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(54) Title: THE USE OF A GRAPH IN A PROCESS CONTROL SYSTEM FOR DISPLAYING A PHYSICAL PROPERTY OF A PROCESS CONTROLLED BY THE SYSTEM

(57) Abstract: An operator terminal in a process control system obtains measurement data related to a physical property of a process controlled by the system, where the measurement data comprises data obtained at different points in time during the control, displays a current value (43) of the physical property at a corresponding level in a graph (36), which current value is obtained via a current piece of measurement data and where physical property value levels below the current value level are displayed with a first colour (40) and physical property value levels above the current value level are displayed with a second colour (38) and displays at least one historical value (44, 46, 48) of the physical property at a corresponding physical property level in the graph as a variation of the colour (38) in the part of the graph where the historical physical property value is displayed.



**THE USE OF A GRAPH IN A PROCESS CONTROL SYSTEM FOR DISPLAYING A PHYSICAL
PROPERTY OF A PROCESS CONTROLLED BY THE SYSTEM**

FIELD OF INVENTION

5 The present invention generally relates to displaying
process control data in a process control system. More
particularly the present invention relates to a method
and computer program product for economical displaying
of data in a process control system as well as to an
10 operator terminal in the process control system.

BACKGROUND

Process control systems can be complex and comprise a
15 number of different interfaces to the process. These
interfaces can provide data that is directly related to
the process, like for instance the current in a power
line or the temperature of pulp being made into paper.
However, these interfaces can also provide data
20 relating to the interface itself, for instance the
temperature of the interface itself. Interfaces can
furthermore perform control activities in relation to
the process, like for instance opening and closing of
valves.

25 In such processes it is then often important that the
process itself can be visualized. It is also important
that data such as different physical properties
relating to the process as well as system element
30 status data is visualized. This is a lot of data that
may be needed to be displayed on an operator terminal.

When a multitude of data is displayed, there is a problem in that the view presented may be cluttered, i.e. that the view which a system operator observes, includes so many different details that it may be hard
5 to discern vital data, for instance in relation to alarms. The view thus often needs to be simplified. However, it is at the same time important that no important data is lost.

10 This is an ongoing challenge when providing operator terminals in process control systems. As can thus be seen, there is a need for simplified views that limit cluttering.

15 There have previously been made some efforts in relation to bar graphs.

US 2009/0113295 does for instance describe a bar graph where current data is displayed together with rate of
20 change and direction of change data. This is done through providing an arrow with variable length that can be combined with a current data indicator. The document also discusses the use of shading and brightness for indicating special indicia, such as
25 alarm zones.

Bar graphs have also been used in other technical fields.

30 US 6,100,887 does for instance describe a bar graph that has a progress indicator changing color in a direction when the downloading of a computer program

has been completed and changing color in another direction when a computer program has been removed.

US 2010/0251151 describes a bar graph for a statistical
5 report, where the bar graph can be magnified.

However, there is still room for improvement in the condensing of displaying data relating to a physical property in process control systems using bar graphs.

10

SUMMARY OF THE INVENTION

The present invention is directed towards condensing the data relating to a physical property that is
15 displayed in a graph of a process control system.

One object of the present invention is to provide a method for economical displaying of data in a process control system, which method displays data relating to
20 a physical property in the process control system in a condensed way.

This object is according to a first aspect of the present invention achieved through a method for
25 economical displaying of data in a process control system comprising the steps of:
obtaining measurement data related to a physical property in a process controlled by the process control system, where the measurement data comprises data
30 obtained at different points in time during the control of the process,
displaying a current value of the physical property at a corresponding level in a graph, which current value

is obtained via a current piece of measurement data and where physical property value levels below the level of the current value are displayed with a first colour and physical property value levels above the level of the
5 current value are displayed with a second colour, and displaying at least one historical value of the physical property at a corresponding level in the graph as a variation of the colour in the part of the graph where the historical physical property value is
10 displayed.

Another object of the present invention is to provide an operator terminal in a process control system, which displays data relating to a physical property in a
15 condensed way.

This object is according to a second aspect of the present invention achieved through an operator terminal in a process control system comprising:
20 an interface for receiving measurement data of one or more physical properties relating to a process being controlled by the process control system,
a display unit for displaying physical properties of the process control system to a system operator, and
25 a display control unit configured to
 obtain measurement data related to a physical property of the process, where the measurement data comprises data obtained at different points in time during the control of the process,
30 control the display unit to display a current value of the physical property at a corresponding level in a graph, which current value is obtained via a current piece of measurement data and where physical

property value levels below the level of the current value are displayed with a first colour and physical property value levels above the level of the current value are displayed with a second colour, and
5 control the display unit to display at least one historical value of the physical property at a corresponding physical property level in the graph as a variation of the colour in the part of the graph where the historical physical property value
10 is displayed.

Another object of the present invention is to provide a computer program product for economical displaying of data in a process control system, which displays the
15 data relating to a physical property in a condensed way.

This object is achieved by a computer program product for economical displaying of data in a process control
20 system,
the computer program product comprising a data carrier with computer program code which when run on a processor forming a display control unit of an operator terminal, causes the display control unit to:
25 obtain measurement data related to a physical property of a process controlled by the process control system, where the measurement data comprises data obtained at different points in time during the control of the process,
30 control a display unit of the operator terminal to display a current value of the physical property at a corresponding level in a graph, which current value is obtained via a current piece of measurement data and

where physical property value levels below the level of the current value are displayed with a first colour and physical property value levels above the level of the current value are displayed with a second colour, and
5 control the display unit to display at least one historical value of the physical property at a corresponding level in the graph as a variation of the colour in the part of the graph where the historical physical property value is displayed.

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The present invention has a number of advantages. An operator can directly and intuitively get an understanding of the direction in which the values of the physical properties are changed. Furthermore,

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because of the colour variation scheme used, the operator can also directly and intuitively get an understanding of the rate of change of the physical property. This is achieved without providing any further indicators to the graph that requires space.

20

This means that the graph can provide a large amount of information in an economical fashion. This also means that display area is freed up for other uses, where one use is not to display anything at all in order to avoid cluttering of an overview of the process. This can also
25 be used to save energy, in that these parts of the display unit, which do not have to be used, can be the turned off.

BRIEF DESCRIPTION OF THE DRAWINGS

30

The present invention will in the following be described with reference being made to the accompanying drawings, where

fig. 1 schematically shows a process control system for controlling a process,
fig. 2 shows a block schematic of an operator terminal
5 in the process control system,
fig. 3 schematically shows a bar graph displaying data according to a first variation of the invention,
fig. 4 schematically shows a bar graph displaying data according to a second variation of the invention,
10 fig. 5 schematically shows a flow chart including a number of method steps in a method for economical displaying of data in the process control system and being performed by the operator terminal, and
fig. 6 schematically shows a data carrier carrying
15 program code for implementing a display control unit of the operator terminal.

DETAILED DESCRIPTION OF THE INVENTION

20 In the following, a detailed description of preferred embodiments of the invention will be given.

Fig. 1 schematically shows a control system 10 for a process 28, i.e. a process control system. The process
25 28 may be an industrial process and may furthermore be any of a number of different types of processes such as a pulp and paper production process, an oil refining process, an electric power transmission process or an electric power distribution process. The control system
30 10 may for instance be an object based computerised system for controlling the process 28.

In fig. 1 the process control system 10 includes a number of operator terminals 12 and 14 connected to a first bus B1. There is furthermore a second bus B2 and between the first and second busses there are connected
5 a server 16 providing control and monitoring of the process 28 and a database 18 where data, like historical data relating to control and monitoring of the process 28 is stored. To the second bus B2 there are furthermore connected process interface units 20,
10 22, 24 and 26 for providing control of the process and for receiving measurement data from the process 28. In the figure there are provided four such process interface units 20, 22, 24 and 26 that interfaces the process 28. It should however be realized that there
15 may be more or fewer of each of these units. It should here also be realized that some of these may only be provided for control, some only for measurements and some for both control and measurements. Such units are thus all involved in controlling the process 28 and in
20 doing this also involved in measuring physical properties related to the process. The measured properties may here be properties of the process itself such as a voltage of or current running in a power line or the pulp temperature of a pulp and paper process.
25 However the measured properties may also be properties of an interface unit, like for instance the temperature of a transformer. The process interface units 20, 22, 24 and 26 therefore also provide information on their on properties or status.

30

An operator terminal 12, shown in fig. 2, in a process control system 10 includes a user input unit 32, a display unit 34, a display control unit 30 and an

interface 36 for communicating with the other parts of the process control system 10 via the first bus B1. An operator terminal provides a graphical user interface for an operator of the system. The control unit 30 may
5 be a processor with an associated program memory including program code for performing the functionality of the present invention, which will be described later on. The display unit 34 may be any suitable display unit, such as a liquid crystal display. The user input
10 unit 32 is a unit through which a user of the operator terminal 12, i.e. an operator, may enter data. As such it may be a keyboard, a keypad or a mouse. It may also be combined with the display unit in order to together form a touch screen. The operator terminal 12 may also
15 include other user interfaces such as a speaker or a microphone in order to present and receive data to and from one or more users of the operator terminal in other ways than through the display unit.

20 Data from the various process interfaces can be collected and stored in a history data base 18 as well as presented in real-time to an operator via the display unit 34.

25 The operator terminal 12 in the process control system 10 may present data regarding the process in a number of different ways. It may present the process through a number of interconnected process control units, which process control units may include process interface
30 units. However they may also include other units where the process is carried out but no measurements are being made or no control is carried out. Along with these units the operator terminal may furthermore

display data relating to the process as well as to the process control units, such data may be measurement data of a physical property of the process and/or of process interface units. The data may also include data
5 of a physical property that has been derived from a measured physical property. The data may furthermore include status data of various units in the system.

In such a process control system it is then often
10 important that the process itself can be visualized in a view together with process control units. It is also important that different physical properties as well as process control unit status data is visualized. Furthermore, a system may be complex and include a
15 number of interconnected process control units. This together with there being a lot of data that may be needed to be displayed may clutter the view so that the overview is of the system hard for an operator to gather.

20

When a multitude of data is displayed, there is thus a problem in that the view presented may be cluttered, i.e. that the view of the operator includes so many different details that it may be hard to get an overall
25 understanding of the functioning of the process. This may cause an operator to make bad decisions, for instance in relation to alarms. This can be fatal because an operator may accidentally miss a serious alarm or fail to understand the consequences of it. The
30 view thus needs to be simplified. However, it is at the same time important that important data is retained.

This is an ongoing challenge when providing operator terminals in process control systems. As can thus be seen, there is a need for simplified views that limit cluttering, however without taking away necessary data.

- 5 There is therefore a need for displaying data more economically or more condensed.

One type of data displaying element is the graph. A graph, like a bar graph, is helpful in that it can
10 provide the operator in a process control system an immediate understanding of the level of a current value of a physical property and if this level is normal or not. The physical property may, as was mentioned before, be a physical property of a process control
15 unit or of the process itself. However, it is often of interest to, apart from the current value, also display historical values, i.e. older values of the physical property. This may be helpful for the operator in identifying how fast the values of the property are
20 changing and in what direction. It would however be of interest to display such data in a more economical fashion, i.e. in a way that does not enlarge the graph or the environment in which the graph is displayed, for instance in order to avoid cluttering. Here it may also
25 be advantageous if the historical data is also presented in a manner that allows the operator to get an immediate understanding of the significance of the historical data. The economical display of data provides a more efficient display use, i.e. a smaller
30 display area is used. This frees up display area for other uses, like for displaying more data. A freed area does not need to have further data displayed on it, in

which case it may be shut off and thereby allow energy to be saved.

The present invention is directed towards solving one
5 or more of these problems.

Fig. 3 shows an element 35 in the process being displayed on the display of the operator terminal. On this element 35 there is shown a graph 36, which in
10 this example is a bar graph. The bar graph 36 is scaled, which scale is as an example between 0 and 100. The bar graph also has a current value presenter 42, here in the form of an arrow pointing at the top of a bar 40 in the bar graph. The current value presenter 42
15 presents a current value 43 of a physical property associated with the element 35 at a corresponding level in the bar graph 36. Physical property value levels below the level of the current value 43 are displayed with a first colour 40, here a dark colour. The first
20 colour 40, is thus the colour of the bar. Physical property value levels above the level of the current value 43 are displayed with a second colour 38 here a light colour, like white. Thus physical property value levels below the current value on the scale will in
25 principle have the first colour 40 and physical property value levels above the current value 43 on the scale will in principle have the second colour 38. There is here furthermore a latest historical physical property value 44 being higher than the current value,
30 a second latest historical physical property value 46 being higher than the latest historical physical property value 44 and a third latest historical physical property value 48 being higher than the second

latest historical physical property value 46. These are all being displayed in the graph through variations of the colour in the part of the graph where they are provided, and here thus as colour variations of the
5 second colour 38, which is a variation of the background colour. In this way there is a presentation of the difference in level between the current and historical values. However, there is also a presentation of the difference in time. Here the newest
10 value has the highest degree of variation and the oldest the smallest degree of variation. The variation is here also a variation towards a darker colour than the second colour 38.

15 Fig.4 shows the same type of view as fig. 3. One difference from fig. 3 is that the historical values 50 52 and 54 are lower than the current value presented by the current value presenter 42. Another is that there are more historical values. There is a latest
20 historical physical property value 50 being lower than the current value 43, a second latest historical physical property value 52 being lower than the latest historical physical property value 50, a third latest historical physical property value 54 being lower than
25 the second latest historical physical property value 52 and a fourth latest historical physical property value 55 being lower than the third latest historical physical property value 54. These are all being displayed in the graph as variations of the colour in
30 the part of the graph where they are provided, and here thus as colour variations of the first colour 40, i.e. as variations of the colour used for indicating the current level of the physical property. As before, it

is the difference in time of values that is presented with a colour variation. Also here the newest value 50 has the highest degree of variation and the oldest 55 the smallest degree of variation. The variation is here also a variation towards a darker colour than the first colour 40. Another difference from fig. 1 is that the bar graph is provided with a lower alarm zone 56 in the lower end of the scale 36 and a higher alarm zone at the higher end of the scale. Here the upper end of the lower alarm zone 56 provides a lower alarm limit and the lower end of the upper alarm zone 58 provides an upper alarm limit.

The invention will in the following be described in more detail with reference being made to the previously mentioned figures 1 - 4 as well as to fig. 5, which shows a flow chart including a number of method steps in a method for economical displaying of data in the process control system and being performed by the operator terminal 12.

In the exemplifying process control system 10 the process interface units 20, 22, 24 and 26 provide measurement data to the first server 16, which performs control and monitoring of the process. However, this server 16 also provides the data, which is current data, to the operator terminals 12 and 14. These operator terminals 12 and 14 do furthermore also obtain historical data i.e. previous measurement data or data samples from the database 18. In this case a first of the interface units 20 is a unit obtaining measurements of a physical property of the process. As an example this unit may be the sensor in a tank filled with fluid

and the sensor provides temperature measurements. These measurements are provided to the server 16 for control and monitoring, which server 16 may also provide them to the operator terminal 12. The measurements are also
5 provided to the database 18, which thus holds historical data of the temperature measurements. The measurements are here typically measurements obtained at discrete and equidistant consecutive points in time, i.e. as data samples of the process.

10

The current measurement data is then provided from the server 16 to the operator terminal 12 and the older or previous measurement data provided to the operator terminal 12 from the data base 18. As the operator
15 terminal 12 is continuously receiving current measurement data from the server 16, it may as an alternative store some of the received measurement data and use as previous or historical measurement data as new current data is received from the server 16. It is
20 also possible that the server 16 performs some processing on the measurement data received from the process interface unit 20 and that it is this processed measurement data that is presented by the operator terminal 12. It is thus clear that the measurement data
25 is thus related to the displayed physical property through either being measurement data of the displayed physical property or being used for determining the physical property to be displayed. Take the example of a tank and sensing temperature. If for instance the
30 tank is filled with a known gas and the temperature is sensed, it is possible that instead the server 16 determines the pressure and provides to the operator terminal 12 for being displayed. The physical property

being displayed is furthermore related to the process,
through for instance being the physical property of the
process itself, like pulp temperature or a voltage of a
power line, or related to a process control unit, like
5 the temperature of a transformer or the temperature of
a ball bearing.

The interface 36 of the operator terminal 12 receives
such measurement data from the server 16 and database
10 18 and forwards the received measurement data to the
display control unit 30. With regard to the measurement
data sensed by the process interface unit 20, it can
thus be seen that the display control unit 30 obtains
the data of the physical property relating to the
15 process, step 60. The obtained data furthermore
provides a current value of the physical property,
provided through a current piece of data, as well as a
number of historical values of the physical property,
with advantage provided immediately before the current
20 value in time. The data thus comprises data obtained at
different points in time during the control of the
process, like equidistant points in time. The display
control unit 30 may then control the display unit 34 to
display the data in an element or icon representing a
25 process control unit from where the measurements were
made. In the present example, the display control unit
30 controls the display unit 34 to display the values
of the physical property in a graphical representation
35 of the tank. More particularly the display control
30 unit 30 controls the display unit 34 to display a
current value 43 of the physical property in the bar
graph 36 at a corresponding level with the help of the
current value indicator 42, step 62. Here the display

control unit 30 furthermore controls the display unit 34 to display physical property value levels that are below the current value level 43 with a first 40, and in this example with a dark colour, such as dark grey, and to display physical property value levels above the current level 43 with a second colour 38, and here with a light colour, such as white. This means that the current value level is in fact also being displayed using the first colour 40. Finally the display control unit 30 controls the display unit 34 to display at least one previous or historical value, and here three or four historical values of the physical property, at corresponding physical property levels in the bar graph 36. More particularly the display control unit 30 controls the display unit 34 to display the historical values of the physical property using variations of the colour in the part of the bar graph where these physical values are displayed, step 64.

If these historical values are higher than the current value 43, then the historical values are displayed in the area of the graph, having the second colour 38, i.e. above a bar in the bar graph having the first colour 40, where the top of this bar also provides an indication of the current value 43. If the historical values are lower they are presented in a part of the bar graph 36 having the first colour 40.

More particularly, in relation to the historical values a degree in variation in colour corresponds to the difference in time from the current value 43. This thus means that a latest historical value, which may be the one that is immediately before the current value 43,

may have a higher degree in variation of colour from the colour in the part of the bar graph where this latest physical value is displayed and a shorter difference in time from the current value compared with
5 a second latest historical value, which may be the value immediately before the latest historical value of the physical property. The same relationship exists between the third latest historical value and the second latest historical value, where the third latest
10 historical value thus precedes the second latest historical value and thus has a longer difference in time to the current value and a smaller variation in colour. In case there is a fourth latest historical value this would precede the third latest historical
15 value in time and thus have a longer difference in time to the current value and an even smaller variation in colour.

In fig. 3 all the historical values are higher than the
20 current value and therefore they are presented as differences in colour from the second lighter colour. It can here be seen that the first preceding value 44, which thus directly precedes the current value 43 in time has a large difference in colour from the second
25 colour 38 and is thus darker than the second colour 38. It can also be seen that it is slightly lighter in colour than the first colour 40. The second latest historical value 46, which thus precedes the latest historical value 44 in time, has a smaller difference
30 in colour from the second colour 38 than the latest historical value 44 and is thus lighter than the latest historical value 44. Finally it can be seen that the third latest historical value 48, which thus precedes

the second latest historical value 46 in time, has a smaller difference in colour from the second colour 38 than the second latest historical value 44 and is thus lighter than the second latest historical value 46 As
5 can thus be seen in fig. 3 the third latest historical value 48 is the one that differs the least from the second colour 38. The latest historical value is here also the one that has the smallest difference from the first colour 40.

10

Fig. 4 shows the opposite situation, where all the historical values are lower than the current value and therefore they are presented as differences in colour from the first darker colour 40. The darker colour 40
15 has in this figure been made lighter than the darker colour 40 in fig. 3. This has only been done in order to better show the functioning of the displaying performed. It can here be seen that the first preceding value 50,, i.e. the latest historical value that thus
20 directly precedes the current value in time, has a large difference in colour from the first colour 40 and is thus darker than the first colour 40. It can also be seen that it provides a sharp contrast to the second colour 38. The second latest historical value 52, which
25 thus precedes the latest historical value 50 in time, has a smaller difference in colour from the first colour 40 than the latest historical value 50 and is thus lighter than the latest historical value 50. It can also be seen that the third latest historical value
30 54, which thus precedes the second latest historical value 52 in time, has a smaller difference in colour from the first colour 40 than the second latest historical value 52 and is thus lighter than the second

latest historical value 52. Finally it can be seen that the fourth latest historical value 55, which thus precedes the third latest historical value 54 in time, has a smaller difference in colour from the first colour 40 than the third latest historical value 54. Therefore, it can here in fig. 4 be seen that the fourth latest historical value 55 is the one that differs the least from the first colour 40. Opposed to this it can be seen that the latest historical value 50 differs the most from the first colour 40 and also differs the most from the second colour 38.

With this way of presenting previous or historical values a number of advantages are obtained. An operator can directly and intuitively get an understanding of the direction in which the values of the physical properties are changed. Furthermore, because of the colour variation scheme used, the operator can also directly and intuitively get an understanding of the rate of change of the physical property. This is furthermore achieved without providing any further indicators to the graph that requires space. This thus means that the graph can provide a large amount of information in an economical fashion. This also means that display area is freed up for other uses, where one use is not to display anything at all in order to avoid cluttering of the overview. This can also be used to save energy, in that these parts of the display unit, which do not have to be used can be turned off.

30

There are a number of variations that can be made to the invention. One, which is schematically indicated in fig. 4, is that the bar graph can be provided with one

or more alarm limits. In fig. 4 there is an upper alarm zone 58 and a lower alarm zone 56. If the current value crosses the alarm limit provided by one of these alarm zones, i.e. enters one of the alarm zones, the display control unit 30 may be configured to generate an alarm. This may involve the display control unit 30 controlling the display unit 34 to present a visual alarm. However, also audio alarms are possible. Another variation that is possible is that the current level indicator may be deleted. If the current level needs to be emphasized, it is instead possible that a line of a distinctly different colour than both the first and second colours is provided between these two colours. The number of previous or historical values described were three or four. It should be realized that they may be more or fewer and be at least one. In the exemplifying embodiment, the graph was a bar graph. It should also be realized that other types of graphs are possible, such as pie or line graphs. Another variation is that the graph does not need to be presented in an element representing a process control unit.

The display control unit may be realized in the form of a discrete component, such as an Application Specific Integrated Circuit (ASIC). However, it may also be implemented in the form of a processor with accompanying program memory comprising computer program code, which program code performs the function of the display control unit when being run on the processor. This computer program product can be provided as a data carrier such as one or more CD ROM discs or one or more memory sticks carrying computer program code, which provides the above-described display control unit when

being run by said processor. One such data carrier 66 in the form of a CD ROM disk with a computer program 68 carrying such computer program code is schematically shown in fig. 6.

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From the foregoing discussion it is evident that the present invention can be varied in a multitude of ways. It shall consequently be realized that the present invention is only to be limited by the following

10 claims.

CLAIMS

1. A method for economical displaying of data in a process control system (10) comprising the steps of:
 - 5 - obtaining (60) measurement data related to a physical property in a process (28) controlled by the process control system, where the measurement data comprises data obtained at different points in time during the control of the process,
 - 10 - displaying (62) a current value (43) of the physical property at a corresponding level in a graph (36), which current value is obtained via a current piece of measurement data and where physical property value levels below the level of the current value
15 are displayed with a first colour (40) and physical property value levels above the level of the current value are displayed with a second colour (38), and
 - displaying (64) at least one historical value (44, 46, 48; 50, 52, 54, 55) of the physical property at
20 a corresponding level in the graph as a variation of the colour (38; 40) in the part of the graph where the historical physical property value is displayed.
2. The method according to claim 1, further
25 comprising more than one historical value, and where a degree in variation in colour corresponds to the difference in time from the current value.
3. The method according to claim 2, wherein a
30 latest historical value (44; 50) of the physical property that has a higher degree in variation of colour than a second latest historical value (44; 52) of the physical property also has a shorter difference

in time from the current value than the second latest historical value.

4. The method according to claim 2 or 3, wherein
5 one of the two colours is a light colour and the other is a dark colour.

5. The method according to claim 4, wherein a
historical value having a shorter difference in time
10 from the current value is darker than a historical value having a longer difference in time from the current value.

15 6. A method according to any previous claim, wherein the graph comprises an upper alarm zone (58) and/or a lower alarm zone (56) and further comprising the step of generating an alarm if the current value enters one of the alarm zones.

20 7. A method according to any previous claim, wherein the measurement data are data samples collected at discrete and equidistant consecutive points in time.

25 8. An operator terminal (12) in a process control system (10) comprising:
- an interface (36) for receiving measurement data of one or more physical properties relating to a process (28) being controlled by the process control
30 system (10),
- a display unit (34) for displaying physical properties of the process control system to a system operator, and

- a display control unit (30) configured to
 - obtain measurement data related to a physical property of the process, where the measurement data comprises data obtained at different points in time during the control of the process,
 - control the display unit to display a current value (43) of the physical property at a corresponding level in a graph (36), which current value is obtained via a current piece of measurement data and where physical property value levels below the level of the current value are displayed with a first colour (40) and physical property value levels above the level of the current value are displayed with a second colour (38), and
 - control the display unit to display at least one historical value (44, 46, 48; 50, 52, 54, 55) of the physical property at a corresponding physical property level in the graph as a variation of the colour (38; 40) in the part of the graph where the historical physical property value is displayed.

9. The operator terminal according to claim 8, wherein there is more than one historical value, and where a degree in variation in colour corresponds to the difference in time from the current value.

10. The operator terminal according to claim 9, wherein a latest historical value (44; 50) of the physical property that has higher degree in variation of colour than a second latest historical value (46; 52) of the physical property has a shorter difference

in time from the current value than the second latest historical value.

11. The operator terminal (12) according to claim
5 9 or 10, wherein one of the two colours is a light colour and the other is a dark colour.

12. The operator terminal (12) according to claim
10 11, wherein a historical value having a shorter difference in time from the current value is darker than a historical value having a longer difference in time from the current value.

13. The operator terminal (12) according to any
15 of claims 8 - 13, wherein the graph comprises an upper alarm zone (58) and/or a lower alarm zone (56) and the display control unit is further configured to generate an alarm if the current value enters one of the alarm zones.

20

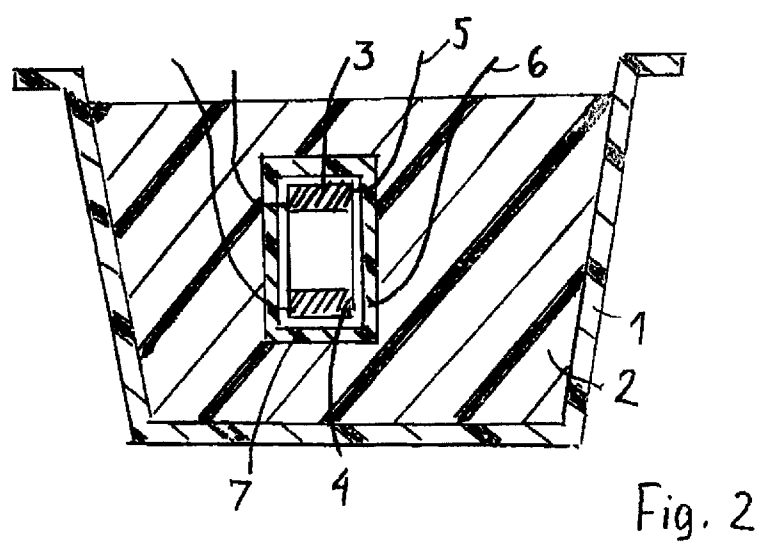
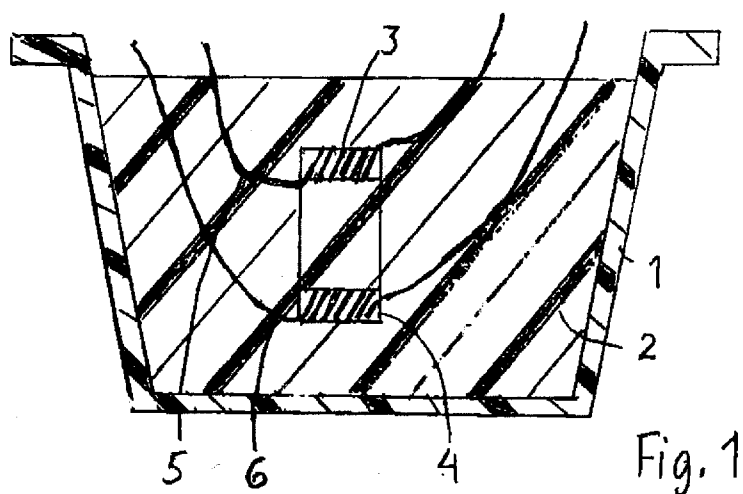
14. The operator terminal (12) according to any of
claims 8 - 13, wherein the measurement data are data samples collected at discrete and equidistant consecutive points in time.

25

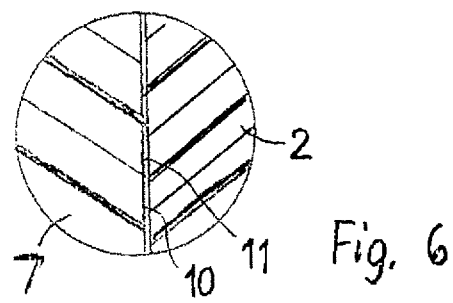
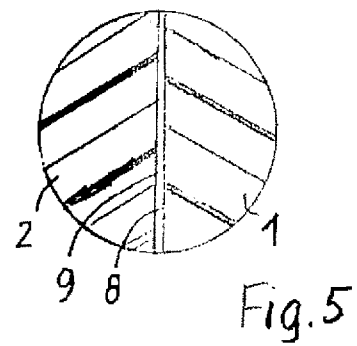
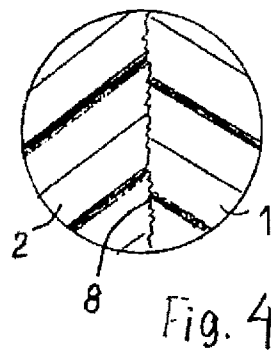
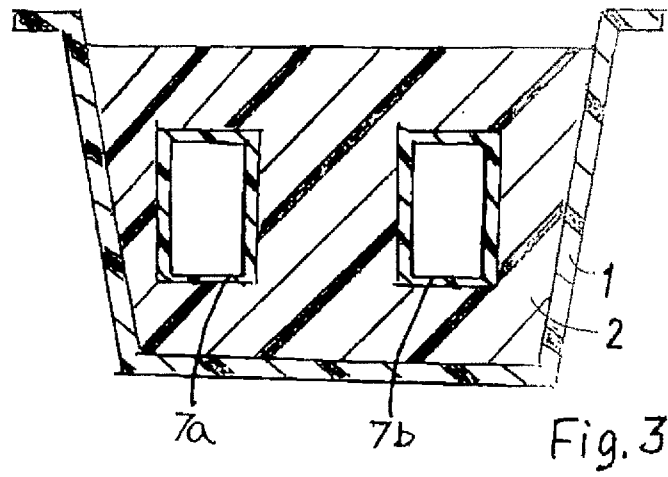
15. A computer program product for economical
displaying of data in a process control system (10),
the computer program product comprising a data carrier
(66) with computer program code (68) which when run on
30 a processor forming a display control unit (30) of an operator terminal (12), causes the display control unit to:

- obtain measurement data related to a physical property of a process (28) controlled by the process control system (10), where the measurement data comprises data obtained at different points in time during the control of the process,
- control a display unit (34) of the operator terminal to display a current value (43) of the physical property at a corresponding level in a graph (36), which current value is obtained via a current piece of measurement data and where physical property value levels below the level of the current value are displayed with a first colour (40) and physical property value levels above the level of the current value are displayed with a second colour (38), and
- control the display unit to display at least one historical value (44, 46, 48; 50, 52, 54, 55) of the physical property at a corresponding level in the graph as a variation of the colour (38; 40) in the part of the graph where the historical physical property value is displayed.

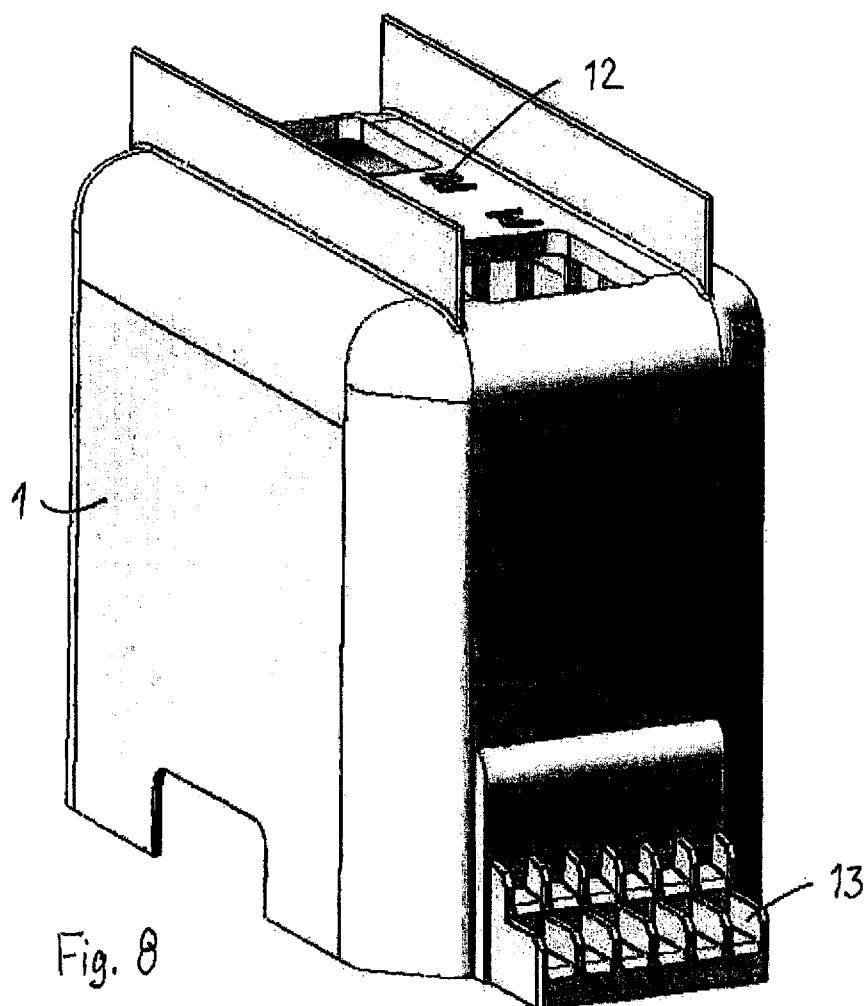
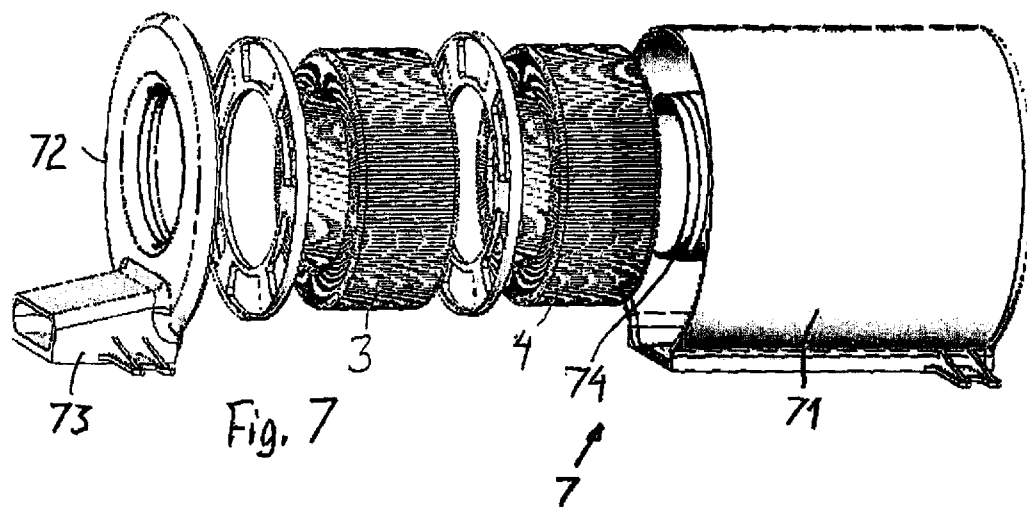
1/3



2/3



3/3



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2011/051598

A. CLASSIFICATION OF SUBJECT MATTER

INV. G05B19/00 G06F3/00 G09G1/16
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G05B G06F G09G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EP0-Internal, INSPEC, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2010 272043 A (NEC CORP) 2 December 2010 (2010-12-02) figure 10	1-15
X	----- EP 0 935 233 A2 (HONEYWELL INC [US]) 11 August 1999 (1999-08-11) paragraph [0067]; figure 4b -----	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

10 June 2011

Date of mailing of the international search report

24/06/2011

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Kamps, Stefan

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2011/051598

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2010272043 A	02-12-2010	NONE	
EP 0935233 A2	11-08-1999	US 6097399 A	01-08-2000