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Processing Data from Automatic Measurement Device

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Abstract

This article deals with the problem of automated data processing in automotive industry. Correct and productive control has an unprecedented importance and this area of Metrology is very intensively developed at the present. Researchers at University of West Bohemia in cooperation with company Astro-Kovo Plzeň developed progressive measuring device "Astro-box", which allows highly progressive automatic control simple parts mass and mass production. The article contains a brief presentation of the CMM measuring unit along with reasons its use of this unit. The authors also present possibilities the location measuring device in real production conditions through environmental box. The main part of the paper, however, deals with the transfer of large amounts of data acquired in the automatic mode of the machine. This data may be used locally for basic binary analysis, or transmit through protocols in order complex statistical analysis required in the automotive industry.

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Keywords: Data Processing; Equator; Measuring unit

1. Introduction

Surface integrity nowadays takes unprecedented importance. University of West Bohemia and company Astro-Kovo Plzeň s.r.o. monitor especially geometric parameters, tolerances of form and position. For control of these parameters is determining the number of options. One option is to manually check according to predefined procedures. Next, highly developing variants take place using the 3D measuring device (CMM) [5].

In the days before automation applications the company was forced to invest a lot of time to 100% control of the parts that automotive customers typically require. The company until 2012 used manual measurements for 100%

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inspection of parts. Since 2012, Astro transferred to the automated control by using a 3D measuring device Equator from Renichaw [1].

Implementation of the new software allowed upgrade the device to the required level of work with the data obtained in the automatic mode. Till the final version of operating SW, none of the programs supplied with the device, allow high-level statistic evaluation. Nowadays, however, necessary to use the maximum capabilities of the device, which the company has available, and therefore was established a team of experts who will solve this issue [3].

2. Measuring device

Why Renishaw Equator? When selecting, assessing and current possibilities of CMM on the market, any of them offer flexibility, used friendliness, performance measurement per unit of time. But only Equator has ability to work in automatic mode, for which the device is very well prepared. It devalues competitors in 3D measuring with the unique architecture, based on the parallel kinematics.

Automatic mode allows 100% control of the entire volume of parts of production. After comparison with the standard it can evaluate whether the measured piece is good or bad and display outputs on the control screen. The basic principle of the measurement process is based on comparing inspection = comparison measured part to the "golden" or etalon. "Golden" part is the one that is made as a model for mastering = initial setup of parameters before or during the measurement, temperature change, achieving limit number of checked items, or the expiry of the time limit, the setting, etc. [2].

2.1. Placement of the device

A great advantage of the device is that it theoretically does not require constant climatic conditions. The device can be placed in the air-conditioned space enclosed fence area in metrology lab, so it can work in space without air-condition directly at the production hall where the temperature is still changing. This placement allows the characteristics of the device when you change the temperature in the interval of the value entered by the user, the surrounding area or parts alone will require a new re-mastered. Current test device is placed in the measuring box with air conditioning directly in the production hall. This placement simplifies parts handling.

Fig. 1.Measuring device Equator [5].

2.2. Measuring box

Measuring box (AstroBox) is fully automated measuring station for non-stop measuring without affecting by the human factor. Box is made out in excellent design quality that makes AstroBox admiration of all customers. When using the products, to ensure the required 100% inspection of all parts.Circle of potential users, and thus the possibility of wider application device provides the ability to control not only for metal parts, but also for parts made of plastics, ceramics, etc.Astrobox measuring device is (after changing sensor unit) also suitable for measuring very small parameters such a micro-geometry of cutting tools. It was, among others, successfully tested in laboratories at the University of West Bohemia in Pilsen. Measured parameters and experimental details are given in the article [8].

Fig. 2.AstroBox [5].

3. Data analysis in the automatic mode

For the processing of the measured data is currently not possible to use factory Renishaw SW. This SW can only evaluate whether the part is within tolerance or out of tolerance, output results on the display (see Figure 3) and store the data in PDF file. This file format can be very difficult to process further. Because of these weaknesses there have been taken steps to improve in this area already. It was created custom software that can read data from a bar code placed on pallets on which parts are delivered to the space of AstroBox. The aim was to obtain information, which worker manufactured the product and evaluate data of good / bad pieces with regard to the individual worker and the display on the screen (see Figure 3). However, even this was not enough.

Fig. 3. Screen Control PC [2].

3.1. Data processing program

In the beginning of the searching for solutions, it was important to focus on changing the format of data storage obtained from the Equator. The file format to be able to use many types of file formats such as: PDF, CSV, RTF, RES, XML, OUT, etc. Company used PDF format file. This format is however not suitable for further processing of the data stored in it. Therefore, it was chosen to create a custom SW for processing other format of stored data. It was elected .CSV file storage format. In this format, the data can be converted to any other program thus change the format of the data.

For own work with the data was elected MS EXCEL program. It allows processing of large amounts of data, because for each type of part has several parameters measured. When storing the data obtained from the measurement is assumed to use one .CSV file for one type of part. The processing of the data is performed after loading in MS Excel.

The form of the stored data in the CSV file is written. This form is given directly by the commands in the source code for the measurement of test pieces that were added to the measurement program.

Own work with the program for data processing is simple. After the initial start of the program for data processing booted into a form that can be seen in Figure 5 offers in the form of pre-prepared, but blank table to retrieve data, through which the user opens the form by which the entire data processing is carried out.

Custom form in Figure 6 is used for simple and centralized control of the entire data processing, using macros, which are usually hidden under the buttons that are on the user form.

The first step in the initiation of data processing must be launched MS Excel, in which it is first necessary to always announced after booting to retrieve information form to be processed. Then one of the generated CSV files. This is done with buttons, load the data. Under which is concealed a macro that you can see in the excerpt in Figure 7, using commands hidden in it converts the data from the form into a CSV file, which you can see in figure 8 in the data processing. Additionally, this macro commands for the evaluation of individual items measured in terms of the number of parts in tolerance and inter tolerance and to find and call a critical value. After running the entire macro will return to the screen a user form which is filled with informatics gathered during the initial load data, see Figure 8. We now have data in the and partially canned for further processing.

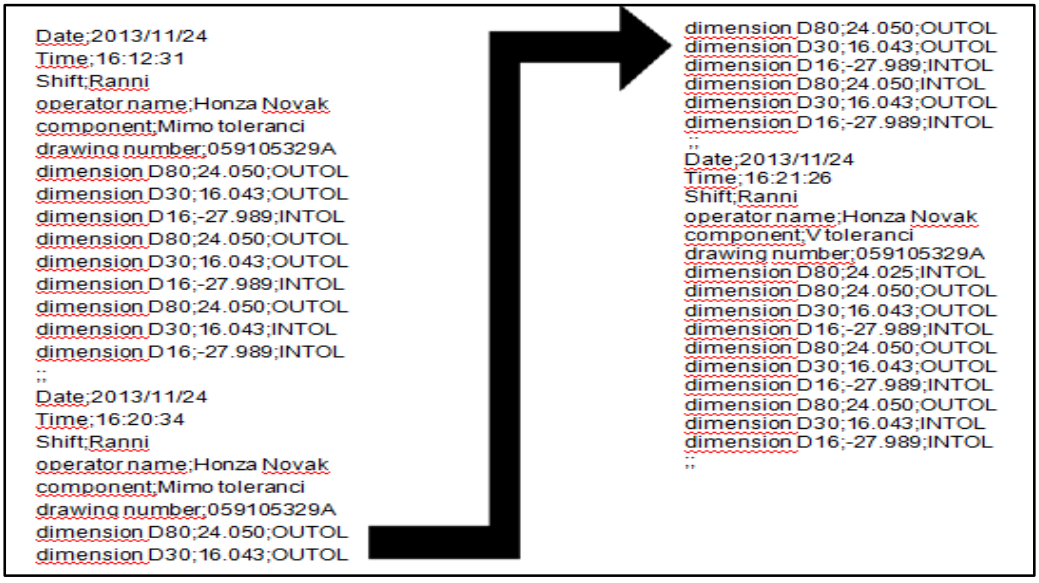


Fig. 4. Form data in the CSV file saved.

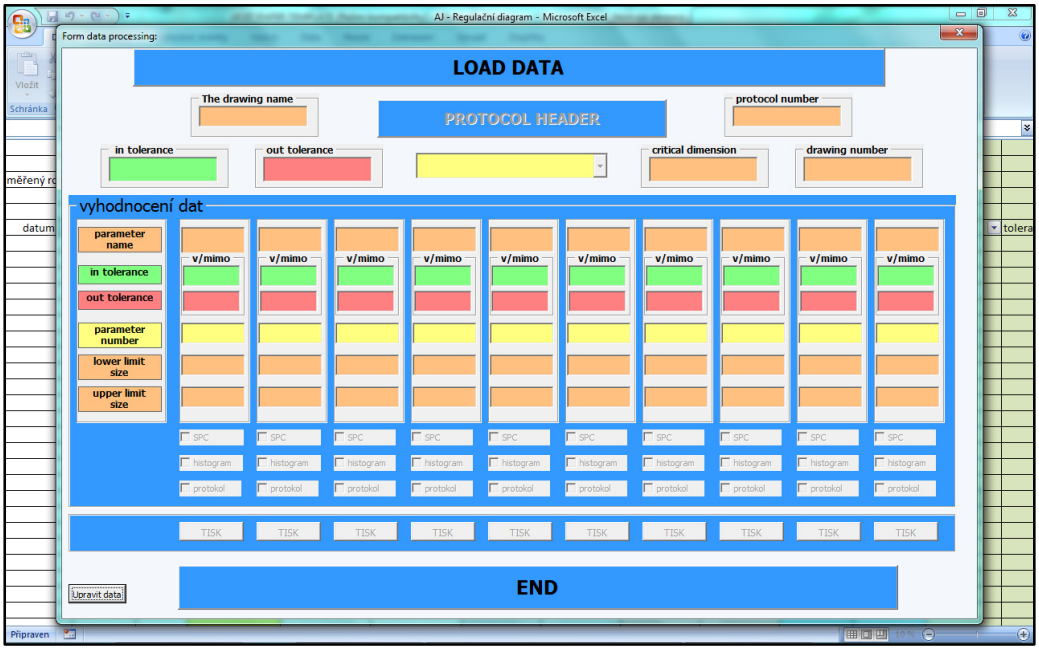
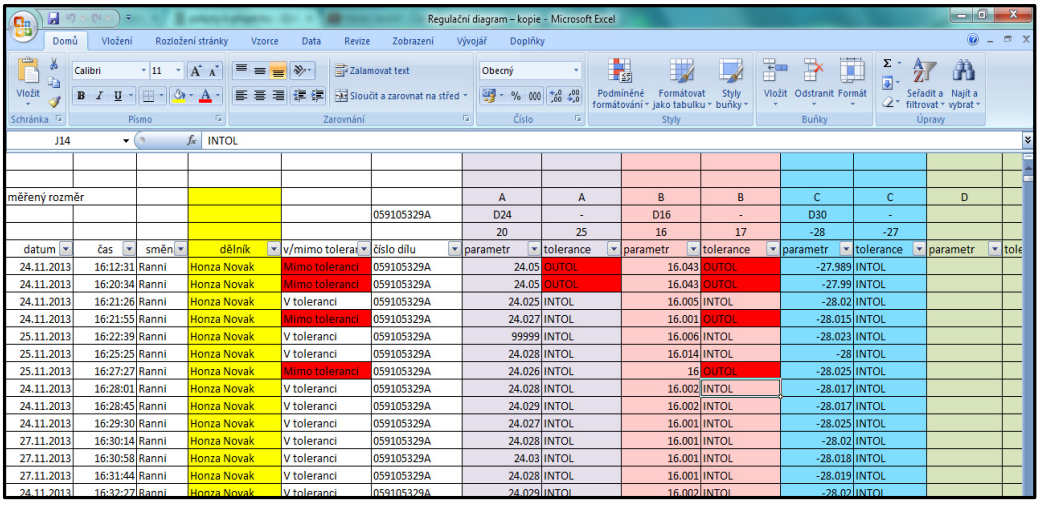


Fig. 5. Custom form control data processing.



měřený rozměr						A	A	B	B	C	C	D	
					059105329A	D24	-	D16	-	D30	-		
						20	25	16	17	-28	-27		
datum	čas	směn	dělník	v/mimo toleran	číslo dílu	parametr	tolerance	parametr	tolerance	parametr	tolerance	parametr	tole
24.11.2013	16:12:31	Ranni	Honza Novak	Mimo toleranci	059105329A	24.05	OUTOL	16.043	OUTOL	-27.989	INTOL		
24.11.2013	16:20:34	Ranni	Honza Novak	Mimo toleranci	059105329A	24.05	OUTOL	16.043	OUTOL	-27.99	INTOL		
24.11.2013	16:21:26	Ranni	Honza Novak	V toleranci	059105329A	24.025	INTOL	16.005	INTOL	-28.02	INTOL		
24.11.2013	16:21:55	Ranni	Honza Novak	Mimo toleranci	059105329A	24.027	INTOL	16.001	OUTOL	-28.015	INTOL		
25.11.2013	16:22:39	Ranni	Honza Novak	V toleranci	059105329A	99999	INTOL	16.006	INTOL	-28.023	INTOL		
25.11.2013	16:25:25	Ranni	Honza Novak	V toleranci	059105329A	24.028	INTOL	16.014	INTOL	-28	INTOL		
25.11.2013	16:27:27	Ranni	Honza Novak	Mimo toleranci	059105329A	24.026	INTOL	16	OUTOL	-28.025	INTOL		
24.11.2013	16:28:01	Ranni	Honza Novak	V toleranci	059105329A	24.028	INTOL	16.002	INTOL	-28.017	INTOL		
24.11.2013	16:28:45	Ranni	Honza Novak	V toleranci	059105329A	24.029	INTOL	16.002	INTOL	-28.017	INTOL		
24.11.2013	16:29:30	Ranni	Honza Novak	V toleranci	059105329A	24.027	INTOL	16.001	INTOL	-28.025	INTOL		
27.11.2013	16:30:14	Ranni	Honza Novak	V toleranci	059105329A	24.028	INTOL	16.001	INTOL	-28.02	INTOL		
27.11.2013	16:30:58	Ranni	Honza Novak	V toleranci	059105329A	24.03	INTOL	16.001	INTOL	-28.018	INTOL		
27.11.2013	16:31:44	Ranni	Honza Novak	V toleranci	059105329A	24.028	INTOL	16.001	INTOL	-28.019	INTOL		
24.11.2013	16:32:27	Ranni	Honza Novak	V toleranci	059105329A	24.029	INTOL	16.002	INTOL	-28.02	INTOL		

Fig. 6. The form of the data transfer using a macro.

The second step is to select a date (Figure 8 marked with the letter A) for which filters the data. Compare the filtered data to be processed.

The actual processing is performed only after the check of buttons below the corresponding parameter (in Figure 8, marked with the letter B). Again, the processing is done from the ground below the buttons that are hidden macros with these commands.

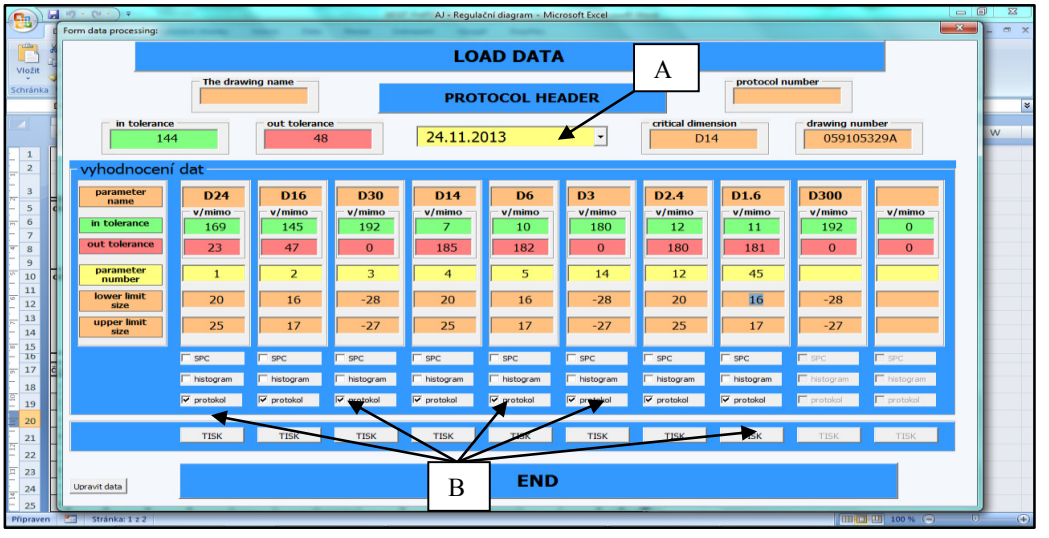


Fig. 7. The completed form ready for further processing.

3.2. Data processing outputs

The output from the data processing report page is a report that is filled directly from the already well-known user form and using the protocol. This is when clicked opens over the original user form another, which is used to fill the report page header and adding information which are necessary to interpret the data, but to uniquely identify reports of measurements so. The form of the form shown in Figure 9 to the appropriate position in the report header

of measurement, see Figure 10 The Protocol Company supplies its customers to demonstrate control measurement.

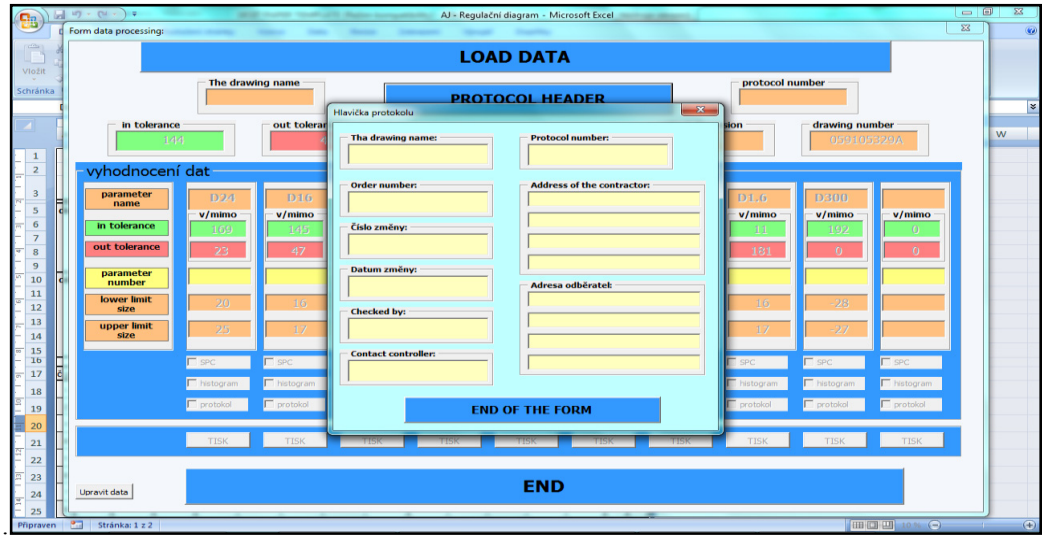


Fig. 8. User form to supplement the information in the log.

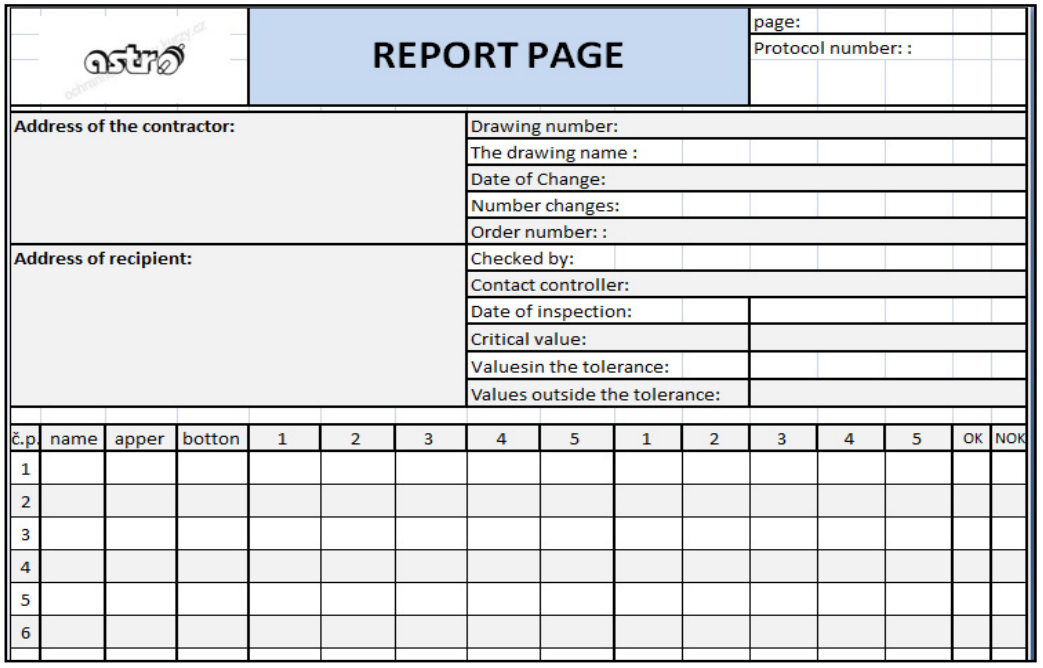


Fig. 9. Report Page.

Information that must be specified to determine are:

- Critical value
- Assessment of the number of parts in tolerance and out of tolerance

- Value indices cp and cpk
- Protocol for the first 5 values from the set of the day

Additional data are required, but not with every message of measurement, it is the distribution of parts in the tolerance field histogram. Thus, the process, and all this can be evaluated by researchers, relays, series, benefits, etc. Everything is in final form appears in the minutes of measurement, which is issued every day. Once created, again using a macro sends email to the person responsible. Data in the report is displayed by selecting the check boxes on a user form after the initial launch of the program for data processing [7].

4. Conclusion

The current time is in the business environment characterized by extreme pressure to guarantee product quality. Manufacturers in the automotive industry, where fall in to company are pushed to a maximum of 5ppm were out of tolerance production, which is very difficult to achieve and maintain, but it works“. It is important to know that the bad parts will be always producing, but must not get to the customer"! (Words of Mr. Dusek owner and CEO of Astro-Kovo Plzeň s.r.o.)

Astrobox originally allowed only simple sorting products within statistical sampling to good and bad pieces. That in itself was sufficient progress and streamlining control process. The aim of the research was originally prepared-machine interface for the preparation of a deeper analysis of the results. In the next step, so it was necessary to connect the control module software to the area of statistical treatment of advanced applications development and quality management tools. For the near future it is planned replacement of Microsoft interface by interface to the Linux or web-based. It should allow in the future and advanced remote management of Astrobox including complex diagnostic of controlled manufacturing process.

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