible for the production or the supply of any part, product, material, etc., are registered in this catalogue with a unique code.

PRODUCTS. Each product, raw material, part, subassembly, component, process, etc., that you wish to measure or inspect will have a unique code in this catalogue.

FORMATS. One or more quality characteristics of the same part, product or process, will be included or grouped into a sheet, template or inspection screen designated as Format. Every format should have a unique code.

CHARACTERISTICS. Characteristic is the variable, inspection attribute or identifier that is going to be measured, inspected or established for any sample of product or process. All characteristics are registered in this catalogue with a unique code.

CONNECTIONS. In this option the equipment and/or instruments that can be connected to the system through serial ports (RS-232) or Ethernet adapter (TCP/IP) appear. The connection will allow immediate transfer of the readings provided by the equipment or instrument to SuperSPC for its automatic processing and storage.

INFORMATION. The use of this catalogue is optional. It is employed to fill the content of texts that can be shown automatically when the sample data indicate situations or trends out of specification or statistical control. These notices will be directed to operators to help them take corrective actions and to activate alarms and control procedures. General information or instructions about process settings can also be registered here to be viewed at the Information menu.

RELATIONS

USER STATIONS. In this option the system receives indication of each user location according to the workstation where he works, in order to have access and analyze the information of his area or department. The same user can access several stations.

STATION MACHINES. Every machine, production line or department should be assigned to a station.

MACHINE PRODUCTS. In this option you should relate every product to the machine that manufactures it and every process to the department that carries it out. The system will display only the appropriate products or processes when a user accesses a particular machine or department.

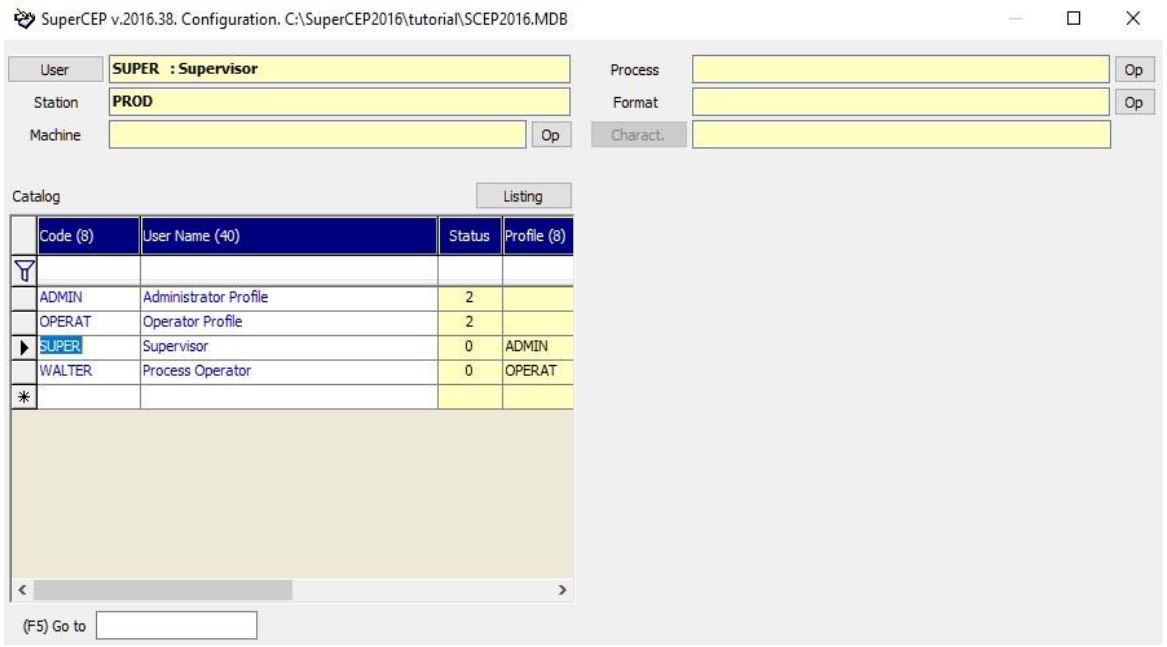
PRODUCT FORMATS. These are the data sheets or templates that are suited for the inspection of a particular product or process.

FORMAT CHARACTERISTICS. A format is made up of quality characteristics. Every characteristic generates a column (a field in a database table) where data is entered. The position and width of each column on the screen is defined here.

PRODUCT CHARACTERISTICS. This table keeps record of all measured or inspected characteristics of a product, material, etc. The system requests technical data of these characteristics, such as specification limits, batch or subgroup size, decimals, input mode (keyboard, connection to an instrument or formula), among others.

When the system is installed, a set of example tables are copied which are useful in the initial system explorations. This example is located at the \Tutorial folder. When the example is no longer needed, the Database Location can be changed to the system root folder that holds the database structure without any data.

5.1.2 Entering the Configuration Module



Enter the program and select user SUPER. Click on the Configure Database menu option. If this option is not enabled try with another user. If no user enables this option you will have to exit the program and run it directly with the command C:\SuperSPC2016\SCEP2016.EXE PASSWORD. Add at least one user with configuration rights.

The configuration screen displays: At the upper part you will find the fields that indicate the selection of User, Station, Machine, Process, Format and Characteristic. At the lower part there is a table showing the user catalogue with a blue foreground. If your screen looks different click on the user field over the word SUPER.

5.1.3 USERS Catalog

Important: This section is not accessible to users with the Users Conf. option disabled.

To find a user press key F5 and next the first letters of his code. When it is shown in the table press the tab key to place the cursor on it.

To add a new user place the cursor on the blank row at the end of the table (marked with an asterisk *) at the first column titled Code (8). Type a user code employing only capital letters or numbers without spaces. The code can have up to 8 characters. Take note that, when editing, the asterisk moves downward and a pencil appears in its place indicating the edition in progress. To cancel the edition press <Esc>. Press

<Enter> to advance to the next column titled Name (30). Type the name of the User with up to 30 characters. To finish editing place the cursor on the next row (now marked with the asterisk *). The pencil will disappear indicating that a new User has been registered with default options.

Important: If the message "[ ] invalid Character in code …" appears, verify that all the characters of the user code are letters, numbers or #$% - . The spaces in any position are interpreted as characters.

Important: If the message "Value duplicated …" appears, verify that the code of the element is not already registered in this catalogue.

If you wish to delete a record from the catalogue, click in the corresponding line and then click on the button on its left side. The line will be marked in a black background. Press the <Del> key. It is possible to delete a user or edit his name only if the corresponding options in *Security* > *Identity* are not enabled (see section 5.5).

To modify the content of a field from a previous record without retyping it completely, place the cursor over the field, select it (blue background) and press F2.

You can also modify the user options putting the cursor on the table on the user row. The User field at the top left will change to indicate the current user. Press the button on the left titled User to enter the User Configuration window.

Fill this form according to the following explanation:

PROFILE. Optional. Enter the code of a virtual user that will serve as a model to assign the necessary rights to the current user. When adding a new user you can link him to a profile bypassing the need to declare his rights because those properties will be taken from the profile.

STATUS. Only Active users can gain access to the system. Blocked users can be reactivated by an administrator. Disabled users can be reactivated except when the *Security* > *Identity* > *User suspension is final* is enabled (see section 5.5).

PASSWORD RESET. The default password defined for a new user is .. (dot dot). This value is good for a single use, the user being obliged to change it confidentially. If a user forgets his password, the Administrator can reset it to this original value. If the option *Security* > *Access* > *Mandatory password change* is enabled, then the password will expire after the indicated period from the date shown in the From field (see section 5.5).

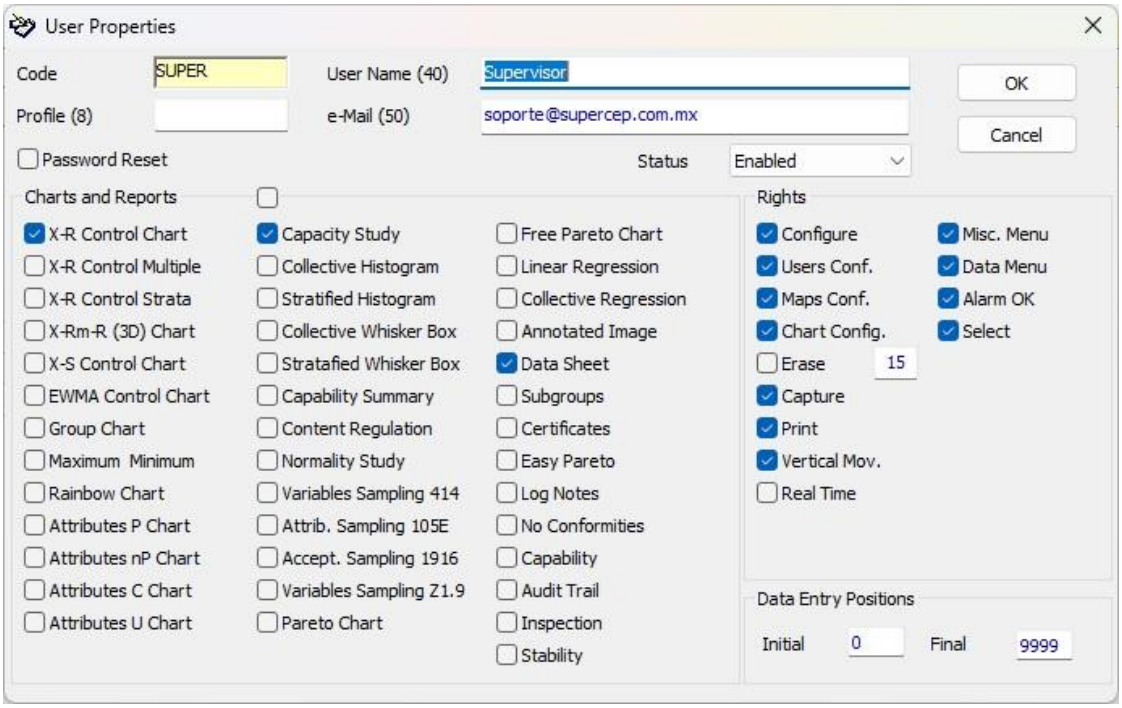
E-MAIL. Type the user's e-mail address.

GRAPHS AND REPORTS. Check the boxes corresponding to the graphs and reports that the user is authorized to obtain from the system:

Graph	Description
X-R Control Chart	Means and Ranges Chart or Individuals and Moving Ranges Chart
X-R Control Multiple	Means and Ranges Charts or Individuals and Moving Ranges Charts of several characteristics in one window
X-R Control Strata	Means and Ranges Chart or Individuals and Moving Ranges Chart for one characteristic stratified based on the content of another
X-Rm-R (3D) Chart	Means, Moving Ranges and Ranges Chart
X-S Control Chart	Means and Standard Deviations Chart
EWMA Control Chart	Exponentially Weighted Moving Averages Chart (EWMA)
Group Chart	Individuals Maximum and Minimum and Moving Ranges Chart
Maximum Minimum	Means Control Chart with subgroup maximum and minimum amplitude lines. Grouped by period
Rainbow Chart	Process Control Chart by direct comparison with specification limits
Attributes P Chart	Attributes Chart of Non-Conforming Fractions (variable sample size)
Attributes nP Chart	Attributes Chart of Non-Conforming (constant sample size)
Attributes C Chart	Attributes Chart of the number of Non-Conformities
Attributes U Chart	Attributes Chart of the number of Non-Conformities per Unit
Capacity Study	Frequencies Distribution Histogram and Process Capability Study (Cp y

	Cpk). Normal or Non-Normal Distributions.
Collective Histogram	Frequencies Distribution Histogram and Cpk of several characteristics in one window
Stratified Histogram	Frequencies Distribution Histogram and Cpk for one characteristic stratified based on the content of another
Collective Whisker Box	Whisker Box diagrams representing the probability distribution of several characteristics in one window
Stratified Whisker Box	Whisker Box diagrams representing the probability distribution for one characteristic stratified based on the content of another
Capability Summary	Stacked Bar Graph showing the Cp and Cpk level of several characteristics at different periods
Content Regulation	Evaluation Report of inspection approval of weight or volume content under government regulations
Normality Study	Accumulated Frequencies chart on a Normal Probability scale, Whisker Box, Median and Quartiles and Frequencies Histogram
Variables Sampling 414	Lot Acceptance Sampling by Variables according to Military Standard 414.
Variables Sampling Z1.9	Lot Acceptance Sampling by Variables according to ANSI ASQ Z1.9 2003.
Attributes Sampling 105E/Z1.4	Lot Acceptance Sampling by Attributes according to Military Standard 105E or ANSI ASQ Z1.4.
Acceptance Sampling 1916	Lot Acceptance Sampling by Attributes according to Military Standard 1916.
Pareto Chart	Diagram, curve and tabulation of the number of non-conformities for a group of characteristics in decreasing frequency or cost-impact magnitude
Free Pareto Chart	Diagram, curve and tabulation of the number of non-conformities for a group of free-coded characteristics in decreasing frequency or cost-impact magnitude
Linear Regression	Fit and linear correlation between two original or transformed variables
Collective Regression	Fit and linear correlation between several original or transformed variables
Annotated Image	Displays the image of the Process or Product along with the current values of its characteristics.

Report	Description
Data Sheet	Report of sample data points and its descriptive statistics
Subgroups	Report of the Mean, Standard Deviation and Range of grouped sample data points.
Certificates	Printing of Quality Certificates from sample data
Easy Pareto	Report of the number of non-conformities conformities for a group of free-coded characteristics in decreasing frequency or cost-impact magnitude
Log Notes	Consolidated report of out of specification data points and process log notes
Non Conformities	Consolidated cross tabulation of non-conformities by Process and Machine
Capability	Consolidated report of Process Capability Indexes
Audit Trail	Data modification Log report
Inspection	Report of the Control Plan Compliance
Stability	Report of Stability or Statistical Control



RIGHTS. Check the boxes corresponding to the capacities or rights that the user has in the system:

Right	Description
Configure	Right to add or edit any configuration element except Users and Users Stations. Access to the definition of the type and location of the database, printer setup, shifts schedule and operation language.
User Configure	Permission to register or edit new Users and their access to Stations.
Maps Configure	Permission to change images and modify the position of labels on the Plant, Station, Machine and Product maps.
Chart Configure	Permission to define parameters and options for graphs.
Erase	Permission to delete or modify sample data. Even when this right is removed, it can still be allowed in individual cells by defining a window in minutes applicable from the date of the record to be modified.
Capture	Permission to enter new sample data and row insertions.
Print	Permission to print graphs and reports.
Vertical Movement	Permission to move to other rows on the datasheet apart from the addition row.
Real Time	Enabled charts will be automatically presented to the user immediately after the sample is captured or as he moves across the datasheet. Not recommended if the user has more than 3 active graphs. Only available on SC version.
Process Change	Permission to switch to another datasheet different from the current one.
Miscellaneous Menu	Access to the Miscellaneous menu where sample date or time can be edited, datasheet columns scroll fixed, serial connections disabled, etc.
Reports Menu	Access to the Reports menu.
Alarm OK	Authorization to unblock an alarm message from a control chart. This is an additional right to the one granted to the 4 supervisors declared at each machine process.
Select	Access to the dialog window to select and filter data to include in charts and reports.

INITIAL AND FINAL POSITIONS. Allows user access to a limited section of the datasheet between these two positions. Introduce numeric values from 0 to 9999.

To finalize press OK to record and go back to the previous screen.

It is possible to show a photograph of the operator by copying to the \Image folder a jpg image with the same name as the User's Code.

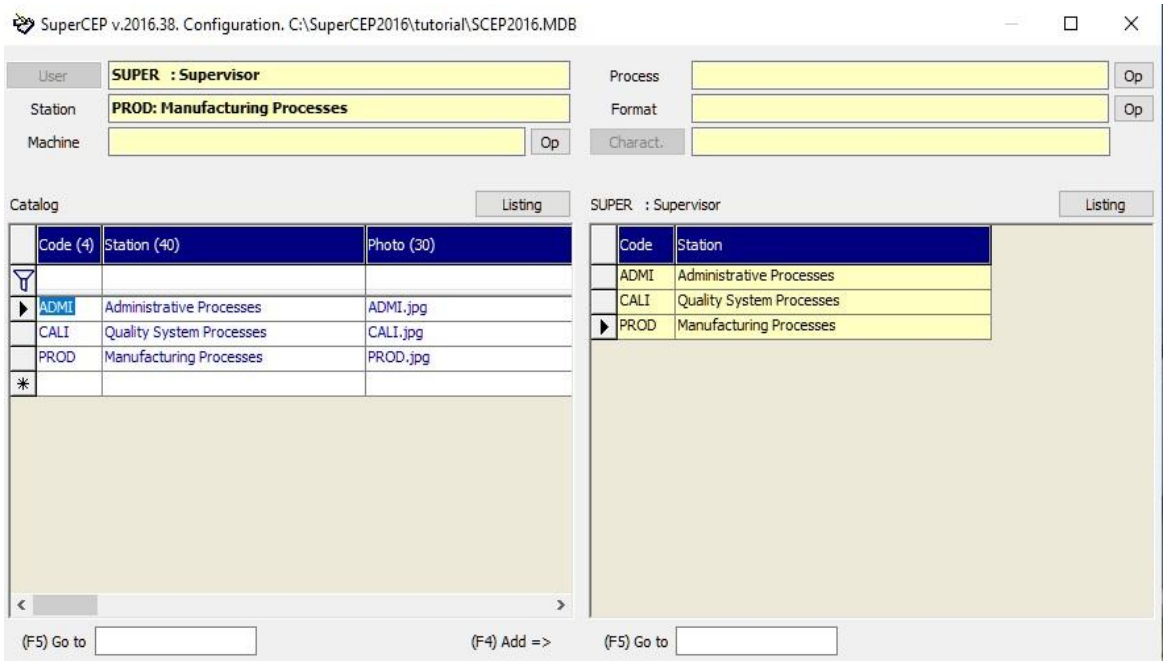
You can preview and print a Users Report pressing the Listing button and then Prepare.

5.1.4 STATIONS Catalog

Important: This section is not accessible to users with the Users Conf. option disabled.

Once the new User is added, go on to add a new Station. Click on the Station field located on the top left under the User field.

Two tables show at the lower part of the window. The left table with blue foreground is the Stations catalog. To find a station press F5 and then the first few letters of the code. When the table scrolls to the appropriate code press Tab to put the cursor on it.



To add a new Station place the cursor on the blank row at the end of the table (marked with an asterisk *) at the first column titled Code (8). Type a station code employing only capital letters or numbers without spaces. The code can have up to 8 characters. Take note that, when editing, the asterisk moves downward and a pencil appears in its place indicating the edition in progress. To cancel the edition press <Esc>. Press <Enter> to advance to the next column titled Station (40). Type the name of the Station with up to 40 characters. Press <Enter> to advance through the next columns. At the column titled Map you can optionally type the name of an image of the station. The image file should be in the BMP or JPG format at the \Image folder. To finish editing, place the cursor on the next row (now marked with the asterisk *). The pencil will disappear indicating that a new Station has been registered.

<u>Important</u>: Most catalogs have fields for writing alternate descriptions in other languages. This information is optional and will be used in case you wish to obtain graphs and reports with titles and legends in these languages.

If you wish to delete a record from the catalogue, click in the corresponding line and then click on the button on its left side. The line will be marked in a black background. Press the <Del> key.

Important: When a station is deleted, all its connections to users are only disabled not deleted.

To modify the content of a field from a previous record without retyping it completely, place the cursor over the field, select it (blue background) and press F2.

You can preview and print a Stations Report pressing the Listing button and then Prepare.

5.1.5 USER STATIONS Relation

Important: This section is unavailable to users with the Users Config. option disabled.

Once a new station is registered you should add it to the User Stations list that is shown at the right bottom corner of the window. If the user is also new the table will be empty. To add a Station, finish any edition in progress (no visible pencil), click on the corresponding catalog row and press the F4 key. In the table at right a new row will appear with the station code and description. Double click can be used instead of the F4 key.

Repeat this procedure for each station you want the user to have access to. Each user should have access to at least one station, except for those users that will only serve as profiles. One station can be assigned to several users.

If you wish to delete a station from the User Stations list, click in the corresponding line and then click on the button on its left side. The line will be marked in a black background. Press the <Del> key.

You can preview and print a User Stations Report pressing the Listing button and then Prepare.

5.1.6 MACHINES Catalog

When the user has a station assigned proceed to register a new Machine. Make sure the station field shows the code of the new station. Click on the Machine field located on the top left under the Station field.

Two tables show at the lower part of the window. The left table with blue foreground is the Machines catalog. To find a machine press F5 and then the first few letters of its code. When the table scrolls to the appropriate code press Tab to put the cursor on it.

To add a new Machine place the cursor on the blank row at the end of the table (marked with an asterisk *) at the first column titled Code (8). Type a machine code employing only capital letters or numbers without spaces. The code can have up to 8 characters. Take note that, when editing, the asterisk moves downward and a pencil appears in its place indicating the edition in progress. To cancel the edition press <Esc>. Press <Enter> to advance to the next column titled Machine (40). Type the name of the Machine with up to 40 characters. Press <Enter> to advance through the next columns. At the column titled Map you can optionally type the name of an image of the machine. The image file should be in the BMP or JPG format at the Image folder. To finish editing, place the cursor on the next row (now marked with the asterisk *). The pencil will disappear indicating that a new Machine has been registered.

If you wish to delete a record from the catalogue, click on the corresponding line and then click on the button on its left side. The line will be marked in a black background. Press the <Del> key.

Important: When a Machine is deleted, all its connections to Stations and Processes are only disabled not deleted.

To modify the content of a field from a previous record without retyping it completely, place the cursor over the field, select it (blue background) and press F2.

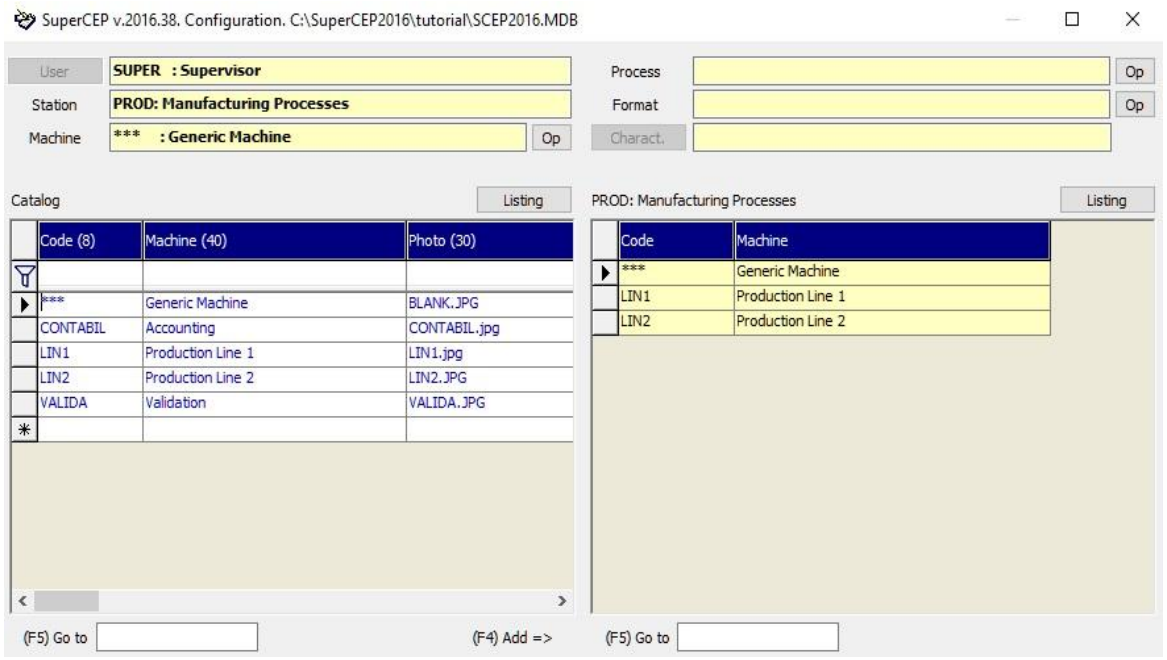
You can preview and print a Machines Report pressing the Listing button and then Prepare.

5.1.7 STATION MACHINES Relation

Once the new machine is registered you should add it to the Station Machines list that is shown at the right bottom corner of the window. If you are at a new Station then the table will be empty. To add a Machine, finish any edition in progress (no visible pencil), click on the corresponding catalog row and press the F4 key. In the table at right the machine code and description will appear in a new row. Double click can be used instead of the F4 key.

Repeat this procedure for each Machine pertaining to this station. Each station should have at least one assigned machine. One machine can be assigned to several stations.

If you wish to delete a machine from the Station Machines list, click on the left side button of the corresponding row. The line will be marked in a black background. Press the <Del> key.



You can preview and print a Station Machines Report pressing the Listing button at right and then Prepare.

5.1.8 PRODUCTS / PROCESSES Catalogue

After the machine is assigned to a station proceed to register a new Product / Process. Make sure the machine field shows the code of the new machine. Click on the Process field located on the top right corner of the window.

Two tables show at the lower part of the window. The left table with blue foreground is the Products catalog. To find a product press F5 and then the first few letters of its code. When the table scrolls to the appropriate code press Tab to put the cursor on it.

To add a new Product place the cursor on the blank row at the end of the table (marked with an asterisk *) at the first column titled Code (16). Type a product or process code employing only capital letters or numbers without spaces. The code can have up to 16 characters. Take note that, when editing, the asterisk moves downward and a pencil appears in its place indicating the edition in progress. To cancel the edition press <Esc>. Press <Enter> to advance to the next column titled Product (40). Type the name of the Product with up to 40 characters. Press <Enter> to advance through the next columns. At the column titled Map you can optionally type the name of an image of the product. The image file should be in the BMP or JPG format at the \Image folder. To finish editing, place the cursor on the next row (now marked with the asterisk *). The pencil will disappear indicating that a new Product / Process has been registered.

If you wish to delete a Product from the catalogue, click on the corresponding row and then click on the button on its left side. The line will be marked in a black background. Press the <Del> key.

Important: When a Product is deleted, all its connections to Machines, Formats and Characteristics are only disabled not deleted.

To modify the content of a field from a previous record without retyping it completely, place the cursor over the field, select it (blue background) and press F2.

You can preview and print a Products Report pressing the Listing button and then Prepare.

5.1.9 MACHINE PRODUCTS Relation

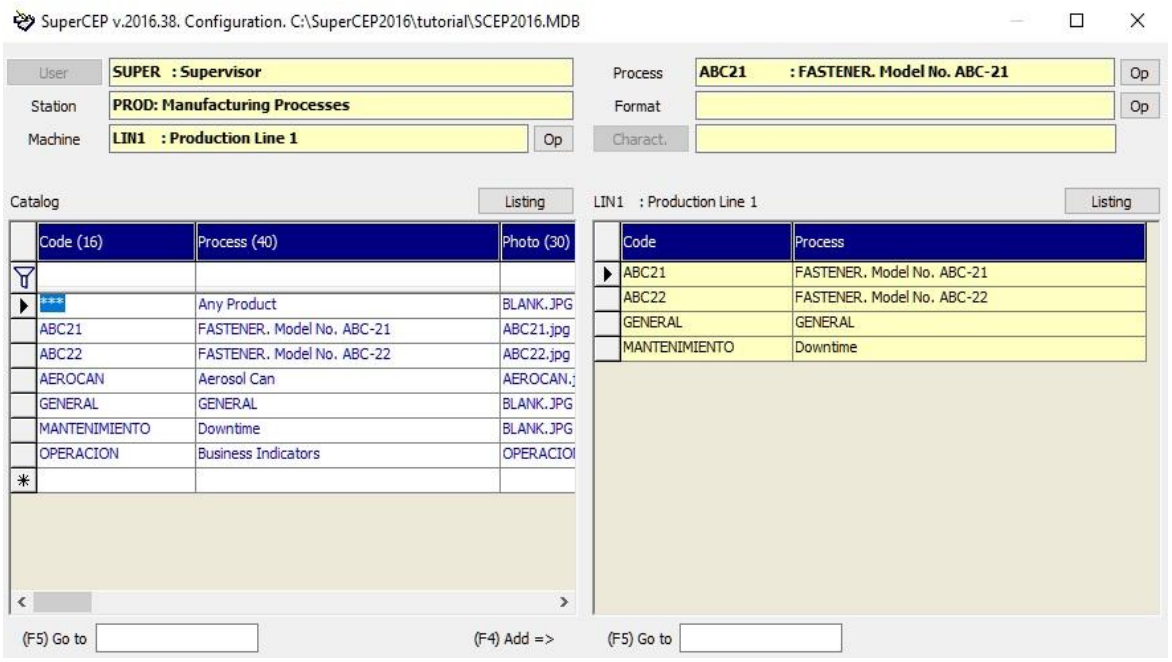
Once the new product is registered you should add it to the Machine Products list that is shown at the right bottom corner of the window. If you are at a new Machine then the table will be empty. To add a Product finish any edition in progress (no visible pencil), click on the corresponding catalog row and press the F4 key. In the table at right the product code and description will appear in a new row. Double click can be used instead of the F4 key.

Repeat this procedure for each Product / Process realized in this machine. Each machine should have at least one assigned product. One product can be the outcome of several machines.

It is possible to assign a product to all existing machines by right-clicking on the code of the selected product. It is also possible to assign all products to the selected machine by right-clicking on the code of the selected machine.

If you wish to delete a product from the Machine Products list, click on the left side button of the corresponding row. The line will be marked in a black background. Press the <Del> key.

You can preview and print a Machine Products Report pressing the Listing button at right and then Prepare.



5.1.10 FORMATS Catalog

A Format is a collection of process variables, quality characteristics or identifiers that you wish to capture and / or consult together in a Data Sheet.

After the Product is assigned to its Machine proceed to register a new Format. Make sure the product field shows the code of the new product. Click on the Format field located on the top right corner of the window below the Process field.

Two tables show at the lower part of the window. The left table with blue foreground is the Formats catalog. To find a format press F5 and then the first few letters of its code. When the table scrolls to the appropriate code press Tab to put the cursor on it.

To add a new Format place the cursor on the blank row at the end of the table (marked with an asterisk *) at the first column titled Code (8). Type a format code employing only capital letters or numbers without spaces. The code can have up to 8 characters. Take note that, when editing, the asterisk moves downward and a pencil appears in its place indicating the edition in progress. To cancel the edition press <Esc>. Press <Enter> to advance to the next column titled Format (40). Type the name of the Format with up to 40 characters. Press <Enter> to advance through the next columns. To finish editing, place the cursor on the next row (now marked with the asterisk *). The pencil will disappear indicating that a new Format has been registered.

If you wish to drop a Format from the catalogue, click on the corresponding row and then click on the button on its left side. The line will be marked in a black background. Press the <Del> key.

Important: When a Format is deleted, all its connections to Products and Characteristics are only disabled not deleted.

To modify the content of a field from a previous record without retyping it completely, place the cursor over the field, select it (blue background) and press F2.

You can preview and print a Formats Report pressing the left Listing button and then Prepare.

5.1.10.1 UNION FORMATS

Capture the letter U in the Type field if you want to use a special type of format called Union Format which allows you to gather in a Data Sheet the information previously recorded in other formats. It is useful, for example, to display together data of the same Product made in different Machines or Final Quality characteristics together with their Root causes, registered in different stages of the process. The data is shown interleaved according to its date and time. These formats are for consultation and analysis only. Section 5.1.14 explains how to relate the columns of a Union Format with columns of other formats.

5.1.11 PRODUCT FORMATS Relation

Once the new format is registered you should add it to the Product Formats list that is shown at the right bottom corner of the window. If you are at a new Product then the table will be empty. To add a Format, finish any edition in progress (no visible pencil), click on the corresponding catalog row and press the F4 key. In the table at right the format code and description will appear in a new row. Double click can be used instead of the F4 key.

Repeat the operation for each Format applicable to this Product / Process. Each product should have at least one format assigned. The same Format can be used with several products.

If you wish to delete a format from the Product Formats list, click on the left side button of the corresponding row. The line will be selected with a black background. Press the <Del> key.

You can preview and print a Product Formats Report pressing the Listing button at right and then Prepare.

5.1.12 CHARACTERISTICS Catalogue

Once a Format is assigned to the Process/Product proceed to register a new quality Characteristic. Make sure the Format field shows the code of the new Format. Click on the Charact field located at the right of the window under the Format field (click inside the field not on the button).

Two tables show at the lower part of the window. The left table with blue foreground is the Characteristics catalog. To find a characteristic press F5 and then the first few letters of its code. When the table scrolls to the appropriate code press Tab to place the cursor on it.

To add a new Characteristic place the cursor on the blank row at the end of the table (marked with an asterisk *) at the first column titled Code (8). Type a quality characteristic code employing only capital letters or numbers without spaces. The code can have up to 8 characters. Take note that, when editing, the asterisk moves downward and a pencil appears in its place indicating the edition in progress. To cancel the edition press <Esc>. Press <Enter> to advance to the next column titled Characteristic (40). Type the name of the Characteristic with up to 40 characters. Press <Enter> to advance through the next columns. To finish editing, place the cursor on the next row (now marked with the asterisk *). The pencil will disappear indicating that a new Characteristic has been registered.

Important: Do not add characteristics with codes N, FECHA, TURNO, OPERADOR, BITACORA or FLAGS because they are reserved for the system internal operation.

If you wish to delete a Characteristic from the catalogue, click on the corresponding row and then click on the button on its left side. The line will be marked in a black background. Press the <Del> key.

Important: When a Characteristic is dropped, all its connections to Formats and Products are disabled but not deleted. When opening a data sheet having any of those Formats the corresponding column will be hidden. Sample data will show again if the characteristic is re-enabled with the same code and data type.

To modify the content of a field from a previous record without retyping it completely, place the cursor over the field, select it (blue background) and press F2.

You can preview and print a Characteristics Report pressing the left Listing button and then Prepare.

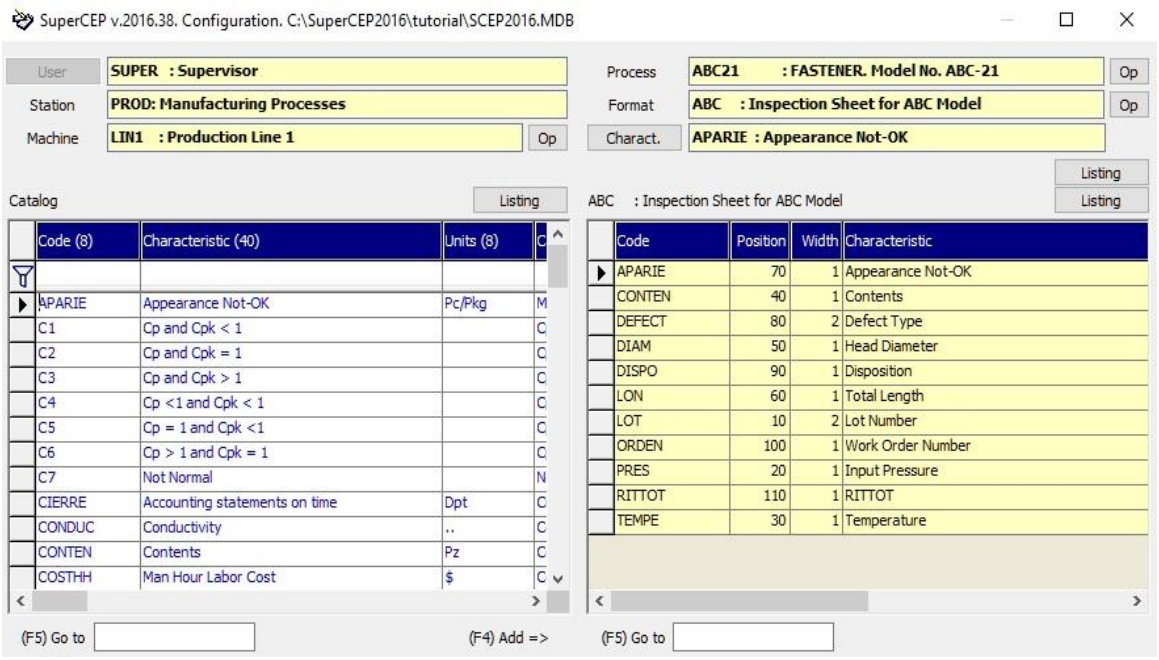
5.1.13 FORMAT CHARACTERISTICS Relation

When the new characteristic is registered you should add it to the Format Characteristics list that is shown at the right bottom section of the window. If you are at a new Format then the table will be empty. To add a characteristic, finish any edition in progress (no visible pencil), click on the corresponding catalog row and then double-click or press the F4 key. In the table at right the characteristic code, position, width and description will appear in a new row.

Repeat this procedure for each Characteristic that you wish to include in the Format. Each Format should have at least one Characteristic assigned and a maximum of 250. The same characteristic can be declared for several Formats.

If you wish to delete a characteristic from the Format Characteristics list, click on the left side button of the corresponding row. The line will be selected with a black background. Press the <Del> key.

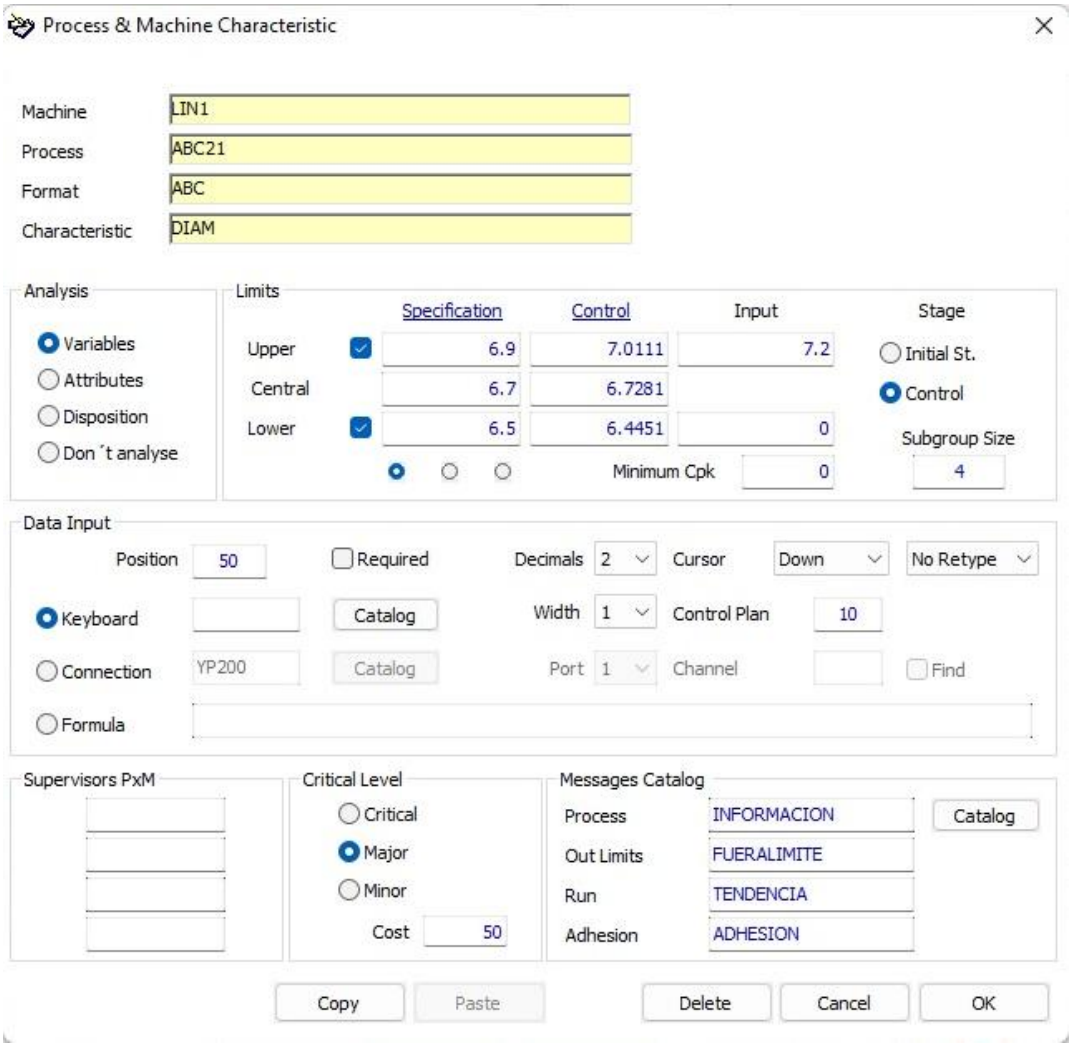
Important: When a Format Characteristic is deleted, the corresponding column will be hidden when opening the data sheet but its data contents are not lost.



You can preview and print a Format Characteristics Report pressing the Listing button at right and then Prepare.

5.1.14 PRODUCT/PROCESS and MACHINE CHARACTERISTICS Relation

The same Format Characteristics table serves the purpose of configuring the Product/Process and Machine quality Characteristics. Place the cursor at the corresponding row in the right-side table. The Character. field will show the Characteristic code and description. Press the Character button to show the Product and Machine Characteristic configuration window.



Fill this form according to the following indications:

ANALYSIS TYPE.

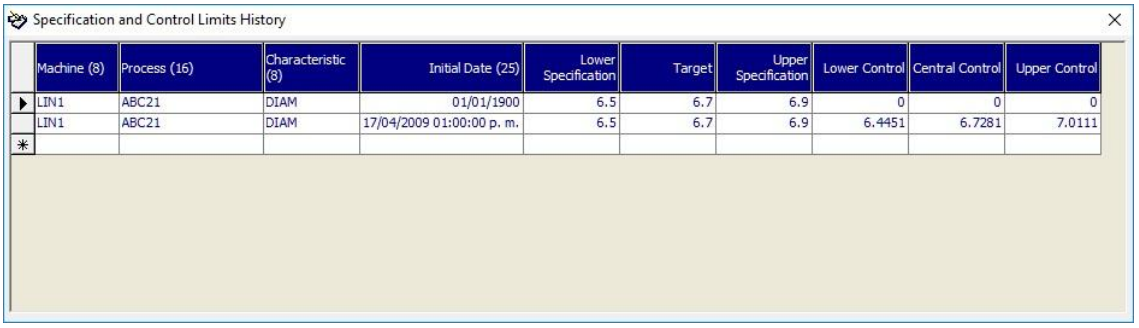
- Variables to analyze data obtained from precision instruments.
- Attributes to analyze data obtained from imprecise numeric scales or counts of defectives or defects.
- Disposition to analyze data obtained from Pass / Fail inspections.
- Don't Analyze for label data not requiring statistical analysis.

Important: If you modify the analysis type from Variables or Attributes to Disposition or Don't Analyze, of a product characteristic that already has a column on the data sheet, you will see the message "Change Type …" when you re-enter that sheet. If the modification is the other way around from Disposition or Don't Analyze to Variables or Attributes, you will see a message indicating that the change is not possible because it would mean losing all non-numeric data on that column.

LIMITS

- Upper, Target and Lower Specification. Nominal value and tolerance range established by product/process engineering or client requirement. If the characteristic has only one limit, check the corresponding box. If the characteristic has bilateral limits check both boxes. Do not leave both boxes unchecked. Please note that if the characteristic is of type Attribute or Disposition and you plan to obtain P (defective fraction) charts these limit entries are considered to be percentages.
- Upper, Central and Lower Control. Mean Value and natural 6-sigma variation range of individual or grouped samples of a process under statistical control. If these values are not yet known they can be left blank to be later evaluated by the system.
- Stage. Initial Study means that the statistical control limits have not been established as representative of the process or that they are being revised due to profound changes in the process. Control means that the statistical limits have been previously fixed and represent the stability of the current process.
- Upper and Lower Input. Range of allowed values according to the physics and logics of the process. Intended to avoid input mistakes. These limits should fall outside the specification limits.
- Minimum Cpk: Used to activate an alarm message when, on the Control Chart, the Capability Index of the process falls below this acceptable value.
- Subgroup Size. Number of samples that are averaged to form a statistical subgroup. The value 1 means individual data (useful with normally distributed populations). Values 4 and 5 are preferred for discrete productions where samples have great variability, for non-Normal distributions or where a more rigorous analysis is required.

Each specification or control limits modification is kept recorded. This modifiable history can be accessed clicking on the fields blue labels. On the data sheet these limits are enforced strictly according to their starting date-time. Limits at control charts will reflect these variations if the data timestamps span more than one period.



Machine (8)	Process (16)	Characteristic (8)	Initial Date (25)	Lower Specification	Target	Upper Specification	Lower Control	Central Control	Upper Control
LIN1	ABC21	DIAM	01/01/1900	6.5	6.7	6.9	0	0	0
LIN1	ABC21	DIAM	17/04/2009 01:00:00 p. m.	6.5	6.7	6.9	6.4451	6.7281	7.0111

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DATA INPUT

- Position. A number that determines the location of the column relative to the rest of the format columns. Defines accessible sections for users. The Position is defined for the Characteristic in this Format regardless of the Process or Machine in question.

- Required. Check this box if you want to not be allowed to leave a record without having captured a value in this characteristic. This option is incompatible with the vertical input of subgroups in other columns of the Data Sheet.

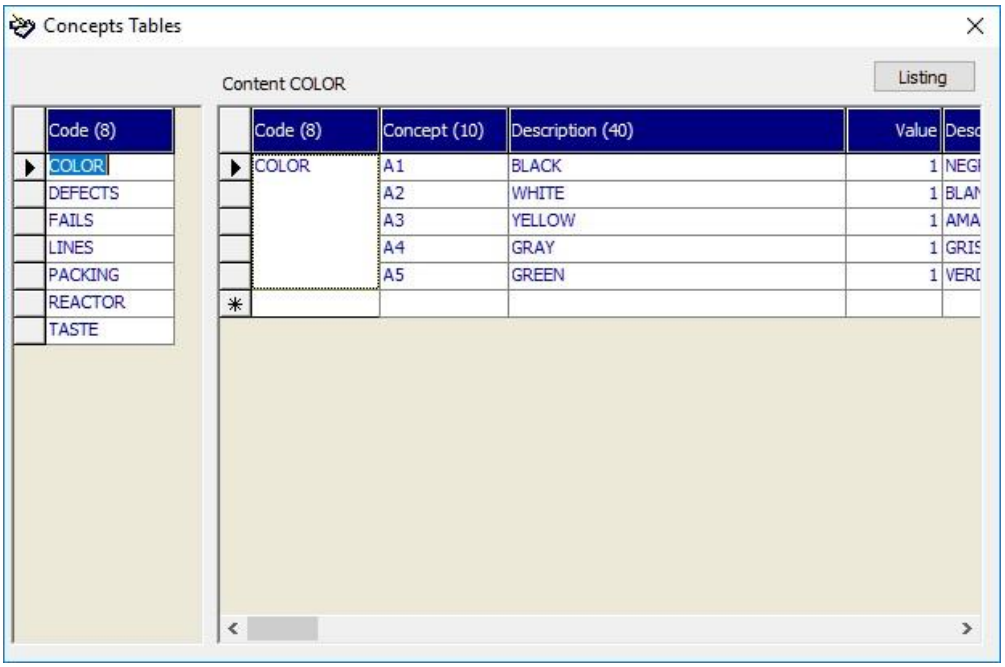
- Decimals. Number of decimals that the database will store. Determines the results precision on graphs and reports. A zero value in a Don't Analyse column indicates that the cell contents will not be formatted.

- Width. Choose 1 to accept up to 9 characters in the column cells. Choose 2 to accept for up to 14 characters and 3 for up to 30 characters. The Width is defined for the Characteristic in this Format regardless of the Process or Machine in question.

- Control Plan. Sampling frequency established by the control plan expressed in minutes. Used for column headers and by the Inspection Compliance report.

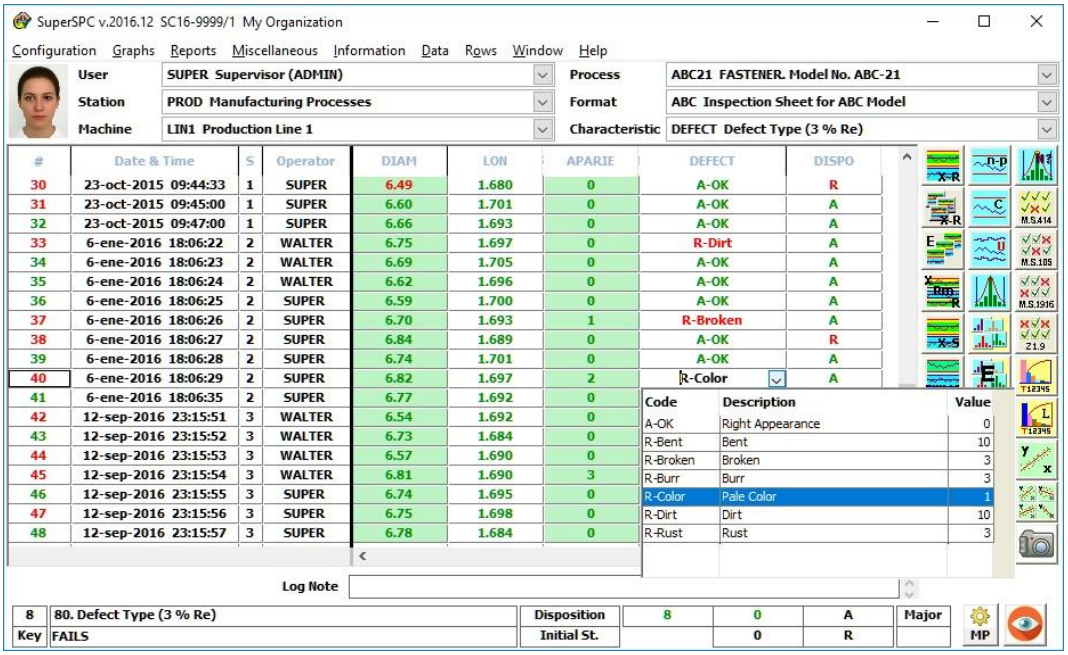
- Keyboard. Manual input with the keyboard.

  To facilitate manual input you can pre-establish Concept Lists associated with Disposition or Don't analyze columns up to a maximum of 16 columns on any single Data Sheet Format.



To create a new Table enter the Code in the field next to the asterisk (*) and move the cursor to the next line. After a few moments you can start recording the various concepts of the new table. To edit an existing Table select it at the list on the left.

The Value column is a useful scale for assessing cost in the Pareto Chart.



- Cursor. Indicate where to position the cursor after pressing <Enter>. Options are: Down, Up, Right, Tab and Don't Move. Also applies by default for data received through an instrument connection.

- Replication. The system can retype the data just captured in the open window of another application. Write that window's title (for example Microsoft Excel) into the Formula field and select the cursor movement sent to the target application. Options are: Down, Up, Right, Left, Enter and Tab.
- Connection. Automatic data acquisition through a RS-232 serial port or Ethernet TCP/IP. Enter the connection code according to the connections catalog, the serial port number (1 to 8), the channel number if there is an automatic multiplexer, check *Find* box if multiplexed data should find its column according to the corresponding channel of data received. If you wish to view the connections catalog press the Catalog button. New connections can be added if the communication parameters and data format are known from the inspection equipment manuals.

- Formula. Data is calculated from data in other columns. Write down an algebraic formula to obtain the variable's value. Each column reference used in the formula should be preceded with the @ sign.

  Available functions and operators are:

Symbol	Operation
( )	Group terms
+	Addition
-	Substraction
*	Multiplication
/	Division
^	Exponentiation
&	Text Concatenation
LOG( )	Natural Logarithm
EXP( )	Natural Inverse Logarithm
SIN( )	Sine
COS( )	Cosine
TAN( )	Tangent
ATN( )	Arc Tangent
ABS( )	Absolute Value
SQR( )	Square Root
SUM( )	Sum Total
AVG( )	Average
MAX( )	Maximum
MIN( )	Minimum
RNG( )	Range
SUMV( )	Vertical Sum Total
AVGV( )	Vertical Average
MAXV( )	Vertical Maximum
MINV( )	Vertical Minimum
RNGV( )	Vertical Range
TSTV( )	Vertical Student's t
DIS( )	Disposition
INC( )	Increment Function
SEQ( )	Sequence Function
IIF( )	Conditional IF
SGN( )	Digital Signature
TIS( )	Timestamp
CDATE()	Date to day count conversion
WRD()	Working days between 2 dates

The following rules apply:

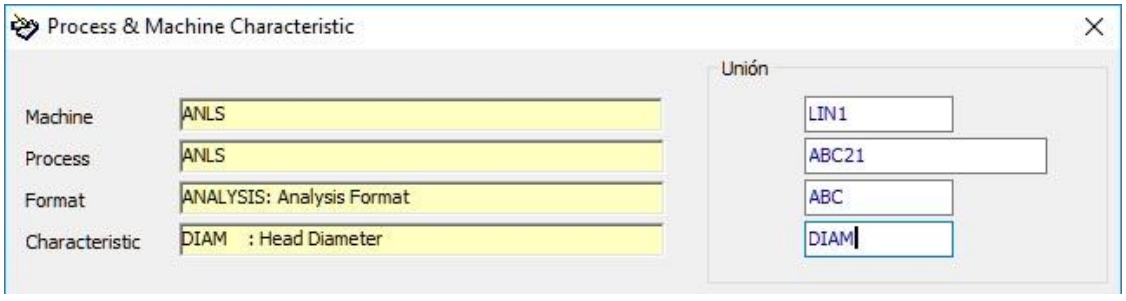
- Operations are allowed only between columns of the same data sheet.
- References to any column (characteristic) should come preceded by the character @ (at). Examples: @DIAM or @WEIGHT or @PH or @L76_X5

- Constants with decimals are always separated with a dot instead of a comma.
- Formulas should not contain other signs different from those enlisted. You will not be able to include characteristic codes that contain an operator symbol for example DI-01 or PH/009 because the formula would not evaluate correctly.
- The formula should not include its own code, that is if you are defining a formula for column ABCD, you cannot include the code @ABCD.
- The result of one column can be used in the formula of another column as long as it is positioned to the right of the first column.
- Arguments of trigonometric functions are expressed in radians (180 degrees = PI radians).
- Functions SUM( ), AVG( ), MAX( ), MIN( ), RNG( ), DIS( ) and TIS( ) take as argument a list of characteristics separated with commas. Formulas with these functions cannot include other functions or operators. Function TIS( ) with no arguments will react to editions on all columns.
- Functions SUMV( ), AVGV( ), MAXV( ), MINV( ), RNGV( ) and TSTV( ) take as argument the code of a characteristic and the number of vertical rows to operate on; for example AVGV(@WEIGHT,5) will average every 5 data of column WEIGHT. If to the left of the column there is another one with formula INC() or SEQ(), the operation is done at the end of each subgroup. Formulas with these functions cannot include other functions or operators.
- The Increment function INC( ) defines a formula that increments an alphanumeric value by the parameter value. For example if the initial value is A50 and the formula is INC(2), the values of the following rows will be: A52, A54, A56, etc. If you wish to repeat the initial value simply write INC(0). To set the initial value append it with an * (asterisk). One column can have as many initial values as is necessary. The column must be of type Don't analyze. It can also be defined in a column with Keyboard and Catalog input type.
- The Sequence function SEQ( ) defines a list that generates the next alphanumeric value following the previous record. Do not repeat the same value in the sequence. To set the initial value append it with an * (asterisk). One column can have as many initial values as is necessary. The column must be of type Don't analyze.
- The Digital Signature function SGN( ) takes as an argument the code of a column containing the code of a user. When that column is edited the user password is required. If it is correct the OK value is returned, otherwise the NOK value is returned.
- The IIF conditional requires 3 arguments separated by comma. 1) the expression to evaluate, 2) the result in case the expression is true and 3) the result in case the expression is false.
- To calculate with date-time values enter them on a Don't analyze column using a Windows acceptable format and in the formula use the CDATE( ) conversion function.
- Variables @FECHA, @TURNO, @OPERADOR, @BITACORA y @STATION are valid.
- In general, Microsoft VBScript's numeric or alphabetic functions can be used.

Formula Examples:

- Density @WEIGHT / @VOLUME
- Total @C1 + @C2 + @C3
- Average AVG(@C1,@C2,@C3)
- Area 3.14159 * (@DIAMETER / 2) ^2
- Hour Interval (CDATE(@T1) – CDATE(@T0)) * 24.0
- Digital Signature SGN(@REVIEWER)
- Lot Encoder "M1" & DatePart("yyyy",@Fecha) & DatePart("y",@Fecha)

UNION. If the format type is defined as Union (Type = U), the codes of the Machine, Product, Format and Characteristic where the data will be taken to display them in this Format must be indicated.



SUPERVISION. Optionally enter the codes of up to 4 users that will supervise this product/process. Supervisors will see a parenthesis on their maps beside the codes of the elements that require supervision. On entering the data sheet they will see colors at the labels of samples that are in exception. Also they will receive a notification e-mail when an out of limits value is input in a characteristic considered critical. This configuration affects all characteristics of the product/process on this machine.

CRITICAL LEVEL. Indicates the severity of the impact of having one sample out of specification limits and its relative cost to quantify on a Pareto Chart. Characteristics can be filtered by this concept to be output by the Log, Defects and Capability consolidated graphs and reports.

MESSAGES. Enter the codes of pre-established text messages in the Messages Catalog. These messages are shown to the operator at different situations:

- Process. At operator discretion when he presses Alt-Information being at this characteristic on the data sheet.
- Out of limits. When on a Control Chart the operator clicks on an alarm symbol indicating a point out of statistical or specification limits.
- Run. When on a Control Chart the operator clicks on an alarm symbol indicating a run or tendency out of statistical control.
- Adhesion. When on a Control Chart the operator clicks on an alarm symbol indicating an adhesion to limits out of statistical control.

To view or edit the Messages Catalog press the Catalog button.
As an alternative, messages can be links to any document for which there is a viewer, explorer or the original application. Edit the text file SCVIEWER.IAU to associate the file extensions of the documents (.xlsx, .doc, .ppt, .pdf, .htm, etc.) with the access path of their location. There is no need to register the name of these documents in the Messages Catalog, just enter the file name and extension in the fields of the Messages frame.

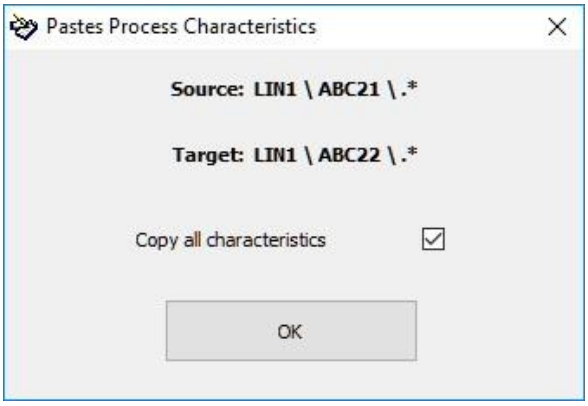
Important: Notice that the characteristic configuration is independent for each different product / machine combination. If the specifications and control parameters are similar on all machines and / or on all products, configure first on the Generic machine (code ***) and Generic product (code ***) and then copy, paste and modify what necessary only at the machines and / or products that require it. In the configuration button of the Data Sheet a code is displayed that indicates if the current characteristic has a generic or particular configuration:

MP = column configuration is particular to this Machine and Process.
*P = column configuration is general for all Machines of this Process.
M* = column configuration is general for all Processes of this Machine.
** = column configuration is general for all Processes and all Machines.

You can preview and print a listing of the Product Characteristics pressing the right bottom Listing button and then Prepare.

COPY AND PASTE

It is possible to copy and then paste one or more characteristic properties from one product to another or from one product to the same product in another machine.



Go to the configuration window of the characteristic you wish to copy and press the Copy button. Leave the window and select the machine and/or product that will receive the information, open the configuration window of the target characteristic and press the Paste button. Check the box on the dialog window if you wish to copy all characteristics from the source machine/product to the target.

5.1.15 CONNECTIONS Catalog

Data can be input directly from measuring instruments if they provide a RS-232 or TCP/IP Ethernet output. To enable the connection check the Connection option at the Data Input frame in the Product Characteristics configuration window. In the next field type the connection code of the measuring instrument according to the Connections catalog. To view or edit this catalog press the Catalog button.

There you will see a table with the pre-defined connections. Look for the one most similar to the maker and model of your instrument. Verify that the default communication parameters match the settings on your instrument. If this is not the case modify them at the catalog or at the instrument whichever is easier. To modify the content in a field of an existing record without retyping it completely, place the cursor on the field, select it (blue background) and press the F2 key.

New connections can be added filling the information on a new record at the last row marked with an asterisk.

CODE. Enter a code for the Connection using only capital letters and numbers without spaces. The code can have no more than 8 characters. Notice that the asterisk drops one row and a pencil appears indicating the edition in progress. Press <Esc> to cancel the edition or <Enter> to advance to the next cell titled Connection (40).

CONNECTION. Free format description of the instrument or communication interface.

TYPE. Either RS-232 or TCP/IP.

BAUD (RS-232). Baud rate or transmission speed in bits per second. From 300 up to 115200.

PARITY (RS-232). Parity type. N = none, E = even, O = odd, M = mark, S = space.

DATA BITS (RS-232). Number of bits that represent data. 7 or 8.

STOP BITS (RS-232). Number of stop bits. 1 or 2.

HANDSHAKE. Communication protocol. 0 = None, 1 = XOn/XOff, 2 = RTS/CTS and 3 = Both.

ACTIVE DTR (RS-232). Activate Data Terminal Ready Line.

ACTIVE RTS (RS-232). Activate Request to Send Line.

BUFFER (RS-232). Memory space for data transfer. Default 1024 characters.

RECEIVE THRESHOLD (RS-232). Windows response threshold. Normally 1 character.

HOST IP (TCP/IP). IP address of the instrument or remote host.

TCP PORT (TCP/IP). TCP port number of the instrument.

START COMMAND. Initial command to activate communication with the equipment. If there is a variable channel number in the command use the placeholder %CH. If special characters are required type their ASCII code after a slash. For example the instruction S1%CH1000/013 will send characters S151000 followed by a Car Return (ASCII character 013) when the channel configured for the column is 5.

DATA COMMAND. Command to request one reading from the equipment. Follows the same syntax of the start command, for example #%CHPS/013 will send #5PS followed by a CR when the channel number is 5.

START. Position of the first data character. Useful when the result message includes information preceding that of interest.

TERMINATOR. ASCII code of the character marking the end of the result message. 10=LineFeed, 13=CarReturn or 03=EndofText.

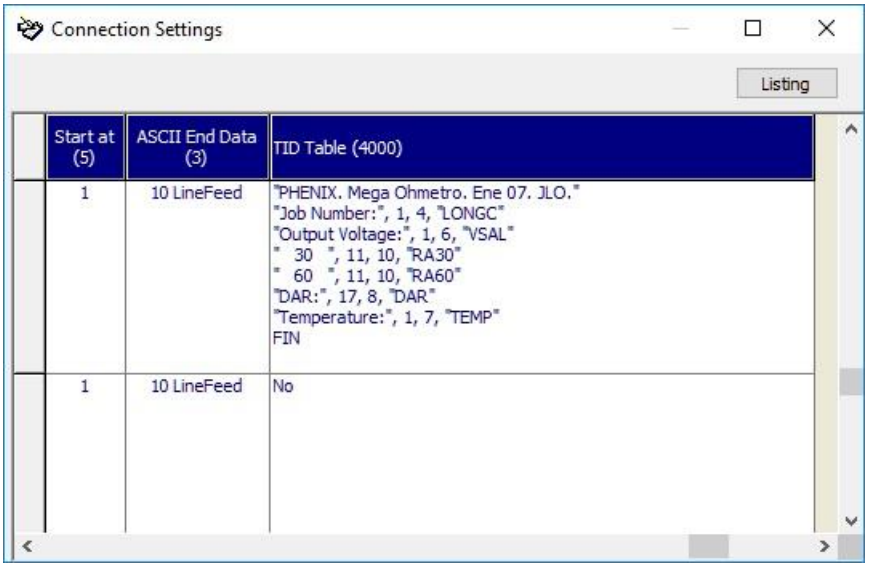
TID TABLE. If the result message from the measuring equipment has a complex format it might be necessary to build a Data Interpretation Table. For more details read ahead.

Before registering a new connection we recommend testing if communication is functional on the serial port with the RS-232 test tool located in the Miscellaneous Menu or with the PING command of your computer's operating system when communicating through an Ethernet port.

TID TABLES CONSTRUCTION.

SuperCEP can capture data from instruments having complex output formats. Data items can be extracted locating fixed positions or constant tags or labels. TID tables can also be used at the MAD RS232 module.

TID Table example with 6 data tags definitions:



A traditional TID table must contain exactly:

- One header row of free text enclosed in double quotes.
- One row for each data item with four comma-separated fields:
  - Tag or empty string in double quotes.

- Data reading start position counted from the end of the located tag.
- Number of characters to be read from the start position.
- Code of the characteristic in double quotes where the data item is to be written.

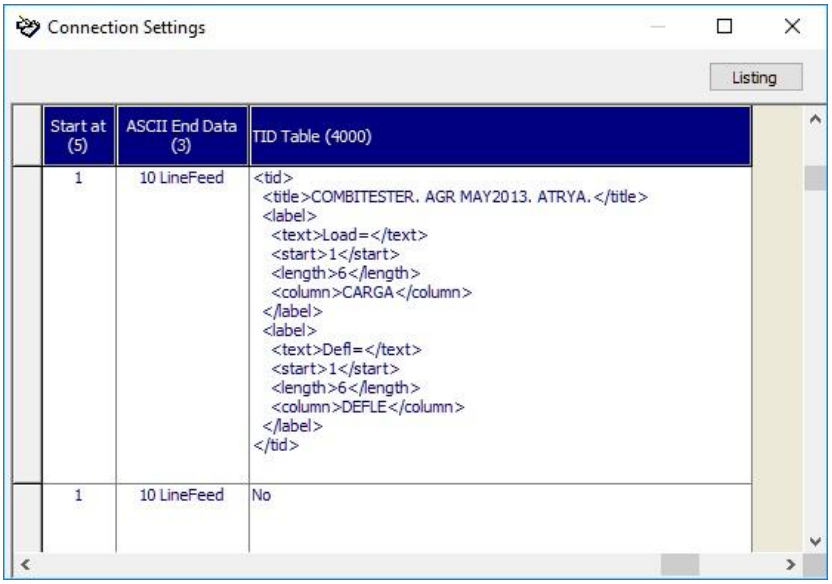
- One row with the text FIN (meaning END).

When the tag is null ("") the reading start position is taken from the beginning of the data message row. The same tag can be used to position more than one data item. If the code of the characteristic does not match any column in the data sheet format, the data item is dropped. If the code of the characteristic is left blank, the data item is written to the current column where the cursor is found.

The following XML tags with no attributes will be recognized:

<tid>	Start of TID table
<label>	Start of data tag definition
<text>	Identifying text
<start>	Data reading start position counted from the end of the located text (accepts negatives)
<length>	Number of characters to be read from the start position
<column>	Code of the characteristic where the data item is to be written
<channel_text>	Transmission channel identifier from the multiplexer (optional)
<channel_id>	SuperSPC corresponding channel id (optional)
<sep_char>	Ascii character code of the separator to be expanded to 15 spaces (optional)

Example of an XML TID table with 2 data tag definitions:



Other XML tags will be ignored. Remarks are not accepted. Remember that all XML elements must be terminated with their corresponding </tag> and that double quotes are not used.

Note: It is possible to receive the data captured from a connection in another focused application. The presence of the IAU\NoSendKeyFocus.iau file determines this behavior.

5.1.16 MESSAGES Catalog

Important: There is no obligation to register any code in this catalog if you already have documented information files of any kind for which there is a viewer, explorer or application installed on your PC. Just type the names and extensions of the files in the corresponding fields of the Product Characteristic configuration window.

This catalog is useful for compiling commentaries about preventive and corrective actions or reaction plans that operations personnel should undertake. These texts have the main objective of instructing users about recommended paths of action triggered by out of limits, runs and adhesion to limits conditions present on a control chart. Specific instructions to control each quality characteristic of each different product could be necessary. Nonetheless the content of this catalog is optional.

Text messages will display when clicking on the red warning points at the control chart each time the following conditions are present:

Case 1. Out of Limits. When 1 point falls outside control or specification limits. On the Rainbow chart this corresponds to the Stop action.

Case 2. Adhesion to Limits. When 2 out of 3 consecutive points fall between 2 and 3 standard deviations from the central limit on either side or n out of m consecutive points fall within 1 standard deviation of the central limit on either side. On the Rainbow chart this is equivalent to the Adjust action following 2 yellow points.

Case 3. Runs and Tendencies. When there are N out of M consecutive points over or under the central line or N out of M consecutive points with an upward or downward tendency. Also when there are N out of M consecutive points beyond 1 standard deviation or N out of M consecutive alternating points. On the Rainbow chart this corresponds to the Adjust action from 1 red point and another point on the same side.

These stated rules can be modified at the Control Chart configuration window.

Regardless of the condition of the control chart the operator can view the messages directly from the data sheet by clicking on the Information menu.

Enter the configuration window for the Product Characteristic to be attached with information messages. Press the Catalog button in the Messages frame. At the last row type a Message code using only capital letters or numbers without spaces. The code can have 20 characters at most. Notice that the asterisk goes down one row and a pencil icon replaces it indicating the edition in progress. Press <Esc> to cancel the edition. Press <Down arrow> to save the code. Press <Up arrow> to go back to the newly added row. Click on the text box at right and type up to 1400 characters. Press the Save button to save the updated text.

If you wish to delete a message from the catalog, click on the button at the left of the corresponding row. The row's background will turn black. Press the <Del> key.

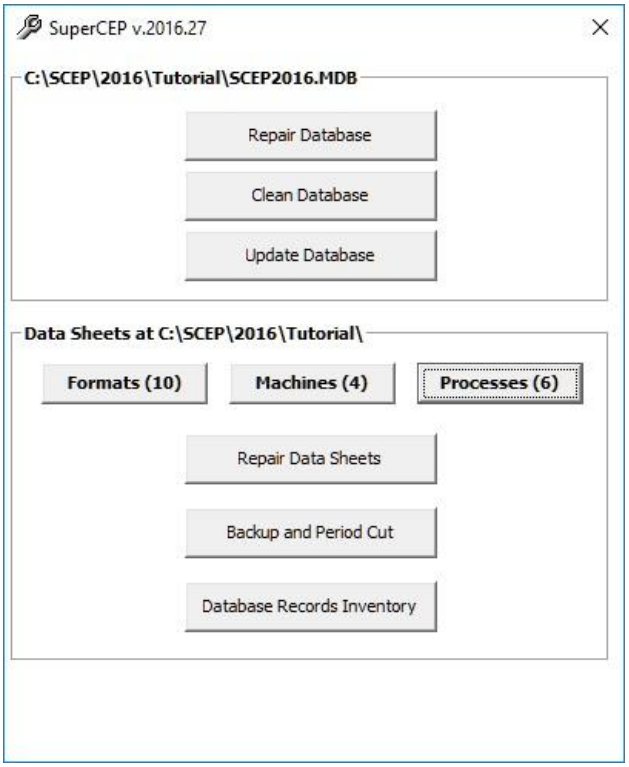
Important: References to a message are not automatically deleted from the Product Characteristics table when a message is eliminated, therefore there will be a warning when the system tries to show it.

Double-clicking on a row of the messages catalog will copy the corresponding code to the first empty field of the Messages frame at the Product Characteristics configuration window.

5.2 Database Repair, Cleanse and Update

5.2.1 Database Repair

All the information registered in the Configuration modules is stored in an Access 2000 compatible database (SCEP2016.MDB). It is highly advisable to maintain this database in a periodic manner or when it is suspected that the configuration information is not being correctly stored because of equipment or network connection failures. These utilities are not available for SQL Server.



Make sure nobody is using the database. Run the Database Repair program (REPAIR2016.EXE) located at the SuperCEP program group or directly from the installation folder. Press Repair Database. The operation will take only a few seconds. Sometimes it will be necessary to repair twice.

It is also possible to repair a particular selection of Data Sheets indicated using the Formats, Machines and Processes buttons.

Every time a database is repaired, cleaned or updated the system creates a backup copy identified with a timestamp.

5.2.2 Database Cleanse and Update

The database cleansing process will cascade delete records that have lost their parent relationships. These lost relations are generated when for example you delete the WEIGHT characteristic without first deleting the existing definitions of that characteristic for products A, B and C. Physical records for the Product Characteristic still exist but are invisible to the system because there is no definition of the WEIGHT characteristic that allows access to them. If you enter the WEIGHT characteristic again, then you would see those records re-linked. When you run the cleansing process all records in this situation will be permanently deleted. Press the Clean Database button to execute this option. Repairing after Cleaning will compact your database file size.

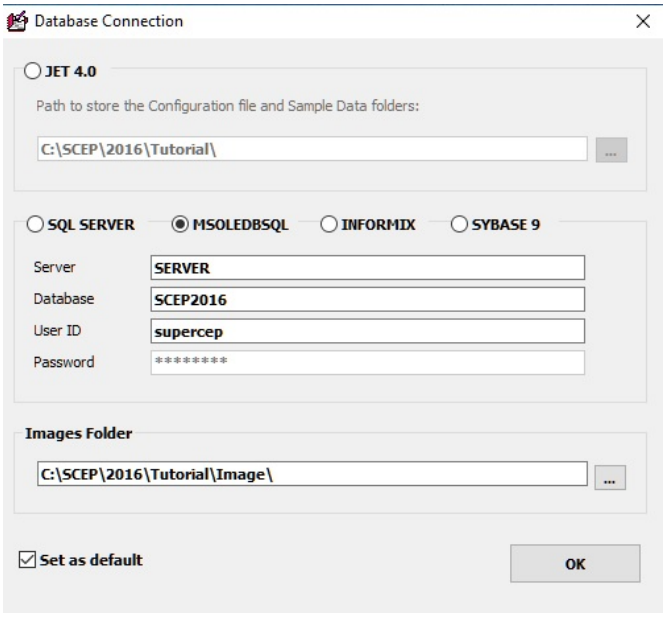
When you install software revisions within the same 2016 version it might be necessary to use the Update button to have your database structure up to date (tables, fields, indexes and views).

The Period Cut function allows you to backup and then delete old data from one or more Data Sheets. You must indicate the initial date of the data that will remain. A true copy of the files before the Cut will be stored in the Cut_YYMMDD_hhmmss folder indicating the date and time the period cut was made. You will also find a backup of SCEP2016.MDB in this folder so that it can be used to establish the Database location and query the old data.

The Records Inventory function prepares a report of the total number of records present in each table of the Database.

5.3 Database location

SuperCEP can store its databases on two quite different systems of database management. The first is called Jet 4, which is compatible with Microsoft Access 2000 although this software is not required on the PC or on a server. It also includes what is necessary to connect to SQL Server 2005 or later, Informix 10 or later and Adaptive Server Anywhere 9 or later. The licenses of these servers are acquired separately.



The decision of which system to use depends on the resources and the information technologies policies of your organization.

From the point of view of SuperCEP's functionality there is not a thing that can be done with Jet that can't be done with SQL Server or Informix and vice versa. Jet database engine can have a bit faster response speed on small files with few users, while SQL Server tends to be faster with large files and many users. From the standpoint of security and robustness, SQL Server or Informix are clearly better options although it is always necessary to have the supervision of a competent technical administrator.

5.3.1 Jet 4

To select the Jet database engine compatible with Access 2000 click the upper radio-button and then enter the complete path to the configuration database SCEP2016.MDB which will be the same path where subfolders will be created to store the data sheet files.

The edition of this folder path enables you to operate the system on a network and share data. You could also create several distinct independent databases stored in different folders or removable drives.

Very Important: Since Windows Vista, it is not recommended to keep database files under any \Program Files folder because the operating system assumes these files to be Read Only. For information backup purposes please be aware that Windows will sometimes mantain the up to date version of some SuperCEP files located at folder \Users\user name\AppData\Local\VirtualStore\Program Files(x86).

If the system is installed on a local network and it is desired to share data, enter here the full path to the folder that contains the configuration database and the data sheet subfolders.

Important: On a network it is recommended to use the full locator of the shared storage resource instead of drive letters, for example: instead of Q:\SuperSPC2016 use \\QUALITY\DISK_C\SuperSPC2016.

Prior to the edition of the access path to configuration and sample data files the referred folder must already exist. The system checks if the SCEP2016.MDB file exists before permitting the modification. To create the folder and relocate the SCEP2016.MDB file use Windows Explorer. Users must have read, write and modify privileges over the shared folder. Additionally, the folder must admit the creation and deletion of subfolders and files.

Important: If the access folder or the configuration file (SCEP2016.MDB) at a later time cease to exist or are not available on the network you will not be able to enter the program. If this happens, use Notepad to fix directly the access path in the SCDIREC.IAU file under the [JET4] tag. The first tag in this file determines the type of the current connection.

Do not point the access path of samples and configuration data to a folder of previous versions of SuperCEP because they are not compatible.

If you wish to store your database in a removable media instead of a fixed disk, change the database folder to the corresponding drive letter (for example E:\).

5.3.2 SQL Server and MSOLEDBSQL

To employ a connection to SQL Server click on the lower button. In the Server field type the name of your server. In the Database field type the name of the database (initially SCEP2016). In the User ID field type a user code that can be authenticated by the server with the same password used for SuperCEP. This password corresponds to the one encrypted in the SCEPPASS.IAU file and therefore it is not necessary to enter it again.

For the connection to be successful the SCEP2016 (or the name given in the Initial Catalog field) database must already exist on the server. For more details read the Database appendix.

To communicate with MS SQL Server, select MSOLEDBSQL if your databse server has TLS 1.2 security enabled. Clients must have installed the driver provided by Microsoft.

Important: If at this point the connection cannot be made because of a parameter error, you will need to close the system and use Notepad to edit the SCDIREC.IAU file under the [SQLSERVER] or [MSOLEDBSQL] tag. The first tag in this file determines the type of the current connection.

5.3.3 Informix and Sybase

In a similar manner SuperCEP can be connected to a database on an Informix 10 or an Adaptive Server Anywhere 9 server (note: not compatible with any other Sybase products).

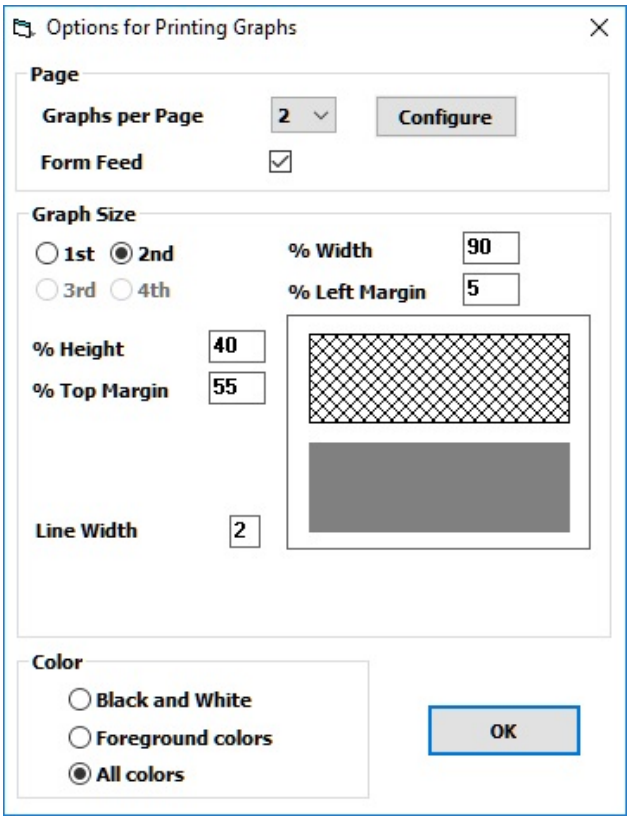
5.3.4 Use more than one database at the same time

It is possible to have several productive Access or SQL databases. Manually edit file IAU\SCDIREC.IAU to include additional [JET4], [SQLSERVER] and / or [MSOLEDBSQL] sections. The system will show a menu to select the desired connection at the beginning of each new session.

5.4 Printer Settings

The program is capable of printing from 1 up to 4 charts per page. The number, size and location of the charts on the page can be configured. Use the Configure button to load the printer driver, which will let you change other properties such as orientation, paper size and number of copies.

The Form Feed option should be unchecked only when you wish to continue printing on the same page after all charts are done printing.



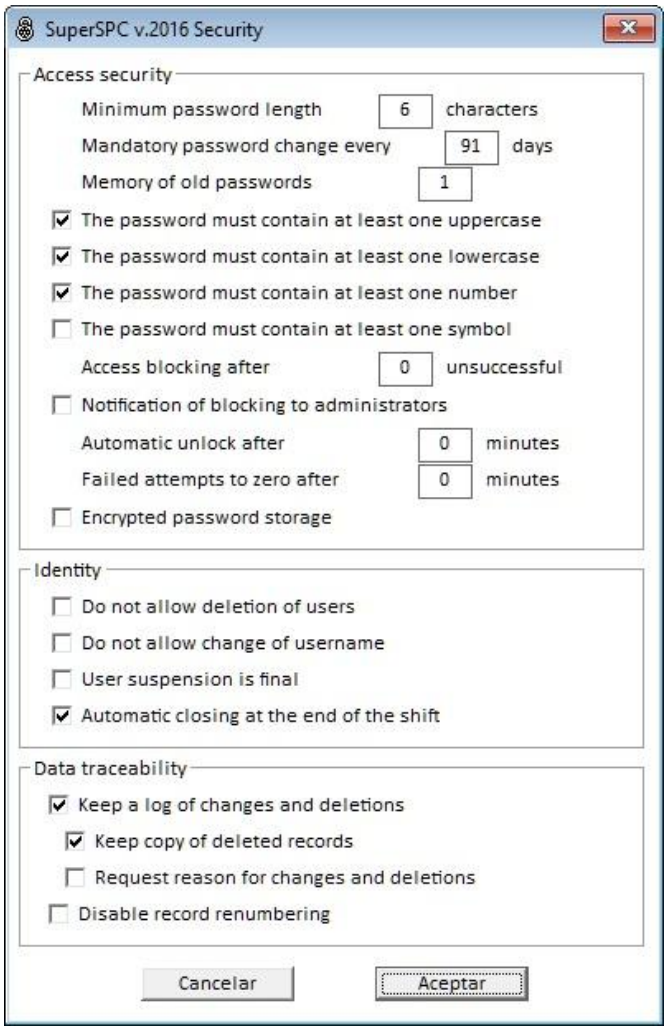
In the Graphs per Page field select a value from 1 to 4. The program will subdivide the page accordingly. In the Graph Size frame select any region with the option buttons found at the upper left. Adjust the size and position of the region changing the percent Height, Width and Margins.

On high resolution printers the graphs will look better using wider Line Widths.

In the Color frame the option Black & White prints black foregrounds, the option Foreground Colors prints foregrounds with a gray scale on monochrome printers or with color on color printers. The option All Colors prints background and foreground colors with a gray scale on monochrome printers or full color on color printers.
Pressing the OK button will save this configuration as default for subsequent SuperCEP print jobs. The system will show the options to apply these changes to the different users.

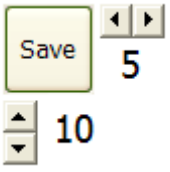
5.5 Security Configuration

Access security, identity security, and data traceability can be aligned to the needs of the organization. Only users with User Configuration permission can modify these parameters.



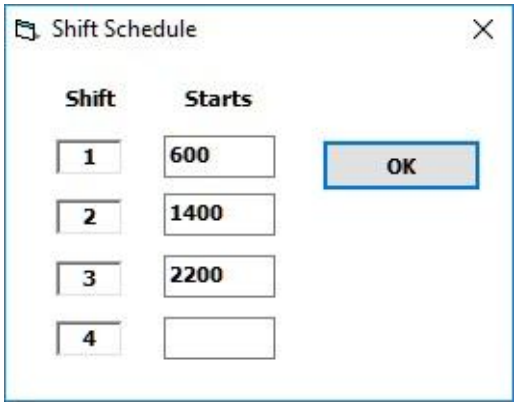
5.6 Map Edit

Authorized users can check this option to change (by right-clicking) the background images or move the tags on the Plant, Station, Machine and Process maps. The arrows at the left side of the screen rearrange all tags on an X by Y matrix. Press Save to keep any modifications. Don't forget to uncheck the Map Edit option so the tags can continue to be used to select and load the Data Sheet.



5.7 Edit Shifts

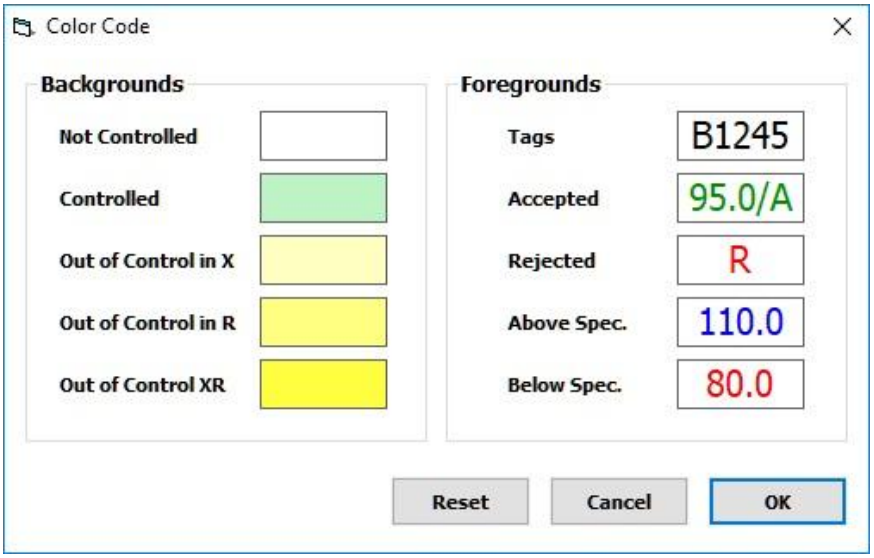
Type the start time of each shift using the HHMM (HourMinute) format. This schedule determines what number is generated in the Shift column when each sample is collected. The user's session in SuperCEP will automatically close at the end of each shift if it is at the moment in the Data Sheet or any Graph and the Identity Security option is checked.



The system will show the options to apply these changes to the different users.

5.8 Color Code Configuration

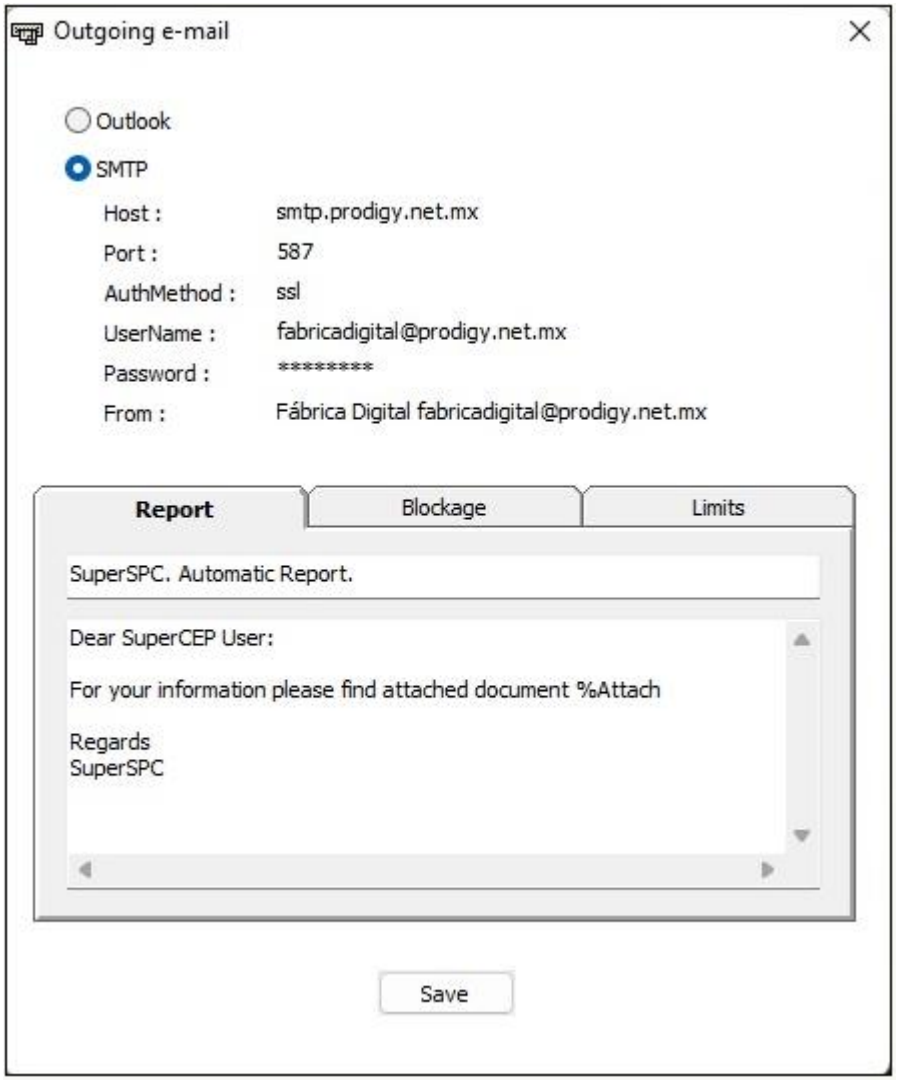
The colors shown on the Data Sheet and on Maps labels can be configured by double clicking on the fields. The Reset button resets the original configuration.



The system will show the options to apply these changes to the different users.

5.9 Outgoing e-mail.

You can choose to send emails through Microsoft Outlook or directly by configuring an SMTP server.



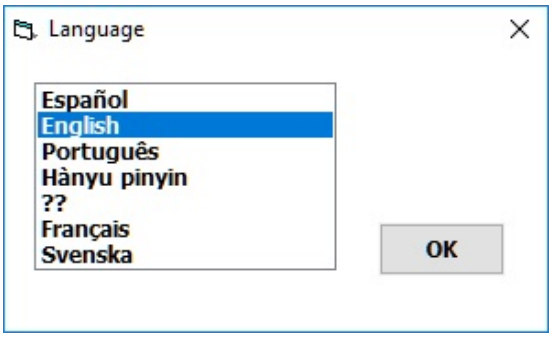
If the server is Google Mail configure an Application Password at the account Security.

Modify the subject and the default message for sending reports, the user block notice and the data out of limits notifications to your liking.

The configuration is stored in the IAU\SCMail.xml file. Customized versions can be saved per user.

5.10 Operation Language.

The operation language can be selected between Spanish, English, Portuguese, phonetic Chinese, simplified Chinese, French and Swedish.



Note: In order to correctly display the Simplified Chinese Unicode characters, you must configure this language in Control Panel> Regional Settings> Advanced Options> Language for non-Unicode programs.

6. STATISTICAL CHARTS

6.1 How to obtain a Chart

To obtain the charts that the system offers, go into a data sheet selecting the user, the station, the machine, the process and the format. Enter some data. Verify that the data is displayed in green or red, which indicates that they are analyzable, by variables or attributes.

Place the cursor on the column (characteristic) you wish to analyze.

Use the icons on the right side of the screen or the Graphs menu to request the graph.

Each user on the system might have access to different sets of charts. If an icon is missing, verify that the current user has the corresponding option checked in the Users catalog in the Database Configuration module. Modify as necessary and re-select the user.

If the current user has the Real Time mode activated, the graph icons are not visible because charts are automatically displayed with column or row changes or new data input. The charts shown in Real Time mode display more condensed information than those obtained manually.

Important: Not all graphs can be requested for each column. At the right bottom part of the data sheet you will see the type of analysis and other properties of the current characteristic that determine the applicable graphs:

Graph	Variables	Attributes	Disposition
X-R chart or Individuals and mR chart.	X		
X-mR-R (requires subgroup size greater than 1)	X		
X-S chart.	X		
EWMA-R chart	X		
Group Chart (requires subgroup size greater than 1)	X	X	
Maximum and Minimum	X	X	
Rainbow Chart (requires bilateral specification)	X		
P Chart (requires lot size column)		X	X
NP chart		X	X
C chart		X	X
U chart (requires lot size column)		X	X
Process Capability Study	X	X	
Whisker Box Diagram	X	X	
Capability Summary.	X	X	X
Content Acceptance	X	X	
Normality Study.	X	X	
Lot Acceptance Sampling 414.	X		
Lot Acceptance Sampling Z1.9.	X		
Lot Acceptance Sampling 105E / Z1.4.		X	X
Lot Acceptance Sampling 1916	X	X	X
Pareto chart	X	X	X
Free Pareto chart (requires defect codes column)	X	X	
Linear Regression	X	X	
Annotated Image	X	X	X

Each chart is presented in an independent window that can be moved or size adjusted just as any other window of the system.

The following buttons give access to the options for modifying, copying or printing graphs:


Select and filter samples


Configure graph parameters


Change colors


Change font


Print


Copy to clipboard


Filter a subgroup (drag and drop)


Divide the data (drag and drop)


Set new control limits

You can add options to the Graph menu to execute other applications without leaving SuperCEP. To do this, edit the IAU\MENU.IAU file.

6.2 Control Charts

X-R CHART. To obtain the Means and Ranges chart it is necessary to have the product characteristic declared with Variables analysis type and subgroup size greater than 1. Each point of the Means (X) chart is the average of the samples of a subgroup. Each point of the Ranges (R) chart is the difference between the maximum and minimum values of each subgroup. The amplitudes of the Ranges are shown as vertical lines on the X chart. The control limits are calculated from the average Range and delimit a zone of 3 standard deviations on each side of the average. The process capacity indexes are calculated from Average Range (Cp and Cpk) or from the Mean Square Root (Pp and Ppk) depending on how the Capability Study was configured. The OOC initials emphasize that these indexes were calculated from data lacking statistical control

I-mR CHART. In the Individuals chart each point represents an individual value. In the Moving Range chart each point is the difference between the current sample and the previous sample. This chart is obtained for any characteristic with Variables analysis type and subgroup size equal to 1 selecting the X-R chart icon. Control limits are calculated from the average moving range and delimit a 3 standard deviations zone on each side of the average. The process capacity indexes are calculated from Average Range (Cp and Cpk) or from the Mean Square Root (Pp and Ppk) depending on how the Capability Study was configured. The OOC initials emphasize that these indexes were calculated from data lacking statistical control

COLLECTIVE X-R CHART. One X-R or I-mR chart will be drawn for each characteristic in the data sheet with Variables analysis type. The characteristics can be selected in the Columns field. The first column stands out because it has a larger size. If you do not want this feature, modify the file IAU\GRAFPARM.IAU so that it says "CBig", 0. Pressing the right button produces the detailed version of the Chart or another Collective Chart if the Format is Union type and the characteristic is defined in the first position within another Union Format.

STRATAFIED X-R CHART. One or more charts are drawn from subsets of the data of the same characteristic cut by some classification. The classification criteria is the content of any other column of the data sheet, for example the lot number, the shift id, the operator or the machine. Pressing the right button produces the detailed version of the Chart.

X-mR-R (3D) CHART. To obtain the Means, Moving Ranges and Ranges chart it is necessary to define the process characteristic with Variables analysis type and subgroup size greater than 1. Each point of the Means chart is the average of the samples of a subgroup. Each point on the Moving Ranges chart is the difference between the mean of the current subgroup and the previous one. Each point of the Ranges chart is the difference between the maximum value and the minimum value of each subgroup. Control limits are calculated from the average moving range and delimit a 3 standard deviations zone on each side of the average. The process capacity indexes are calculated from Average Range (Cp and Cpk) or from the Mean Square Root (Pp and Ppk) depending on how the Capability Study was configured. Please note that the indexes will differ from those obtained from the Capability Study. The OOC initials emphasize that these indexes were calculated from data lacking statistical control.

X-S CHART. To obtain the Means and Standard Deviations chart it is necessary to have the product characteristic declared with Variables analysis type and subgroup size greater than 1. Each point of the Means chart is the average of the samples of a subgroup. Each point of the Standard Deviations chart is the internal standard deviation of each subgroup. Control limits are calculated from the average standard deviation and delimit a 3 standard deviations zone on each side of the mean. The process capacity indexes are calculated from Average Range (Cp and Cpk) or from the Mean Square Root (Pp and Ppk) depending on how the Capability Study was configured. The OOC initials emphasize that these indexes were calculated from data lacking statistical control.

EWMA-R CHART. Each point on the graph is an exponentially weighted value from all previous data. A weighing factor (lambda) must be selected between 0 and 0.99 which is a direct function of the “smoothing“ to be done. The graph can be obtained from individuals or grouped data. The Ranges chart is standard.

GROUP CHART. To obtain the Group chart it is necessary that the product characteristic be declared with Variables analysis type and subgroup size greater than 1. In the upper graph, the average, minimum and maximum values for each subgroup are shown, together with the corresponding sample number within the subgroup. In the lower graph, the minimum and maximum moving range of each subgroup are identified with their sample number. The overall maximum and minimum values and the positions or elements with greater minimum or maximum occurrences are shown.

MAXIMUM AND MINIMUM CHART. To obtain this graph it is necessary that the characteristic is of Analysis Type Variable or Attribute. Each point on the graph represents the average value in each period (month, week, day, shift or hour). Vertical lines join the maximum and minimum values of each period. Means statistical control limits calculated from the average range are also shown. Initial studies will show variable control limits from period to period if the sample size is not constant for each period.

RAINBOW CHART. This graph can be requested for characteristics of Variable Analysis type only. Each vertical line on the chart represents the range between individual values drawn as X’s. The subgroup is always of size 2 with no regard to the subgroup size pre-defined for this characteristic. Target and Specification limits are shown delimiting Red, Yellow and Green zones. The X-axis has a scale for relative Subgroup number, Date-Time, Upper and Lower values and recommended Action.

c CHART. To obtain the number of Non-Conformities or Defects chart it is necessary that the product characteristic is defined with analysis type Attributes or Disposition. Each point on the graph is the number of defects found in the sample if the characteristic is of type Attribute. For the Disposition type characteristic, each point on the graph is the number of Defects (Rejections) found in a specific period (month, week, day, shift or hour). Control limits embrace a 3-sigma probability zone above and under the mean, thus the interpretation of points outside the limits is similar to that of variables control charts.

p CHART. The Non-Conforming (or defective) Fraction chart requires a characteristic of Attribute or Disposition analysis type. When the characteristic is of Attribute type there must be a second column where the lot or sample size is entered. It is not necessary to calculate the defective fraction. Each point on the graph is the percentage fraction defective with respect to lot size. If the characteristic is of type Disposition there is no need for additional columns because each point on the graph is the fraction of rejected product with respect to the number of samples taken in each period (month, week, day, shift or hour). Control limits are interpreted as usual but vary from point to point as an inverse function of sample size. Specification limits are adjusted for the target value of the lot size column.

u CHART. To obtain the Non-Conformities (or defects) per Unit chart it is required that the product characteristic be of Attribute or Disposition analysis type. If the type is Attribute there must be a second column displaying the lot sizes. It is not necessary to calculate the defects per unit quotient. Each point of the u chart then represents the quotient between the number of defects in the lot and its size (defects per unit). For the Disposition characteristic type there is no need for additional columns because each point on the graph plots the fraction of defects with respect to the number of samples taken in the corresponding period (month, week, day, shift or hour). Control limits are interpreted as usual but vary from point to point as an inverse function of sample size. Specification limits are adjusted for the target value of the lot size column.

np CHART. The Non-Conforming (or defective) chart can be obtained for product characteristics of type Attribute or Disposition. Enter the number of Rejects for each lot if the characteristic is of type Attribute. Each point on the graph represents the number of defectives of each lot. If the characteristic is of type Disposition, each point on the graph is the number of defectives in each period (month, week, day, shift or hour). Control limits are constant and interpreted in the usual manner.

Subgroup Information. In most of the graphs so far described you can click on any plotted point to obtain the list of samples that make up the corresponding subgroup and any log notes associated. When the selected point is in a situation out of statistical control or specification there will be an alarm displayed for each of the diagnostic rules being met. Optionally, a text or document will display in line with the configuration of the Out of limits, Run or Tendency fields in the Information section of the Product Characteristic configuration.

6.3 Control Charts Configuration

6.3.1 Subgroup Selection. When a graph is requested the system includes data according to the most recent data selection. The right top button that appears on all graphs permits the modification of this selection.

Click this button to define the way the program determines which samples to include in the graph calculations. The "**From**" box section determines the way to locate the initial sample, the "**Up To**" box section determines the way to locate the last sample. Allmost any option of the "**From**" box can be combined with any option of the "**Up To**" box.

Sample number. Input the starting and ending sample numbers to be processed for the chart or report.

Date & Time. Select or write dates in a standard Windows format. The system will include on the chart or report all samples in the period.

1st and last sample in column. The system will include all samples of the current column.

Cursor. The samples under the cursor will be used as the initial and/or final sample.

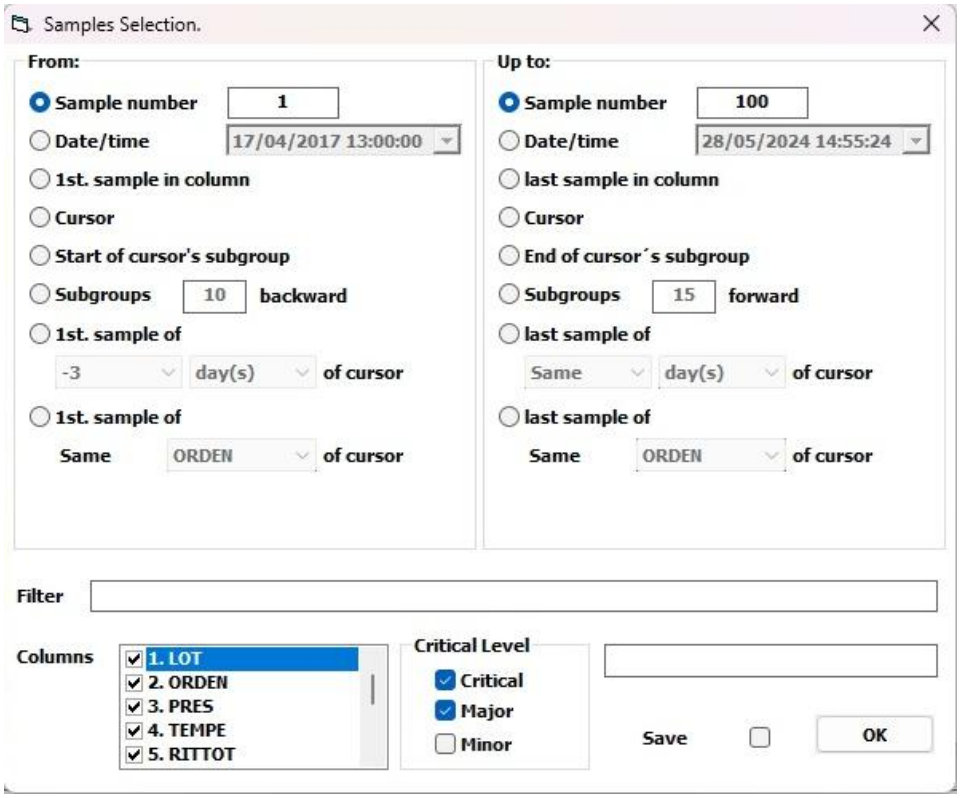
Cursor subgroup Start / End. The initial / final sample of the subgroup under the cursor will be used as the starting / ending sample. Not useful if the column has blank cells in the range.

n Subgroups Backward. Includes the n subgroups preceding the final sample determined by the Up To section. Does not combine with the Subgroups Forward option.

n Subgroups Forward. Includes the n subgroups trailing the sample determined by the From section. Does not combine with the Subgroups Backward option.

1st and last sample of. Allows the selection of a time interval forward or backward from the cursor position in minutes, hours, days, weeks, months or years. The amount of time units can be set from 0 to 99.

1st and last sample of same. Allows the selection of an initial / final sample by means of a common identification in other column.



Filter. You can select a data subset to be processed for your chart or report. The filter expression indicates the logical conditions that a data point must meet to be included on a chart. For example the expression

DIAM > 0.65

indicates that only those samples with diameter (characteristic code DIAM) greater than 0.65 will be accounted for to construct the graph.

Comparators that can be used are:

= …	Equal to …
<> …	Different from …
like '...%'	Starts with …
like '%...'	Ends with …

like '%...%'	Contains …
> …	Greater than …
< …	Lesser than …
>= …	Greater or equal to …
<= …	Lesser or equal to …
between ... and ...	Interval

Two or more conditions can be joined or connected by means of the operators "and" & "or". The “and” connector indicates that both conditions must be met. The “or” connector indicates that one condition met will suffice.

If you know the syntax of SQL languages you will notice that the filter syntax is that of the WHERE clause. Enclose the characteristic name in brackets [ ] if it starts with a digit character or contains characters different from letters and numbers.

To clarify the usefulness of the Filter option some examples follow:

Imagine you a want a graph of the “DATUM” characteristic measurement results for the second shift that are beyond the upper specification, which is 9.3. In such case the filter expression will be:

[SHIFT] = 2 and DATUM > 9.3

Please observe that the two conditions were joined with the "and" connector, which means that qualifying samples must meet both criteria to be on the graph.

Besides product characteristics, the additional reserved words N, [DateTime], [Shift], [Operator] and [Log] will filter by sample number, date-time, shift, operator and log notes respectively. Date/time values must be enclosed in sharp symbols (#) and formatted with yyyy-m-d h:nn:ss. The next example will filter samples older than March 23rd 2021 at 6 p.m.:

[DATETIME] > #2021-3-23 18:00#

Now consider a graph where samples to be charted have values between 0.3 y 0.7 of relative humidity on the characteristic coded HUM. The instruction for the filter would be the following expression:

HUM >= 0.3 and HUM <= 0.7

Or its equivalent form:

HUM between 0.3 and 0.7

An additional free text column can be used to mark or label sample data on other columns to be able to select or filter them. Consider for example a packaging line where out of spec data is always generated at start-ups. The operator needs to record every sample but does not wishes to show these periods on the control charts. The solution is to create an additional column of type Don’t Analyze to type a code marking those periods and then use a filter based on that column:

MARK <> 'STARTUP'

When interpreting this filter, the program will select those samples that do not have the STARTUP label in the MARK column to process the control chart. Note that the text to be matched is enclosed between single quotes.

When using filters based on Don’t Analyze columns the percent sign (%) can be used to indicate that you wish to include all samples whose label starts with the stated text. For example, to show all lots with labels starting with the letter C:

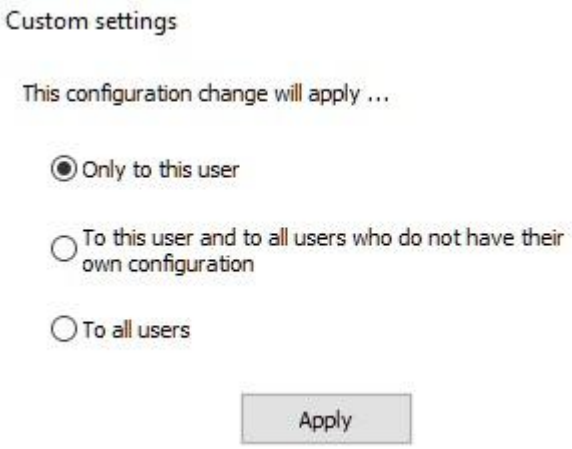
LOT like 'C%'

<u>Important:</u> The filter expression remains in memory and will be applied to any subsequent chart or report until it is modified, deleted or another data sheet with different format is opened.

Columns. Some charts and reports can show data from multiple columns of the data sheet. You can select the columns to include in the graph or report listing the column numbers separated with commas. If columns are consecutive type the first and last one separated with a hyphen (-). For example if you want to show columns 2, 5, 7, 8, 9 and 10 you would type: 2,5,7-10. If this field is left blank, then all columns will be included.

Critical Level. Check the boxes corresponding to the level of the characteristics you want to include in the chart. This level is entered in the Product Characteristics configuration module.

Save. Check this box if you want to store the data selection settings and use them by default in future sessions. When accepting, the system will display the options to apply these changes:



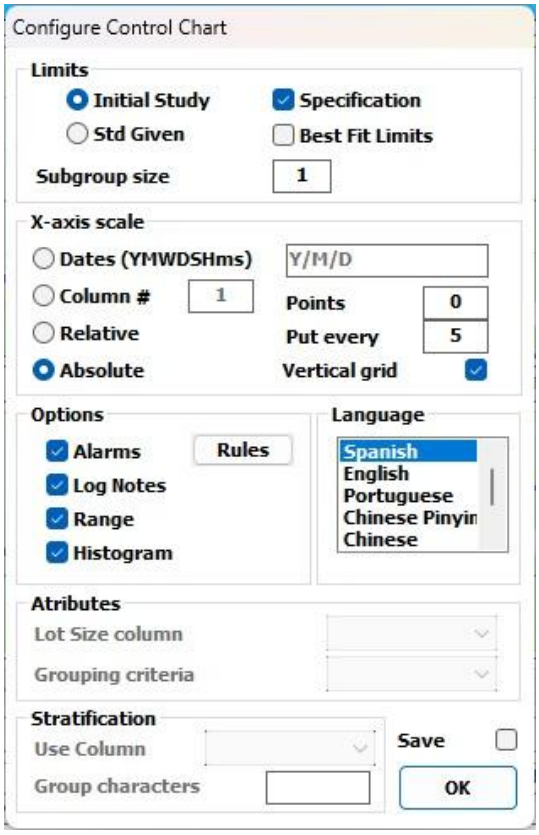
6.3.2 Chart parameters. Allows changing various parameters that affect the way charts are presented. The *Chart Config.* User's right enables this button.

6.3.2.1 Limits. Select Initial Study if you wish to have a new set of statistical limits calculated from the sample data included in the chart. Read more ahead about the use of the **2L** button to store sets of historical statistical limits. Select Standard Given to display the statistical control limits already known from previous data. These previously calculated limits are taken from the Control Limits fields at the Process & Machine Characteristic configuration window. They can also be set from an Initial Study chart with the Set New Limits button.

To compare client Specification limits with Statistical limits check the Specification box.

The Best-Fit Limits box should be checked if you want the initial study statistical limits to accommodate the general tendency of the data. The central limit slope is calculated with the least squares method.

Subgroup size. Each point on the chart represents a subgroup. A subgroup initially contains as many data points as is indicated in the Subgroup Size field at the Process & Machine Characteristic configuration window. You can modify this value temporarily at the subgroup size box. The process standard deviation estimation will vary for different subgroup sizes. These differences will affect the statistical limits and process capability calculations.



6.3.2.2 X-axis Scale. Subgroups identification on the horizontal scale of the chart has the following options:

- **Dates.** Labels subgroups with date, shift and time of their first data point. At the text box type a formatting mask using the following codes: Y = year, M = month, W = week, D = day, S = shift, H = hour, m = minute and s = second.
- **Column.** Uses the content of another characteristic of the same sample to label the subgroup. Type the column number of the characteristic that carries the desired identification.
- **Relative.** Labels subgroups starting from 1.
- **Absolute.** Labels subgroups with the row number from the data sheet of their first data point.
- **Points.** Horizontal spacing between subgroups is determined by this value. Its value adjusts automatically when it is less than the number of subgroups to be displayed. Type 0 (zero) if you wish that points fill the available width of the chart.
- **Put every.** Indicates how many subgroups are skipped for each label.
- **Vertical Grid.** Draws a vertical dotted line to align the subgroup with its label.

6.3.2.3 Options.

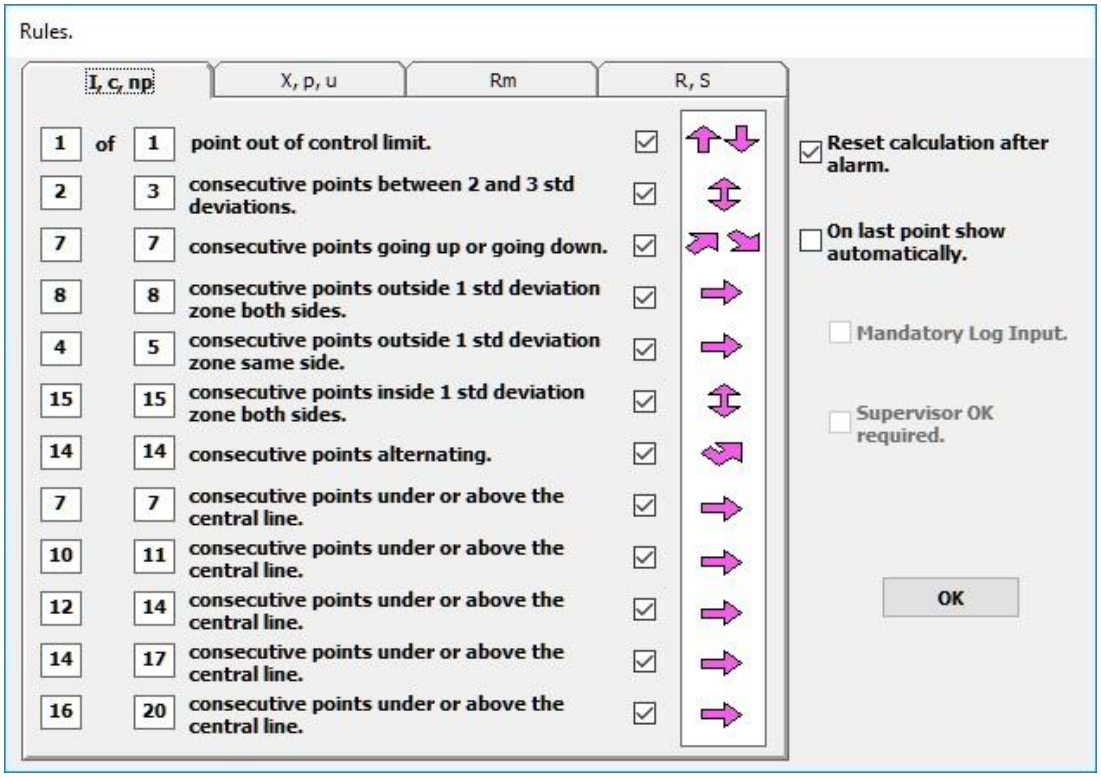
Alarms. Check this box to display arrows over subgroups out of statistical control. The next figure shows different types of arrows and their meaning. On the Ranges, Standard Deviations and Attributes charts the criteria related to the zone under the mean are not evaluated because this area is frequently not a 3-sigma zone.

Rules. Press this button to modify or deactivate the evaluation criteria mentioned in the previous paragraph. Criteria are set individually for the different kinds of charts a) **I, c, np** individuals centering, b) **X, p, u** subgroups centering, c) **Rm** individuals variability and d) **R, S** subgroups variability.

If you wish these criteria to be evaluated restarting from the last alarm check the ***Reset calculation*** box.

If you wish to have a text notice (or any other kind of document) shown when the last subgroup on the graph meets an alarm criterion check the ***On last point show automatically*** option. This box should be checked for the next two options to be enabled.

If a ***Mandatory Log*** must be input before closing the alarm notice window check the corresponding box.



You can force a supervision approval after an automatic alarm. Check the ***Supervision required*** box. The authorization consists of the User code and password of any of the supervisors defined in the characteristic configuration. Also any user with the *Alarm OK* privilege can unblock the alarm. The authorization will be saved into the subgroup log identified by a $ sign.

Log Notes. This option will show, next to the subgroup points on the chart, the corresponding log annotations made on the data sheet. Only the portions of text enclosed in braquets () will display. If the log contains a section for the characteristic then only this section is considered. If more than one sample has log annotations then several rows of text will be displayed.

Range. Shows the amplitude of each subgroup known as short term variation.

Histogram. Displays the frequency distribution of the individual data in a histogram next to the X chart.

6.3.2.4 Attributes.

Lot Size Column. Initial Study Attributes Control Charts of type p and u require the lot size of each sample to calculate statistical limits. Indicate the name of the column that holds this information. The target value of this column will be used to adjust the specifications of the charted characteristic to the area of opportunity.

Grouping criterion. Control Charts for characteristics of type Attribute or Disposition (Accepted / Rejected) and the Maximum Minimum chart form their subgroups in accordance to this field: M = Month, W = Week, D = Day, T = Shift, H = Hour and I = Individuals.

Data can be grouped by Month, Week, Day, Shift, Time, or Individual. Applies to characteristics of Attributes and Disposition types. It is not necessary to calculate the Fraction Defective to obtain the p Chart. The constituent data of each subgroup can be queried clicking directly on any subgroup.

6.3.2.5 Language. Spanish, English, Portuguese, Chinese, French or Swedish. Descriptions of each language will be used to develop the corresponding graph.

6.3.2.6 Stratify. Some graphs allow stratification, this means that instead of one graph several graphs are obtained each one made from data belonging to certain classification. The classification criteria are always taken based on the contents of other columns in the same sheet, typically a lot or machine key. In the Use Column field select the column containing the sort key. In the Group chars. field type the character range of those keys to be taken to form classes (eg, 1-5 indicates to take the first 5 letters or numbers).

Save. Check this box to store the selected parameters and use defaults in coming sessions.

OK. Press this button to re-draw the graph with the new parameters

6.3.3 Filter a subgroup. Drag and drop this button on the item to be deleted from the calculation of historical limits. Notice that the graph is immediately updated with the new filter. You can filter multiple points in sequence. If you wish to cancel or modify this filter you must enter Selection Set Filter and do this manually. This option is not available for charts of characteristics by Disposition. The user's permit *Select* enables this button

6.3.4 Divide the Data. Lets you calculate a new set of historical statistical limits on the same dataset. Show the graph and then divide the data by dragging and dropping the button on any subgroup (except start and end points). You will get statistical limits before and after this subgroup. The last set of statistical values appears on the right of the window. To delete a set of limits, drag and release the button again precisely on the first point of the set to remove. The beginning of each new set of limits is recorded in the log of the sample with an asterisk (*) followed by the characteristic name. The multiple limits function is only available in control charts for variables. The *Conf Charts* user's right enable this button

6.3.5 Set new control limits. This button is enabled on control charts with historical limits and allows for new control limits for future control charts. The *Conf Charts* user's permit enable this button

6.4 Process Capability Studies

HISTOGRAM. To obtain the histogram it is necessary that the product characteristic type is defined with Variable or attribute analysis. The height of each bar of the histogram represents the frequency of the data in that class interval. Clic on the histogram to obtain a table of interval centers, frequencies, relative frequencies, cumulative frequencies and relative cumulative frequencies. The theoretical curve represents a normal distribution with the same mean and standard deviation of the data analyzed. On the curve, the average and standard deviations are indicated. The specification limits are also shown. At the bottom are the results of the process capability study, the normality analysis and estimations of product in and out of specification.

COLLECTIVE HISTOGRAM. Histograms are shown of each characteristic with analysis type by variables or attributes. The capability index of each one is reported. The characteristics can be selected in the Columns field. The first column stands out because it has a larger size. If you do not want this feature, modify the IAU\GRAFPARM.IAU file so that it says "CBig", 0. Pressing the right button gives the detailed version of the Study or another Collective Histogram if the Format is of type Union and the characteristic is defined in first position within another Union Format.

STRATAFIED HISTOGRAM. One or more graphs are made from subsets of data from the same characteristic obtained by some classification. The classification criterion is the content of a column of the data sheet such as lot number, shift number, the operator or machine. Press the right button to obtain the detailed version of the Study.

NORMALITY STUDY. For the study is necessary that the product characteristic type is defined with variable or attribute analysis. There are 3 graphics:

1. Cumulative frequencies. Each point on the graph represents the cumulative frequency up to the interval indicated on the horizontal scale. The diagonal line represents the cumulative frequencies expected for a normal distribution. The left vertical scale indicates the distance to the middle of each interval in standard deviation units. The right vertical scale is the fraction of accumulated area under the curve of each interval. The cumulative total is not represented because it would require an infinite vertical axis. The horizontal scale is adjusted to 6 standard deviations. The diagnosis of normality is made by comparing the correlation coefficient with a minimum value given according to the size of the sample. See Annex C.3.f.
2. Box and whisker. Represents the minimum, first quartile, median, third quartile and maximum of the sample.
3. Frequency histogram. Represents the distribution of frequencies compared to a theoretical curve with the same mean average and deviation. Normality is diagnosed using the Anderson-Darling test. Clic on the histogram to obtain a table of interval centers, frequencies, relative frequencies, cumulative frequencies and relative cumulative frequencies.

HISTOGRAM OF CONTENTS. It makes the verification of the net weight or volume of packaged contents according to the Mexican Official Standard NOM-002-SCFI-2011. Necessary for the study is that the product characteristic type is defined with variable or attribute analysis and there is only one specification limit defined (usually the lower limit). The graph shows the frequency distribution of the sample and diagnoses the four acceptance criteria: declared content, declared content minus 1 tolerance, declared content minus 2 tolerances and Student t test. Clic on the histogram to obtain a table of interval centers, frequencies, relative frequencies, cumulative frequencies and relative cumulative frequencies.

COLLECTIVE BOX AND WHISKER. This diagram shows the data distribution of each characteristic showing the minimum, first quartile, median, third quartile and maximum. Thus the "box" represents the middle 50% of the sample and the left and right "whiskers" represent the upper and lower 25% of the sample respectively. The first column stands out because it has a larger size. If you do not want this function, modify the file IAU \ GRAFPARM.IAU so that it says "CBig", 0. By pressing the right button you get the detailed version of the Study or another collective graphic if the Format is Union and the characteristic is defined in first position within another Union Format.

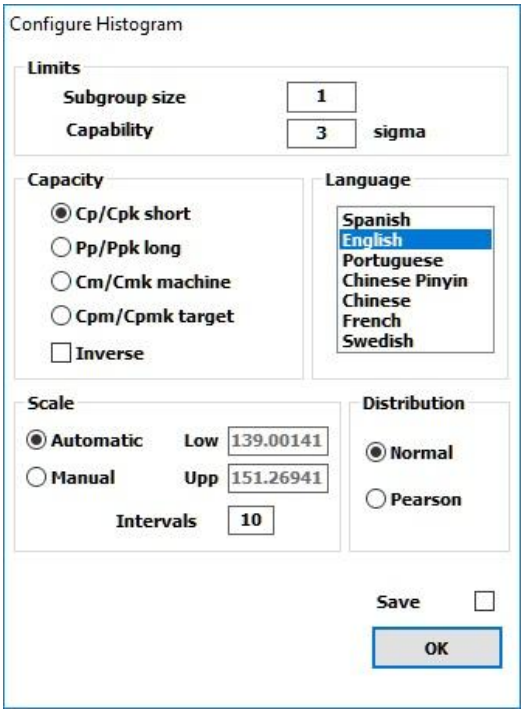
STRATAFIED BOX AND WHISKER. This diagram shows the distribution of subsets of data from the same characteristic classified or segmented according to the contents of another column.

CAPABILITY SUMMARY. It is a graph representing the number of quality characteristics whose process capacity (Cp) and capabilty (Cpk) indexes are in certain predefined levels identified by color codes: Green above 3 sigma, Yellow between 2 and 3 sigma and Red below 2 sigma. The height of each section of the stacked bar represents the number of characteristics whose capability indexes are in the range corresponding to its color. Clicking on any section gives the details of the characteristics that comprise it. You can define up to three periods of tabulation for comparison.

6.5 Setting up Process Capability studies

6.5.1 Subgroups. Selecting Subgroups. Press this button to define how the program determines the samples included in the graph. See explanation in section 6.3.1.

6.5.2 Parameters of the graph. When a graph is requested the system produces it taking the most recently saved parameters. The Configure button allows you to modify these parameters.



6.5.2.1 Subgroup size. You can temporarily change this value in the Size box. The standard deviation calculation is different for size 1 (Root Mean Square) than larger sizes (Average Range / d2). This affects the process capability calculations. The histogram of the frequency distribution and the observed percentages in and out of specification are always calculated based on individual samples.

6.5.2.2 Capability. The number of times the standard deviation is taken towards each side of the mean for calculating the variability.

6.5.2.3 Capacity. Different variants of the process capacity index can be reported according to the standard deviation used: Cp / Cpk obtained with sigma estimated from the Average Range, Pp / Ppk and Cm / Cmk obtained with calculated s of the sample and Cpm / Cpmk obtained with the radius of gyration about the Target. The inverse of the first 2 are also offered (called Cr / Crk and Pr / Prk).

6.5.2.4 Language. Spanish, English, Portuguese, Chinese, French or Swedish. Descriptions of each language will be used to develop the corresponding graph.

6.5.2.5 Scale. The automatic scaling works taking the greater between tolerance (upper limit minus lower specification limit) and variability (6 standard deviations) as the range for the scale. If only one limit is specified, this limit is taken and a range of 6 standard deviations to calculate tolerance. The scale can be set manually where you want it filling the Upper and Lower fields. Although not relevant for statistical results, avoid creating artificial intervals combining the scale range and the number of intervals to coincide with the graduations of the measuring equipment.

6.5.2.6 Intervals. The frequency distribution is performed on the resulting intervals from dividing this many times the scale range. It is recommended to choose this value so that the center of each interval coincides with the graduation of the measuring equipment used. This will allow for a better visual appreciation of the shape of the distribution.

6.5.2.7 Distribution. The calculation of process capability indexes can be done using the values set for the normal distribution or can be more precise using Pearson fittings for clearly non-normal distributions. In this last case, a skewed curve is drawn from LP to UP.

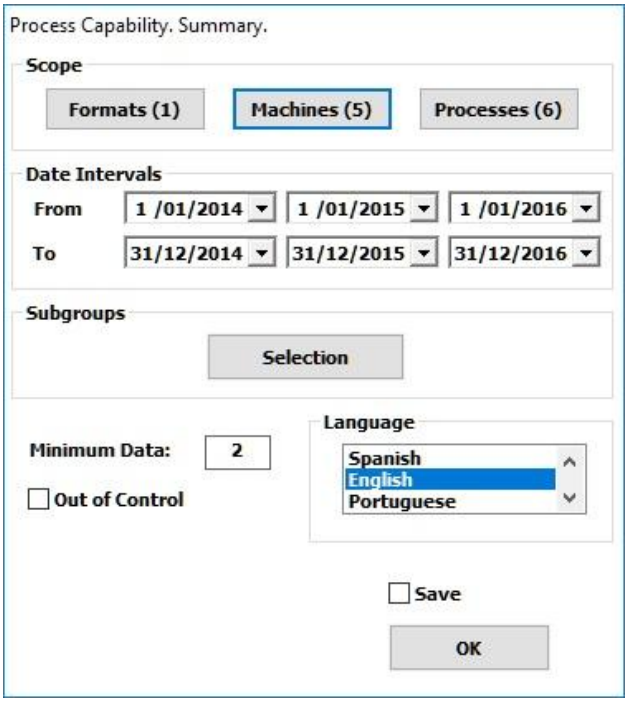
6.5.2.8 Stratify. Some graphs allow stratification, this means that instead of one graph several graphs are obtained each one made from data belonging to certain classification. The classification criteria are always taken based on the contents of other columns in the same data sheet, typically a lot or machine code. In the Use Column select the column containing the sort key. In the Group chars. field type the character range of those keys to be taken to form classes (eg, 2-4 indicates that the second to fourth characters are to be taken).

Save. Check this box to store the selected parameters and use them in future sessions by default.

OK. Press this button to re-draw the graph with the new parameters. If you checked Save, the system will show the options to apply these changes to the different users.

6.6 Configuring the Capability Summary

The modifiable parameters and buttons are explained below:



Scope. The Capability Summary can consolidate information from other data sheets besides the one currently open at the time of request.

- **Formats.** Use this button to mark the formats that will be included in the graph. In the format list Ctrl-click on the desired format codes. Click OK to finish.

- **Machines.** Similarly select the machines to include in the graph.
- **Processes.** Similarly select the processes to include in the graph.

Periods. You can define up to three periods to compare the evolution of Cp and Cpk indexes. The end of the first date is determined by the date of the row from which the chart was requested and the starting date is determined by going back the number of predefined subgroups. If you change format the predefined date range changes. If the number of subgroups can not be completed the starting date shall be the first row of the datasheet. To change these intervals enter new dates in a format compatible with windows (e.g. d-m-yyyy).

Subgroups. Select the rows and columns to include in the graph. For more details see the discussion in Section 6.3.1.

Minimum Data. This is the minimum number of samples needed to evaluate the indexes of each characteristic. The characteristics that do not cover the minimum sample data are reported missing with a blue code.

Out of Control. If you check this box, the characteristiccss containing some point outside the control limits of Means or Ranges are accumulated in a separate level (white) instead of their share according to its process capacity.

Language. Spanish, English, Portuguese, Chinese, French or Swedish. Descriptions of each language will be used to draw the graph.

OK. Press this button to re-draw the graph with the new parameters. If you checked Save, the system will show the options to apply these changes to the different users.

6.7 Acceptance Sampling

MIL-STD-414 by Variables. You can obtain this report from any characteristic of Variables analysis type. Configure the sampling paln and capture the number of samples required. You will get the acceptance criteria, the operating curve and the verdict.

ANSI ASQ Z1.9 by Variables. You can obtain this report from any characteristic of Variables analysis type. Configure the sampling plan and capture the number of samples required. You will get the acceptance criteria, the operating curve and the verdict.

MIL-STD-105E / ANSI Z1.4 by Attributes. You can obtain this report from any characteristic of Attributes or Disposition analysis type. Configure the sampling plan and capture the number of samples required. If of type Attributes all values are added to obtain the total rejections. If of type Disposition only rejections are added to get the total. You will get the acceptance criteria, the operating curve and the verdict.

MIL-STD-1916 by Variables. You can obtain this report from any characteristic of Variables analysis type. Configure the sampling plan and capture the number of samples required. You will get the acceptance criteria, the operating curve and the verdict.

MIL-STD-1916 by Attributes. You can obtain this report from any characteristic of Attributes or Disposition analysis type. Configure the sampling plan and capture the number of samples required. If of type Attributes all values are added to obtain the total rejections. If of type Disposition only rejections are added to get the total. You will get the acceptance criteria, the operating curve and the verdict

.

In all cases the operating curve represents the risk for the customer (of accepting a bad lot) and the risk for the supplier (of rejecting a good lot) of the chosen inspection plan and is useful in selecting the best sampling plan.

6.8 Acceptance Sampling Settings.

Selecting Subgroups. Press this button to define how the program determines the samples to include in the graph. See explanation in section 6.3.1.

Parameters of the chart. When a graph is requested the system produces it taking the most recently saved parameters. The Configure button allows you to modify these parameters.

Sampling Plan. Set the Lot Size, Inspection Level and Acceptable Quality Level according to simple sampling plans of MIL-STD-414 or 105E. For the MIL-STD-1916 instead of the AQL the inspection stage A = Adjusted, N = Normal and R = Reduced must be specified.

Language. Spanish, English, Portuguese, Chinese, French or Swedish. Descriptions of each language will be used to draw the corresponding graph.

Save. Check this box to store the selected parameters and use them as default in future sessions.

OK. Press this button to re-draw the graph with the new parameters. If you checked Save, the system will show the options to apply these changes to the different users.

6.9 Pareto Diagrams

PARETO. The Pareto chart can be requested from any column. The diagram on the left represents the number of non-conformities of each characteristic ranked from highest to lowest frequency. The curve represents the cumulative frequency of these defects. The diagram on the right represents the impact (frequency x unit cost) of non-conformities. The curve represents the cumulative impact. At the bottom the characteristics are listed in descending order of frequency and impact.

FREE PARETO. It is not required to enter different defects in separate columns.To obtain it you only need a Defect code column and optionally a Number of defects column. The plot is called positioned at the Defect codes column (1 code = 1 defect) or at the Number of defects column. Defect codes should be at most 10 characters long. We recommend entering the codes and descriptions of defects in a Concept Table. If you wish to obtain total costs enter the cost weights in the Value column of the table. Clusters of defects can be made using sections of the defect codes. For example if you specify a grouping level 1-2, then all the defects sharing the same first two characters in their codes will be grouped under one heading.

6.10 Pareto Settings

Selecting Subgroups. Press this button to define how the program determines the samples included in the graph. See explanation in section 6.3.1.

Parameters of the graph. When a graph is requested the system produces it taking the most recently saved parameters. The Configure button allows you to modify these parameters.

Accumulate. When you select option *Reds,* one nonconformity or defect will be counted for each datum found out of specification in each column. This option is most useful for Variables analyzable characteristics. When you select option *Total,* defects will be accumulated according to the value recorded in each cell in the data sheet no matter whether they are in or out of specification. This option applies best to characteristics analyzed by Attributes.

Free Pareto. This applies to the construction of free Pareto charts. Indicate the column where to find Defect codes. If defect codes can be grouped, indicate a Grouping Level which is the section of characters shared by the same group of codes. If codes will not be grouped then type 1-10**.**

Language. Spanish, English, Portuguese, Chinese, French or Swedish. Descriptions of each language will be used to draw the corresponding graph.

Save. Check this box to store the selected parameters and use them as default in future sessions.

OK. Press this button to re-draw the graph with the new parameters. If you checked Save, the system will show the options to apply these changes to the different users.

6.11 Linear Regression

REGRESSION. It takes two columns with variables or attributes type of analysis to form XY data pairs. The column from which the chart is requested provides the Y values. Set the location of the X values. For regressions with transformed values create new columns with Formula input type and the desired transformation equation. You can apply a Delay to relate one cause variable values with subsequent values of the effect variable.

COLLECTIVE REGRESSION. You can obtain all possible correlations of X variables with a Y characteristic. The first column stands out because it has a larger size. If you do not want this feature, modify the file IAU\GRAFPARM.IAU so that it says "CBig", 0. By pressing the right button you get the detailed version of the Regression or another Collective graph if the Format is of type Union and the characteristic is defined in first position within another Union Format.

6.12 Linear Regression Settings

Selecting Subgroups. Press this button to define how the program determines the samples included in the graph. See explanation in section 6.3.1.

Parameters of the chart. When a graph is requested the system produces it taking the most recently saved parameters. The Configure button allows you to modify these parameters.

X's Column. Select the column that contains the values to be tested as abscissa of the values from the column on which the regression was requested.

Lag in X. Select the number of rows for the Y (ordinate) data to be paired back to the X values to investigate lag effects and autocorrelations.

Polynomial Order. Select 1 or 2 for order 1 (straight) or order 2 (parabola) fit.

Language. Spanish, English, Portuguese, Chinese, French or Swedish. Descriptions of each language will be used to draw the corresponding graph.

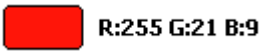
Save. Check this box to store the selected parameters and use them as default in future sessions.

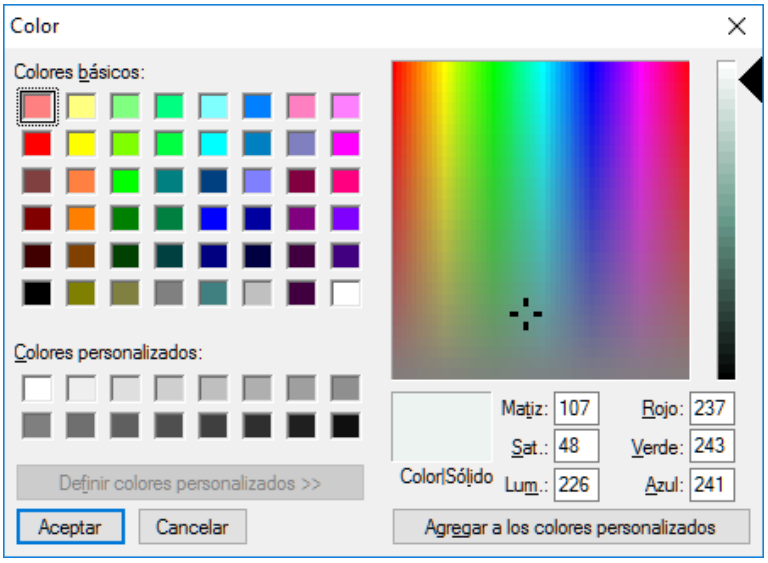
OK. Press this button to re-draw the graph with the new parameters. If you checked Save, the system will show the options to apply these changes to the different users.

6.13 Colors

Allows you to change the color of any element of the graphs. The system will show the options to apply these changes to the different users. When you select this option the cursor is converted to a sensor of each color in the graph. Place the cursor over the color that you want to change verifying that the box located in the lower left corner shows this color pixel amplified. Click to display the color palette and select the new color in the usual way.

At the center right of the chart you will see a box with the solid color corresponding to the point just beneath the mouse pointer. Legend contains RGB color components red, green and blue.

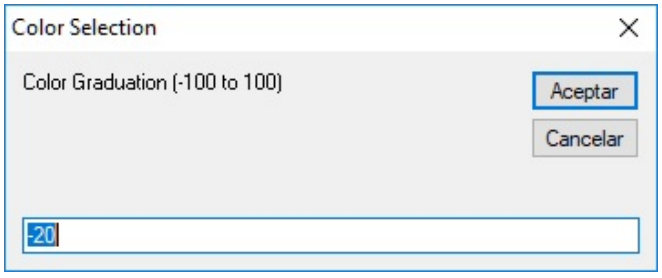




The graph shows the change immediately.

When you have finished modifying the necessary colors do not forget to press the Color button again.

The system will ask for a color gradient parameter which has the effect of "illuminating" the chart. The zero value does not degrade. Negative values go from light to dark. Positive values go from dark to lighter shades.



Note: Some video adapters degrade the colors of the edges of text fonts to improve readability. If so, be sure not to select these degraded tones.

6.14 Fonts

The Fonts button gives you access to the font settings of the chart. A font consists of a fontface plus a style plus a size. The program does not include special fonts so that the options available depend on the font types that have been previously installed on your Windows system. Your font selection is stored for future graphs of the same kind drawn on the same computer. The automatic scaling of font size done to adjust to the actual size of the view window or printer does not affect the original value selected by you.

The font and the content of the graph headers can be configured entirely (except for the name of the organization). Right click anywhere on the header to enter edit mode.

Important: Edit mode requires the use of an RTF (Rich Text Format) file editor. By default \Windows\System32\Wordpad.exe is used. To use another editor modify the contents of the [RichText] tag on the IAU\MENU.IAU file.

Modify the Rich Text Format file ScepHead.RTF RichText to suit your needs. The variable fields you can keep, modify or delete are:

Concept	Field
Graph Title	@Titul
Station Name	@Estac
Machine Name	@Maqui
Format Name	@Forma
Product Name	@Produ
Characteristic Name	@Carac
Selection Filter	@Filtr
Date - Time of first selected sample	@Feini
Date - Time of last selected sample	@Fefin
Location of the characteristic	@Ruta

6.15 Print the Graph

The Print button will send a copy of the graph on the screen to the system's print manager. If you set up more than one chart per page in the Printer Setup module, the Print button will show the sequence number of the following chart to print. When the clock pointer disappears from the screen, the graph has been sent to the print manager. The print job is sent to the printer physically until the print manager has received the total number of Graphs per Page (see section 5.4).

6.16 Copy the Graph

The Copy button will send a copy of the graphic display to the system clipboard. This way you can use the Edit Paste command in any Windows application that accepts imported bitmap images.

7. STATISTICAL REPORTS

7.1 How to Obtain

To get the reports provided by the system first open a data sheet by selecting a user, station, machine, product and format.

Verify that the Reports menu is activated. Otherwise you must enable the User right to access the Reports menu in the Configuration module.

Capture some data. Verify that the data appears green or red indicating that the characteristic was configured as type Variables or Attributes.

Place the cursor in the column corresponding to the characteristic you wish to analyze.

Select the desired report in the Reports menu.

Each system user has access to different reports. If an option is grayed out, check that the current user has the option marked in the catalog within the User Settings module. If necessary modify and then re-select the user.

Important: Not all reports can be obtained in each column: The Type of Analysis of the current column is shown at the bottom right of the screen, which determines the possible reports:

Report	Variables	Attributes	Disposition	Don't Analyse
Data Sheet	X	X	X	X
Subgroups	X	X		
Certificates	X	X	X	X
Free Pareto	X	X	X	X
Audit Trail	X	X	X	X
Log Record	X	X	X	X
Non Conformities	X	X	X	X
Stability	X	X	X	X
Capability	X	X	X	X
Inspection	X	X	X	X

Most reports are produced in HTML format and are displayed in the default web browser on your computer. The exceptions are the MS Excel Quality Certificates and Inspection Compliance in Crystal Reports.

You can add options to the Reports menu to run other applications from here. This requires editing the file IAU\MENU.IAU.

7.2 Data Sheet Report

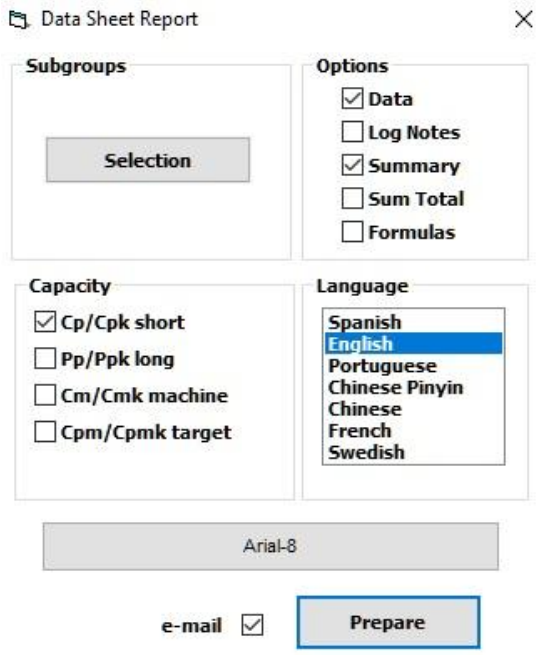
Sample data are listed followed by a statistical summary of each characteristic. The modifiable parameters and buttons are explained below:

Subgroups selection. Press this button to define how the program determines which samples to include in the report. See explanation in section 6.3.1.

Options.

- Data. Check this box to include the details of the sample data of each characteristic.
- Log Notes. Check this box to list the comments captured in the logs of the sample data. Requires Data box checked.
- Summary. Check this box to include a summary of descriptive statistics.

- Total Sum. Report the total addition of each characteristic. Requires Summary box checked.
- Formulas. In case calculated columns exist, their formulas will be printed at the report footer.



Capacity. Include the short term, long term, machine and Taguchi's process capability indexes.

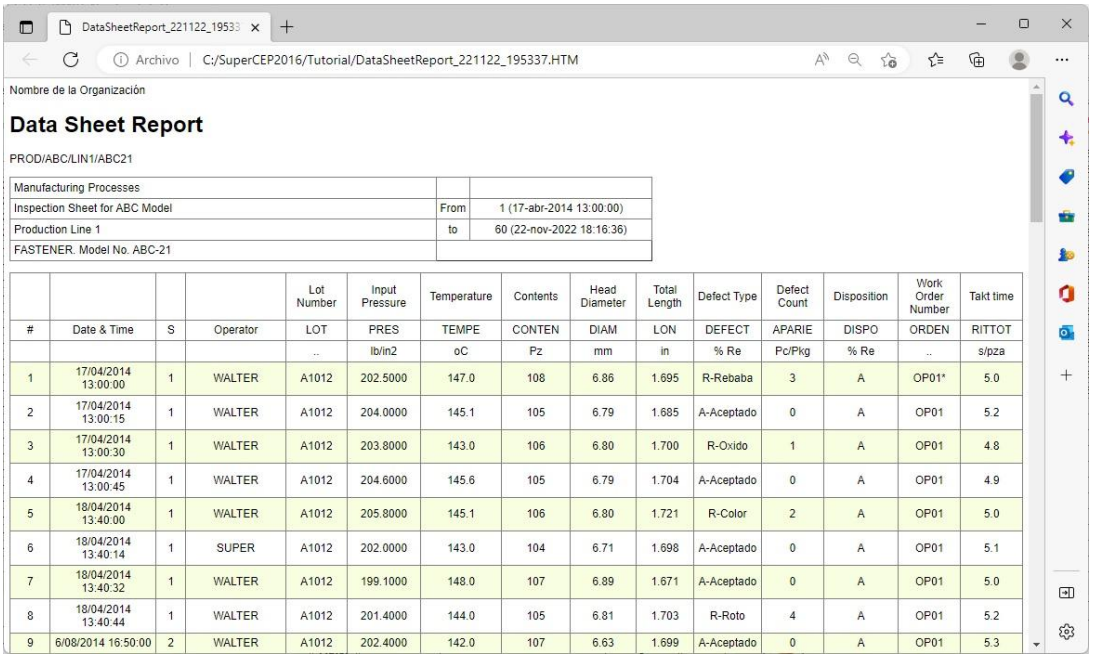
Language. Spanish, English, Portuguese, Phonetic Chinese, Simplified Chinese, Frensh or Swedish. Descriptions of each language will be used to prepare the report**.**

Font. Press the button with the font name to change the font, style or size.

e-mail. Mark this checkbox if you wish to a send a copy of the report attached to an e-mail.

Prepare. Press to prepare the report with the new parameters. The report is displayed as a Web page in your web explorer.

Print, Copy to Excel or Save a Copy. Use your web browser's tools to perform these tasks.



DataSheetReport_221122_19533

Archivo | C:/SuperCEP2016/Tutorial/DataSheetReport_221122_195337.HTM

Nombre de la Organización

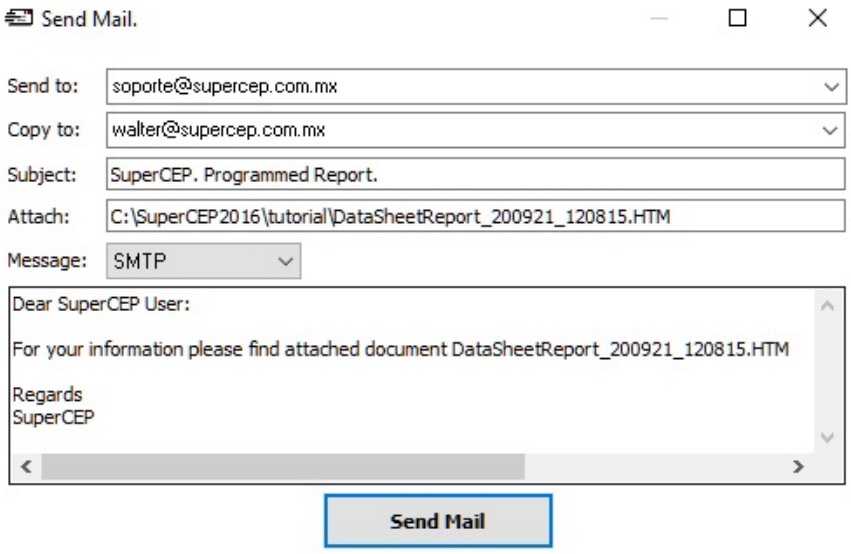
Data Sheet Report

PROD/ABC/LIN1/ABC21

Manufacturing Processes		
Inspection Sheet for ABC Model	From	1 (17-abr-2014 13:00:00)
Production Line 1	to	60 (22-nov-2022 18:16:36)
FASTENER. Model No. ABC-21		

				Lot Number	Input Pressure	Temperature	Contents	Head Diameter	Total Length	Defect Type	Defect Count	Disposition	Work Order Number	Takt time
#	Date & Time	S	Operator	LOT	PRES	TEMPE	CONTEN	DIAM	LON	DEFECT	APARIE	DISPO	ORDEN	RITTOT
				..	lb/in2	oC	Pz	mm	in	% Re	Pc/Pkg	% Re	..	s/pza
1	17/04/2014 13:00:00	1	WALTER	A1012	202.5000	147.0	108	6.86	1.695	R-Rebaba	3	A	OP01*	5.0
2	17/04/2014 13:00:15	1	WALTER	A1012	204.0000	145.1	105	6.79	1.685	A-Aceptado	0	A	OP01	5.2
3	17/04/2014 13:00:30	1	WALTER	A1012	203.8000	143.0	106	6.80	1.700	R-Oxido	1	A	OP01	4.8
4	17/04/2014 13:00:45	1	WALTER	A1012	204.6000	145.6	105	6.79	1.704	A-Aceptado	0	A	OP01	4.9
5	18/04/2014 13:40:00	1	WALTER	A1012	205.8000	145.1	106	6.80	1.721	R-Color	2	A	OP01	5.0
6	18/04/2014 13:40:14	1	SUPER	A1012	202.0000	143.0	104	6.71	1.698	A-Aceptado	0	A	OP01	5.1
7	18/04/2014 13:40:32	1	WALTER	A1012	199.1000	148.0	107	6.89	1.671	A-Aceptado	0	A	OP01	5.0
8	18/04/2014 13:40:44	1	WALTER	A1012	201.4000	144.0	105	6.81	1.703	R-Roto	4	A	OP01	5.2
9	6/08/2014 16:50:00	2	WALTER	A1012	202.4000	142.0	107	6.63	1.699	A-Aceptado	0	A	OP01	5.3

Send E-mail. Before closing the browser window examine the e-mail message attached with a copy of the report. The default values of the following dialog window can be configured at the Outgoing e-mail option (see section 5.9).



7.3 Subgroups Report (Means, Standard Deviations and Ranges)

Lists the Means, Standard Deviations and Ranges of each subgroup. The identification of each subgroup corresponds to the first and last datum of each subgroup. Duration is the time interval in which the internal o Short-Term variation ocurrs. For characteristicss with subgroup size equal to 1, the standard deviation is not defined.

The modifiable parameters and buttons are explained below:

Subgroups Selection. Press this button to define how the program determines which samples to include in the report. See explanation in section 6.3.1.

Language. Spanish, English, Portuguese, Chinese, French or Swedish. Descriptions of each language will be used to prepare the report**.**

Font. Press the button with the font name to change the font, style or size.

e-mail. Mark this checkbox if you wish to a send a copy of the report attached to an e-mail.

Prepare. Press to prepare the report with the new parameters. The report is displayed as a Web page in your web explorer.

Print, Copy to Excel or Save a Copy. Use your web browser's tools to perform these tasks.

7.4 Quality Certificate

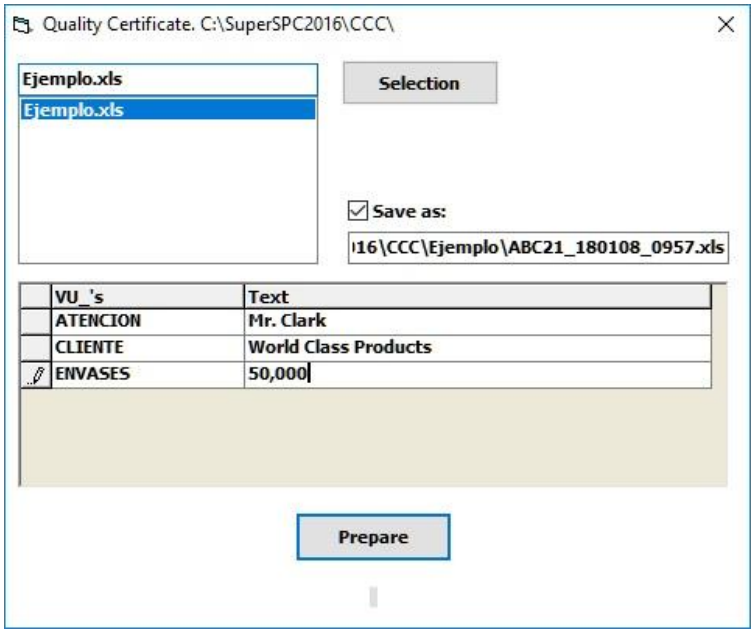
In the data sheet, place the cursor in any of the characteristics of the sample you want to include in the certificate. If the certificate lists or calculates on a range of samples click into any row that belongs to the range. Go to the Reports Certificates menu.

In the list that appears at the top left click on a TXT or XLS/XLSX template file. The installation disk provides a template file that works correctly only with the tutorial example ABC format. To create new template files use Notepad or Microsoft Excel. If the template file was created in Excel you need to have this application installed. For more information see chapter A dedicated to Certificates design.

Once the template file is selected, a table is shown with fields containing the certificate´s user variables. Fill each one in the right column of the table.

Subgroups selection. Press this button to define how the program determines which samples to include in the report. See explanation in section 6.3.1.

Save a copy. Check the box to save a copy of the report with the suggested name or another one of your choice.



Press **Prepare**. If the certificate template was developed in Excel press the flashing button on the Windows taskbar to go to the preview in that application. After printing or revising in Excel you must close the Excel preview to continue operating SuperCEP.

If the certificate template was designed with Notebook a special preview window will automatically display. See the explanation of the functions of the preview in Section 7.2.
.

7.5 Easy Pareto Report

It lists the causes of nonconformities ordered by frequency. It also reports percentages and parts per million of each type of defect with respect to the total lot size.

To obtain this report your data sheet must contain at least three columns: one for the code name of the cause or defect, another for the lot size and the third for the number of defects. The cursor should be placed on this last column before requesting the report.

The modifiable parameters and buttons are explained below:

Subgroups selection. Press this button to define how the program determines which samples to include in the report. See explanation in section 6.3.1.

Language. Spanish, English, Portuguese, Phonetic Chinese, Simplified Chinese, French or Swedish. Descriptions of each language will be used to prepare the report**.**

Free Pareto. Defect code column indicates which column holds the code names of defects. Sample Size column indicates the column where the lot size is written. If the codes for defects can be grouped, Grouping Level indicates the position of characters that share the same group code. If they will not be grouped type positions 1-10.

Font. Press the button with the font name to change the font, style or size.

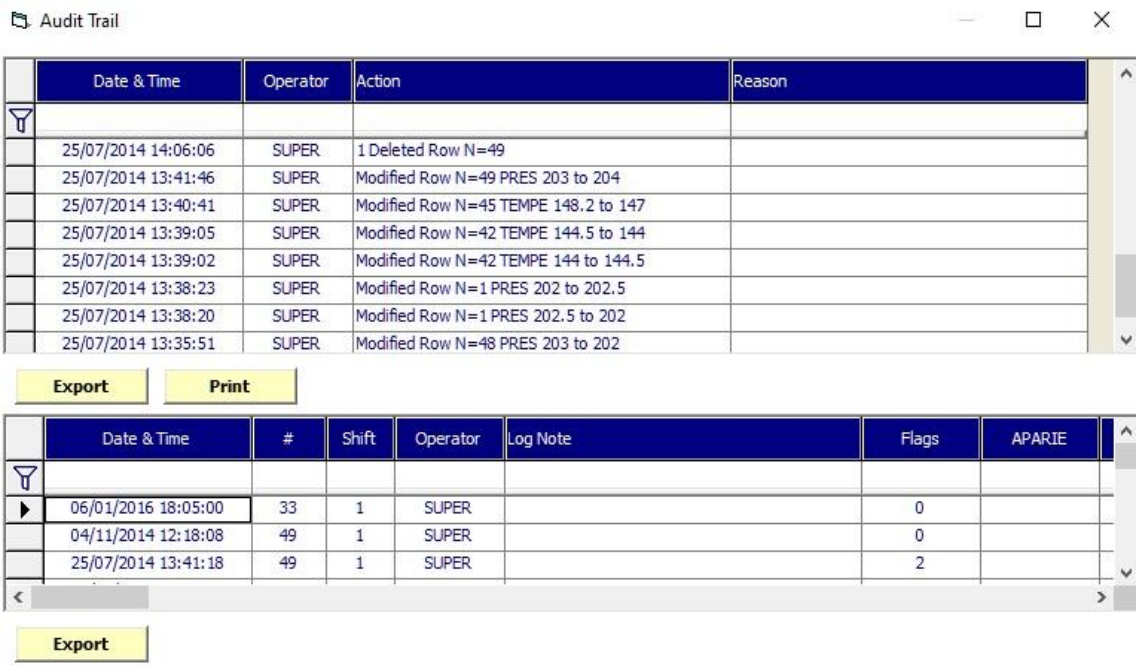
e-mail. Mark this checkbox if you wish to a send a copy of the report attached to an e-mail.

Prepare. Press to prepare the report with the new parameters. The report is displayed as a Web page in your web explorer.

Print, Copy to Excel or Save a Copy. Use your web browser's tools to perform these tasks.

7.6 Audit Trail Report

In this report you will get the list of actions taken by users when they remove or modify data samples. The justification for the action taken can be edited in the Reason column. The query can be filtered by example in the first cell of each column with or without a wildcard character (%). The filtered query can be printed or exported. The complete deleted records are also available for revision, filtering and export.



7.7 Log Notes Report

In this report you will get a listing of data samples falling outside control and / or specification limits and their log comments from one or more sheets. It can also report only samples with missing data cells or all-good data.

Scope. The report can consolidate information from other sheets in addition to the one currently open.

Format. Use this button to select the formats to be included in the report. In the format list select multiple rows by clicking while pressing the Control key. Press OK to finish.

Machines. Select the machines that will be included in the report. In the machine list select multiple rows by clicking while pressing the Control key. Press OK to finish.

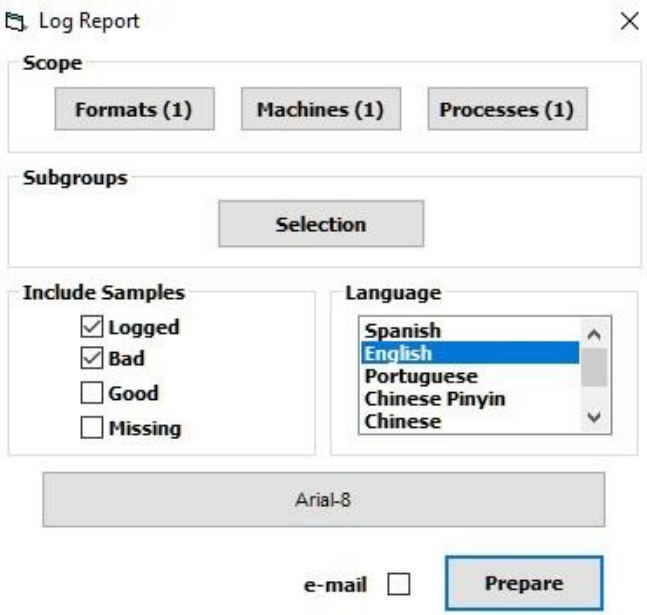
Processes. Select products / processes that will be included in the report.

Subgroups Selection. Select the criteria for rows and columns (characteristics) to be included in the report. For more details see the discussion in Section 6.3.1.

Include samples. Check the boxes for the condition of the samples you want to appear in the report:

- **Logged** Samples with comments regardless of their disposition.
- **Bad** Samples with one or more values out of bounds. The asterisk (*) will indicate statiscally out of control and exclamation (!) indicates out of spec.
- **Good** Samples with all values within limits.
- **Missing** Samples with empty cells.

Language. Spanish, English, Portuguese, Phonetic Chinese, Simplified Chinese, French and Swedish. Descriptions of each language will be used to prepare the report**.**



Font. Press the button with the name of the font to change its type, style or size.

e-mail. Mark this checkbox if you wish to a send a copy of the report attached to an e-mail.

Prepare. Press this button to preview the report based on the new parameters.

Print, Copy to Excel or Save a Copy. Use your web browser's tools to perform these tasks.

Important: When processing this report with several data sheets an 'outdated data sheet' message may appear and a button to update. This is because the system has found a sheet with the same format but different content columns making it necessary to update all the characteristics *to the current format definition. If you choose not to update, then the content of that sheet will be omitted from the report.*

This report can be scheduled to be run automatically by Windows and the result sent attached to an email by typing the following command line:

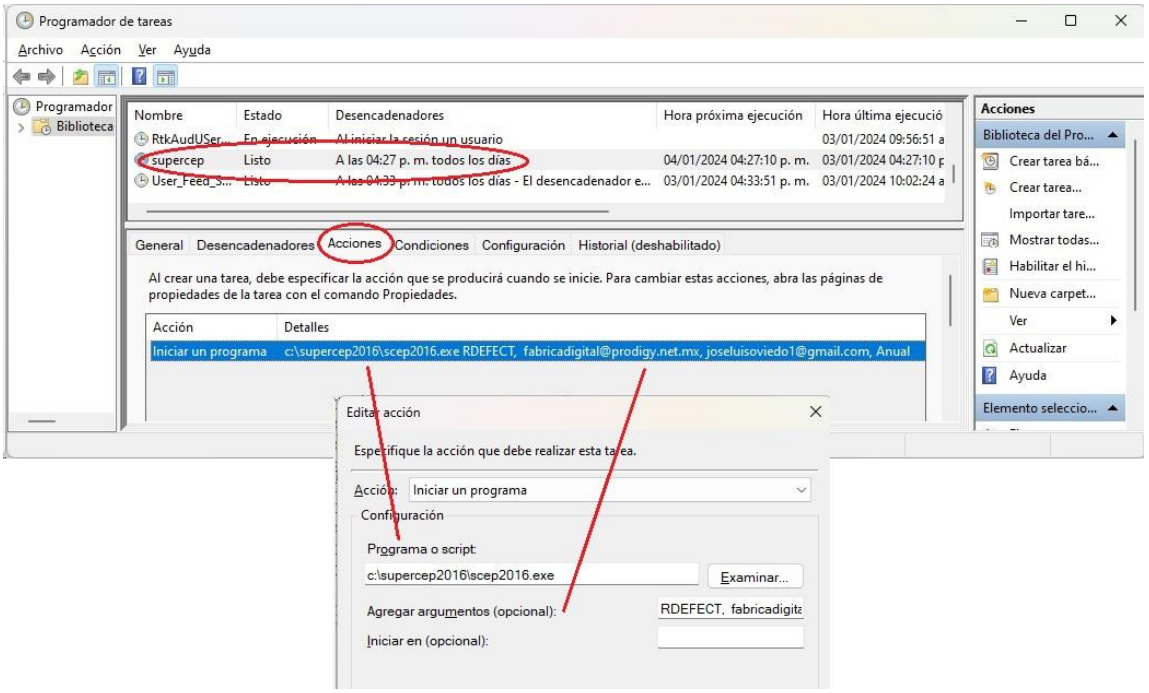
C:\SuperSPC2016\Scep2016.exe RBITACO, <recipient>, <carbon copy>, <period>

Replace <recipient> and <carbon copy> with the recipient's e-mail addresses

Replace <period> by a word that starts with the same first character of the period:

A	To include data from the start of the year to the current date and time.
M	To include data from the start of the month to the current date and time.
S	To include data from the start of the week to the current date and time.
D	To include data from the start of the day to the current time.
T	To include data from the start of the shift to the current time.
H	To include data from the beginning of the hour to the current time

Place this command in Windows Scheduled Tasks.



The email will be sent by the method indicated in the Outgoing e-mail option (see section 5.9). Choices are MS Outlook and SMTP.

7.8 Defects Report

In this report you'll get 3 cross tabulations:

- Defective product by machine.
- Defects by type and product.
- Defects by type and machine.

Before preparing, click the buttons to select the Formats, Machines and Processes to include in the report. Then enter the date range. The modifiable parameters and buttons are the same as in the Log Notes Report.

Finally press the button Prepare to get the preview of the report.

This report can be scheduled to be run automatically by Windows and the result sent attached to an email by typing the following command line:

C:\SuperSPC2016\ scep2016.exe RDEFECT, <recipient>, <carbon copy>, <period>

See details in section 7.7

7.9 Stability Report

The Specified Limits and the 6 sigma Behavioral Limits both Historical and Control are listed for centering and variability.

For each of them, the percentage of the data that falls outside the limits and a Statistically Controlled versus Not Statistically Controlled diagnosis is reported.

Additionally, a warning appears when the Historical limits differ by more than 1.0 sigma from the established Control limits. In this situation, it is recommended to reestablish the Control limits if the process is under historical statistical control.

Before preparing, press the corresponding buttons to mark the Formats, Machines and Processes that you want to include in the report. Then, in the Selection button, enter the date range and check the Critical Levels of the characteristics to be reported. The modifiable parameters and buttons are the same as the Log Report with the exception of:

Minimum Data. This is the minimum number of samples required for each characteristic to appear in the report.

Finally, press the button Prepare to get the preview of the report.

This report can be scheduled to be run automatically by Windows and the result sent attached to an email by typing the following command line:

C:\SuperSPC2016\Scep2016.exe RESTABLE, <recipient>, <carbon copy>, <period>

See details in section 7.7

7.10 Capability Report

It is a summary list of process capabilities in four presentations:

- Summary of capability indexes and process capability (Cp's & Cpk's) per machine, product and characteristic.
- Tabulated summary of capability indexes and process capability (Cp's & Cpk's) per machine, product and characteristic.
- Summary of the observed percentage of product within specification per machine, product and characteristic.
- Weekly average value, standard deviation and percentage observed within specification per machine, product, characteristic and weekday.

Before preparing, click the buttons to select which Formats, Machines and Processes to include in the report. Then enter the date range. The modifiable parameters are the same buttons as in the Log Notes Report except:

Minimum Data. This is the minimum number of samples required for each characteristic to appear in the report.

Finally, press the button Prepare to get the preview of the report.

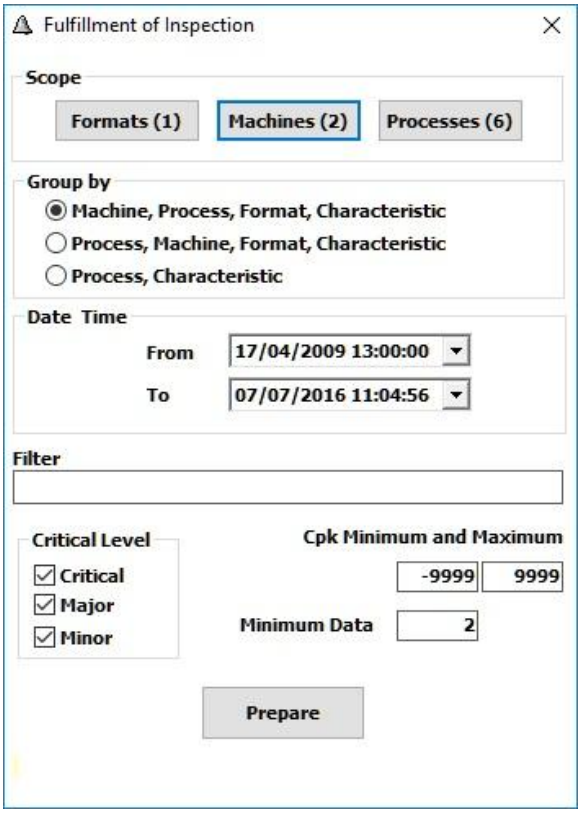
This report can be scheduled to be run automatically by Windows and the result sent attached to an email by typing the following command line:

C:\SuperSPC2016\Scep2016.exe RHABILID, <recipient>, <carbon copy>, <period>

See details in section 7.7

7.11 Inspection Compliance Report

Listing that shows the proportion of samples effectively captured in relation to the control plan of each characteristic. It is based on the Samples per Day field of the Product Characteristics catalog.



In the Scope section, mark the Formats, Machines and Processes that you want to include in the report. Select the type of grouping, the date range and other filters. Finally click on the Prepare button to preview in Crystal Reports.

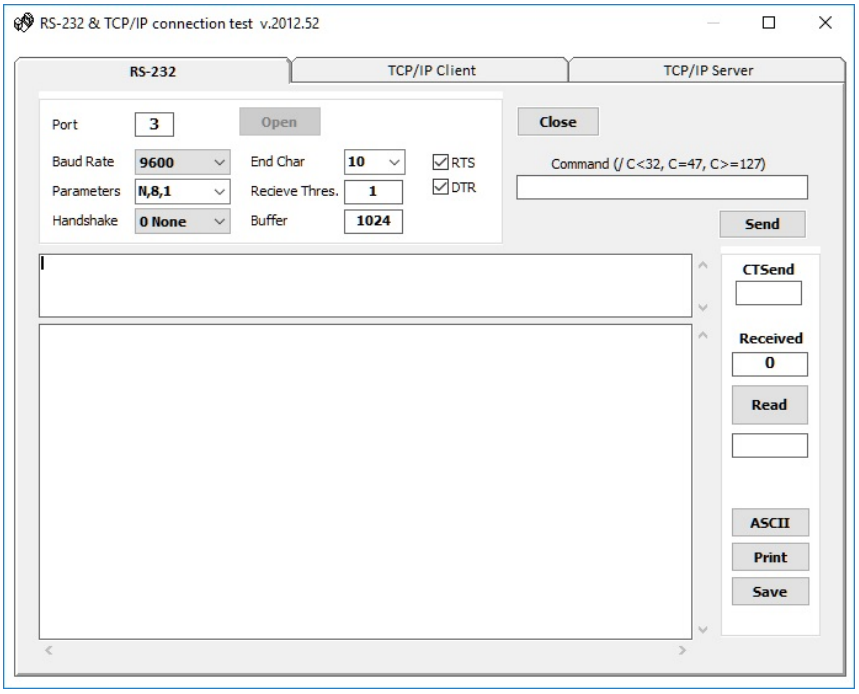
8. MISCELLANEOUS MENU

This menu contains various options for data capture and access to third-party tools.

8.1 RS-232 and TCP/IP Utility

Before setting a format column with Data Input type Connection, you should use this tool to check the availability of data communication with the measuring equipment.

Select the COM port, baud rate (bits per second), parameters (parity, data bits and stop bits), protocol, ASCII code of the terminator character used by the instrument to separate each row of data (13 = CR or 10 = LF), reception threshold (number of bytes that activate reading the buffer), capacity of the receive buffer and activation of RTS and DTR lines. If you are not sure how to set any of the parameters mentioned consult your instrument guide or call our support for free advise.



Press the Open button and do what is necessary on your instrument to send data. The counters on the right side indicate the number of bytes received by the port and the number of bytes present in the buffer and pending to be read by the application. Press the Read button to bring a line of data from the buffer to the text box. The received bytes can be saved in a file by pressing the Save button. This file will be useful if the particular format of the data requires that Fábrica Digital advise you to configure or reprogram SuperCEP for the interpretation of the information.

You can send a command to the instrument by typing in the Command field and pressing the Send button. If the command contains control characters, put the symbol / followed by the ASCII code of the character with 3 digits. For example PRINT/013 would send the word PRINT followed by a character 013 or CR.

If the connection is interrupted or the parameters do not coincide with those of the equipment, the corresponding notifications will be shown as a log in the text box of the middle part of the window.

8.2 Lock Columns

In inspection formats with many columns it is useful to keep the sample identification columns on screen. Use this option to set the ones you always need at the far left.

8.3 Edit Date and Time

When entering the inspection format and start capturing data, the columns of sample number, date/time, shift and operator are automatically filled. If you wish to feed or change these values, check this option. In the case of changes to the date/time, remember that if the chronological order of the samples is altered, the system will present them reordered the next time you enter the Data Sheet regardless of the number of samples they have.

8.4 Serial Port

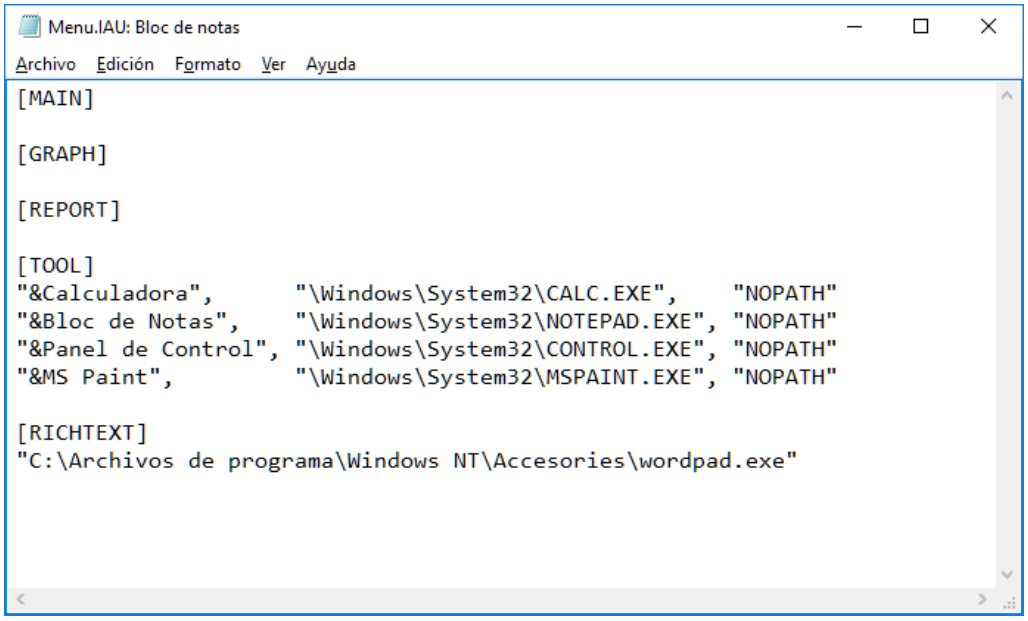
If you need to work in an inspection format that contains one or more columns configured with Connection Data Input type, but the measurement equipment is not working or is not connected to the local computer, you must temporarily disable the accesses to the communication ports to avoid constant warning messages.

8.5 Timer

It is used to initiate or terminate the automatic update, without the intervention of the user, of the data sheet and of the graphic windows displayed. The update interval can be set between 5 and 65 seconds. Each time the period is completed the system will reread the database and redraw the graphs. This is useful in network installations where you want to synchronize queries when feeding data from other terminals or from external data collection applications. The activation or deactivation of the timer is memorized for the next SuperCEP session. A manual update can always be made independent of the status of the timer by pressing the F5 key on the Data Sheet.

8.6 Calculator, Control Panel, MS Paint

These options take you to different programs according to what is established in the file IAU/MENU.IAU under the label [TOOL]. This file can be edited to eliminate these accesses or include others.



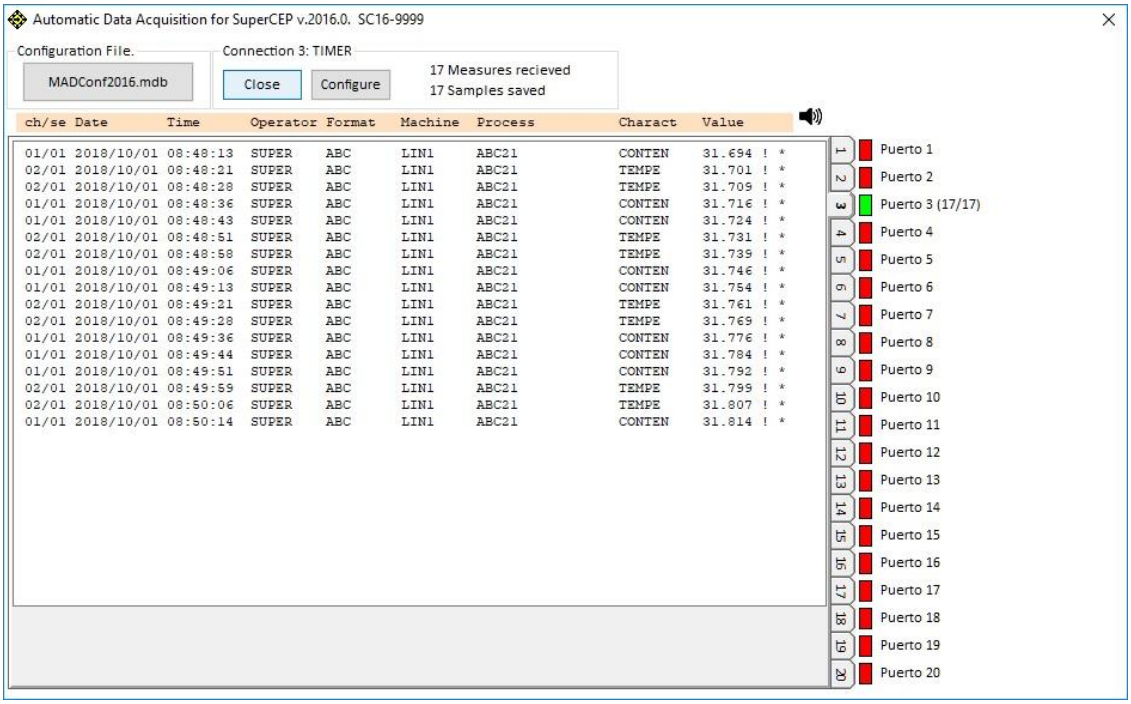
9. MAD. DATA ACQUISITION MODULES

The router applications MAD2016, MADExcel2016, MADDDE2016, MADHtml2016 and MADSQL2016 are auxiliary SuperCEP modules which aim to minimize the data collection effort.

9.1 MAD2016

It allows you to receive data from up to 20 RS-232 serial or Ethernet TCP / IP connections, identifying them, labeling them and recording them in one or more predefined data sheets. Each connection can handle an individual instrument or a multiplexer with several instruments distinguishable through channel numbers. Even by the same connection and channel different quality characteristics can be separated according to their order of arrival at the port (sequences).

Once configured, the program works independently keeping SuperCEP's databse constantly updated.



The connections must be configured so that the program knows how to interpret the data that arrives to it and in which data sheets it must record them.

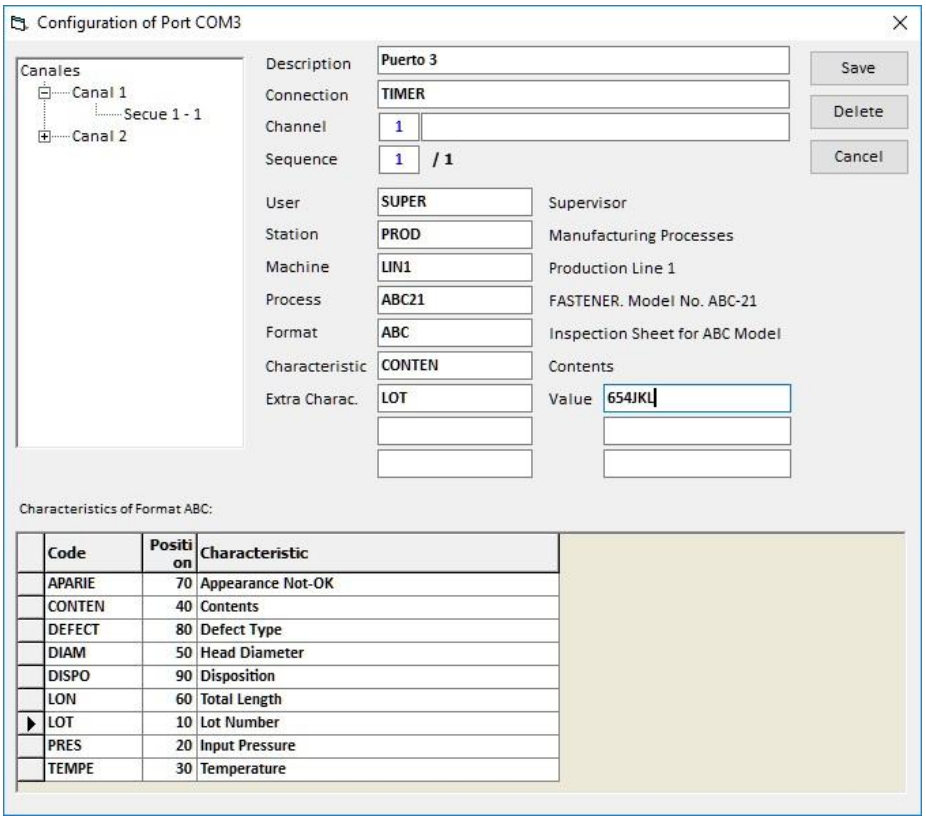
Select the connection by clicking on the numbered tab and then press the Configure button.

When the configuration window appears, select an instrument from the list shown at the bottom. If the instrument has an RS-232 type output then the connection number (1 to 20) corresponds to the serial communication ports COM1 to COM20. If the instrument has TCP / IP type output you can use any of the 20 connections as they all use the same Ethernet adapter.

Enter the number 1 in the Channel field if your connection is not to a multiplexer. If you have a multiplexer connected you must create a separate configuration for each channel of your equipment.

Next, type the number 1 in the Sequence field if the data sent by your instrument via this Connection / Channel correspond to a single characteristic. If the data correspond to different characteristics and they arrive in order, write the sequence number. If the data correspond to different characteristics but do not always arrive in the same order, then they must arrive with an identifier, which is configured in a TID table as explained in Product Characteristics. In the latter case, the sequence is 1.

In the Operator, Station, Machine, Process, Format and Characteristic fields, the codes from the lists that appear in the lower part of the window must be selected. These lists can not be modified here, only in the SuperCEP Configuration module. The three Additional Characteristic and Value fields are optional and allow recording an additional datum with the stipulated value for each datum that arrives through this Connection / Channel / Sequence. In the following example, for each measurement of Content in the CONTEN column the Batch number "654JKL" will be recorded in the LOT column.



If you are using a connection with a TID table, the selection of the characteristic is irrelevant. It is also possible to allow the data message to change the selection of Machine, Process and / or Format in real time. For this, it is necessary to write a TID line to identify any of these concepts in the same way as to identify a datum but instead of the name of a column you write "@MAQUI", "@PRODU" or "@FORMA".

Press Save to save the configuration. Repeat this procedure for each combination of Connection / Channel / Sequence needed.

Once the connection is configured, start receiving data by opening it with the Open button. TCP / IP connections have a waiting time of up to 10 seconds for the instrument to accept the connection. The green color next to the selection tab indicates that it is open. If the connection requires sending a command to request the data, a button with the letter D will be shown. Clicking on the tab displays the last 100 data received by that connection and on which sheet and column they were recorded. If a data point is out of limits there will be an alarm: (*) for Control, (!) for Specification and (?) for Input. On the latter case the datum will not be recorded. To end the communication, press the Close button. The program memorizes the state of the connections before exiting so that, when re-entering, the connections that were opened are automatically restored.

All the configuration of connections of all MAD modules is stored in the file MadConf2016.MDB. If you require different configurations for different applications, you can copy this file, select the copy with the large button at the top left and add or modify what is necessary.

The operation of MAD2016 does not require that SuperCEP be running at the same time. However, if you wish to see the data received in the sheets, you can open SuperCEP in the sheet of interest and press the

F5 key to refresh the screen with the most recently received data. If the timer is activated, the refresh is automatic.

The user can not close this program accidentally. To close it, it is necessary to enter the password of a user with Configuration rights.

9.2 MADExcel2016

It is an alternative way to collect data from MS Excel spreadsheets and other delimited files like CSVs. Using MADExcel connections it is possible to automatically record this information in the SuperCEP database for its storage and statistical analysis. All that is required is to know the name of the Excel Book, Sheet and Cell or Column for each of the data of interest and it will be used to bind them to the corresponding Products and Characteristics in SuperCEP.

The update of the data can be done manually or automatically in predefined time intervals using a configurable set of 10 clocks.

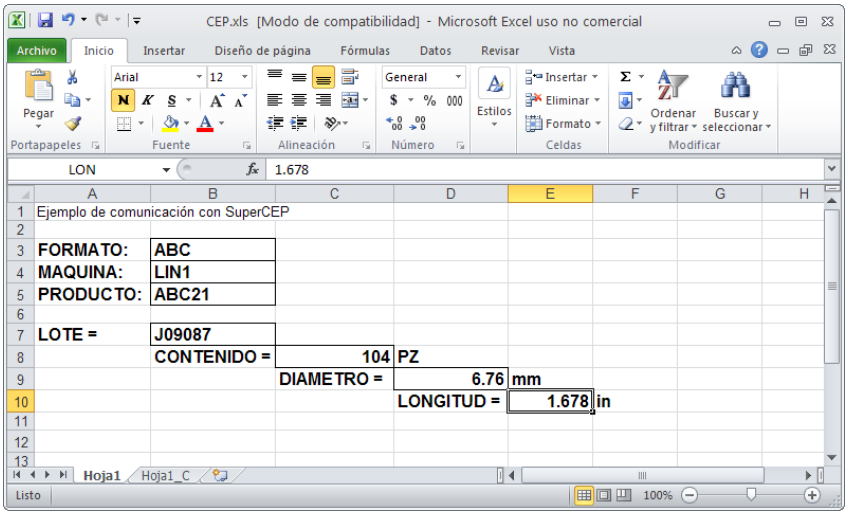
To illustrate the operation of this utility we will connect an Excel worksheet to the sample datasheet that comes with the system. The steps are:

In Excel:

1. Create a workbook called C:\SuperSPC2016\CEP.xlsx containing a sheet named Sheet1.

2. Choose any 4 cells and put data for the following concepts: Identification of Lot, Contents, Diameter and Length.

3. Save and close the Excel workbook.



In MADExcel:

4. On the Excel Book column of the first 4 rows of the table enter C:\SuperSPC2016\CEP.xlsx.

5. On the Excel Sheet column of the first 4 rows of the table type HOJA1.

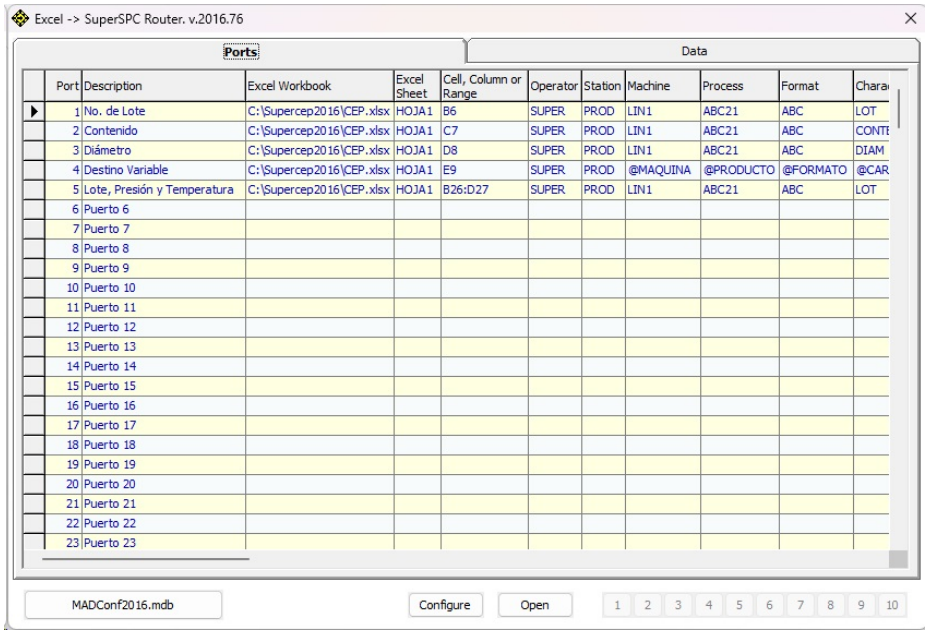
6. On the Cell or Column column of the first 4 rows of the table enter the coordinates of the cells used in step 2. *Note: If you plan to change the coordinates of the data in the future it is convenient to assign names to their cells and use the names instead of coordinates*. If instead of a fixed cell, you need to read the last data in a column, write only the letter of the Excel column without referring to any row. You can also write a range of cells, for example B2:D3 to read cells B2, C2, D2, B3, C3 and D3 consecutively. The data will be recorded from the column indicated in point 8.

7. On the Operator, Station, Machine, Product and Format columns of the first 4 rows of the table type SUPER, PROD, LIN1, ABC21 and ABC respectively

8. On the Characteristic Column of the first 4 rows of the table type the codes LOTE, TAMLOT, DI and LON.

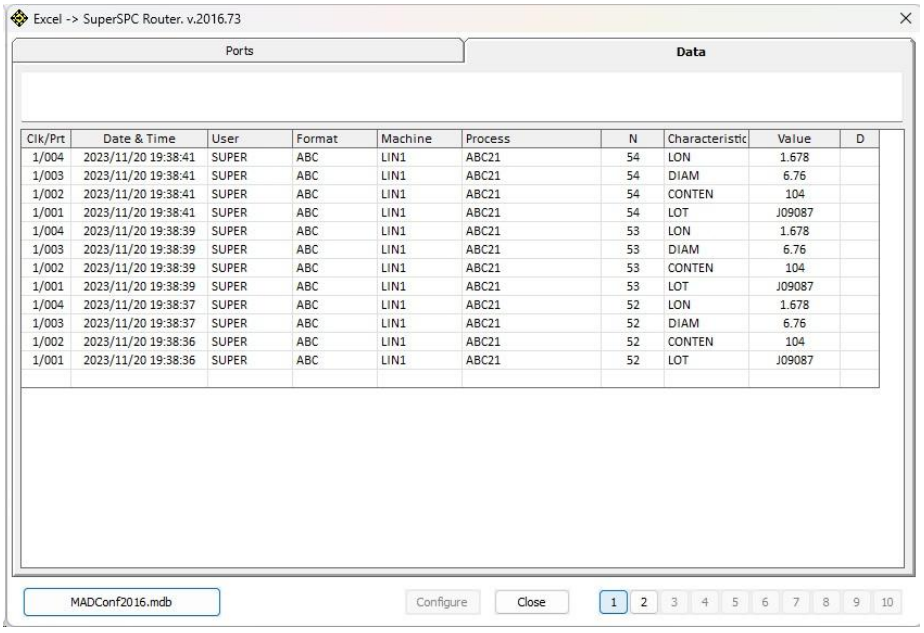
9. On the Clock column of the first 4 rows of the table enter the number 1.

10. On the Minutes column enter the number 0. Changing the value in a row changes the minutes of all rows that have the same clock, although this is not immediately reflected in the table.



Port	Description	Excel Workbook	Excel Sheet	Cell, Column or Range	Operator	Station	Machine	Process	Format	Charac
1	No. de Lote	C:\Supercep2016\CEP.xlsx	HOJA1	B6	SUPER	PROD	LIN1	ABC21	ABC	LOT
2	Contenido	C:\Supercep2016\CEP.xlsx	HOJA1	C7	SUPER	PROD	LIN1	ABC21	ABC	CONTE
3	Diámetro	C:\Supercep2016\CEP.xlsx	HOJA1	D8	SUPER	PROD	LIN1	ABC21	ABC	DIAM
4	Destino Variable	C:\Supercep2016\CEP.xlsx	HOJA1	E9	SUPER	PROD	@MAQUINA	@PRODUCTO	@FORMATO	@CAR
5	Lote, Presión y Temperatura	C:\Supercep2016\CEP.xlsx	HOJA1	B26:D27	SUPER	PROD	LIN1	ABC21	ABC	LOT
6	Puerto 6									
7	Puerto 7									
8	Puerto 8									
9	Puerto 9									
10	Puerto 10									
11	Puerto 11									
12	Puerto 12									
13	Puerto 13									
14	Puerto 14									
15	Puerto 15									
16	Puerto 16									
17	Puerto 17									
18	Puerto 18									
19	Puerto 19									
20	Puerto 20									
21	Puerto 21									
22	Puerto 22									
23	Puerto 23									

Get Data:



Clk/Prt	Date & Time	User	Format	Machine	Process	N	Characteristic	Value	D
1/004	2023/11/20 19:38:41	SUPER	ABC	LIN1	ABC21	54	LON	1.678	
1/003	2023/11/20 19:38:41	SUPER	ABC	LIN1	ABC21	54	DIAM	6.76	
1/002	2023/11/20 19:38:41	SUPER	ABC	LIN1	ABC21	54	CONTEN	104	
1/001	2023/11/20 19:38:41	SUPER	ABC	LIN1	ABC21	54	LOT	J09087	
1/004	2023/11/20 19:38:39	SUPER	ABC	LIN1	ABC21	53	LON	1.678	
1/003	2023/11/20 19:38:39	SUPER	ABC	LIN1	ABC21	53	DIAM	6.76	
1/002	2023/11/20 19:38:39	SUPER	ABC	LIN1	ABC21	53	CONTEN	104	
1/001	2023/11/20 19:38:39	SUPER	ABC	LIN1	ABC21	53	LOT	J09087	
1/004	2023/11/20 19:38:37	SUPER	ABC	LIN1	ABC21	52	LON	1.678	
1/003	2023/11/20 19:38:37	SUPER	ABC	LIN1	ABC21	52	DIAM	6.76	
1/002	2023/11/20 19:38:36	SUPER	ABC	LIN1	ABC21	52	CONTEN	104	
1/001	2023/11/20 19:38:36	SUPER	ABC	LIN1	ABC21	52	LOT	J09087	

11. Press the Open button at the bottom center of the MADExcel window.

12. Press button number 1.

13. Click the tab that says Data and observe the 4 lines that indicate the four data read from Excel cells and the locations where they were recorded in SuperCEP.

In the example above, data were obtained manually by pressing button number 1. You can automate the data collection setting an interval in the Minutes column. Each time the established interval for a clock is met, the program reads data from the Excel spreadsheet (of those characteristics assigned to the clock) and records it in SuperCEP. You can use up to 10 clocks with independent intervals.

An advanced option to dynamically identify the destination of read data in SuperCEP is to use Excel named cells. For example, if an Excel spreadsheet can contain data of different products in the same cells depending on when you read it, you must have a named cell (eg. "ITEM") indicating the product code and then, at the Process column in MADExcel, you will type @ITEM indicating that the product code is variable and should be taken from that cell. This mechanism applies to the Format, Machine, Process and Characteristic columns.

It is possible to make MADExcel write the value read from Excel in the line where the cursor is located in the SuperCEP data sheet, automatically locating the position of the Characteristic. To achieve this you must leave the Machine, Process and Format settings blank. If the Characteristic setting is also left blank, the data will fall into the current cursor cell. Both options require the SuperCEP datasheet to be open.

MADExcel has an option that can identify which data have already been read and do not repeat their capture. This can be useful if you have an Excel spreadsheet that fills slowly with sample data that must be copied to SuperCEP only once but you want to capture them as they are available. To achieve this in the example above, the additional steps are:

In Excel set:

1. In the same workbook make a copy of Sheet1 to Sheet1_C.

2. Delete any content from cells B7, C8, D9 and E10 in Sheet1 and Sheet1_C.

In MADExcel set:

3. In the Input Control column of the first 4 rows enter –1 (minus 1).

Get data:

4. Open the Excel workbook and input data in cells B7 and D9. Close the workbook.

5. Press the Open button situated at the bottom center of the MADExcel window.

6. Press button number 1.

7. Clic on the Data tab and notice that there are only 2 rows containing data read from characteristics LOTE and DI.

8. Open the Excel workbook and notice in Sheet1_C cells B7 and D9 now holding a letter ‘C’.

9. On Sheet1 input data into cells C8 and E10. Close the workbook.

10. In MADExcel press button number 1 again.

11. Clic on the Data tab and notice 2 new rows containing the data read from the corresponfing new contents in cells TAMLOT y LON.

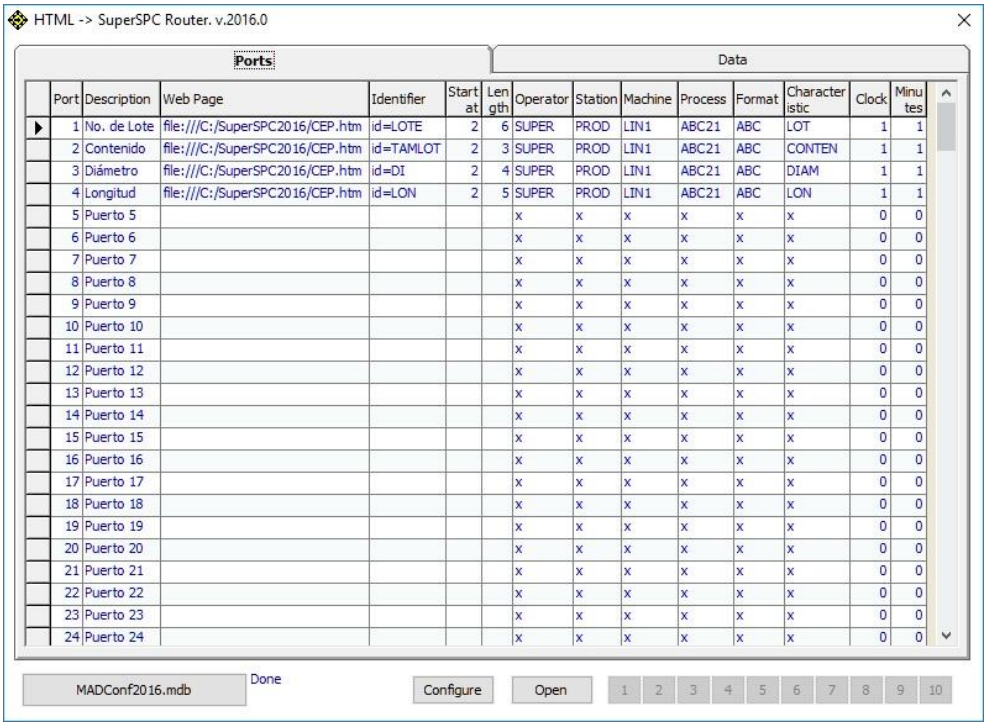
12. Since all four configured data ports are already read, MADExcel will not read them again until in the corresponding cells in Sheet1_C the letters 'C' are eliminated.

All the described configurations are stored in the MadConf2016.MDB file. Should you require working with different configurations you can copy this file and select the copy with the large button located at the bottom left of the window.

9.3 MADHtml2016

It is a capture alternative that collects data from websites. An example of use is with the Siemens S7 PLC.

All that is required is to know the address of the web page and a unique identifier that allows locating the data of interest within the HTML code of the page.

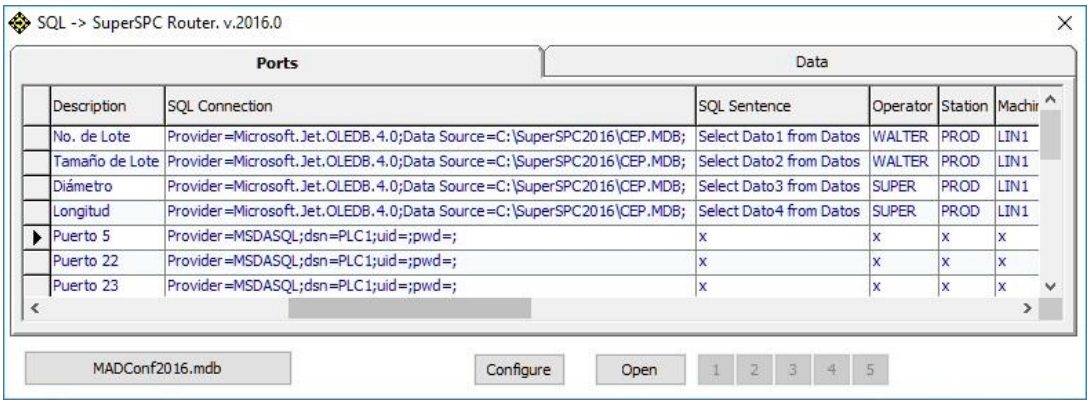


Port	Description	Web Page	Identifier	Start at	Length	Operator	Station	Machine	Process	Format	Characteristic	Clock	Minutes
1	No. de Lote	file:///C:/SuperSPC2016/CEP.htm	id=LOTE	2	6	SUPER	PROD	LIN1	ABC21	ABC	LOT	1	1
2	Contenido	file:///C:/SuperSPC2016/CEP.htm	id=TAMLOT	2	3	SUPER	PROD	LIN1	ABC21	ABC	CONTEN	1	1
3	Diámetro	file:///C:/SuperSPC2016/CEP.htm	id=DI	2	4	SUPER	PROD	LIN1	ABC21	ABC	DIAM	1	1
4	Longitud	file:///C:/SuperSPC2016/CEP.htm	id=LON	2	5	SUPER	PROD	LIN1	ABC21	ABC	LON	1	1
5	Puerto 5					x	x	x	x	x	x	0	0
6	Puerto 6					x	x	x	x	x	x	0	0
7	Puerto 7					x	x	x	x	x	x	0	0
8	Puerto 8					x	x	x	x	x	x	0	0
9	Puerto 9					x	x	x	x	x	x	0	0
10	Puerto 10					x	x	x	x	x	x	0	0
11	Puerto 11					x	x	x	x	x	x	0	0
12	Puerto 12					x	x	x	x	x	x	0	0
13	Puerto 13					x	x	x	x	x	x	0	0
14	Puerto 14					x	x	x	x	x	x	0	0
15	Puerto 15					x	x	x	x	x	x	0	0
16	Puerto 16					x	x	x	x	x	x	0	0
17	Puerto 17					x	x	x	x	x	x	0	0
18	Puerto 18					x	x	x	x	x	x	0	0
19	Puerto 19					x	x	x	x	x	x	0	0
20	Puerto 20					x	x	x	x	x	x	0	0
21	Puerto 21					x	x	x	x	x	x	0	0
22	Puerto 22					x	x	x	x	x	x	0	0
23	Puerto 23					x	x	x	x	x	x	0	0
24	Puerto 24					x	x	x	x	x	x	0	0

The update can be done manually or automatically at predefined time intervals through a set of 10 configurable clocks. The configuration and operation of this module is equal to MADExcel except for the syntax of the Identifiers that must be consulted within the source code of the web page.

9.4 MADSQL2016

It is an alternative to capture that collects data from database that accepts SQL connections.



The configuration and operation of this module is very similar to that of the MADExcel module (see chapter 9.2). The main difference is how to access the files of the databases. It is required to first establish what is known as the SQL Connection String. Each brand of databases has at least one specific syntax. For example:

Brand	SQL Connection String
Access 2000-2010	Provider=Microsoft.Jet.OLEDB.4.0;Data Source=<*database complete URL* >;Jet OLEDB:Database Password=<*password*>;
CSV Comma Separated Values	Provider=Microsoft.Jet.OLEDB.4.0;Data Source=<complete URL of the folder that contains the csv file>; Extended Properties='text;HDR=YES;FMT=Delimited';
SQL Server 2005-2019	Provider=SQLOLEDB.1;Data Source=<*server name*>;User ID=<*user nameo*>;Password=<*password*>;Initial Catalog=<*database name*>;
Informix 10	Provider=Ifxoledbc.2;Data Source=<*database name@servername*>;User ID=<*user name*>;Password=<*password*>;
Oracle 10	Provider=msdaora;Data Source=<*database name*>;User Id=<*user name*>;Password=<*password*>;
MySQL 5	Provider=MySQLProv;Data Source=<*database name*>;User Id=<*user name*>;Password=<*password*>;
Sybase 9	Provider=ASAProv.90;ENG=<*server name*>;User ID=<*user name*>;Password=<*password*>;DBN=<*database name*>;

Once the connection is created it is necessary to obtain the desired data by making a query using an SQL sentence. For example to obtain the data of the TEMPERATURE field of a PROCESS table the sentence is:

Select TEMPERATURE from PROCESS

In the case of CSV files, the name of the table is the name of the file, for example:

Select [VARIABLE 1] from Test.CSV

Commonly it is only necessary to read a few data of the many that a base can contain. The following example reads the most recent data marked in the TIME field (this syntax can change according to the brand):

```
Select top 1 TEMPERATURE from PROCESS order by TIME desc
```

Prior to its execution, SuperCEP substitutes the terms *NOWDATE* and *NOWTIME* in the SQL expressions for the current date and time respectively.

A. CERTIFICATE DESIGN

The objective of this module is to provide the tools that allow you to obtain special reports of the sample data, including any text you want, free variables in each printout, statistical calculations (averages, maximums, minimums, standard deviations). and indexes of process capacity), free arrangement of the columns of the inspection format, complete control over the size and type of letter and insertion of image files. The main use of these tools is to issue Quality Certificates, which are widely used in the industries that deliver lots and that want to accompany the product with a report where the measurements and verifications that were made to it are clearly specified.

To design a new Quality Certificate you should use Microsoft Excel.

A.1 Microsoft Excel Certificates

If you have this application on your computer you can design the report using all the facilities of it. You can use one or more sheets in any position within the Excel Workbook.

To include SuperCEP data or chart in the Excel worksheet, cells must be labeled with names that are listed in the following table:

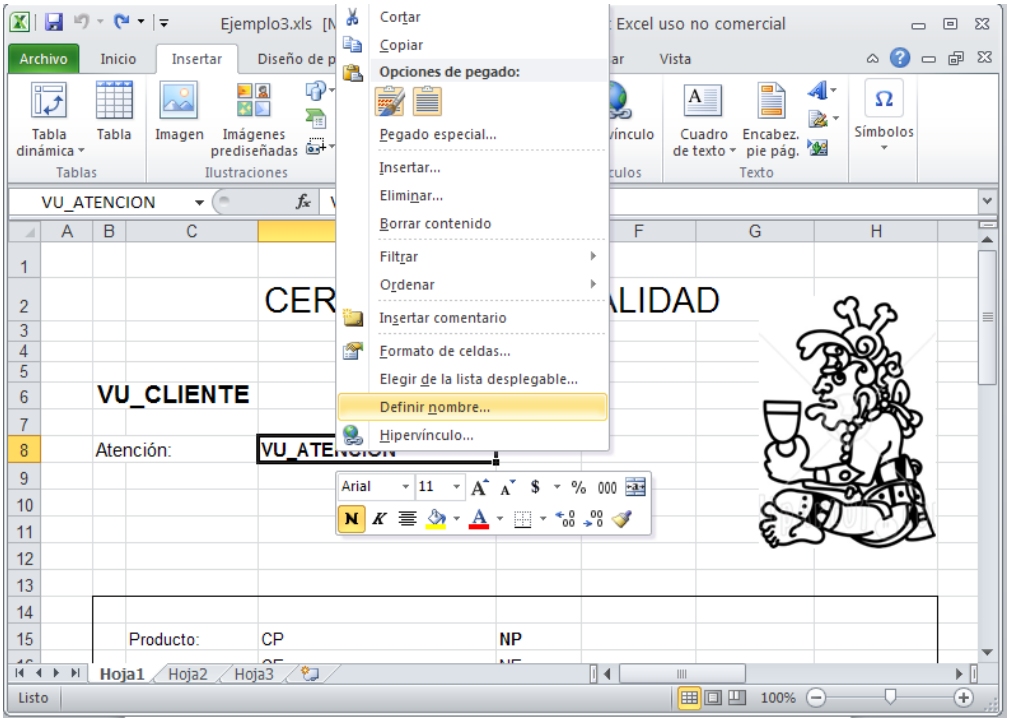
Microsoft Excel Name	Displays
CU	User Code
CE	Station Code
CM	Machine Code
CP	Product Code
CF	Format Code
CC_*code*	Characteristic Code
NU	User Name
NE_1 to 7	Station Name in Language 1 to 7
NM_1 to 7	Machine Name in Language 1 to 7
NP_1 to 7	Product Name in Language 1 to 7
NF_ 1 to 7	Format Name in Language 1 to 7
NC_*code*	Characteristic Name in Spanish
CN_*code*	Characteristic Name in English
BC_*code*	Characteristic Name in Portuguese
UC_code	Characteristic Unit of Measure
VU_*code*	Free field. Content assignable at print time
VA_N	Number of the first sample selected
VA_FECHA	Date of the first sample selected
VA_HORA	Time of the first sample selected
VA_TURNO	Shift of the first sample selected
VA_OPERADOR	Code of Operator that entered the first sample selected
VA_BITACORA	Log of the first sample selected
VA_*code*	Value entered at the *code* cell of the first sample selected
VR_N	Numbers of selected samples
VR_FECHA	Dates of selected samples
VR_HORA	Times of selected samples
VR_TURNO	Shifts of selected samples

VR_OPERADOR	Operator codes of selected samples
VR_BITACORA	Logs of selected samples
VR_*code*	Values of the *code* Characteristic of the selected samples
EI_*code*	Lower Specification of the characteristic in the *code* column
EC_*code*	Target Value of the characteristic in the *code* column
ES_*code*	Upper Specification of the characteristic in the *code* column
ND_*code*	Number of samples selected of *code* characteristic
MA_*code*	Maximum value of the range of *code* column data
MI_*code*	Minimum value of the range of *code* column data
AV_*code*	Average of the range of *code* column data
SD_*code*	Standard Deviation (RMC) of the range of *code* column data
SS_*code*	Sample Standard Deviation of the range of *code* column data
SR_*code*	Standard Deviation (R/d2) of the range of *code* column data
TS_*code*	Radius of Gyration around the Target of the range of *code* column data
PP_*code*	Performance Potential Capacity Index of *code* column
PK_*code*	Performance Capability Index of *code* column
CP_*code*	Process Potential Capacity Index of *code* column
CK_*code*	Process Capability Index of *code* column
TC_*code*	Process Potential Taguchi Capacity Index of *code* column
TK_*code*	Process Taguchi Capability Index of *code* column
FA_code	Estimated fraction of population above specification
FI_code	Estimated fraction of population in specification
FB_code	Estimated fraction of population below specification
ZU_code	Standard distance z from the Mean to the Upper Specification Limit
ZT_code	Standard distance z from the Mean to the Target
ZL_code	Standard distance z from the Mean to the Lower Specification Limit
HI_code	Histogram and Capabilty Study of *code* column
VG_*code*	X-R Variables Chart of *code* column
VS_*code*	X-S Variables Chart of *code* column
HC_code1?_code2?…	Collective Histogram of a list of characteristics

To label the cell use the Define Name procedure.

To include free fields use the VU_ prefix and a word that describes the data type. For example VU_CLIENT will allow you to write the name of the customer before printing each certificate.

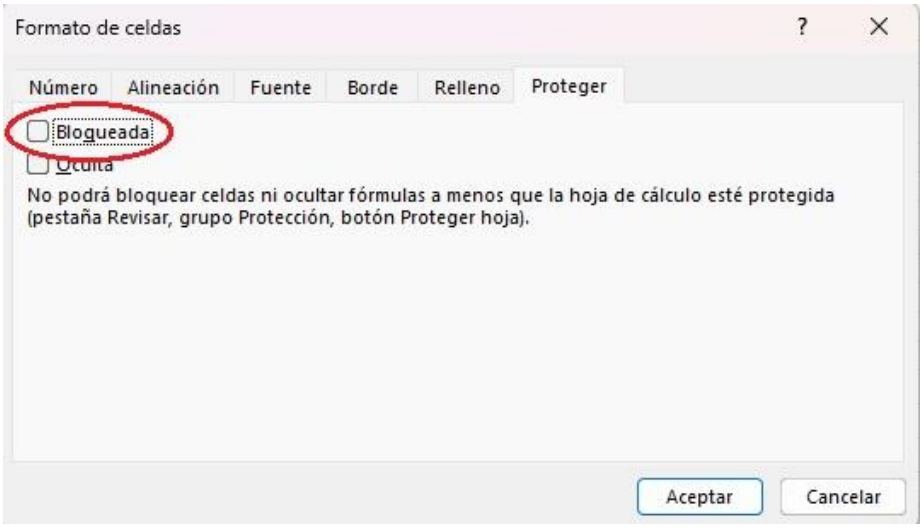
Use the VA_ prefix to display the first selected data and the VR_ prefix to display all the selected data vertically.



Save the Excel workbook in the CCC subfolder within the same folder where SuperCEP is.

Study CCC\Example.xlsx to understand the application.

When issuing the Certificate, SuperCEP creates a Protected copy of the Excel workbook. If you want to Unprotect the Excel workbook, ask your reseller for the password to do so. If you need to modify the contet of some cellsof the Certificate already issued, remove the Locking of the cells that are going to be required from the Excel layout:



B. WEB BOARDS

SuperCEP can update a web page in real time with the Process Capability Indexes (Cpk) of the critical characteristics of the current Process in each Machine of a Station of your choice.

This website can be viewed on any device with connectivity such as smart phones, tablets or smart TVs.

To enable this functionality do the following:

At the Web Server

1. Unzip and copy TableroSuperCEP to your Web server.
2. With the IIS (Internet Information Services) manager create a new Web Site or Virtual Directory named TableroSuperCEP pointing to the folder created in step number 1.
3. Install PHP version 5.2 or better on your Web server.
4. Migrate your database to SQL Server using the application CONV2016 provided with SuperSPC.
5. Edit with Notepad the DATABASE row of file \TableroSuperCEP\connections\scepconf.php so it contains 'SCEP2016' (or the name given to your SQL configuration database).
6. Edit with Notepad the DATABASE row of file \TableroSuperCEP\connections\scepdata.php so it says 'SCEP2016DATA' (or the name given to your SQL samples database).
7. Copy the background images of your SuperSPC Stations to folder TableroSuperCEP\image.
8. Verify that your firewall permits traffic on ports TCP 80 (WEB) and 1433 (SQL).

At SuperSPC

9. Create a new characteristic with code ORDEN (meaning Work Order) in the *** Machine (generic) and *** Product (generic) with 0 decimals and Don't Analyse type.
10. Add this column to all Formats that are used in the Station that is going to be monitored.
11. Open each one of your current Processes so the new ORDEN column is physically created in the database.
12. When beginning to record the results of the inspections, write in the column ORDEN the identification of your work order (only in the first row).
13. When the work order is concluded type FIN (meaning END).

How to Use

In your favorite browser type http://www.mycompany.com/TableroSuperCEP/index.htm (replace www.mycompany.com with the name of your web domain or the IP of your server). In the menu select Quality Level. Then select the Station to be monitored.

A page with the background image that was configured in SuperCEP for the selected Station and the labels of each Machine appears.

Next to the label of each Machine, the Cpk's of the critical characteristics of the work order currently in progress are listed. The green icon corresponds to Cpk's equal to or greater than 1.33, yellow between 1.00 and 1.33, and red to less than 1.00. If in the column ORDEN the most recent data is FIN, a Stop icon is shown.

The page is automatically updated every 30 seconds.

C. DATABASE

C.1 Configuration Tables

If you use the Jet engine database connection, SuperSPC's configuration data are stored in the SCEP2016.MDB file that is in Microsoft Access 2000 compatible format. Copy this file so that you can work in any program that can read this format. If you are using the SQL Server database connection, consult your IT administrator about how you can obtain a copy of the SCEP2016 database.

Very Important: Since Windows Vista, it is not recommended to keep database files under any \Program Files folder because the operating system assumes these files to be Read Only. For information backup purposes please be aware that Windows will sometimes mantain the up to date version of some SuperCEP files located at folder \Users\user name\AppData\Local\VirtualStore\Program Files(x86).

The tables you'll find in this database are:

Table		Description
USU		USERS catalog
EST		STATIONS catalog
EXU		STATIONS per USER relations
MAQ		MACHINES catalog
MXE		MACHINES per STATION relations
PRO		PRODUCTS catalog
PXM		PRODUCTS per MACHINE relations
FRM		FORMATS catalog
FXP		FORMATS per PRODUCT relations
CAR		CHARACTERISTICS catalog
CXF		CHARACTERISTICS per FORMAT relations
CXP		CHARACTERISTICS per MACHINE and PRODUCT relations
ESP		History of LIMITS
AXC		LISTS OF CONCEPTS catalog
INS		INSTRUMENTS connections catalog
TEX		TEXT information catalog

The description of each field contents follows:

Table	Field	Description	Default Value
USU	USUCLAVE	User Code	
USU	USUDESCR	User Name	User Code
USU	USUSSTAT	User Status	0
USU	USUCONTR	Hashes of the last 4 User Passwords	".."
USU	USUGRAFI	User Charts	10000000000001
USU	USUREPOR	User Reports	1
USU	USUPODER	User Rights	00010100000000000000
USU	USURCOLI	Column Initial Position	0
USU	USURCOLF	Column Final Position	9999
USU	USUESTAC	Recent Station	
USU	USUEMAIL	User E-Mail	
USU	USUPROFI	User Profile	
USU	USUBEGIN	Password Date	
USU	USUTWMOD	Minutes to edit	0
USU	UsuCreDa	Creation Date	
USU	UsuCreBy	Created or Modified by	
USU	UsuLstOn	Last Entry Date	
USU	UsuLstOf	Last Exit Date	

EST	ESTCLAVE	Station Code	
EST	ESTDESC1	Station Name main language	Code
EST	ESTDESC2-7	Station Name alternative languages	Code
EST	ESTMAPA	Image for Machines menu	“BLANK.JPG”
EST	ESTMAQUI	Recent Machine	
EXU	EXUUSUAR	User	
EXU	EXUESTAC	Station	
EXU	EXUCOORX-Y	X-Y coordinates of label	Random
EXU	EXUDISPO	Station quality disposition	
MAQ	MAQCLAVE	Machine Code	
MAQ	MAQDESC1	Machine Name main language	Code
MAQ	MAQDESC2-7	Machine name alternative languages	Code
MAQ	MAQPRODU	Recent Product	
MAQ	MAQFORMA	Recent Format	
MAQ	MAQOPER1-3	Not used	
MAQ	MAQMAPA	Image for Products menu	“BLANK.JPG”
MXE	MXEESTAC	Station	
MXE	MXEMAQUI	Machine	
MXE	MXECOORX-Y	X-Y coordinates of label	Random
MXE	MXEDISPO	Machine quality disposition	
PRO	PROCLAVE	Product Code	
PRO	PRODESC1	Product Name main language	Code
PRO	PRODESC2-7	Product Names alternative languages	Code
PRO	PROMAPA	Image for Formats menu	“BLANK.JPG”
PXM	PXMMAQUI	Machine	
PXM	PXMPRODU	Product	
PXM	PXMCOORX-Y	X-Y coordinates of label	Random
PXM	PXMFIMON	Not used	#01/Jan/2011#
PXM	PXMMONID	Not used	7
PXM	PXMSUPV1-4	Supervisors	
PXM	PXMREVI1-4	Supervision done	0
FRM	FRMCLAVE	Format Code	
FRM	FRMDESC1	Format Name main language	Code
FRM	FRMDESC2-7	Format Name alternative languages	Code
FRM	FRMTIPO	Defines Union type Format	
FXP	FXPPRODU	Product	
FXP	FXPFORMA	Format	
CAR	CARCLAVE	Characteristic Code	
CAR	CARDESC1	Characteristic Name main language	Code
CAR	CARDESC2-7	Characteristic Name alternative languages	Code
CAR	CARUNIDM	Measure unit	“..”
CXP	CXPMAQUI	Machine	
CXP	CXPPRODU	Product	
CXP	CXPCARAC	Characteristic	
CXP	CXPANALI	Analysis Type	“V”
CXP	CXPLIMIT	Limits Type	“B”
CXP	CXPDECIM	Decimals	0
CXP	CXPLINFE	Lower Specification Limit (A)	-3
CXP	CXPLMEDE	Target value (A)	0
CXP	CXPLSUPE	Upper Specification Limit (A)	3
CXP	CXPLINEB	Lower Specification Limit (B)	-4
CXP	CXPLMEEB	Target value (B)	0
CXP	CXPLSUEB	Upper Specification Limit (B)	4

CXP	CXPLINEC	Lower Specification Limit (C)	-5
CXP	CXPLMEEC	Target value (C)	0
CXP	CXPLSUEC	Upper Specification Limit (C)	5
CXP	CXPLINFN	Lower Control Limit	-2
CXP	CXPMEDIA	Mean value	0
CXP	CXPLSUPN	Upper Control Limit	2
CXP	CXPLINFC	Lower Input Limit	-999999
CXP	CXPLSUPC	Upper Input Limit	999999
CXP	CXPTSUBG	Subgroup size	1
CXP	CXPETAPA	Control Stage	“H”
CXP	CXPCPMIN	Minimum Cpk	-1
CXP	CXPNMUES	Control Plan minutes / subgroup	3
CXP	CXPCAPTU	Input Type	“M”
CXP	CXPCATAL	Input catalog	
CXP	CXPEQUIP	Instrument connection	
CXP	CXPPUERT	Serial COM port	
CXP	CXPCANAL	Multiplexor channel	
CXP	CXPEQOP2	Column search	0
CXP	CXPEQOP4	Cursor Movement	0
CXP	CXPFORMU	Formula	
CXP	CXPCRITI	Critical level	3
CXP	CXPCOSTO	Cost of non-conformity	1
CXP	CXPINFOP	Process Information	
CXP	CXPAVI01-03	Alarm messages	
CXP	CXPCOORX-Y	X-Y coordinates of label	Random
CXP	CXPDISPO	Characteristic quality disposition	0
CXP	CXPANCHO	Not used	1
ESP	ESPMAQUI	Machine	
ESP	ESPPRODU	Product	
ESP	ESPCARAC	Característic	
ESP	ESPFECHA	Start Date	
ESP	ESPLINFE	Lower Specification Limit (A)	-3
ESP	ESPLMEDE	Target Value (A)	0
ESP	ESPLSUPE	Upper Specification Limit (A)	3
ESP	ESPLINEB	Lower Specification Limit (B)	-3
ESP	ESPLMEEB	Target Value (B)	0
ESP	ESPLSUEB	Upper Specification Limit (B)	3
ESP	ESPLINEC	Lower Specification Limit (C)	-3
ESP	ESPLMEEC	Target Value (C)	0
ESP	ESPLSUEC	Upper Specification Limit (C)	3
ESP	ESPLINFN	Lower Contro Limit	-2
ESP	ESPLMEDN	Mean Value	0
ESP	ESPLSUPN	Upper Control Limit	2
CXF	CXFFORMA	Format	
CXF	CXFCARAC	Characteristic	
CXF	CXFPOSIC	Column relative position	10
CXF	CXFANCHO	Column width	1
CXF	CXFUMAQU	Machine Union	
CXF	CXFUPROD	Product Union	
CXF	CXFUFORM	Format Union	
CXF	CXFUCARA	Characteristic Union	
INS	INSCLAVE	Instrument code	
INS	INSDESCR	Instrument name	Code
INS	INSTIPOC	Type of connection	“RS232”
INS	INSBAUDI	Baud rate	9600
INS	INSPARID	Parity	“N”
INS	INSBDATO	Data bits	8
INS	INSBPARO	Stop bits	1

INS	INSHNDSH	RS232 Handshake	1
INS	INSDTRA	DTR active	-1
INS	INSRTSA	RTS active	-1
INS	INSBUFFE	Data buffer size	1024
INS	INSRCVTH	Receive threshold	1
INS	INSRMTIP	Remote IP	"127.0.0.1"
INS	INSTCPPR	TCP port	1007
INS	INSCINIC	Initial ommand	
INS	INSCDATO	Data request command	
INS	INSINICI	Initial position of data	1
INS	INSTERMI	Message termination character	10
INS	INSTABLA	Data interpretation table	No
AXC	AXCTABLA	Concept Table Code	
AXC	AXCCLAVE	Concept Code	
AXC	AXCDESC1	Description in main language	
AXC	AXCDESC2-7	Description in alternative languages	
AXC	AXCVALOR	Specific weight	1
SEC	ITEM	Security Item	
SEC	VALOR	Established Value	

C.2 SAMPLE DATA TABLES

If you use the Jet engine database connection, there is a data file in a format compatible with Microsoft Access 2000 for each data sheet created. The data files are located within the data folder in the subfolder <Format>\<Machine> named <Product>.MDB. If you are using the connection to SQL Server database, there is a single database called SCEP2016DATA containing all data sheets. Consult your IT administrator about how to obtain a copy of this database.

In Jet format, the data file contains a table named Datos with the following structure (in SQL Server the table is called Datos_<Format>_<Machine>_<Product>):

Field	Jet Data Type	SQL Data Type	Contains
N	Longint	Int autoincrement	Sample number (primary key autoincrement)
Fecha	Date / Time	datetime	Date and time of sample
Turno	Integer	smallint	Corresponding shift
Operador	Text(10)	nvarchar (10)	Operator code
Bitacora	Memo	ntext	Sample Log
Flags	Integer	smallint	Supervision Bits
<Carac1>	Double or Text (14)	float or nvarchar(14)	Value of Characteristic 1
<Carac2>	Double or Text (14)	float or nvarchar(14)	Value of Characteristic 2
<CaracN>	Double or Text (14)	float or nvarchar(14)	Value of Characteristic n

The Log table (or Log_<Format>_<Machine>_<Product> in SQL Server) records modifications, deletion operations or columns eliminations:

Field	Jet Data Type	SQL Data Type	Contains
Date	Date / Time	datetime	Date and time the action was performed.
Usuario	Text (10)	nvarchar(10)	User Code
Accion	Text (250)	nvarchar(250)	Action performed.
Razon	Text (250)	nvarchar(250)	Reason

The Audit table (or Audit_<Format>_<Machine>_<Product> in SQL Server) keeps a copy of deleted records with the same structure as the Datos table.

C.3 Work Files

***Super*CEP® 2016** ® requires the following files for proper operation:

Name	Type	Description
SuperSPC2016.pdf	Help	User's Manual
SCLog.TXT	Log	Development Log
SCEP2016.MDB	Configuration	Configuration Database
SCEPWork.MDB	Configuration	Reporting parameters
IAU\ColoresV.IAU	Configuration	Graphics Colors
IAU\GrafParm.IAU	Configuration	Graphics Parameters
IAU\SeleData.IAU	Configuration	Data Selection
IAU\LastRows.IAU	Configuration	Data Sheet Records Maximum Limit
IAU\Menu.IAU	Configuration	User Menus and RTF editor
IAU\SCDirec.IAU	Configuration	Data Paths
IAU\SCImpre.IAU	Configuration	Graphics printing options
IAU\ScTurn.IAU	Configuration	Work shifts schedule
IAU\SCViewer.IAU	Configuration	Viewers of information
MADConf2016.MDB	Configuration	MAD modules parameters
IAU\MADDirec.IAU	Configuration	MAD modules data path
IAU\ScepPass.IAU	Configuration	Service Password
IAU\ScepHead.RTF	Configuration	Custom Graphics Header
IAU\SCMail.XML	Configuration	Email Definitions
IAU\Caratula1.jpg	Configuration	System Home Image
Image\Planta.jpg	Configuration	Organization Layout
Image\Recepcion.jpg	Configuration	Organization Entrance
Image\Blank.jpg	Configuration	Empty image
Image\User.jpg	Configuration	User picture
Image\Super.jpg	Configuration	Super user picture
TableroSuperCEP.zip	Configuration	SuperSPC Boards Web Site
Tutorial\SCEP2016.MDB	Example	Configuration Database
Tutorial\Image\ABC21.jpg	Example	Image of the product or process
Tutorial\Image\ABC22.jpg	Example	Image of the product or process
Tutorial\Image\ADMI.jpg	Example	Area or station Image
Tutorial\Image\CALI.jpg	Example	Area or station Image
Tutorial\Image\PROD.jpg	Example	Area or station Image
Tutorial\Image\LIN1.jpg	Example	Machine or department Image
Tutorial\Image\LIN2.jpg	Example	Machine or department Image
Tutorial\Image\Contabil.jpg	Example	Machine or department Image
Tutorial\Image\Valida.jpg	Example	Machine or department Image
Tutorial\Image\TORNILLO.BMP	Example	Graphic Information
Tutorial\ABC\LIN1\ABC21.mdb	Example	Sample Data
Tutorial\ABC\LIN1\ABC22.mdb	Example	Sample Data
Tutorial\CPK\VALIDA\ABC22.mdb	Example	Sample Data
Tutorial\EdoRes\Contabil\Operacion.mdb	Example	Sample Data
Tutorial\ISO\VALIDA\ABC22.mdb	Example	Sample Data
Tutorial\Opera\Contabil\Operacion.mdb	Example	Sample Data
Tutorial\PL\VALIDA\ABC22.MDB	Example	Sample Data
Tutorial\QTIPS\VALIDA\AEROCAN.MDB	Example	Sample Data
Tutorial\REGRE\LIN1\ABC21.MDB	Example	Sample Data
Tutorial\TIEMPO\VALIDA\ABC22.MDB	Example	Sample Data
CCC\Ejemplo.xlsx	Example	Excel Quality Certificate
CEP.xlsx	Example	MAD communication with Excel
CEP.mdb	Example	MAD communication with Databases
CEP.htm	Example	MAD communication with HTML
IAU\SC105A2N.IAU	Statistics	Acceptance sampling
IAU\SC1916.IAU	Statistics	Acceptance sampling
IAU\SC414.IAU	Statistics	Acceptance sampling
IAU\SC414B3.IAU	Statistics	Acceptance sampling

IAU\SCACNT.IAU	Statistics	Normal distribution
IAU\SCTAB1A.IAU	Statistics	Acceptance sampling
IAU\SCTAB1B.IAU	Statistics	Acceptance sampling
IAU\SCTAB2.IAU	Statistics	Acceptance sampling
IAU\SCZ19B3.IAU	Statistics	Acceptance sampling
IAU\SCZ19B5.IAU	Statistics	Acceptance sampling
IAU\SCLang.IAU	Dictionary	System
IAU\SCCOMPA.IAU	License	System
MDBBasica.mdb	Template	Sample data
MDBVacia.mdb	Template	Sample data
ScepVacia2016.mdb	Template	Configuration Data
Conv2016.exe	Program	Converter of previous databases
Mad2016.exe	Program	Multiport router
MadExcel2016.exe	Program	MS Excel router
MadHTML2016.exe	Program	Web Page router
MadSQL2016.exe	Program	Data base SQL router
Repair2016.exe	Program	File Repairer
RS232.exe	Program	Serial / Ethernet communication Utilities
Scep2016.exe	Program	Main system
Conv2016.exe.manifest	Program	Modern Style manifest
Mad2016.exe.manifest	Program	Modern Style manifest
MadExcel2016.exe.manifest	Program	Modern Style manifest
MadHTML2016.exe.manifest	Program	Modern Style manifest
MadSQL2016.exe.manifest	Program	Modern Style manifest
Repair2016.exe.manifest	Program	Modern Style manifest
RS232.exe.manifest	Program	Modern Style manifest
Scep2016.exe.manifest	Program	Modern Style manifest
CrystalRPT\SCCAR.Rpt	Report	Characteristics
CrystalRPT\SCCXF.Rpt	Report	Format characteristics
CrystalRPT\SCCXP.Rpt	Report	Product characteristics
CrystalRPT\SCEST.Rpt	Report	Stations
CrystalRPT\SCEXU.Rpt	Report	User Stations
CrystalRPT\SCFRM.Rpt	Report	Formats
CrystalRPT\SCFXP.Rpt	Report	Product Formats
CrystalRPT\SCINS.Rpt	Report	Instruments
CrystalRPT\SCMAQ.Rpt	Report	Machines
CrystalRPT\SCMXE.Rpt	Report	Station Machines
CrystalRPT\SCPRO.Rpt	Report	Products
CrystalRPT\SCPXM.Rpt	Report	Machines Products
CrystalRPT\SCTEX.Rpt	Report	Texts of information
CrystalRPT\SCUSU.Rpt	Report	Users

D. TABLES AND FORMULAS

D.1 Control Charts for Variables:

a. Historical control limits, provisional or initial study. Definition.

$\overline{X} - R$		$\overline{X} - S$	
a1	$LC_{\overline{X}} = \overline{\overline{X}} \pm 3\sigma_{\overline{X}}$	a3	$LC_{\overline{X}} = \overline{\overline{X}} \pm 3\sigma_{\overline{X}}$
a2	$LC_R = \overline{R} \pm 3\sigma_R$	a4	$LC_S = \overline{S} \pm 3\sigma_S$

b. Historical control limits, provisional or initial study. Calculating with estimators.

$\overline{X} - R$		$\overline{X} - S$		$PI - Rm$	
b1	$LC_{\overline{X}} = \overline{\overline{X}} \pm A_2\overline{R}$	b3	$LC_{\overline{X}} = \overline{\overline{X}} \pm A_1\overline{S}$	b5	$LC_{PI} = \overline{PI} \pm E_2\overline{Rm}$
b2	$LSC_R = D_4\overline{R}$ $LIC_R = D_3\overline{R}$	b4	$LSC_S = B_4\overline{S}$ $LIC_S = B_3\overline{S}$	b6	$LSC_{Rm} = D_4\overline{Rm}$ $LIC_{Rm} = D_3\overline{Rm}$

$EWMA - R$		$EWMA - Rm$	
b7	$LC_{EWMA} = \overline{\overline{X}} \pm \frac{\kappa\overline{R}}{d_2\sqrt{n}}\sqrt{\frac{\lambda}{2-\lambda}}$	b9	$LC_{EWMA} = \overline{PI} \pm \frac{\kappa\overline{Rm}}{d_2}\sqrt{\frac{\lambda}{2-\lambda}}$
b8	$LSC_R = D_4\overline{R}$ $LIC_R = D_3\overline{R}$	b10	$LSC_{Rm} = D_4\overline{Rm}$ $LIC_{Rm} = D_3\overline{Rm}$

c. Control limits given, known or standards. Definition.

	$\overline{X} - R$		$\overline{X} - S$
c1	$LC_{\overline{X}} = dados$	c3	$LC_{\overline{X}} = dados$
c2	$LC_R = d_2\sqrt{n}(LSC - LIC)/6 \pm 3\sigma_R$	c4	$LC_S = c_2\sqrt{n}(LSC - LIC)/6 \pm 3\sigma_S$

d. Control limits given, known or standards. Calculating with estimators.

	$\overline{X} - R$ y $PI - Rm$		$\overline{X} - S$
d1	$LC_{\overline{X}} = dados$	d2	$LC_{\overline{X}} = dados$
d3	$LSC_R = D_4\, d_2\sqrt{n}(LSC - LIC)/6$ $LIC_R = D_3\, d_2\sqrt{n}(LSC - LIC)/6$	d4	$LSC_S = B_4\, c_2\sqrt{n}(LSC - LIC)/6$ $LIC_S = B_3\, c_2\sqrt{n}(LSC - LIC)/6$
	$EWMA - R$		$EWMA - Rm$
d5	$LC_{EWMA} = \mu_{dada} \pm \frac{\kappa \overline{R}_{dado}}{d_2\sqrt{n}}\sqrt{\frac{\lambda}{2-\lambda}}$	d7	$LC_{EWMA} = \overline{PI}_{dada} \pm \frac{\kappa \overline{Rm}_{dado}}{d_2}\sqrt{\frac{\lambda}{2-\lambda}}$
d6	$LSC_R = D_4\, d_2\sqrt{n}(LSC - LIC)/6$ $LIC_R = D_3\, d_2\sqrt{n}(LSC - LIC)/6$	d8	$LSC_R = D_4\, d_2\sqrt{n}(LSC - LIC)/6$ $LIC_R = D_3\, d_2\sqrt{n}(LSC - LIC)/6$

e. Development of estimators calculations

To go from a.1 to b.1 & b.5	To go from a.3 to b.3
$\sigma_{\bar{X}} = \sigma' / \sqrt{n}$ $\sigma' = \bar{R} / d_2$ $A_2 = 3 / d_2\sqrt{n}$ $E_2 = 3 / d_2$	$\sigma_{\bar{X}} = \sigma' / \sqrt{n}$ $\sigma' = \bar{S} / c_2$ $A_1 = 3 / c_2\sqrt{n}$
To go from a.2 to b.2 & b.6	**To go from a.4 to b.4**
$\sigma_R = d_3\,\sigma'$ $\sigma' = \bar{R} / d_2$ $D_3 = 1 - 3\frac{d_3}{d_2}$ $D_4 = 1 + 3\frac{d_3}{d_2}$	$\sigma_S = B\sigma'$ $\sigma' = \bar{S} / c_2$ $B_3 = 1 - 3\frac{B}{c_2}$ $B_4 = 1 + 3\frac{B}{c_2}$
To go from a.2 to c.2 & from b.2 to d.2	**To go from a.4 to c.4 & from b.4 to d.4**
$\bar{R} = d_2\,\sigma'$ $\sigma' = \sigma_{\bar{x}}\sqrt{n}$ $\sigma_{\bar{x}} = (LSC - LIC) / 6$	$\bar{S} = c_2\,\sigma'$ $\sigma' = \sigma_{\bar{X}}\sqrt{n}$ $\sigma_{\bar{X}} = (LSC - LIC) / 6$

f. Student's t statistic.

$$t = \frac{\left(\bar{X} - \mu_0\right)}{\left(s / \sqrt{n}\right)}$$

g. Glossary

$\overline{X} - R$	Mean and Range Graph
$\overline{X} - S$	Graph of Means and standard deviations
$PI - Rm$	Individual and moving order 2 ranges Graph
$EWMA - R$	Exponentially Weighted Moving Averages and Ranges Graph
$EWMA - Rm$	Graph of Exponentially Weighted Moving Average and Moving Range of order 2
LC	Control Limits
LSC	Upper control limit
LIC	Lower control limit
n	Subgroup Size
$\overline{X}$	Subgroup Mean
$\overline{\overline{X}}$	Media of the means subgroups
R	Subgroup range
$\overline{R}$	Mean ranges of the subgroups
S	Subgroup standard deviation
$\overline{S}$	Mean standard deviations of the subgroups
PI	Individual data
Rm	Moving range of order 2
σ	Standard deviation
σ'	Standard deviation of the universe
$EWMA$	$EWMA_t = \lambda Y_t + (1-\lambda) EWMA_{t-1}$
μ	Given control Mean
c_2	Estimator universe standard deviation to the mean standard deviation of the subgroups
d_2	Estimator of universe standard deviation to the mean ranges of the subgroups
d_3	Estimator universe standard deviation to the standard deviation of the ranges of the subgroups
B	Estimator universe standard deviation to the standard deviation of the standard deviations of the subgroups
A_1	Facilitator for calculation of means and standard deviations graphic
A_2	Facilitator for calculation of means or individual points and ranges graphs
B_3	Facilitator for calculation of means and standard deviations graphs
B_4	Facilitator for calculation of means and standard deviations graphs
D_3	Facilitator for calculation of means or individual points and ranges graphs
D_4	Facilitator for calculation of means or individual points and ranges graphs
E_2	Facilitator for calculation of individual points and moving ranges graphs
λ	Weighting factor for calculating EWMA
κ	Correction factor 3 sigma (ARL = 370) to calculate EWMA

h. Table of estimators and facilitators

n	c2	d2	d3	A1	A2	B	B3	B4	D3	D4	E2
2	0.5642	1.1280	0.8533	3.7599	1.8806	0.4262	0.0000	3.2664	0.0000	3.2670	2.6596
3	0.7236	1.6930	0.8869	2.3937	1.0231	0.3782	0.0000	2.5682	0.0000	2.5740	
4	0.7979	2.0590	0.8813	1.8799	0.7285	0.3367	0.0000	2.2659	0.0000	2.2820	
5	0.8407	2.3260	0.8644	1.5959	0.5768	0.3053	0.0000	2.0895	0.0000	2.1140	
6	0.8686	2.5340	0.8472	1.4100	0.4833	0.2808	0.0300	1.9700	0.0000	2.0040	
7	0.8882	2.7040	0.8325	1.2766	0.4193	0.2612	0.1176	1.8824	0.0760	1.9240	
8	0.9027	2.8470	0.8199	1.1750	0.3726	0.2452	0.1850	1.8150	0.1360	1.8640	
9	0.9139	2.9700	0.8084	1.0942	0.3367	0.2317	0.2395	1.7605	0.1840	1.8160	
10	0.9227	3.0780	0.7976	1.0282	0.3082	0.2205	0.2830	1.7170	0.2230	1.7770	
11	0.9300	3.1730	0.7872	0.9726	0.2851	0.2102	0.3219	1.6781	0.2560	1.7440	
12	0.9359	3.2580	0.7777	0.9253	0.2658	0.2019	0.3529	1.6471	0.2830	1.7170	
13	0.9410	3.3360	0.7692	0.8842	0.2494	0.1939	0.3818	1.6182	0.3070	1.6930	
14	0.9453	3.4070	0.7617	0.8482	0.2353	0.1870	0.4064	1.5936	0.3280	1.6720	
15	0.9490	3.4720	0.7552	0.8162	0.2231	0.1809	0.4281	1.5719	0.3470	1.6530	
16	0.9523	3.5320	0.7491	0.7876	0.2123	0.1750	0.4487	1.5513	0.3630	1.6370	
17	0.9551	3.5880	0.7434	0.7618	0.2028	0.1702	0.4655	1.5345	0.3780	1.6220	
18	0.9576	3.6400	0.7378	0.7384	0.1943	0.1657	0.4810	1.5190	0.3910	1.6080	
19	0.9599	3.6890	0.7325	0.7170	0.1866	0.1611	0.4964	1.5036	0.4030	1.5970	
20	0.9619	3.7350	0.7278	0.6974	0.1796	0.1573	0.5094	1.4906	0.4150	1.5850	
21	0.9638	3.7780	0.7236	0.6792	0.1733	0.1532	0.5231	1.4769	0.4254	1.5746	
22	0.9655	3.8190	0.7196	0.6625	0.1675	0.1495	0.5354	1.4646	0.4347	1.5653	
23	0.9670	3.8580	0.7152	0.6469	0.1621	0.1464	0.5458	1.4542	0.4438	1.5562	
24	0.9684	3.8950	0.7102	0.6324	0.1572	0.1433	0.5561	1.4439	0.4530	1.5470	
25	0.9696	3.9310	0.7074	0.6188	0.1526	0.1410	0.5638	1.4362	0.4602	1.5398	
30	0.9747	4.0855	0.7040	0.5619	0.1341	0.1287	0.6039	1.3961	0.4830	1.5170	
35	0.9784	4.2134	0.7000	0.5183	0.1204	0.1193	0.6342	1.3658	0.5016	1.4984	
40	0.9812	4.3220	0.6970	0.4835	0.1098	0.1111	0.6604	1.3396	0.5162	1.4838	
45	0.9831	4.4151	0.6951	0.4549	0.1013	0.1059	0.6767	1.3233	0.5277	1.4723	
50	0.9849	4.4982	0.6939	0.4308	0.0943	0.1000	0.6953	1.3047	0.5372	1.4628	
55	0.9900	4.5720	0.6930	0.4086	0.0885	0.0415	0.8744	1.1256	0.5453	1.4547	
60	0.9900	4.6220	0.6914	0.3912	0.0838	0.0569	0.8277	1.1723	0.5512	1.4488	
65	0.9900	4.6720	0.6881	0.3759	0.0796	0.0672	0.7964	1.2036	0.5582	1.4418	
70	0.9900	4.7220	0.6815	0.3622	0.0759	0.0749	0.7729	1.2271	0.5670	1.4330	
75	0.9900	4.7720	0.6702	0.3499	0.0726	0.0810	0.7544	1.2456	0.5787	1.4213	
80	0.9900	4.8220	0.6521	0.3388	0.0696	0.0860	0.7393	1.2607	0.5943	1.4057	
85	0.9900	4.8720	0.6249	0.3287	0.0668	0.0902	0.7267	1.2733	0.6152	1.3848	
90	0.9900	4.9220	0.5864	0.3194	0.0642	0.0937	0.7159	1.2841	0.6426	1.3574	
95	0.9900	4.9720	0.5335	0.3109	0.0619	0.0968	0.7066	1.2934	0.6781	1.3219	
100	0.9900	5.0220	0.4635	0.3030	0.0597	0.0995	0.6985	1.3015	0.7231	1.2769	

D.2. Control Charts for Attributes:

a. Historical control limits, provisional or initial study. Definition.

c		p	
a1	$LC_c = \bar{c} \pm 3\sigma_c$	a2	$LC_p = \bar{p} \pm 3\sigma_p$
np		**u**	
a3	$LC_{np} = \overline{np} \pm 3\sigma_{np}$	a4	$LC_u = \bar{u} \pm 3\sigma_u$

b. Historical control limits, provisional or initial study. Estimators calculation.

c		p	
b1	$LC_c = \bar{c} \pm 3\sqrt{\bar{c}}$	b2	$LC_p = \bar{p} \pm 3\sqrt{\bar{p}(1-\bar{p})/n}$
np		**u**	
b3	$LC_{np} = \overline{np} \pm 3\sqrt{\overline{np}(1-\bar{p})}$	b4	$LC_u = \bar{u} \pm 3\sqrt{\bar{u}/n}$

c. Control limits given, known or standards.

c		p		np		u	
c1	$LC_c = given$	c2	$LC_p = given$	c3	$LC_{np} = given$	c4	$LC_u = given$

d. Development of estimators calculations.

To get from a.1 to b.1	To get from a.2 to b.2
$\sigma_c = \sqrt{\bar{c}}$	$\sigma_p = \sqrt{\bar{p}\left(1-\bar{p}\right)/n}$
To get from a.3 to b.3	**To get from a.4 to b.4**
$\sigma_{np} = \sqrt{\overline{np}\left(1-\bar{p}\right)}$	$\sigma_u = \sqrt{\bar{u}/n}$

e. Glossary

n	Sample Size
c	Number of nonconformities or defects
$\bar{c}$	Defects Average
p	Fraction nonconforming or defective
$\bar{p}$	Average fraction defective
np	Number of non-conforming or defective
$\overline{np}$	Average defective
u	Nonconformities or defects per unit
$\bar{u}$	Average defects per unit
LC	Control Limits
σ	Standard Deviation

D.3. Frequency distribution and Process Capability:

a. Performance Index

$$\overline{\overline{X}} = \left(\sum x\right) / n$$

$$s = \sqrt{\sum \left(\overline{\overline{X}} - x\right)^2 / (n-1)}$$

$$Pp = \frac{LSE - LIE}{2n_\sigma s}$$

$$z_{INF} = \left(\overline{\overline{X}} - LIE\right) / s$$

$$z_{SUP} = \left(LSE - \overline{\overline{X}}\right) / s$$

$$Ppk = \frac{min\left[z_{INF}, z_{SUP}\right]}{n_\sigma}$$

b. Capacity Index (grouped data)

$$\overline{\overline{X}} = \left(\sum x\right) / n$$

$$s = \overline{R} / d_2$$

$$Cp = \frac{LSE - LIE}{2n_\sigma s}$$

$$z_{INF} = \left(\overline{\overline{X}} - LIE\right) / s$$

$$z_{SUP} = \left(LSE - \overline{\overline{X}}\right) / s$$

$$Cpk = \frac{min\left[z_{INF}, z_{SUP}\right]}{n_\sigma}$$

c. Taguchi's Capacity Index

$$\overline{\overline{X}} = \left(\sum x\right) / n$$

$$\sigma = \overline{R} / d_2$$

$$MSD(\tau) = \sigma^2 + (\overline{\overline{X}} - \tau)^2$$

$$Cpm = \frac{LSE - LIE}{2n_\sigma \sqrt{MSD(\tau)}}$$

$$z_{INF} = \left(\overline{\overline{X}} - LIE\right) / \sqrt{MSD(\tau)}$$

$$z_{SUP} = \left(LSE - \overline{\overline{X}}\right) / \sqrt{MSD(\tau)}$$

$$Cpmk = \frac{\min\left[z_{INF}, z_{SUP}\right]}{n_\sigma}$$

d. Percentages outside specification of a normal distribution

Z	+0.0	+0.2	+0.4	+0.6	+0.8
-6.0	100.00000	100.00000	100.00000	100.00000	99.99999
-5.0	99.99997	99.99992	99.99979	99.99946	99.99867
-4.0	99.99680	99.99280	99.98410	99.96600	99.93100
-3.0	99.86500	99.74400	99.53000	99.18000	98.61000
-2.0	97.72000	96.41000	94.52000	91.92000	88.49000
-1.0	84.13000	78.81000	72.58000	65.54000	57.93000
0.0	50.00000	42.07000	34.46000	27.42000	21.19000
1.0	15.87000	11.51000	8.08000	5.48000	3.59000
2.0	2.28000	1.39000	0.82000	0.47000	0.25600
3.0	0.13500	0.06900	0.03400	0.01590	0.00720
4.0	0.00320	0.00133	0.00054	0.00021	0.00008
5.0	0.00003	0.00001	0.00000	0.00000	0.00000
6.0	0.00000				

This table was extracted from the inner table of the system which has a resolution 20 times higher and a linear interpolation mechanism.

e. Bias and kurtosis

$$\overline{\overline{X}} = \left(\sum x\right) / n$$

$$\overline{X^2} = \left(\sum x^2\right) / n$$

$$\overline{X^3} = \left(\sum x^3\right) / n$$

$$\overline{X^4} = \left(\sum x^4\right) / n$$

$$Mo_2 = \overline{X^2} - \overline{\overline{X}}^2$$

$$Mo_3 = \overline{X^3} - 3\overline{\overline{X}}\,\overline{X^2} + 2\overline{\overline{X}}^3$$

$$Mo_4 = \overline{X^4} - 4\overline{\overline{X}}\,\overline{X^3} + 6\overline{\overline{X}}^2\,\overline{X^2} - 3\overline{\overline{X}}^4$$

$$Sk = \frac{Mo_3}{\sqrt[3]{Mo_2^2}}$$

$$Ku = \frac{Mo_4}{Mo_2^2} - 3$$

f. Normality Test Anderson-Darling

Result	The data are from a normal distribution	Certainty
A^2 mod > 1.159	No	99.5% probability
A^2 mod > 1.035	No	99.0% probability
A^2 mod > 0.873	No	97.5% probabilty
A^2 mod > 0.752	No	95.0% probability
A^2 mod > 0.631	No	90.0% probability
A^2 mod <= 0.631	Yes	

g. Minimum correlation coefficients for cumulative frequency linear fit (Ryan-Joiner 90% Normality Test)

Number of intervals	Minimum coefficient
5 to 9	0.9033
10 to 14	0.9347
15 to 19	0.9506
20 to 24	0.9600
25 to 29	0.9662
30 to 39	0.9707
40 to 49	0.9767
50 to 59	0.9807
60 to 74	0.9835
75 or more	0.9865

h. Glossary

x	Individual sample
n	Sample Size
$\overline{\overline{X}}$	Sample media
s	Sample standard deviation
LSE	Upper specification limit
LIE	Lower specification limit
z_{INF}	Standardized distance from the media to the lower specification limit
z_{SUP}	Standardized distance from the middle to the upper specification limit
n_σ	Standardized units of each side of the media used as a reference for the calculation of the indexes of capacity and ability.
Pp	Potential process capacity index for ungrouped data
Ppk	Process capability index for ungrouped data
$\overline{R}$	Average range of subgroups
d_2	Estimator of universe standard deviation to the media ranges subgroups
Cp	Potential process index for grouped data
Cpk	Process capability index for grouped data
τ	Target Value
$\sqrt{MSD(\tau)}$	Radius of Gyration around the Target
Cpm	Taguchi's Capacity Index for grouped data
$Cpmk$	Taguchi's Capability Index for grouped data
Mo_2	Second-order momento
Mo_3	Third order momento
Mo_4	Fourth-order momento
Sk	Bias
Ku	Kurtosis

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