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(54) **Title**: A METHOD OF HANDLING AN ALARM OR AN EVENT WITHIN A PROCESS CONTROL SYSTEM

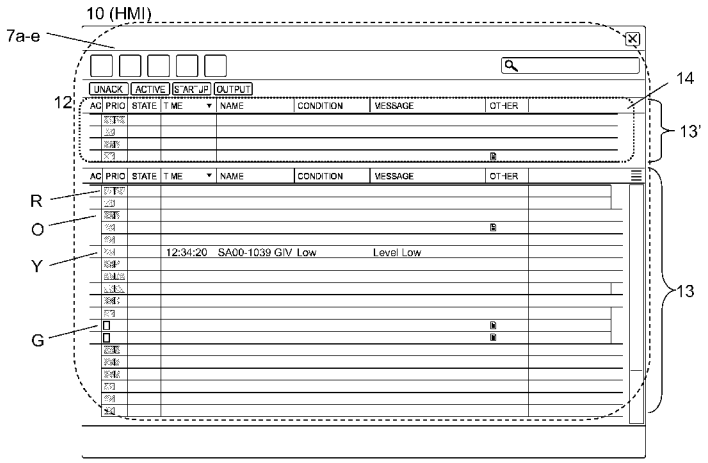

Fig 1

(57) **Abstract**: A method of handling an alarm or an event within a process control system is described. The process control system comprises a workstation and computer programs for carrying out process monitoring and control operations and the method includes displaying in a display window (12) of the workstation (26-28) a first event or alarm list (13). The alarms or events in the first list are arranged in a first order. The method further comprises opening, on receipt of a first command input, a new display area(14) within the display window (12) displaying the first alarm or event list (13), and displaying in the new display area apart(13') of the first event or an alarm list (13) in which the alarms or events are displayed in a second order. A computer program adapted for carrying out the method and workstation arranged for carrying out the method are also described.

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A method of handling an alarm or an event within a process control system

TECHNICAL FIELD.

The invention relates to a method of handling an alarm or an event in a process control system. In particular, the invention is concerned with making efficient use of limited display space of a human-machine interface (HMI) connected to the process control system and providing improved means and methods for an operator to investigate alarms and events in a process control system.

TECHNICAL BACKGROUND

Computer controlled systems for monitoring and/or controlling manufacturing processes in chemical, pharmaceutical, food, metal, mines, and pulp and paper industries are well known. Other examples of industries and utilities where control systems are used are automotive, steel mills etc., consumer products, power generation, power distribution, pure and waste water handling, oil refineries, gas pipe-lines and off-shore platforms. Besides functions for controlling a process, control systems normally also include monitoring or supervisory functions, including functions for generating events dependent on various conditions related to the controlled and supervised process. Other sources of events include software applications such as applications for condition monitoring, optimization, calculations etc. Events are stored in one or more event logs

for later retrieval for presentation to users as event lists, and for various other functions such as analysis of courses of events, etc. Events may also be used to generate alarms. As part of the functions of the elements in the system, measurements on parameters such as currents, voltages, phases, temperatures and so on are made substantially continuously and may result in different safety alarms and/or events, including even a plant shut-down.

Alarm systems are important sub-systems in monitoring systems or control systems of a technical plant and are an important aid for assisting operating personnel in detecting plant or process states which may require immediate intervention. Very often, alarms are generated due to a slight deviation of the process variables from a desired value, and do not correspond to a critical system failure. These alarms may be called nuisance alarms. Most conventional alarm systems display even the nuisance alarms. In other situations, a critical failure, which affects many parts of the monitored system, most often leads to the generation of a very large number of alarms. Most of these alarms are generated due to the same root failure and correspond to the various degrees of the failure and the process variables involved in the failure. Hence, generally, a particular alarm is often either a cause or an effect of a previously generated alarm, thereby, making many of the generated alarms redundant.

The task of finding the relevant technical information for a given technical subject or condition in a large information space is often further complicated by the fact that in many situations the operator often has limited time available to make

a decision. The operator has to know where to find information about a process condition and how to find that information. Furthermore, a process control system is often complex and includes a number of interconnected process control units. This together with there being great amount of data that may need to be displayed may clutter the view, so that the useable summary of a situation or cause of an alarm or event may be difficult for an operator to gather.

The act of obtaining information about a condition of a process may be time-consuming and may be error-prone. During times of emergency or other unexpected events the time taken to acquire information about a condition of a process may be crucial. However, the operator in an industrial plant or supervising an industrial process is continually presented with an alarm list, or an event list, or a combined alarm and event list. The operator has to make sense of the alarms and events presented, identify the higher priority alarms or events, if any, and investigate and work through the alarms in the way that the operator has prioritized.

In an article entitled "A Pilot Project on Alarm Reduction and Presentation Based on Multilevel Flow Models" by Tuszynski, J. et. al, 2002, an account is given of work to evaluate alarm reduction methods in nuclear facilities. Amongst other things, an HMI is disclosed in which an alarm list is displayed as a split alarm list. The upper window displays primary alarms and a lower window displays secondary alarms. A third explanatory window may be added displaying a chain of events leading to the particular alarm. US20100156654, entitled "Alarm trend summary display system and method" and assigned to Honeywell Inc

describes an alarm display system. An alarm display system is described in which an alarm trend list can be operated (and displayed) in conjunction with an alarm summary list. The alarm trend list may be displayed such that alarms with higher priority are displayed on the top of the list. WO200225420, entitled "Method, system and computer program for managing views at a computer display" and assigned to IBM Corp disclose methods for dynamic splitting of windows or panes in user interfaces. A system user can configure the display to show any number and arrangement of tiled views. Similarly, US20020191028, entitled "Window manager user interface" and assigned to D.A. Senechalle et al, discloses a window manager with a frame window and one or more pane windows. It discloses that, when splitting a pane, the original view will occupy one of the split panes and the other pane will be available for an additional view.

The inventors have determined that display space on workstation displays is limited and that the display space on a workstation is usually fully utilized. They have further determined that an operator investigating an alarm or an event, needs to examine alarm lists or event lists for information related to the alarm or event but, at the same time, the operator does not wish to cover up information about the first alarm or event information with an additional window to examine information in.

SUMMARY OF THE INVENTION

The aim of the present invention is to provide a method of handling an event or an alarm within a process control system that solves some of the above problems. Advantageous embodiments are described in sub-claims to the independent claims.

In a first aspect of the invention a method is disclosed for handling an event or an alarm within a process control system, the process control system comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, and that the method further comprises opening, on receipt of a first command input, a new display area within the display window displaying the first alarm or event list, and also displaying in the new display area a part of the first event or an alarm list in which the alarms or events are displayed in a second order.

According to an embodiment of the invention a method is described for handling an alarm or an event within a process control system, the process control system comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, and that the method further comprises opening, on receipt of a first command input, a new display area within the display window displaying the first alarm or event list, the method further comprising filtering the part of the first alarm or event list to show only high priority alarms or events and displaying it in the new display area wherein the alarms or events in the copy of the alarm or event list are arranged according to the first order.

According to another embodiment of the invention a method is described for handling an alarm or an event within a process

control system, the process control system comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, and that the method further comprises opening, on receipt of a first command input, a new display area within the display window displaying the first alarm or event list, the method further comprising filtering the first alarm or event list according to a user selected order. The user may thus sort the original alarm or event list in any way to find information associated in some way with an alarm or event of interest now displayed in the new display area.

According to an embodiment of the invention a method is described for handling an alarm or an event within a process control system, the process control system comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, and that the method further comprises displaying the part of the alarm or event list in the new display area and wherein, on receipt of a second command input, the part alarm or event list is arranged filtered according to an operator selection in which alarms or events from a selected process section are shown at the top of the list.

According to an embodiment of the invention a method is described for handling an alarm or an event within a process control system, the process control system comprising a

workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, and that the method further comprises displaying the copy of the alarm or event list in the new display area and wherein, on receipt of a second command input, the part alarm or event list is arranged filtered according to an operator selection in which alarms or events associated with a selected process object are shown at the top of the list.

According to an embodiment of the invention a method is described for handling an alarm or an event within a process control system, the process control system comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, and that the method further comprises displaying the first or the new alarm or event list in which the first order is any from the group of: latest alarm or event at top of list; latest alarm associated to selected event at top of list; most recent acknowledged active alarms at top of list.

According to an embodiment of the invention a method is described for handling an alarm or an event within a process control system, the process control system comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a

first order, and that the method further comprises displaying the first alarm or event list, or the new alarm or event list, in which the second predetermined order is any from the group of: high priority un-acknowledged alarms; high priority shelved alarms; active alarms; alarms with a selected priority level equal to any from 1 to 4; acknowledged alarms.

According to an embodiment of the invention a method is described for handling an alarm or an event within a process control system, the process control system comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, and that the method further comprises opening the new display area on receipt of a command input generated by a user input to manipulate a handle element arranged adjacent to the left side or right side of the display window displaying the alarm list. Alternatively the handle element is arranged adjacent to bottom edge or top edge of the display window displaying the alarm list.

According to an embodiment of the invention a method is described for handling an alarm or an event within a process control system, the process control system comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, and that the method further comprises opening and displaying, on receipt of an alternative command input, a new

display area superimposed or floating on top of part of the alarm list in the display window, which new display area does not extend beyond the display space occupied by the alarm list.

In the first aspect of the invention a method provides a practical tool for the operator to search for and retrieve additional information without losing sight of an alarm of interest, and without using up extra display space or cluttering up the display on a workstation. An operator examines an alarm or event list and needs to find further information about one or more alarms, or events, in order to know more about an alarm or event of interest. However, the operator does not want to lose sight of the alarm or event of interest. Thus while viewing the alarm or event list the operator elects to split the list either horizontally or vertically and open a new display window. This is performed by a user input action such as by dragging a splitter handle either from eg the bottom or the left of the alarm list. When the alarm list has been split and a new display window opened the two windows can show different views of the same alarm or event list within the same total display area as the original alarm or event list.

The default configuration may be that the original list is filtered to only show, for example, a view showing high priority active unacknowledged alarms, while the new copy of the alarm and event list has, for example, a view showing the same configuration as the original list had. The new list can then be scrolled. The operator or engineer can select to filter the original list (or the new list) in any one of a number of ways as described herein. Thus filtering of an alarm or event list may be carried out on receipt of user input to filter alarms

and/or events in a list according to a user selected order. The operator can examine any or all of the lines in the new copy of the alarm and event list for information that may be associated or connected in some way to an alarm or event of interest in the original list.

The new list may also be changed to show a different view, it may be filtered or sorted to select e.g. shelved alarms, while the operator can still see the alarm or event of interest in the high priority active unacknowledged alarms in the original list. The operator then examines the information about the alarms and or events in the original list filtered to show, for example, high priority active unacknowledged alarms and compare those alarms to alarms or events filtered in a different way to identify associations or causes between the alarm of interest and other alarms or events displayed in either of the two versions of the alarm or event list. The original list may be filtered to show a first order of any of, for example: latest alarm or event at top of list; latest alarm associated to selected event at top of list; most recent acknowledged active alarms at top of list.

It is also possible to automatically split the list when the user wants to view a shelved list or use a preconfigured filter. The user is, in other words, not forced to first perform the split and then select what to view. Dependent on a particular user input, the split may take place and automatically sort the alarm list in the new window and the remainder of the original window according to one or many possible preconfigured selections. Either of the original list, or the alarm list in the new display window, may be filtered to show a second order

of, for example: high priority un-acknowledged alarms, high priority shelved alarms, active alarms, acknowledged alarms, alarms in a selected process section, alarms for a selected process object.

In this way the improved alarm list or event list display allows the operator to examine other alarms or events without losing sight of an alarm (or event) of interest. Thus all the line details of the alarm of interest are continuously visible while the operator can at the same time examine details of events and other alarms in another list. As the alarm and event list is live and online, any changes in the status, condition, message etc of the alarm of interest will be displayed. Thus any updates to the alarm or event of interest may be seen by the operator, even though the operator may, for part of the time, be examining the other part or selection of the same alarm and event list. The operator may work to understand and investigate an alarm, and still have oversight of what is happening in the alarm or event list at the same time.

Because the new display window is opened inside the same display space efficient use is made of display space on the operator workstation. This display may be used with alarm lists, with event lists, or with lists containing both alarms and events.

In a second aspect of the invention a workstation is disclosed which is configured for handling an event or an alarm within a process control system, the process control system comprising computer programs for carrying out process monitoring and control operations, where processing an alarm includes displaying in a display window of the workstation a first alarm

or event list in which the alarms or events are arranged in a first order, wherein the workstation is arranged with hardware and software for processing an alarm or event according to a method that comprises the steps of:

opening, on receipt of a command input, a new display area within the display window displaying the first alarm or event list, and displaying in the new display area a part of the first alarm or event list in which the alarms or events are arranged in a second order.

The workstation may be used by an operator or process engineer or a maintenance person. It provides a graphical user interface for eg an operator of the system, with which process graphics, alarm and/or event lists, trends, production history, logs and other human machine interface screens for monitoring or controlling a process may be displayed. The workstation may be arranged as a computer or computer terminal at a fixed position, connected by wires or wirelessly to the process control system. The workstation may advantageously be arranged as a portable device, a notepad, tablet computer, smart phone or other computing device that communicates wirelessly with the control system.

In another aspect of the present invention, an computer program product is provided, and a non-transitory, computer readable medium having a program recorded thereon, which computer program is adapted to, when loaded into a processor of a computer or controller, have the processor or computer carry out the method including displaying in a display window of the workstation a first event or alarm list in which the alarms or events are arranged in a first order, which method further comprises

opening, on receipt of a first command input, a new display area within the display window displaying the first alarm or event list, and also displaying in the new display area a part of the first event or an alarm list in which the alarms or events are displayed in a second order.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of the method and system of the present invention may be had by reference to the following detailed description when taken in conjunction with the accompanying drawings wherein:

Figure 1 shows a simplified schematic diagram of a display for an alarm or event list and in particular an alarm or event list which has been divided into two lists within the same display space according to an embodiment of a first aspect of the invention;

Figure 2 shows the display for the alarm or event list of Figure 1 and in particular shows an embodiment in which a graphical handle element is shown which may be used to operate the invention of Figure 1;

Figure 3 (Prior Art) shows a known alarm or event list for the purpose of explaining the invention;

Figure 4 shows schematically a process control system within which the invention of Figure 1 is practiced, and Figure 5 shows schematically a workstation with which the invention of Figure 1 is practiced;

Figure 6 shows a flowchart for carrying out a method for providing the display for an alarm or event list of Figure 1, according to another aspect of the invention, Figure 7 shows a flow chart for carrying out another embodiment of providing the display for an alarm or event list of Figure 1, and Figure 8

shows a non transitory computer readable medium on which is stored a computer program adapted for carrying out the method of the invention of Figure 1.

Generally, all terms used in the claims are to be interpreted according to their ordinary meaning in the technical field, unless explicitly defined otherwise herein. All references to "a/an/the element, apparatus, component, means, step, etc." are to be interpreted openly as referring to at least one instance of the element, apparatus, component, means, step, etc., unless explicitly stated otherwise. The steps of any method disclosed herein do not have to be performed in the exact order disclosed, unless explicitly stated. The use of “first”, “second” etc. for different features/components of the present disclosure are only intended to distinguish the features/components from other similar features/components and not to impart any order or hierarchy to the features/components.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 3 (Prior Art) shows schematically an alarm or event list 12 in the form of a display window on a human machine interface 10 (HMI) of a process control system, for example a workstation. The alarm and event list 12 display shows a series of rows 13, in which the alarms or events are normally displayed as text names, often with short text descriptions. The rows 13 may be divided into fields forming vertical columns. Each field (column) has a header, with titles per field such as: ACK, PRIO, STATE, TIME, NAME, CONDITION, MESSAGE, OTHER; which means Ack = acknowledged; Priority means which priority level the alarm or event has, commonly indicated by a number between 3 (highest)

and 1 (lowest); a State, depending on which states are possible for that alarm or event; Time is time the alarm or event was received, Name is a short name for the process object to which the alarm or event is associated, it may be a tag name; Condition depends on which conditions are possible for that alarm or event; similar for Message and Other. Other headings may also or instead be used.

The display window 10 also contains controls for user input such as buttons labelled UNACK, with which the alarms or events list may be filtered to show only those in an un-acknowledged state; ACTIVE which may be used filter the list to show an alarms or events with a status of Active.

Similarly in Figure 1 a number of buttons (UNACK, ACTIVE, STARTUP, OUTPUT) and indicators are also shown on the display. Certain buttons eg 7a-e may be used to perform actions on a selected one or more alarms or events. More or fewer buttons for user input may be included on the display. A selection of buttons may be pre-configured to each activate a selected sort or filter of an alarm or event list 13 or 13'. Buttons or icons outside of the list area such as UNACK, ACTIVE and buttons 7a-e are active for the presently active list. Thus depending on whether the user has a computer cursor or other selection function placed in the original list 13 or placed in the new list 13', then the buttons work on that 'active' list. For example with the computer cursor in the original list 13, when the operator left-clicks with a computer mouse or eg 'taps' on a touchscreen on the button UNACK, the list is filtered to display all the un-acknowledged alarms or events first.

Figure 1 shows schematically the alarm or event list in a display window, according to an embodiment of the invention, on a human machine interface 10 (HMI) of a process control system, with a number of rows 13. The display also shows a new display area 14 containing a number of rows 13' of an alarm or event list. The part of the original alarm and event list 13, as well as the new display area 14 with the new copy of the alarm list 13', together take up the same display area or display space as the original alarm and event list did. In other words, the window containing the alarm or event list 13, similar to the one shown in Figure 3 (Prior Art), has been split and a new window display 14 has been opened in part of the space previously occupied by the original alarm or event list 13.

Each text row in the alarm or event lists 13, 13' includes then summary information fields to present information about each alarm or event. For example the Name is likely to be a short name or abbreviated name for the process object concerned. Additional information, for example the full name, may also be retrieved by using a mouse-over function to point to the Name or other field in the alarm or event row. As described in an application WO2009/034000, entitled "A System And A Computer Implemented Method For Automatically Displaying Process Information in an Industrial Control System", and assigned to ABB, information about a process object of interest, such as the recorded information content of the event, can be displayed using a computer mouse roll over or mouse over command. The operator positions a computer mouse such that the pointer on the display is over the process object of interest. The information retrieved by the mouse-over or mouse hover function is displayed in a tool tip field. Thus extended information about the

information fields such as Name, Condition, Message, Other; of the alarm or event of interest may be retrieved by the operator by hovering the mouse pointer over an information field in the row of the alarm or event of interest. This function is provided by a modified set of touch and/or gesture commands when the display is presented on a touchscreen display.

Figure 6 is a flowchart with steps that are included in the method. The figure shows the following steps:

40 Open the alarm list,
this may be an alarm list, an alarm and event list, or an event list;

42 Sort the alarm list in a first predetermined order,
which may be a default setting, such as: highest priority alarms shown first, and the highest priority alarms shown at top of alarm list in order such as most recent alarm or event first, top of the list;

44 Operator input to: Open a window inside alarm list, display copy of same alarm list in new window;

46 Automatically sort the alarm or event list in the new window and display in a second predetermined order,
the second predetermined order may be any of: shelved alarms, acknowledged alarms, alarms related to a selected process section, alarms related to a selected process object, events related to a selected process section or selected process object, and so on.

The advantage of preconfigured lists may be illustrated with the following example. An operator examines an alarm list in his process section. He sees many alarms for one part of the factory. The operator wants to investigate alarms for a

particular tank further, and requires more information. He splits the alarm list with a particular command. A second window opens inside the first window area. Automatically, a particular filter command is activated which is configured so that only alarms relevant to a selected process object, which in this case would be the tank, are displayed in the second window. At the same time as the operator can see the filtered alarms for the tank in the second window, he can also examine the original alarm list for the one part of the factory which is still displayed in the first window. Thus without covering up the original alarm list, and without covering up other control objects on the workstation display, the operator can manually or automatically retrieve additional data about alarms or events which are associated in some way with an alarm or event of interest for the purpose of monitoring or control and display it in the second window.

A process engineer examines an alarm list and wants to investigate any/which events that may have led to the alarms of interest. He chooses to split the existing alarm list by:
selecting a predetermined command that automatically makes the control system:
split the window so that a second window 14 opens inside the first window area 12,
retain the present alarms in the first window,
sort the alarm list to show high priority sorted alarms at the top of the list in the first window,
and automatically retrieve and filter an event list into the newly opened second window for events related to the alarm list.

Thus at the same time the process engineer can examine the

filtered events related to the current alarms in the second window and he can also still examine the original alarm list displayed in the first window. The original list may be displayed exactly as it was prior to the split command or the list may be automatically sorted using a predetermined filter to show, eg high priority un-acknowledged alarms, high priority shelved alarms, acknowledged alarms, and so on. Thus without covering up the original alarm list of interest, and without covering up other control objects on the workstation display, the process engineer can manually or automatically retrieve data about related, reported events (or alarms) for the purpose of carrying out engineering, monitoring or control functions and display the data in the second window. The operator or engineer can select to filter the original list (or the new list) in any one of a number of ways. Filtering of an alarm or event list may be carried out on receipt of user input to filter alarms and/or events in a list according to a user selected order.

Figure 7 is a flowchart for steps that are included in the method according to an embodiment of the invention. The figure shows the following steps:

50 Open the alarm list,
or the alarm and event, or the event list;

52 Sort the alarm list in a first predetermined order, which may be a default setting, such as: highest priority unacknowledged alarms shown first, most recent highest priority alarms shown at top of alarm list;

55 Open a new window inside the alarm list, filter alarm list to display alarms or events for a selected process section in the new window;

57 Optionally - Automatically sort the alarms in the new window

to show alarms or events specific to a selected process object, having previously selected one or more process sections;
58 Optionally - Filter, on user input, alarms in the new window to display most recent alarms or events first in the new window;
59 Optionally - Filter, on user input, alarms in the new window to display highest priority unacknowledged alarms first in the new window.

Thus the operator can arrange and re-arrange alarms and events according to a process section that the operator wishes to examine in relation to an alarm or event of interest. While still able to see the alarm or event of interest in the original list, the operator can scroll through a number of possible different filters or selections of alarms and/or events in the new window 14 to find information relevant to a cause or effect associated with the alarm or event of interest.

Figure 1 also shows a new visualisation of a Priority level assigned to an event or alarm. The diagram shows a number of shaded squares between 1 and 4 in each row. The number of shaded squares is the assigned priority, such that more squares = higher priority level. In the diagram, the squares representing each different priority level 2-4 are shown with a different shading, with priority level 1 being represented as blank. When the display is shown on a workstation the priority level is also colour coded instead of having different shading patterns.

Thus the squares referenced with the letter R show 4 squares, which on a normal workstation are also shown coloured Red on the display, priority level 4 (highest). Squares with the letter O show 3 squares, normally coloured Orange and squares with the

letter Y are displayed as 2 squares, normally coloured Yellow. The single squares with the letter G are normally coloured Green, with priority level 1, the lowest priority level. Normally the priority level squares are shown coloured, the text in the rows is in white or grey and displayed against a plain, black or dark grey background. The inventors have found that using two visual cues (both colour and number) are associated with a priority level with a minimum of difficulty by operators with normal colour vision. Accuracy of perception also seems to be aided or reinforced by combining two cues or visual indicators. For operators with impaired colour vision the use of between 1 and 4 squares still provides an effective visualisation for the priority level. When filtering alarm or event lists, an operator may also select to sort according to a priority level by selecting to filter an alarms/events list with a priority level equal to a number between 1 and 4. Thus the selection may be made by an operator from a drop-down menu or similar by selecting one number from a choice of numbers 1-4.

Alternatively an operator may be able to make a selection of one colour group from four groups of coloured squares from a display or menu showing: 4 red squares; 3 orange squares; 2 yellow squares; 1 green square; each one of which indicating a priority level. These four priority levels may be arranged as preconfigured options assigned to particular buttons or button combinations.

Figure 2 shows an alarm or event list 13 in a display window 12. The figure shows a handle 9 or splitter element arranged at the left side of the display window 12. The operator can split the alarm or event list by dragging the handle element 9 from the

left side out towards the middle of the screen. This causes a new window to be displayed as shown in Figure 1, new window area 14 with a copy 13' of the same alarm or event list 13. Optionally the handle 9 may be positioned and operated from the right side of the display; or at the top or bottom of the display. This function is provided by one or more touch and/or gesture commands when the display is presented on a touch screen display.

In another embodiment of the invention the new display window 14 displaying part of the original alarm or event list may be opened and displayed in the form of a new window 14' that is superimposed over the original window 12. The new display window 14' may be arranged and displayed in response to an alternative command input so that it "floats" above an image of the original alarm and event list. The new window may be arranged so that it may be moved around by the operator, eg by dragging it with a left mouse-click-and-hold-down user input, anywhere within the area of the display occupied by the original list 13 in the full sized display 12. Figure 2 shows schematically such a new list 14' floating over the lower part of the original alarm or event list 13. Thus the floating new window may be positioned over a middle part of the original alarm or event list if the operator so prefers. This function is provided by one or more touch and/or gesture commands when the display is presented on workstation with a touch screen display.

Figure 4 shows schematically a control system 20 for a process 30, i.e. a process control system. The process control system 20 is a computerized process control system for controlling an industrial process 30. The process may comprise a number of

different sub-processes and process sections. The process can be any type of industrial process, such as electrical power generation, transmission and distribution processes as well as water purification and distribution processes, oil and gas production and distribution processes, petrochemical, chemical, pharmaceutical and food processes, and pulp and paper production processes. These are just some examples of processes where the system can be applied. There exist countless other industrial processes. The process may also be other types of industrial processes such as the manufacturing of goods. The process may be monitored through one or more process monitoring computers, which communicate with a server handling monitoring and control of the process.

The control system 20 may for instance be an object-based computerised system for controlling the process 30, a system such as the 800xA system supplied by ABB. An alarm and event handling system may be an integrated part of the control system or may be implemented as an add-on module or application that can access the history database 23 of the process control system. Preferably such an alarm and event handling system can also access sensor data or other data direct from the control system or via process interface units (64-70). In Figure 4 the process control system 20 includes a number of operator workstations or terminals 27, 28 connected to a first data bus D1. A wireless gateway 25, which gateway is connected to at least one wireless network, is also connected to the first data bus D1 and configured such that such that portable workstations such as workstation 26 may access the control system 20 wirelessly. There is furthermore a second data bus D2, and between the first and second busses there is connected a server

21 providing control and monitoring of the process 30. Process 30 may comprise monitored equipment such as a motor 36, valves 38, 34, measuring equipment such as sensors 35, 37, and process controllers 31, 32. Controller 31, motor 36, valve 38, sensor 37 may be part of a first process section, and controller 32, valve 34 and sensor 35 may be part of a second process section.

The controllers 31, 32, valves 34, 38, motor 36 and sensors 35, 37 are also each an example of a process object, meaning an object in the process that is monitored and/or controlled by the process control system 20. Second data bus D2 is also connected to the database 23 where data, such as historical data relating to control and monitoring of the process 30, including history of alarms and events and other process history is stored. To the second data bus D2 there are furthermore connected process interface units 64, 66, 68 and 70 for providing control of the process and for receiving measurement data from the process 30.

It should however be realized that there may be more or fewer of each of these interface units 64-70. 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. It should be realized that one or more of sensor units 35, 37 may be connected to such process interface units. Such units are involved in controlling the process 30 and in doing this also involved in measuring physical properties related to the process. The measured properties may here comprise properties of the process itself such as measurements of temperature or pressure in a pulp and paper process, a steel mill, an oil & gas production site, a petrochemical process, a pharmaceutical process or measurements such as current and

voltage in electrical power process measurements of generation, transmission and distribution processes.

Figure 5 shows an operator workstation (26-28) in the process control system 20. Each workstation includes a user input unit 72, a display unit 76, a display control unit 74 and an interface 78 for communicating with the other parts of the process control system 20 via the first data bus D1. An operator workstation 26, 27 or 28 provides a graphical user interface for an operator of the system, with which process graphics, alarm and/or event lists, trends and other human machine interface screens for monitoring or controlling a process may be displayed.

The control unit 74 may comprise a processor with an associated program memory including program code for performing the functionality of the present invention. The display unit 76 may be any suitable display unit, such as a liquid crystal display, plasma display, LED or OLED (organic light emitting diode) or CRT device. The user input unit 72 is a unit through which a user of the operator workstation 26, 27 or 28, i.e. an operator, may enter data. As such it may be a keyboard, a keypad or a mouse or other data input device. The user input unit 72 may also be combined with the display unit in order to together form a touch screen. The touch screen may be arranged as a multi-touch apparatus with a resistive or capacitive-type touch and display surface.

The workstation may also be a portable computer in the form of a notebook, tablet computer, smart phone, or other small computer-equipped device running a suitable application or a thin client

or web-browser adapted for accessing the control system 20. When the workstation is a portable computer 26 or smart phone or other computing device arranged with a touchscreen then the mouse-over function may not work in the absence of an on-screen mouse pointer or cursor. In that case the mouse-over function may be configured to be activated by another control, such as a button or buttons, gestures, and/or a hold-and-touch or gesture-and-touch combination.

A thin client is a program run by the computer of the workstation, which is not required to be resource intensive since most of the computing calculation work is done on another, normally remote computer, a server machine. This may be a server machine such as data server 21 in Figure 4. Using a client-server implementation has advantages in particular when it comes to providing the visualization in a graphical user interface on a remote workstation or portable computer, notebook, PDA, smart phone or other portable computing device. The methods may also be implemented in a similar way using applications of the process control system running in a cloud and providing computing power to thin client or web browser applications running on a fixed workstation 27, 28 or a portable workstation 26. The operator workstation or terminal 26-28 may also include other user interfaces such as a camera for recognizing gesture commands, a speaker or a microphone for registering spoken commands 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. The unit may for example be arranged with sensors and software suitable for receiving gesture-based commands, as well or instead of commands by means of touching or sweeping fingers on a touch screen or instructions input via a

computer mouse and so on.

Data from the various process interfaces such as 64, 66, 68, 70 can be collected and stored in the history data base 23 as well as presented in real-time to an operator via the display unit 76. The alarm and event history, production history and sensor measurement of physical parameters, recorded during the process is stored in the databases connected to the process control system. The operator workstation 26-28 in the process control system 20 may present data regarding the process in a number of different ways.

The methods of the invention may, as described herein, be carried out by means of one or more computer programs comprising computer program code or software portions running on a computer or a processor. The microprocessor (or processors) comprises a central processing unit CPU performing the steps of the method according to one or more methods of the invention. The invention is performed with the aid of one or more said computer programs, adapted for carrying out the method of the invention such as the methods flowcharted in Figures 6, 7 which are stored at least in part in memory and as such accessible by the one or more processors. The processor may be in a memory storage unit of a process system control unit or a PLC (Programmable Logic Controller) such as controllers 31, 32 (Fig 4) or other system part thereof, in a local or distributed computerised control system. It is to be understood that said computer programs may also be run on one or more general purpose industrial microprocessors or computers instead of one or more specially adapted computers or processors.

A part of the program may be stored in a processor as above, but also in a ROM, RAM, PROM, EPROM or EEPROM chip or similar memory means. The program in part or in whole may also be stored on, or in, other suitable computer readable medium such as a magnetic disk, or a non-transitory computer readable medium such as a CD (compact disc) or a DVD (digital versatile disc), stored on a hard disk, magneto-optical memory storage means, in volatile memory, in flash memory, as firmware, stored on a data server or on one or more arrays of data servers. As an alternative it may be provided in the form of an Application Specific Integrated Circuit (ASIC) or Field-Programmable Gate Array (FPGA). This computer program code may also be provided on one or more data carriers which perform the functionality of the present invention when the program code thereon is being loaded into a mobile terminal. One such data carrier 80 with computer program code 82, in the form of a CD ROM disc, is schematically shown in Figure 8. Such computer program may as an alternative be provided on another server and downloaded there from into the mobile terminal.

The embodiments illustrated and discussed in this specification are only intended to teach those skilled in the art the best way known to the inventors to make and use the invention. The person skilled in the art realizes that the present invention is by no means limited to the examples described. On the contrary, many modifications and variations are possible within the scope of the appended claims.

Claims

1. A method of handling an alarm or an event within a process control system, the process control system (20) comprising a workstation and computer programs for carrying out process monitoring and control operations, the method including displaying in a display window (12) of the workstation (26-28) a **first** alarm or event list (13)
in which the alarms or events are arranged in a first order, **characterised** in that the method further comprises
opening, on receipt of a first command input (44, 55), a new display area (14) within the display window (12) displaying (42, 52) the first alarm or event list (13), and displaying in the new display area **a** part (13') of the first event or an alarm list
in which the alarms or events are displayed (46, 57-59) in a second order.

2. A method according to claim 1, **characterised** by filtering the part (13') of the first alarm or event list to show only high priority alarms or events (55) and displaying it in the new display area (14) wherein the alarms or events in the copy of the alarm or event list are arranged according to the first order.

3. A method according to claim 1, **characterised** by filtering the the first alarm or event list (13) according to a user selected order (58, 59).

4. A method according to claim 1, **characterised** by displaying the part (13') of the alarm or event list in the new display area (14) and wherein, on receipt of a second command input

(55), the part alarm or event list (13') is arranged filtered according to an operator selection in which alarms or events from a selected process section are shown at the top of the list.

5. A method according to claim 1, **characterised** by displaying the copy of the alarm or event list in the new display area (14) and wherein, on receipt of a second command input (57), the part alarm or event list (13') is arranged filtered according to an operator selection in which alarms or events associated with a selected process object are shown at the top of the list.

6. A method according to claim 1, **characterised** by displaying the first or the new alarm or event list in which the first order is any from the group of: latest alarm or event at top of list; latest alarm associated to selected event at top of list; most recent acknowledged active alarms at top of list.

7. A method according to claim 1, **characterised** by displaying the first alarm or event list, or the new alarm or event list, in which the second predetermined order is any from the group of: high priority un-acknowledged alarms; high priority shelved alarms; active alarms; alarms with a selected priority level equal to any from 1 to 4; acknowledged alarms.

8. A method according to claim 1, **characterised** by opening the new display area on receipt of a command input generated by a user input to manipulate a handle element (9) arranged adjacent to the left side or right side of the display window displaying the alarm list.

9. A method according to claim 1, **characterised** by opening the new display area on receipt of a command input generated by a user input to manipulate a handle element (9) arranged adjacent to bottom edge or top edge of the display window (12) displaying the alarm list.

10. A method according to claim 1, **characterised** by opening and displaying, on receipt of an alternative command input, a new display area (14') superimposed or floating on top of part of the alarm list (13) in the display window (12), which new display area does not extend beyond the display space occupied by the alarm list (13).

11. A computer program product on encoded on a non-transitory computer readable medium comprising computer program code adapted and configured, when said program code is loaded into a processor of a workstation (26-28) provided in a process control system (20), to carry out the steps of a method according to any one of claims 1-10.

12. A workstation configured for handling an alarm or an event within a process control system, the process control system (20) comprising computer programs for carrying out process monitoring and control operations, where processing an alarm includes displaying in a display window (12) of the workstation a first alarm or event list in which the alarms or events are arranged in a first order, **characterised** in that the workstation (26-28) is arranged with hardware (72-78) and software for processing an alarm or event according to a method that comprises the steps of opening, on receipt of a first command input (44, 55), a new display area (14) within the display window (12)

displaying (42, 52) the first alarm or event list (13), and displaying in the new display area **a** part (13') of the first event or an alarm list in which the alarms or events are displayed (46, 57-59) in a second order.

13. A workstation according to claim 12, **characterised** in that the workstation is arranged with hardware and software for filtering the part (13') of the first alarm or event list to show only high priority alarms or events (55) and displaying it in the new display area (14) wherein the alarms or events in the copy of the alarm or event list are arranged according to the first order.

14. A workstation according to claim 12, **characterised** in that the workstation is arranged with hardware and software for filtering the first alarm or event list (13) according to a user selected order (58, 59).

15. A workstation according to claim 12, **characterised** in that the workstation is arranged with hardware and software configured to display the part of the alarm or event list in the new display area (14) and wherein, on receipt of a second command input (55), arrange the part alarm or event list (13') filtered according to an operator selection in which alarms or events from a selected process section are shown at the top of the list.

16. A workstation according to claim 12, **characterised** in that the workstation is arranged with hardware and software configured to display the copy of the alarm or event list in the new display area (14) and wherein, on receipt of a second

command input (57), arrange the part alarm or event list (13') filtered according to an operator selection in which alarms or events associated with a selected process object are shown at the top of the list.

17. A workstation according to claim 12, **characterised** in that the workstation is arranged with hardware and software configured, on receipt of a third command input to display the first or the new alarm or event list in which the first order is any from the group of: latest alarm or event at top of list; latest alarm associated to selected event at top of list; most recent acknowledged active alarms at top of list.

18. A workstation according to claim 12, **characterised** in that the workstation is arranged with hardware and software configured to display the first alarm or event list, or the new alarm or event list, in which the second order is any from the group of: high priority un-acknowledged alarms; high priority shelved alarms; active alarms; alarms with a selected priority level equal to any from 1 to 4; acknowledged alarms.

19. A workstation according to claim 12, **characterised** in that the workstation is arranged with hardware and software configured to open the new display area on receipt of a command input generated by a user input to manipulate a handle element (9) arranged in the display window displaying the alarm list in any position from the groups of: top edge, bottom edge, left side, right side.

20. A workstation according to claim 12, **characterised** in that the workstation is arranged with hardware and software

configured to open and display, on receipt of an alternative command input, a new display area superimposed or floating on top of part of the alarm list (13) in the display window (12), which new display area does not extend beyond the display space occupied by the alarm list.

21. A process control system (20) comprising a workstation configured for handling an alarm or an event within the process control system, which further comprises computer programs for carrying out process monitoring and control operations, where processing an alarm includes displaying in a display window (12) of the workstation a first alarm or event list in which the alarms or events are arranged in a first order, **characterised** in that the workstation (26-28) is arranged with hardware (72-78) and software for processing an alarm or event according to a method that comprises the steps of opening, on receipt of a first command input (44, 55), a new display area (14) within the display window (12) displaying (42, 52) the first alarm or event list (13), and displaying in the new display area **a** part (13') of the first event or an alarm list in which the alarms or events are displayed (46, 57-59) in a second order.

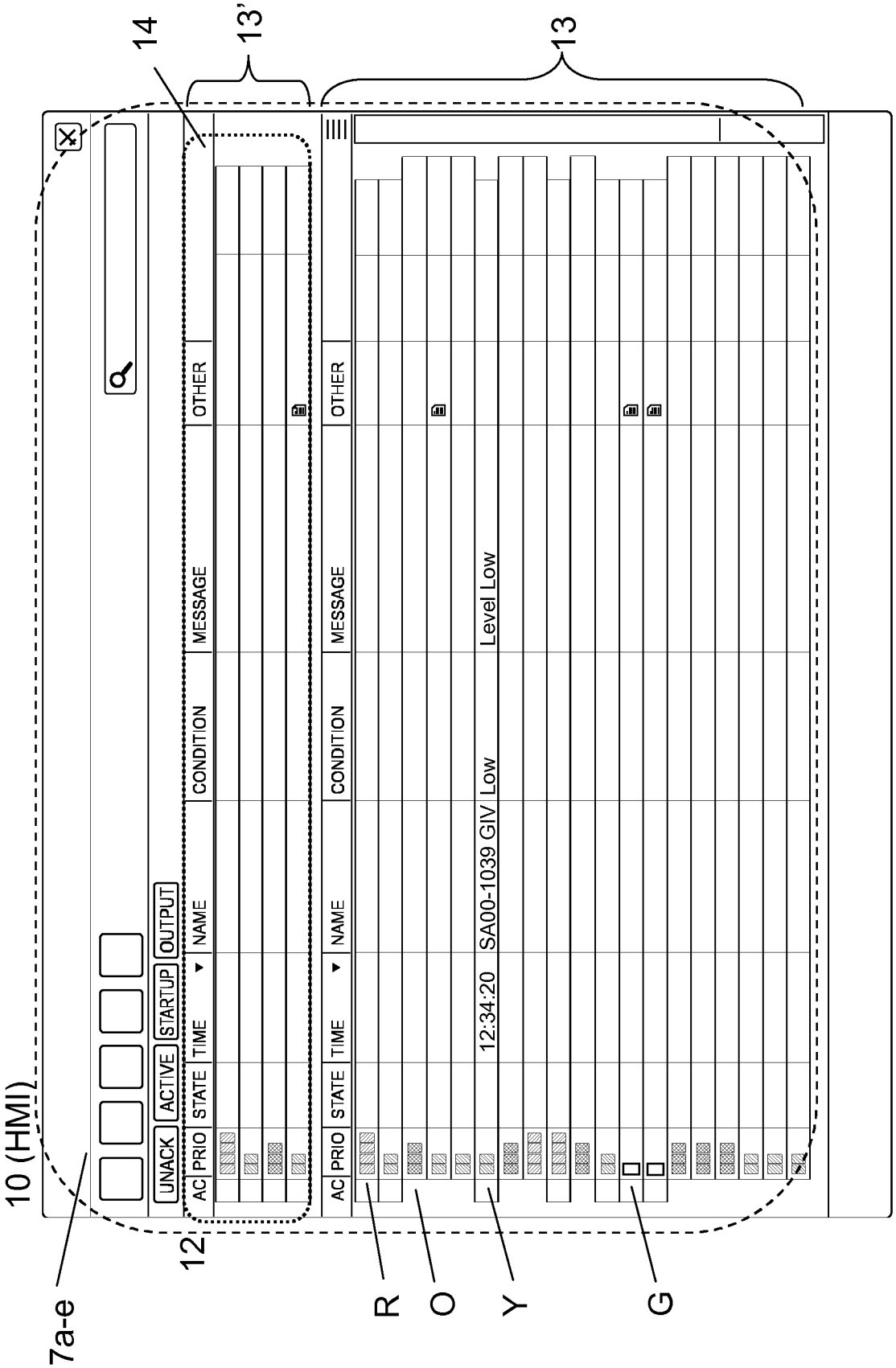
10 (HMI)
14
13'
13
UNACK
ACTIVE
STARTUP
OUTPUT
AC
PRIO
STATE
TIME
NAME
CONDITION
MESSAGE
OTHER
12:34:20
SA00-1039 GIV Low
Level Low
12
7a-e
R
O
Y
G

Fig 1

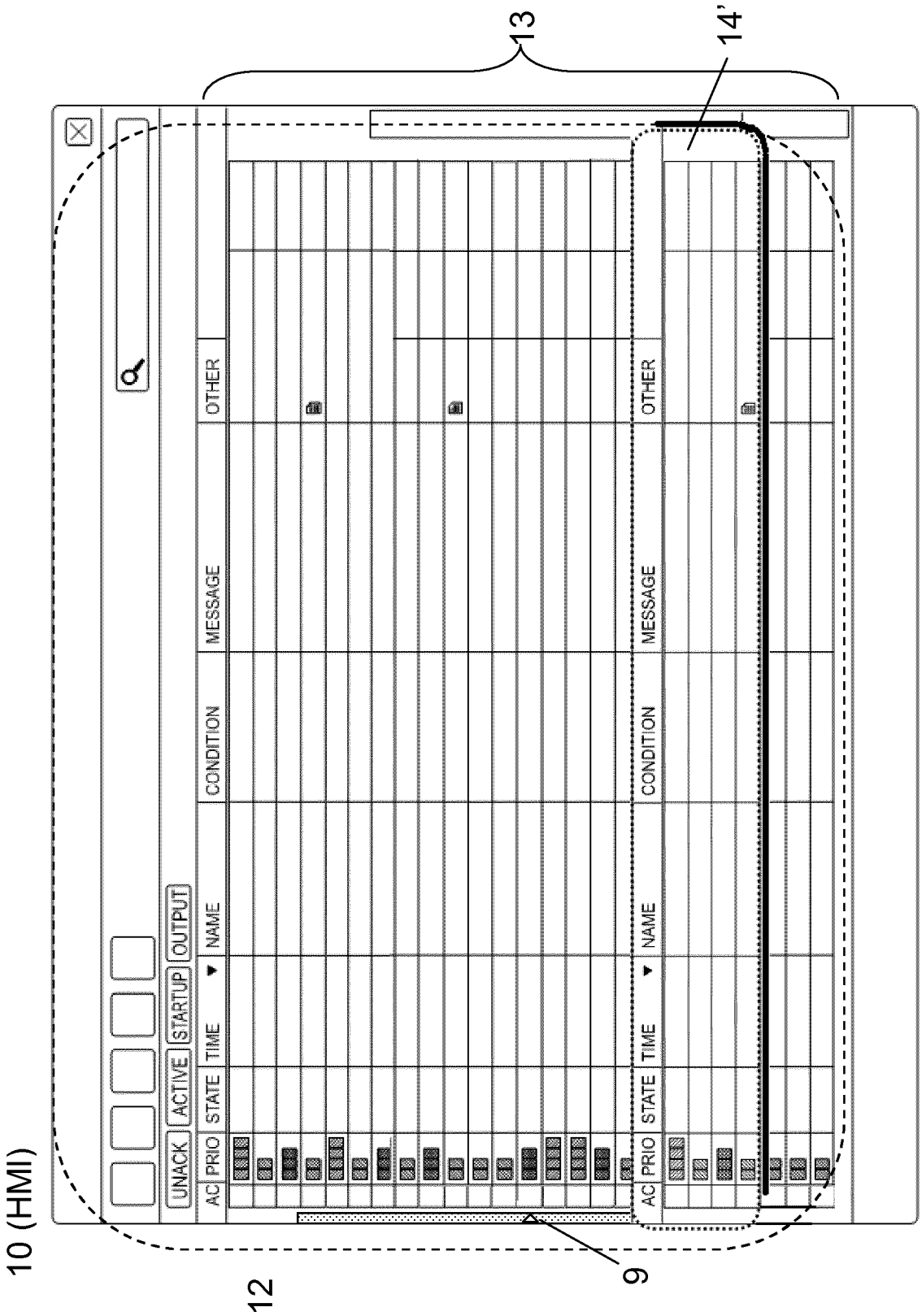
13
14'
10 (HMI)
12
9
UNACK
ACTIVE
STARTUP
OUTPUT
AC
PRIO
STATE
TIME
NAME
CONDITION
MESSAGE
OTHER

Fig 2

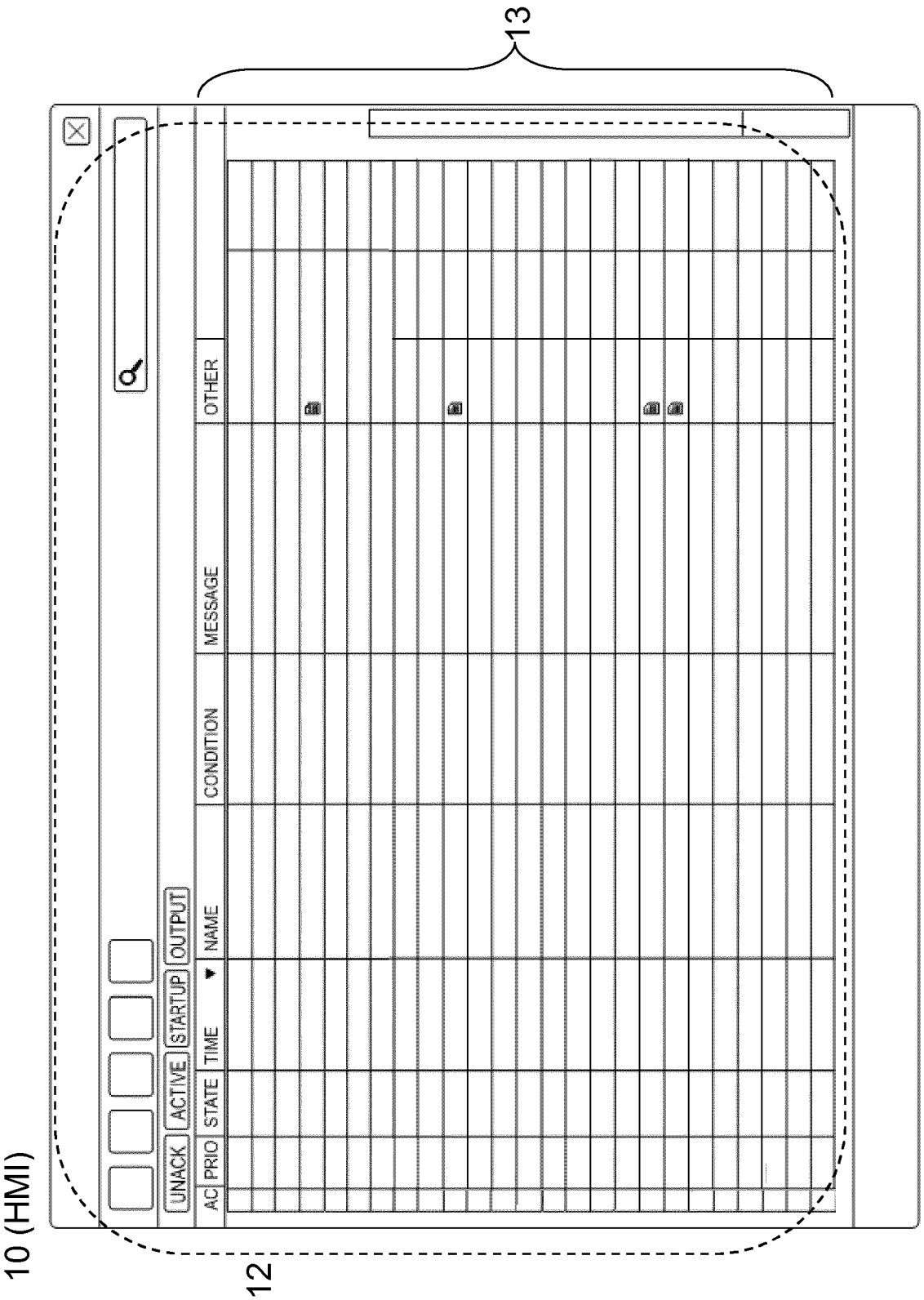

Fig 3
Prior Art

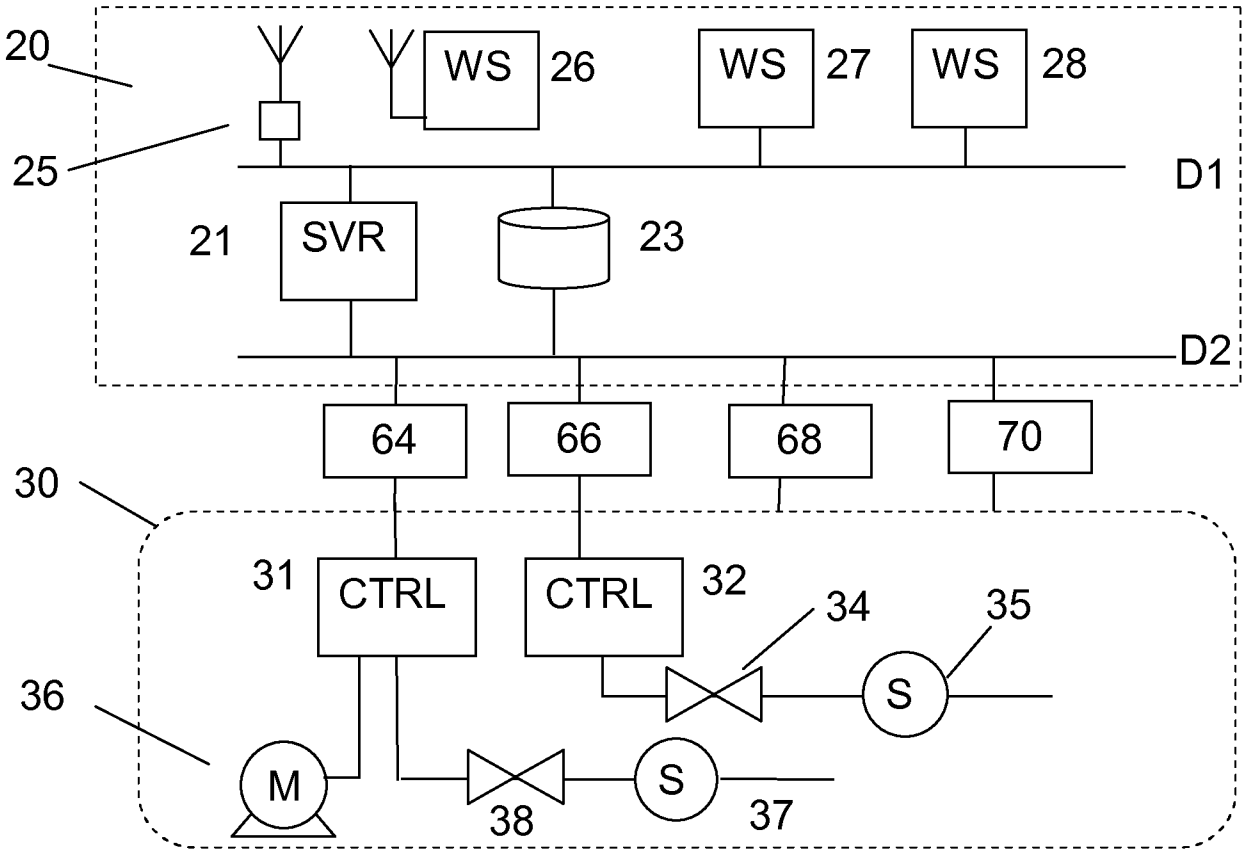
20
25
WS
26
WS
27
WS
28
D1
21
SVR
23
D2
64
66
68
70
30
31
CTRL
CTRL
32
34
35
36
S
M
S
38
37

Fig 4

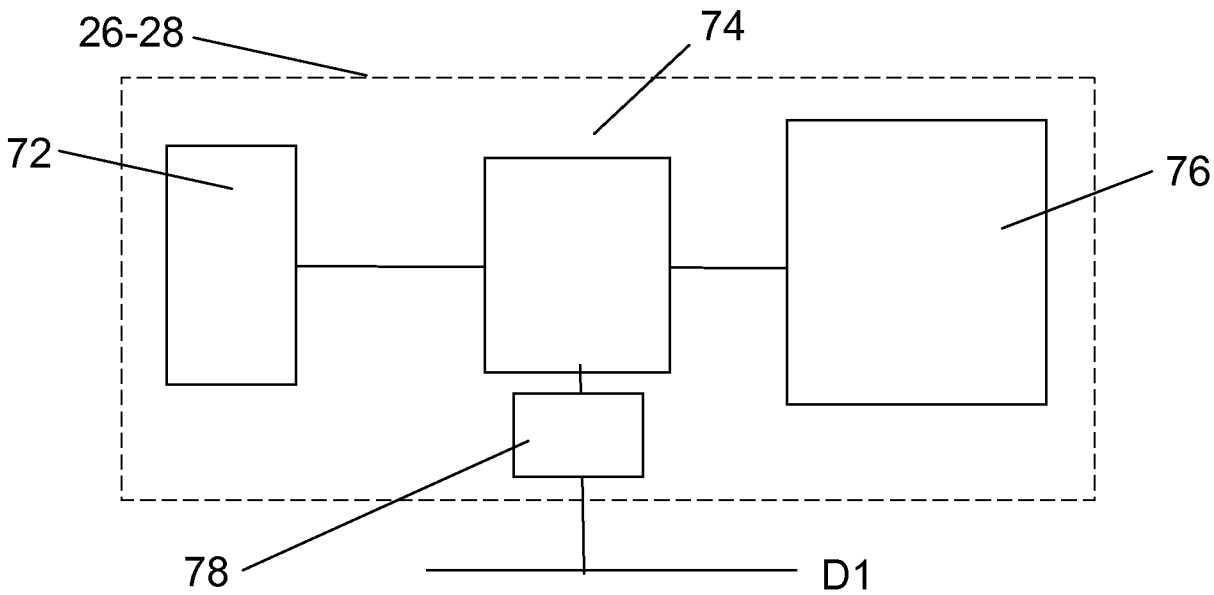
26-28
74
72
76
78
D1

Fig 5

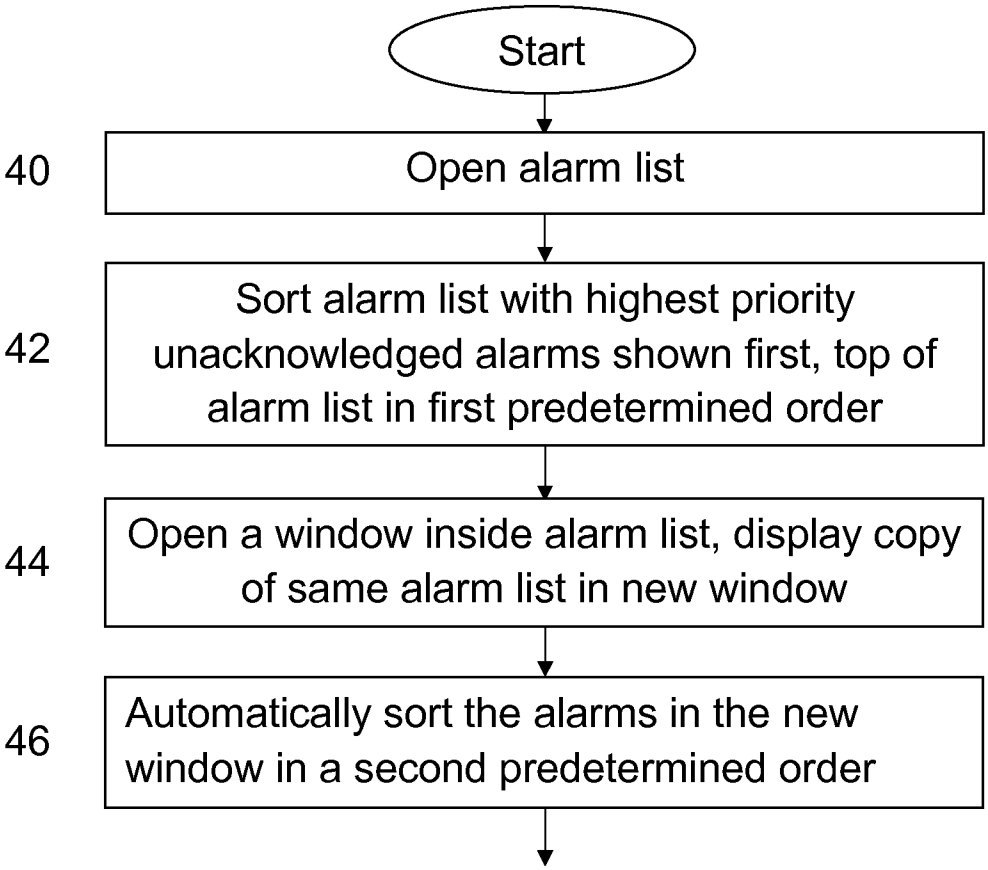
Start
40
Open alarm list
42
Sort alarm list with highest priority unacknowledged alarms shown first, top of alarm list in first predetermined order
44
Open a window inside alarm list, display copy of same alarm list in new window
46
Automatically sort the alarms in the new window in a second predetermined order

Fig 6

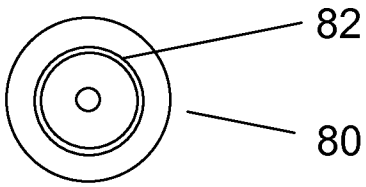
82
80

Fig 8

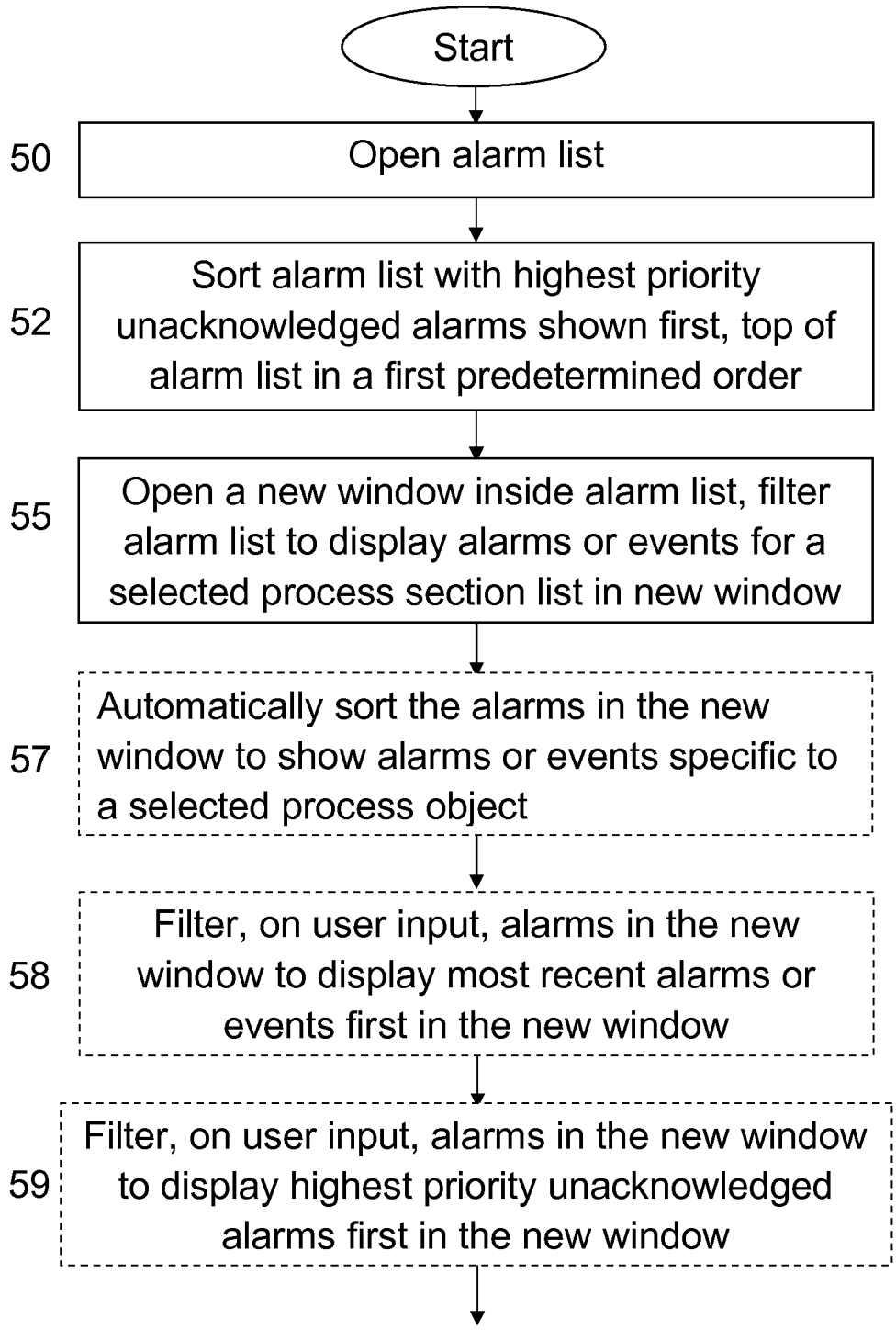
Start
50
Open alarm list
52
Sort alarm list with highest priority unacknowledged alarms shown first, top of alarm list in a first predetermined order
55
Open a new window inside alarm list, filter alarm list to display alarms or events for a selected process section list in new window
57
Automatically sort the alarms in the new window to show alarms or events specific to a selected process object
58
Filter, on user input, alarms in the new window to display most recent alarms or events first in the new window
59
Filter, on user input, alarms in the new window to display highest priority unacknowledged alarms first in the new window

Fig 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/063709

A. CLASSIFICATION OF SUBJECT MATTER
INV. G05B23/02 G06F13/00
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

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 practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2010/156654 A1 (BULLEMER PETER [US] ET AL) 24 June 2010 (2010-06-24) cited in the application the whole document	1-21
Y	US 2008/270942 A1 (PETERSEN KRISTIN [US] ET AL) 30 October 2008 (2008-10-30) paragraphs [0014] - [0023]; figure 3	1-21
A	US 2002/070972 A1 (WINDL HELMUT [DE] ET AL) 13 June 2002 (2002-06-13) the whole document	1-21
A	EP 0 528 396 A2 (IBM [US]) 24 February 1993 (1993-02-24) line 45 - page 4, line 53	1-21

☐ 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 application or patent 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	Date of mailing of the international search report
13 September 2012	20/09/2012

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	José Luis Meseguer

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/063709

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010156654 A1	24-06-2010	CA 2747410 A1	15-07-2010
		CN 102326142 A	18-01-2012
		EP 2359232 A1	24-08-2011
		JP 2012513066 A	07-06-2012
		US 2010156654 A1	24-06-2010
		WO 2010080324 A1	15-07-2010
US 2008270942 A1	30-10-2008	NONE	
US 2002070972 A1	13-06-2002	EP 1207450 A2	22-05-2002
		US 2002070972 A1	13-06-2002
EP 0528396 A2	24-02-1993	EP 0528396 A2	24-02-1993
		JP 1987126 C	08-11-1995
		JP 5210478 A	20-08-1993
		JP 7019199 B	06-03-1995