

Managing Alarms in StruxureWare SCADA Expert Vijeo Citect

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Introduction

The aim of this white paper is to describe how to use the Alarming features within SCADA Expert Vijeo Citect v7.40 to effectively manage your alarm system.

Customer Challenges

Alarm management is a topic which is becoming increasingly important in the process industry. In a typical day for a plant operator, a lot of time can be taken up in the management of alarms. The operator needs time to detect an alarm, navigate to the relevant data in the SCADA system, analyze and perform actions resulting from an alarm and ensure that the alarm condition has been handled successfully. Due to these actions required from the operator, there are guidelines on the number of alarms which can be successfully managed by an operator. The ISA 18.2 Alarm Management standard provides metrics regarding manageable average alarm rates, an average of one alarm per ten minutes is very likely to be acceptable, with a maximum manageable level of two alarms per ten minutes. Alarm rates of ten alarms in a ten minute period is not sustainable for the operator to manage and therefore can result in missed alarms.

As process complexity has increased, the control system operator interface technologies have also had to improve to better communicate the abnormal conditions, which must be addressed. EEMUA 191 and ISA 18.2 complement each other. EEMUA describes in detail the tools and techniques for various aspects of alarm management (e.g. rationalization, risk assessments, graphics design); whilst ISA 18.2 clearly defines the required performance KPIs and the overall lifecycle approach to alarm management. The performance KPIs for both documents are similar.

Main Considerations

Vijeo Citect v7.40 provides new features focused around some core objectives: Equipment Hierarchy, Alarm Management and Open Interfaces. The main focus of this white paper will be to implement the new features in Vijeo Citect in order to assist operators in the runtime management of alarms in their control system.

Requirements

- Management of different alarm priorities (levels of alarm)
- Improve the Analysis phase of alarms
- Appropriate usage/display of alarms according to users within the system
- Demonstration of common alarm actions

Alarm System Selection

The SCADA system is responsible for acquiring real-time data from the programmable automation controllers (PACs) in the system and displaying that data on operator workstations. The SCADA system also hosts services for alarming, reporting and trending. In this white paper, Vijeo Citect will be used as the SCADA system, and this white paper will focus on how to take advantage of Vijeo Citect's alarming functionality.

The alarming system performs a critical function by monitoring the equipment within the system for unexpected conditions, such as operator actions failing or process limits being exceeded. The alarm server in Vijeo Citect v7.40 has undergone an architectural change and additional features have been added to the product.

Alarm Types

Alarms can be configured in Vijeo Citect via different alarm types. The choice of alarm type will be dependent on the user's needs. The types of alarms that can be configured in Vijeo Citect include:

- **Digital alarms** are triggered based on the state of up to two digital variables. The time associated with the state change will be based on the latest of the two variable tags' time stamps.
- **Analog alarms** are triggered when an analog value goes beyond limits that have been configured by the user.
- **Advanced alarms** are triggered based on the result of a Cicode expression. Unlike all other alarm types, this expression is evaluated periodically, as defined by the alarm scan rate. Other alarm types are only evaluated when their associated variable tag's value changes. These give the user much greater flexibility. However it increases the processing load on the Alarm server.
- **Time stamped digital alarms** are triggered based on the state of one or two digital alarms, however the time associated with each state change can either come directly from a PAC for drivers that use the Driver runtime interface, or via a Cicode function. The time stamp of a time stamped digital alarm has millisecond precision.
- **Time stamped analog alarms** are similar to analog alarms except they also contain the same time stamping functionality that exists in time stamped digital alarms.
- **Time stamped alarms** are triggered based on the state of up to two digital variables but the time associated with each state change is read from another variable tag rather than using the time stamp of the two variable tags. This requires the engineer to configure an additional variable for each alarm. Time stamped alarms are not as precise as time stamped digital or analog alarms. With the precision of these alarms being controlled by the parameter [Alarm] HresType.

Users that are using the CRP 312 00 and CRA 312 10 time stamping module should configure their system using time stamped analog or time stamped digital alarms.

Alarm Archiving

Vijeo Citect v7.40 provides control over the archiving of alarm data. Alarm Archiving in Vijeo Citect v7.40 is controlled by a series of parameters.

- The citect.ini parameter **[Alarm] ArchiveAfter** sets the period of time in weeks after which alarms can be archived. After this time, alarms in the system are read-only. This means that for systems using RTU based push alarms, no alarms can be injected into the system after this time. Note that alarms are not automatically archived after this time. To archive alarms, the user must either set the “archive every” setting on the alarm server form, or by calling the cicode function “AlarmArchive()”. By default this parameter is set to 4 weeks. The alarm server must be restarted after changing this parameter.
- The citect.ini parameter **[Alarm] KeepOnlineFor** controls how long alarm data stays in the system. After this time, the history of alarms will be removed from the system and will no longer be displayed at runtime. If archiving is not configured, this means that alarm data will be lost after this time. This defaults to 6 weeks. The alarm server must be restarted after changing this parameter.
- The alarm server setting “**Archive Every**”, controls the number of days after which alarms are automatically archived. This setting can be found in Vijeo Citect Project editor on the alarm servers form, which can be opened by selecting the menu item Servers \ Alarm Servers.

The event journal stores 768 bytes of data for each event that occurs within the alarm system. On a typical system, there are three event transitions per alarm (ON, OFF and ACKNOWLEDGE). In the system under test, in which alarms are triggered at the rate of 10 alarms per operator per 10 minutes with 4 operators for a period of 6 weeks, the event journal will require:

$$\begin{aligned}
 \text{Event journal size} &= \text{bytes per event} * \text{operators} * \text{event transitions} * \text{alarms per 10 minute} * \\
 &\quad (\text{seconds per day} / \text{seconds per 10 minutes}) * [\text{Alarm}] \text{ KeepOnlineFor (in days)} \\
 &= 768 * 4 * 3 * 10 * (86400 / 600) * 42 \\
 &= \mathbf{531 \text{ Mb}}
 \end{aligned}$$

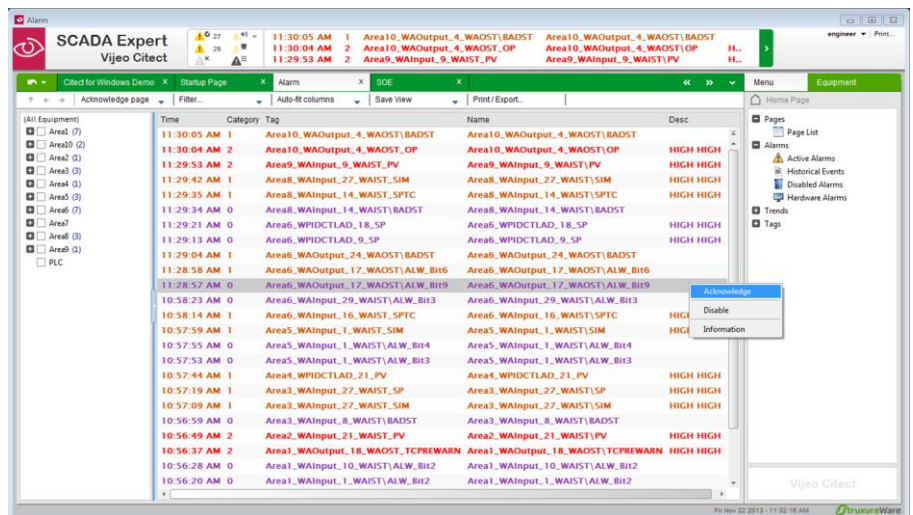
This calculation does not include the space required for configuration, security and logging.

Graphics Page Templates

Vijeo Citect v7.40 is shipped with different template styles that can be used to create graphics pages. Users can choose to use one of the existing template styles or create their own templates.

Vijeo Citect contains seven template styles:

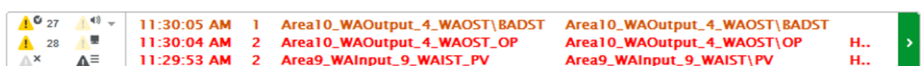
- SxW Style (StruxureWare Style)
- Tab Style
- Standard
- XP Style
- Bottom
- Top
- Version 2



Of these seven template styles, four are no longer supported, and are only shipped for backwards compatibility purposes. The four styles that are no longer supported are XP Style, Bottom, Top and Version 2. Of the remaining three styles, this white paper will use StruxureWare Style templates. This template style offers an increased amount of alarm functionality and thus reduces the amount of Cicode that needs to be written by the user.

Built into the tab style alarm templates is the ability to:

- Acknowledge alarms
- Enable and disable alarms
- Filter and sort the alarm list
- Add additional fields to the alarm list
- Get a count of the number of active and disabled alarms on all pages
- Display a sequence of events (SOE) page
- Display alarms and a SOE list within an equipment tree
- Add user events to SOE list



All **StruxureWare** style pages contain an alarm banner at the top of each page. This alarm banner displays the last three alarms that have occurred, as well as a count of the active alarms, the unacknowledged alarms and the disabled alarms in the system. Alarms can be acknowledged and disabled directly from the banner, meaning an operator can quickly action alarms without leaving their current page.

Historical Alarm Page

Historical alarms can be viewed in Vijeo Citect by using either an alarm summary or a SOE page. Both pages allow the user to display a list of historical alarms, but both have different functionality.

The alarm summary page contains one entry for each instance of an alarm that is raised. The time that instance of the alarm went on, off and was acknowledged, are all stored in the same record. If the same alarm is raised a subsequent time, a new instance of this alarm is created in the summary page.

By comparison, the sequence of events has a number of advantages over the summary page. The SOE page contains one entry for each time an alarm changes state i.e. in a typical system, each alarm goes on before being acknowledged and being turned off (or vice versa). On the sequence of events page, this sequence of alarm state transitions will be displayed as three separate records. The SOE page also has the advantage that comments and user events can be added to it. The SOE page also records security information, with all login and logout events throughout the system being stored in this same view. Vijeo Citect v7.40's filtering functionality allows these events to be removed from the SOE page, without the need for the integrator to write any Cicode.

For these reasons, the SOE page will be used to display historical alarms in this white paper.

The screenshot displays the 'SOE' (Sequence of Events) page in the Vijeo Citect SCADA Expert interface. The page shows a list of historical alarms with columns for Date, Time, Tag, Name, and Message. The interface includes a top menu bar with options like 'Citect for Windows Demo', 'Startup Page', 'Alarm', 'SOE', and 'Menu'. A left sidebar shows a tree view of equipment areas (Area1 to Area9). The main table lists various alarm events, such as 'Area10_WAOOutput_4_WAOST_BADST' and 'Area9_WAInput_9_WAIST_PV'. The bottom status bar indicates the date and time as 'Fri Nov 22 2013 - 11:44:20 AM'.

Date	Time	Tag	Name	Message
22/11/2013	11:37:59 AM	Area6_WA...	Area6_WAOOutput_...	Alarm "11/22/2013 11:28:57:618 AM Area6_...
22/11/2013	11:30:05 AM	Area10...	Area10_WAOOutp...	Area10_WAOOutput_4_WAOST\BADST ...
22/11/2013	11:30:04 AM	Area10...	Area10_WAOOutp...	Area10_WAOOutput_4_WAOST_OP - Va...
22/11/2013	11:29:53 AM	Area9_W...	Area9_WAInput...	Area9_WAInput_9_WAIST_PV - Value:...
22/11/2013	11:29:42 AM	Area8_W...	Area8_WAInput...	Area8_WAInput_27_WAIST_SIM - Valu...
22/11/2013	11:29:35 AM	Area8_W...	Area8_WAInput...	Area8_WAInput_14_WAIST_SPTC - Va...
22/11/2013	11:29:34 AM	Area8_W...	Area8_WAInput...	Area8_WAInput_14_WAIST\BADST - A...
22/11/2013	11:29:21 AM	Area6_W...	Area6_WPIDCT...	Area6_WPIDCTLAD_18_SP - Value: 1...
22/11/2013	11:29:13 AM	Area6_W...	Area6_WPIDCT...	Area6_WPIDCTLAD_9_SP - Value: 100...
22/11/2013	11:29:04 AM	Area6...	Area6_WAOOutput...	Area6_WAOOutput_24_WAOST\BADST ...
22/11/2013	11:28:58 AM	Area6...	Area6_WAOOutpu...	Area6_WAOOutput_17_WAOST\ALW_Bi...
22/11/2013	11:28:57 AM	Area6...	Area6_WAOOutput...	Area6_WAOOutput_17_WAOST\ALW_Bi...
22/11/2013	10:58:23 AM	Area6_W...	Area6_WAInput...	Area6_WAInput_29_WAIST\ALW_Bit3 ...
22/11/2013	10:58:14 AM	Area6_W...	Area6_WAInput...	Area6_WAInput_16_WAIST_SPTC - Va...
22/11/2013	10:57:59 AM	Area5_W...	Area5_WAInput...	Area5_WAInput_1_WAIST_SIM - Value...
22/11/2013	10:57:55 AM	Area5_W...	Area5_WAInput...	Area5_WAInput_1_WAIST\ALW_Bit4 - ...
22/11/2013	10:57:53 AM	Area5_W...	Area5_WAInput...	Area5_WAInput_1_WAIST\ALW_Bit3 - ...
22/11/2013	10:57:44 AM	Area4_W...	Area4_WPIDCT...	Area4_WPIDCTLAD_21_PV - Value: 1...
22/11/2013	10:57:19 AM	Area3_W...	Area3_WAInput...	Area3_WAInput_27_WAIST_SP - Value...
22/11/2013	10:57:09 AM	Area3_W...	Area3_WAInput...	Area3_WAInput_27_WAIST_SIM - Valu...
22/11/2013	10:56:59 AM	Area3_W...	Area3_WAInput...	Area3_WAInput_8_WAIST\BADST - A...
22/11/2013	10:56:49 AM	Area2_W...	Area2_WAInput...	Area2_WAInput_21_WAIST_PV - Value...
22/11/2013	10:56:37 AM	Area1...	Area1_WAOOutpu...	Area1_WAOOutput_18_WAOST_TCPR...
22/11/2013	10:56:28 AM	Area1_W...	Area1_WAInput...	Area1_WAInput_10_WAIST\ALW_Bit2 ...



How to Manage Alarms in Vijeo Citect

Alarm System Design

Alarm Priorities

In any alarm system it is extremely useful to prioritise the alarms in the system so that more important alarms are more obvious to an operator. This is useful in periods of high activity, where a large number of alarms can occur at once and the operator must choose which alarms to action first. An alarm priority is usually based on one of two factors:

- The severity of the consequence that could occur if the operator does not take the appropriate corrective action to the alarm.
- The amount of time that the operator has available compared to the amount of time that it would take to perform a corrective action.

The EEUMA 191 standard recommends that three alarm priorities should be used within one alarm display. Many sites however have more than one alarm system. Some sites may have safety related alarms hard-wired and a separate fire or gas alarm panel. In this situation it is recommended that alarm priorities be consistent across all systems.

In this white paper, alarms will be given one of the following priorities:

- High
- Medium
- Low

However on most sites, as safety alarms are handled by one or more separate systems, no Critical alarms will be configured in the SCADA system. Under most circumstances it is recommended that only High, Medium and Low priority alarms be configured within Vijeo Citect.

The EEMUA 191 standard recommends that to make it easier for an operator to identify higher priority alarms, the frequency at which alarms occur should decrease as the priority increases. For each increase in priority, it is recommended that the frequency at which those alarms occur decreases by a factor of five.

Priority	Target Maximum occurrence rate
Critical	Very infrequently
High	Less than 5 per shift
Medium	Less than 2 per hour
Low	Less than 10 per hour

When designing a system it is difficult to know at what rate alarms will be triggered at, on the running system. For this reason, during the design phase, alarms should be assigned in proportions according to the table below (Alarm Priority breakdown). Then during commissioning, alarm priorities should be adjusted so that the system achieves a performance similar to the table above (Target Maximum alarm frequency).

Priority	Proportion
Critical	About 20 altogether
High	< 5% of configured alarms
Medium	< 15% of configured alarms
Low	80% of all alarms

Alarm Categories

Alarms within Vijeo Citect can be grouped together into categories. The priority of an alarm is defined within an alarm category. Alarm categories also allow the user to define:

- The font in which an alarm is displayed
- The fields that are displayed when an alarm is triggered
- An action that is triggered when an alarm changes into the ON, OFF or ACK state
- Alarm log devices, such as SQL databases, dbf or text files
- Whether the alarm is displayed on the alarm, summary or SOE pages

Alarms can also be filtered and sorted based on their category.

Equipment Hierarchy

Equipment hierarchy can be used to define plant equipment to assist with conforming to various standards, such as the batching standard S88. Equipment hierarchy allows alarms, as well as variable tags, trends, accumulators and other types of information to be bound to a specific piece of equipment. At runtime this allows alarms to be displayed in an equipment tree, and gives users a lot of flexibility to filter, sort and count alarms by its equipment.

Sequence of Events

The sequence of events list is a historical view of all events that have occurred in your system. An event is logged in Vijeo Citect's event journal view when:

- An alarm changes state, i.e. if an alarm goes ON, turns OFF or is acknowledged
- An alarm is enabled or disabled
- A user logs onto the system
- A user adds a comment to an alarm
- A new user event is added to the system
- The configuration of an alarm is first loaded from the project configuration
- The configuration of an alarm is changed and the alarm server is reloaded

Configuring the Alarm System

Alarm Priorities

An alarm's priority is defined within the "Alarm Category form". The priority is a number in the range 0-255. Lower numbers indicate higher priority alarms. However, for ease of configuration, a label can be used in place of this number within the priority field. Labels can only be used at configuration time and not at runtime.

Labels [alarm_include]

Label Name: HIGH

Expression: 2

Comment: High Priority Alarms

Buttons: Add, Replace, Delete, Help

Record: 1 Deleted Linked: No

Configure the following labels for the four alarm priorities:

Label Name	Expression
High	2
Medium	3
Low	4

Font Customization

Different alarms can be configured to display with different fonts at runtime. Alarms of the same priority can be configured to be displayed using the same fonts. This quickly allows the operator to determine an alarm's importance.

Alarm fonts are configured per category, and a different font can be configured for each of the five states that an alarm can appear in (ON Unacknowledged, ON Acknowledged, OFF Unacknowledged, OFF Acknowledged and Disabled). Font colors are defined by using labels.

Labels [alarm_include_sxw]

Label Name: DarkOrange

Expression: 0x00D35400

Comment: RGB Value 211, 84, 0

Buttons: Add, Replace, Delete, Help

Record: 8 Deleted Linked: No

Colors in Vijeo Citect are represented by number that can be calculated using the formula:

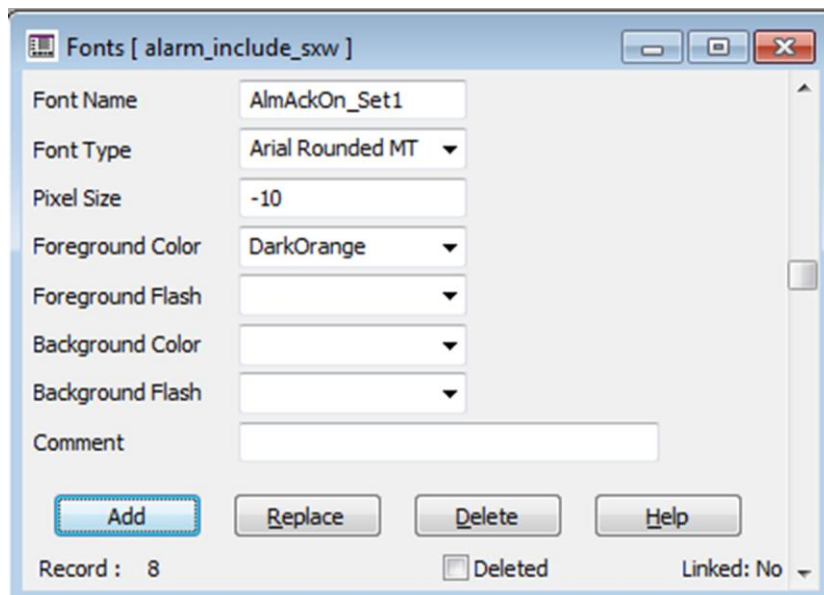
$$\text{Color} = (\text{Blue} + (\text{Green} * 256) + (\text{Red} * 65536))$$

Where blue, green and red represent the RGB value for that color (which is a number between 0 and 255). Alternatively, this can be defined as a three byte hexadecimal value with the high byte representing the red value, the middle byte representing the green value and the low byte representing the blue value.

In this project, five additional colors have been defined. The remaining alarm font colors have been defined in the "Include" project.

Label Name	Red	Green	Blue	Label Value
DarkPurple	142	68	173	0x008E44AD
Mauve	188	137	208	0x00bc89D0
DarkOrange	211	84	0	0x00D35400
LightOrange	238	167	104	0x00EEA768
PalePink	228	142	133	0x00E48E85

Once the labels have been defined, these can be used within the fonts form. By defining the pixel size, as negative, the font size is as a point size.



Fonts can then be used within the alarm categories. This project has the following fonts defined.

Font Name	Font Type	Pixel Size	Foreground Color
AlmUnAckOn_Set0	Lucida Sans Unicode,B	-10	DarkPurple
AlmUnAckOff_Set0	Lucida Sans Unicode,B	-10	Mauve
AlmAckOn_Set0	Arial Rounded MT	-10	DarkPurple
AlmAckOff_Set0	Arial Rounded MT	-10	Grey2
AlmDisabled_Set0	Arial Rounded MT	-10	MidBlue
AlmUnAckOn_Set1	Lucida Sans Unicode,B	-10	DarkOrange
AlmUnAckOff_Set1	Lucida Sans Unicode,B	-10	LightOrange
AlmAckOn_Set1	Arial Rounded MT	-10	DarkOrange
AlmAckOff_Set1	Arial Rounded MT	-10	Grey2
AlmDisabled_Set1	Arial Rounded MT	-10	MidBlue
AlmUnAckOn_Set2	Lucida Sans Unicode,B	-10	LIGHT_RED
AlmUnAckOff_Set2	Lucida Sans Unicode,B	-10	PalePink
AlmAckOn_Set2	Arial Rounded MT	-10	LIGHT_RED
AlmAckOff_Set2	Arial Rounded MT	-10	Grey2
AlmDisabled_Set2	Arial Rounded MT	-10	MidBlue

Alarm Categories

Alarms can be grouped together via alarm categories. Alarm categories allow the user to define the fonts that an alarm is displayed in, its priority, its display format, as well as some advanced functionality, such as On, Off and Acknowledge actions. At runtime, alarms can be sorted and filtered by their category, and a number Cicode functions exist that allow the user to interact with alarms in specific categories. At a minimum, define one category for each priority of alarms. In the example below, the contents of the “Priority”, “Unack On Font”, “Unack Off Font”, “Ack Off Font”, “Ack Off Font” are the labels that were defined earlier.

For more information on configuring Alarm Categories, please refer to the Vijeo Citect documentation. This project contains the following categories:

Category	Priority	UnAck On Font	UnAck Off Font
2	HIGH	AlmP2OnUnackFnt	AlmP2OffUnackFnt
1	MEDIUM	AlmP3OnUnackFnt	AlmP3OffUnackFnt
0	LOW	AlmP4OnUnackFnt	AlmP4OffUnackFnt

Alarm Pages

Alarm pages can be created in Graphics Builder. Pages have been created in this project using the following templates:

Page Name	Library	Template
Alarm	Sxw_Style_Include	Alarm
Disabled	Sxw_Style_Include	Disabled
SOE	Sxw_Style_Include	SOE

All alarm pages from the SxW Style Include project have in-built functionality that allows an operator to acknowledge, enable, disable, sort and filter alarms without the need for any additional configuration.

Alarm Filter Rules

In addition to the advanced filtering functionality that is available at runtime, Vijeo Citect v7.40 allows the user to add alarm filter rules to the alarm filter dialog, without having to write any additional Cicode. This allows the engineer to add filter rules for common queries that will need to be performed without the operator having to build a new filter every time the alarm page is displayed.

Adding a simple filter rule to the alarm filter form can be done by opening the Computer Setup Editor and adding the following parameters to your citect.ini file:

- [AlarmFilterRules] <RuleName>
- [AlarmFilterRuleList] Rule<n>
- [AlarmFilterRuleList.Active] Rule<n>
- [AlarmFilterRuleList.Disabled] Rule<n>
- [AlarmFilterRuleList.Summary] Rule<n>
- [AlarmFilterRuleList.SOE] Rule<n>

For example, to add a simple filter rule to the Active Alarm and SOE pages that only displays critical priority alarms, configure the following parameters:

Citect.ini parameter	Value
[AlarmFilterRules] High Priority Alarms	Priority = 2
[AlarmFilterRuleList.Active] Rule3	High Priority Alarms
[AlarmFilterRuleList.SOE] Rule4	High Priority Alarms

To configure alarm filters to filter alarms based on the remaining three alarm priorities defined above, add the following citect.ini parameters.

Citect.ini parameter	Value
[AlarmFilterRules] Medium Priority Alarms	Priority = 3
[AlarmFilterRuleList.Active] Rule4	Medium Priority Alarms
[AlarmFilterRuleList.SOE] Rule5	Medium Priority Alarms
[AlarmFilterRules] Low Priority Alarms	Priority = 4
[AlarmFilterRuleList.Active] Rule5	Low Priority Alarms
[AlarmFilterRuleList.SOE] Rule6	Low Priority Alarms
[AlarmFilterRules] Last 8 hours	#Now[-28800]
[AlarmFilterRuleList.Active] Rule6	Last 8 hours
[AlarmFilterRuleList.SOE] Rule7	Last 8 hours

Filter rules can also be combined together using the semicolon character (;), which acts as a logical AND.

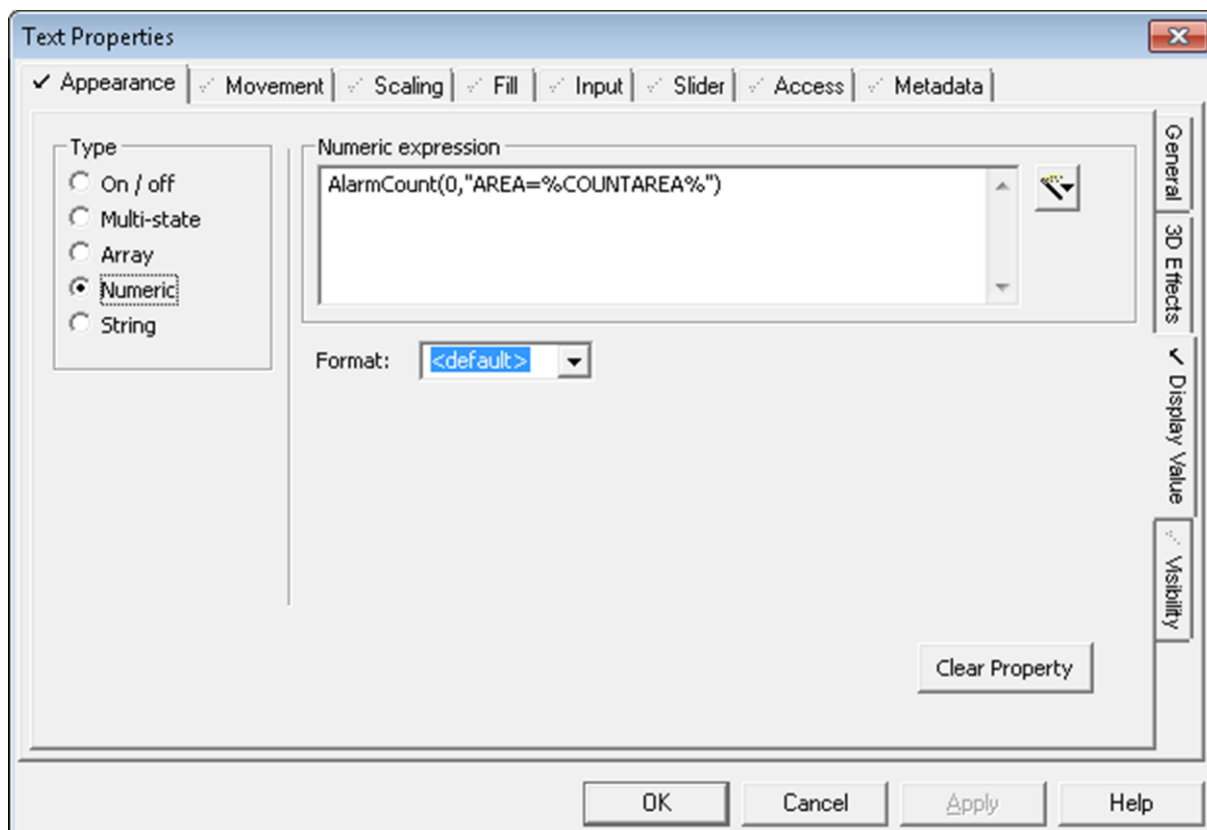
Citect.ini parameter	Value
[AlarmFilterRules] High Alarms Last 8 hours	Priority = 2;#Now[-28800]
[AlarmFilterRuleList.Active] Rule7	High Alarms Last 8 hours
[AlarmFilterRuleList.SOE] Rule8	High Alarms Last 8 hours

For more information on configuring simple filter rules, please refer to the topic “AlarmFilterRule Parameters” in the Vijeo Citect documentation.

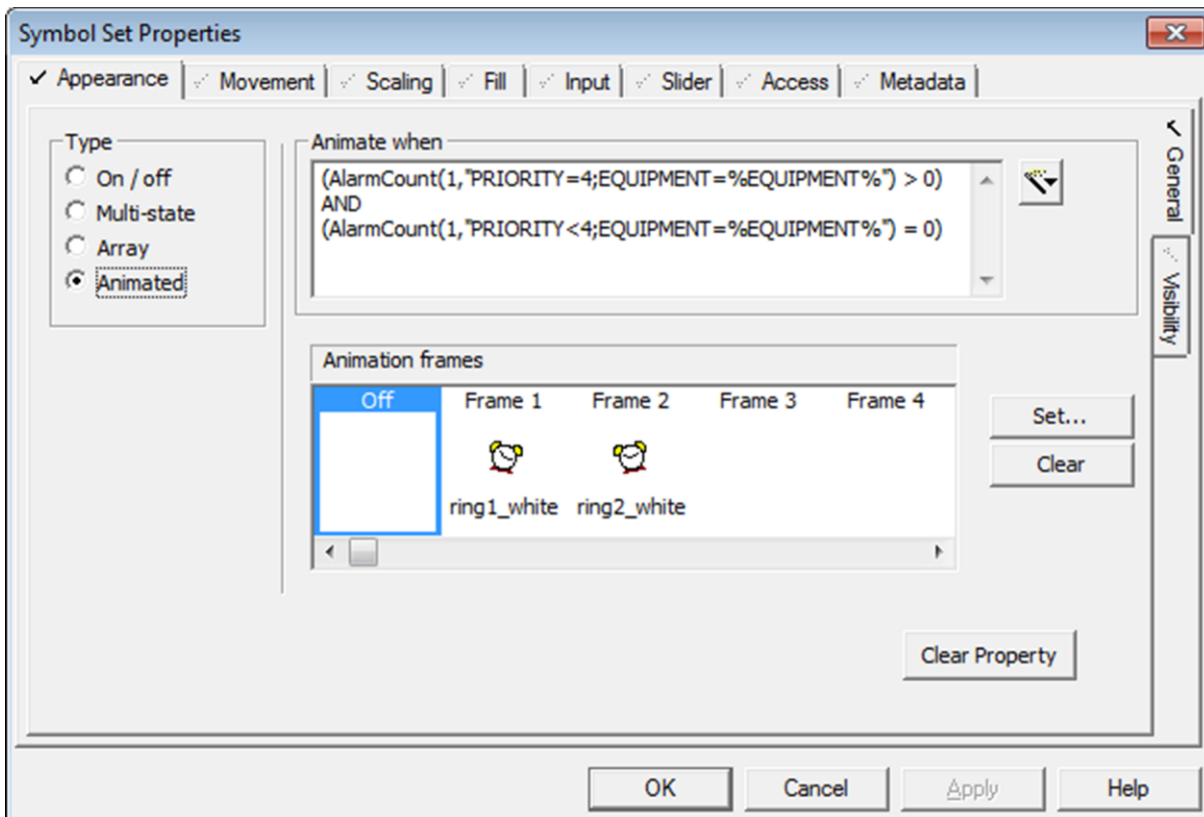
Alarm Count Display

Alarm counts can easily be configured on Vijeo Citect graphics pages. Alarm counts can be configured to count the total number of alarms in an alarm list, or to count the number of alarms that match a certain criteria. In this white paper, I will use this functionality to build two genies. The first will count the number of alarms in each area of the plant for an overview page, and the second will be a flashing warning icon that will change color dependent on the highest priority of alarm for a specific piece of equipment.

The number of alarms in an area can be displayed by creating a genie and placing a number object on it. The Cicode function AlarmCount() will be used within this genie. The area will be passed into the genie using a genie substitution. Note that using genie substitution %Area% is not supported.



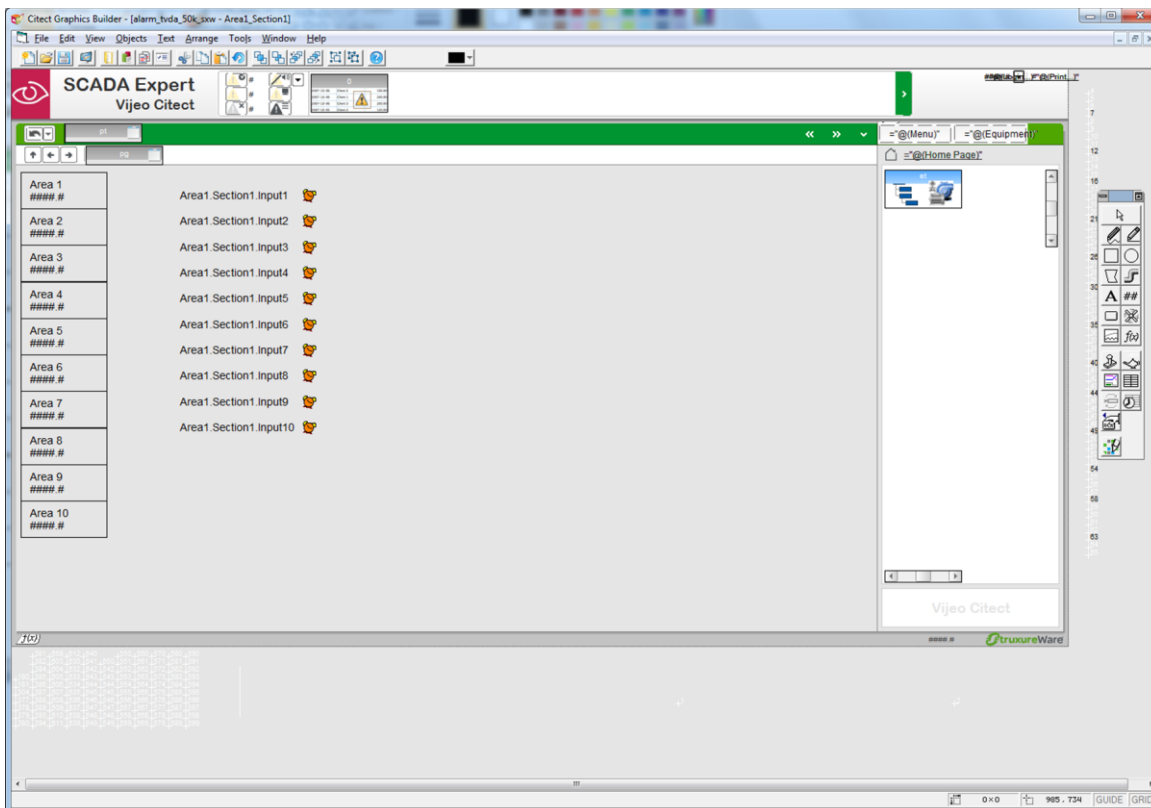
To create a genie that will change color depending on the highest priority of alarm that is occurring for a piece of equipment, create a new genie and place a symbol set of it. Again, the Cicode function AlarmCount() will be used, but this time, the filter parameter will be set to count by priority and equipment. This will be done by creating four animated symbol sets, which are aligned on top of each other.



In total, three symbol sets will be configured on top of each other, configured as follows:

Animate When Expression	Frame 1 Symbol	Frame 2 Symbol
<code>(AlarmCount(1, "PRIORITY=4;EQUIP=%EQUIPMENT%") > 0)</code> AND <code>(AlarmCount(1, "PRIORITY<4;EQUIP=%EQUIPMENT%") = 0)</code>	Ring1_white	Ring2_white
<code>(AlarmCount(1, "PRIORITY=3;EQUIP=%EQUIPMENT%") > 0)</code> AND <code>(AlarmCount(1, "PRIORITY<3;EQUIP=%EQUIPMENT%") = 0)</code>	Ring1_yellow	Ring2_yellow
<code>AlarmCount(1, "PRIORITY=2;EQUIP=%EQUIPMENT%") > 0</code>	Ring1_orange	Ring2_orange

These genres can then be used in graphics pages, templates or other genres.



For information on creating graphics pages, please refer to the Vijeo Citect documentation.

Alarm Archiving

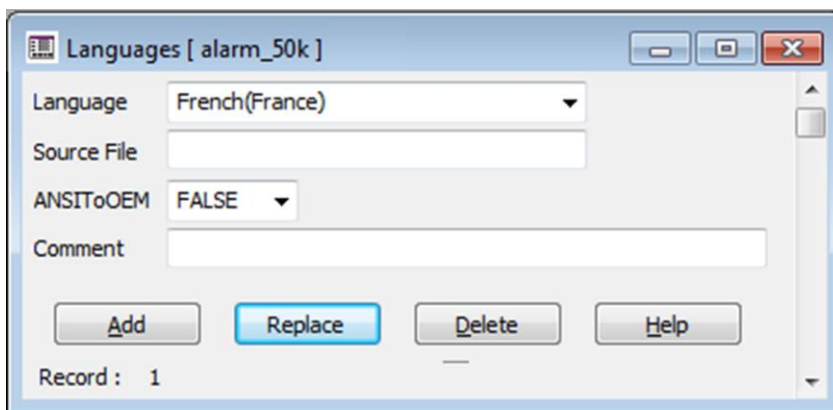
Alarm archiving can be configured by setting a combination of alarm server settings and citect.ini parameters. In this example, the alarm server will be configured to archive after four weeks and keep alarm data online for six months.

Citect.ini parameter	Value
[Alarm.c1.AlarmServer1] ArchiveAfter	4
[Alarm.c1.AlarmServer1] KeepOnlineFor	26

Localization

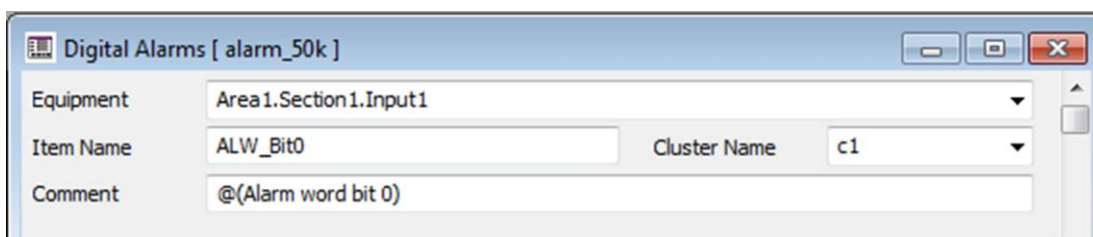
The language that alarm field is displayed in can be configured to be changed at runtime. In Vijeo Citect v7.40, the language that is displayed can be selected when a user logs in. To configure the languages that the operator can use at runtime:

1. In Project Editor, select System\Languages to open the languages form.
2. Select the language that you wish to configure from the drop down list.
3. Configure the ANSI to OEM setting. For details on this setting please refer to the Vijeo Citect documentation.



4. Mark the contents of any fields that are to be translated with the language change indicator @(). For example to mark the string "Alarm word bit 0" for translation, enter "@(Alarm word bit 0)". Vijeo Citect v7.30 does not support the localization of partial strings. In this project, only the contents of the "Comment" field will be marked for localization. The following fields can be marked for translation:

- Name
- Description
- Comment
- Custom1 – Custom 8



5. Once all of your strings have been marked for localization, compile your project. The compiler will create the file “French(France).dbf”. This file contains the mapping between the native content (that have been marked for localization) and their local translations.
6. Vijeo Citect does not contain a facility to translate these strings. Translation can be done by a professional translator, a native speaker of both languages, or through various online translation services. Online translation web sites will not read dbf files, so the contents of the “Local” column should be saved to a text file which can then be automatically translated. The translated strings can then be copied into the “Native” column.

NATIVE	LOCAL
37 Print / Export	Imprimer / exporter
38 Silence Options	Options de silence
39 Historical Events Options	Événements historiques options
40 Reset alarm filter.	Réinitialiser le filtre d'alarme.
41 Disable all alarms on page.	Désactiver toutes les alarmes sur la page.
42 Total Disabled Alarms	Total des alarmes réduite
43 No Filter	Pas de filtre
44 Display Page Select Dialog	Afficher la boîte de dialogue Sélecteur de page
45 Save view	Enregistrer voir
46 Go to first page	Aller à la première page
47 Silence Alarms	Alarmes Silence
48 Unacknowledged Alarms	Les alarmes non acquittées
49 Set filter	Set filtre
50 Silence Time Remaining	Temps restant Silence
51 Auto size column widths of the alarm list.	Auto largeurs de colonnes de taille de la liste des alarmes.
52 Display Active Alarms	Afficher des alarmes actives
53 Reload column view settings of the alarm list	Recharger les paramètres d'affichage des colonnes de la liste des alarmes
54 Display Parent Page	Afficher la page parente
55 Print / export alarm list to file.	Liste des alarmes Imprimer / exporter dans un fichier.
56 Scroll to first page of alarms.	Faites défiler à la première page des alarmes.
57 Alarm sound is being silenced	Alarme sonore est réduit au silence

Alarm System Operation

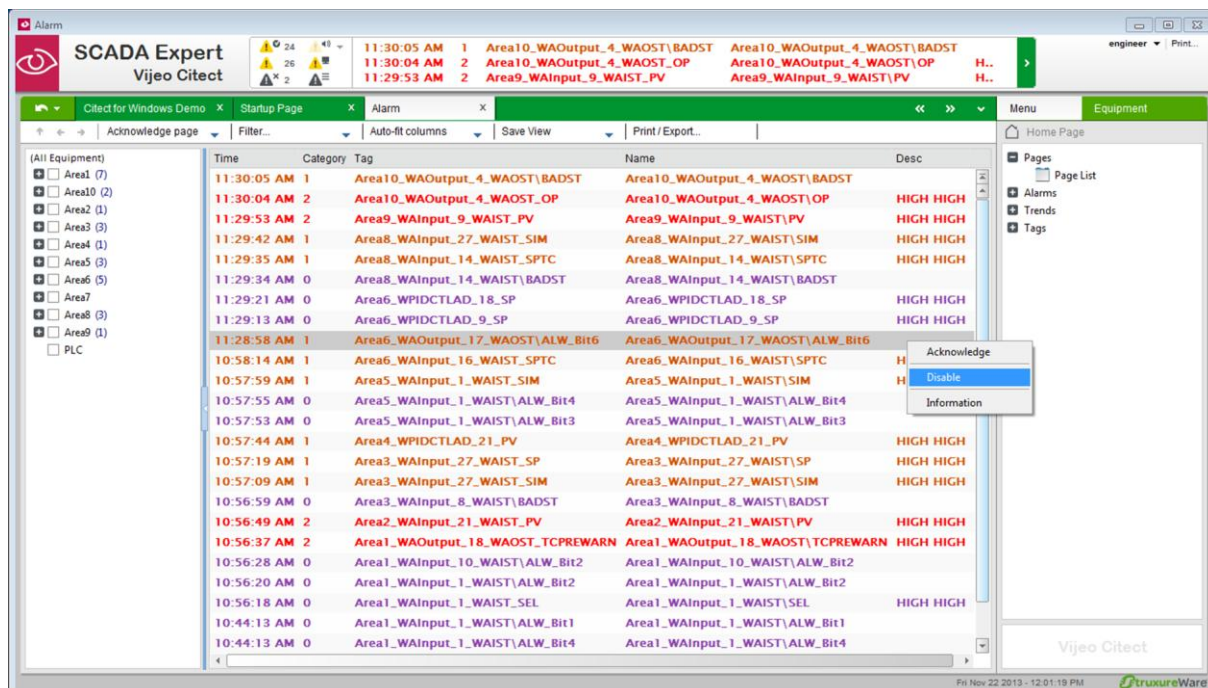
Acknowledging Alarms

Alarms can be acknowledged on the active alarm page, or from the alarm banner on any StruxureWare style alarm page. Alarms can be acknowledged by users if they have access to the privilege defined for that alarm, and the user has access to the privilege defined in the parameter [Privilege] AckAlarms. By default, users must have access to privilege 1 to acknowledge alarms. An Alarm can be acknowledged by right clicking on the alarm, on the active alarm page or on the alarm banner. To allow alarm acknowledgement to be controlled through the privileges associated with each user's role, set [Privilege] AckAlarms to 0.

Regardless of the alarms configured area and privilege, and the value of the parameter [Privilege] AckAlarms, alarms cannot be acknowledged if no user is logged into Vijeo Citect.

Disabling and Enabling Alarms

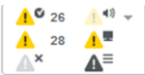
Alarms in Vijeo Citect can be disabled directly from any active alarm page or from the alarm banner, by right clicking on the alarm and selecting "Disable" from the pop up menu. Alarms can be disabled by users if they have access to the privilege defined for that alarm, and the user has access to the privilege defined in the parameter [Privilege] DisabledAlarms. This parameter defaults to 8. To allow the disabling of alarms to be controlled through the privileges associated with each users' role, set [Privilege] AckAlarms to 0.



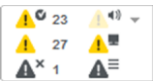
Similarly to disable an alarm, if the currently logged in user does not have the correct privilege for that alarm, the disabled item in the pop-up menu will be unavailable. Again, regardless of the alarms configured area and privilege, and the value of the parameter [Privilege] DisabledAlarms, alarms cannot be disabled if no user is logged into Vijeo Citect. Once an alarm has been disabled, the alarm will no longer appear on the active alarm page. The current list of disabled alarms can be seen by displaying the "Disabled" Page. Alarms can be re-enabled by right clicking the alarm on the disabled page and selecting "Enable".

Alarm Counts

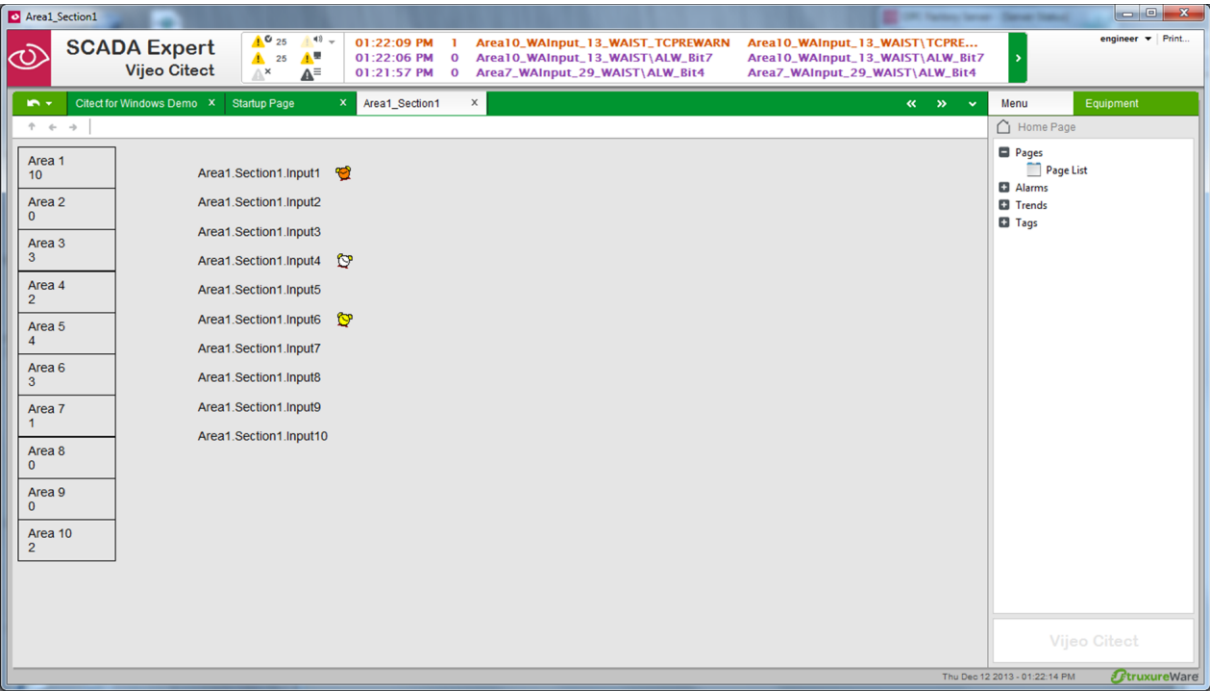
The count of all unacknowledged alarms is displayed next to the alarm icon in the bottom left hand corner of graphics pages that have been configured using templates from the StruxureWare style include project.



If the system also contains disabled alarms, the count of disabled alarms will be shown next to the disabled alarm icon.



Any genies that have been configured to use the AlarmCount()Cicode function will also display the count of alarms.



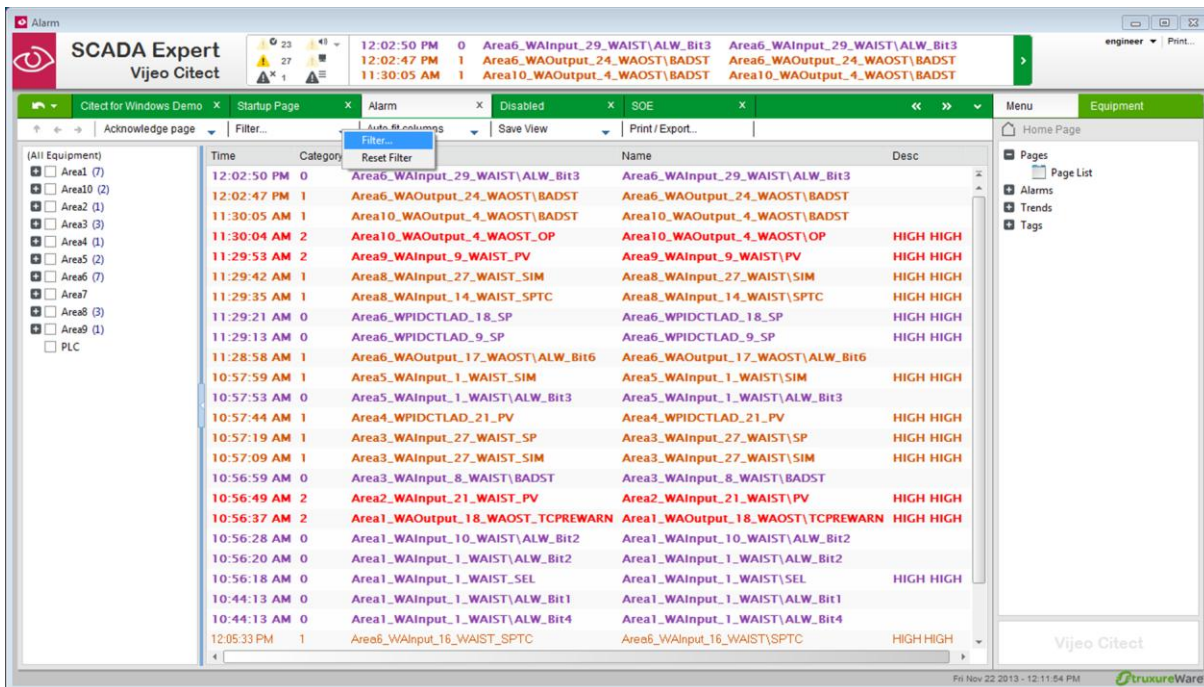
Comments and User Events

Comments can be added to any event on the SOE page, apart from other comments. To add a comment, right click on the event that you want to add the comment to and select “Comment”. To add a comment, a user must have privileges 1 - 8. Once a comment has been added, it will appear as a new record in the SOE list, with the “Tag”, “Time” and “Date” fields being inherited from the event that the comment was added to. The “Classification” set to “Comment”. The “Message” field will contain the comment that was added by the user.

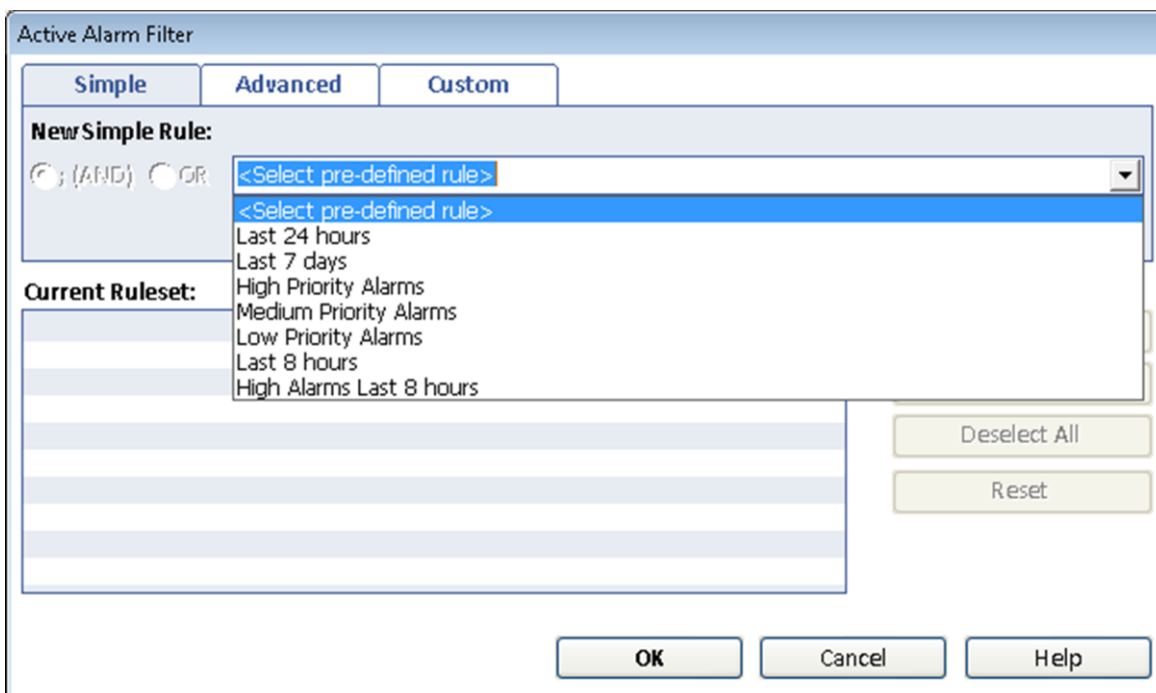
The screenshot displays the SCADA Expert Vijeo Citect interface. The main window shows the SOE (Sequence of Events) page with a list of events. The events are organized into columns: Date, Time, Tag, Name, and Message. A right-click context menu is visible over one of the events, and a 'Comment' dialog box is open, allowing the user to add a comment to the selected event. The dialog box contains the text 'Issue under investigation' and has 'OK' and 'Cancel' buttons. The background shows a list of events with various tags and messages, including 'Area6_WAInput_29_WAIST\ALW_Bit3' and 'Area6_WAOutput_24_WAOST\BADST'.

User events can be added to the SOE list in a similar manner to comments, except that to add a user event, the current logged in user must have access to privileges 1 through 8. A hotfix for this issue exists for v7.40 service pack 1 and this fix is planned to be included in v7.40 service pack 2. User events appear in the SOE list with the “Tag” field inherited from the event the user event was added to, but the time will be set to the current time. The “Message” field will again contain the details of the user event.

Using the Alarm Filter Form



The tab style alarm page can be filtered by pressing “Filter”.



To use one of the simple filter rules that were added previously, select the rule and click “Add” and then OK.

Active Alarm Filter

Simple

Advanced

Custom

New Simple Rule:

☒ ; (AND)
 ☐ OR

Medium Priority Alarms

Add

Clear

Current Ruleset:

Priority = 3

Delete

Select All

Deselect All

Reset

OK

Cancel

Help

Alarm

SCADA Expert

Vijeo Citect

23

27

1

11:30:05 AM

1

Area10_WAOutput_4_WAOST\BADST

Area10_WAOutput_4_WAOST\BADST

H..

11:30:04 AM

2

Area10_WAOutput_4_WAOST_OP

Area10_WAOutput_4_WAOST_OP

H..

11:29:53 AM

2

Area9_WAInput_9_WAIST_PV

Area9_WAInput_9_WAIST_PV

H..

Cited for Windows Demo

Startup Page

Alarm

Menu

Equipment

Acknowledge page

Filter...

Auto-fit columns

Save View

Print / Export...

Home Page

Pages

Page List

Alarms

Active Alarms

Historical Events

Disabled Alarms

Hardware Alarms

Trends

Tags

	Time	Category	Tag	Name	Desc
	11:30:05 AM	1	Area10_WAOutput_4_WAOST\BADST	Area10_WAOutput_4_WAOST\BADST	
	11:29:42 AM	1	Area8_WAInput_27_WAIST_SIM	Area8_WAInput_27_WAIST\SIM	HIGH HIGH
	11:29:35 AM	1	Area8_WAInput_14_WAIST_SPTC	Area8_WAInput_14_WAIST\SPTC	HIGH HIGH
	11:29:04 AM	1	Area6_WAOutput_24_WAOST\BADST	Area6_WAOutput_24_WAOST\BADST	
	11:28:58 AM	1	Area6_WAOutput_17_WAOST\ALW_Bit6	Area6_WAOutput_17_WAOST\ALW_Bit6	
	10:57:59 AM	1	Area5_WAInput_1_WAIST_SIM	Area5_WAInput_1_WAIST\SIM	HIGH HIGH
	10:57:44 AM	1	Area4_WPIDCTLAD_21_PV	Area4_WPIDCTLAD_21_PV	HIGH HIGH
	10:57:19 AM	1	Area3_WAInput_27_WAIST_SP	Area3_WAInput_27_WAIST\SP	HIGH HIGH
	10:57:09 AM	1	Area3_WAInput_27_WAIST_SIM	Area3_WAInput_27_WAIST\SIM	HIGH HIGH
	12:05:33 PM	1	Area6_WAInput_16_WAIST_SPTC	Area6_WAInput_16_WAIST\SPTC	HIGH HIGH
	10:43:39 AM	1	Area1_WAInput_1_WAIST_TCFREWARN	Area1_WAInput_1_WAIST\TCFREWARN	HIGH HIGH

Vijeo Citect

Print Nov 22 2013 - 12:51:38 PM

truxware

Operators can tell that the alarm page is filtered by the text “Filter Applied” underneath the “Set Filter” option.

Sorting

All alarm pages can be sorted by any configured field, simply by adding an additional column to the alarm display. Additional columns can be added either by clicking “Add Column” or by right clicking on the column names.

The screenshot shows the SCADA Expert Vijeo Citect Alarm page. A right-click context menu is open over the 'Tag' column header. The menu options include: Remove Column, Insert Column, Tag, Equipment, Name, Desc, Alarm Comment, Comment, Cluster, State, Type, LogState, Category, Priority, Area, Priv, Help, Date, Time, Millisec, TSQuality, Quality, Custom1, Custom2, Custom3, Custom4, Custom5, Custom6, Custom7, and Custom8. The 'Area' option is highlighted. The background table shows alarm data with columns: Time, Category, Tag, Name, and Desc.

Time	Category	Tag	Name	Desc
11:30:05 AM	1	Area10_WAOutput_4_WAOST\BADST	Area10_WAOutput_4_WAOST\BADST	
11:30:04 AM	2	Area10_WAOutput_4_WAOST_OP	Area10_WAOutput_4_WAOST_OP	H..
11:29:53 AM	2	Area9_WAInput_9_WAIST_PV	Area9_WAInput_9_WAIST_PV	H..

The screenshot shows the same SCADA Expert Vijeo Citect Alarm page, but now the 'Area' column has been added to the table. The data is sorted by the 'Area' column. The table columns are: Time, Category, Area, Tag, Name, and Desc.

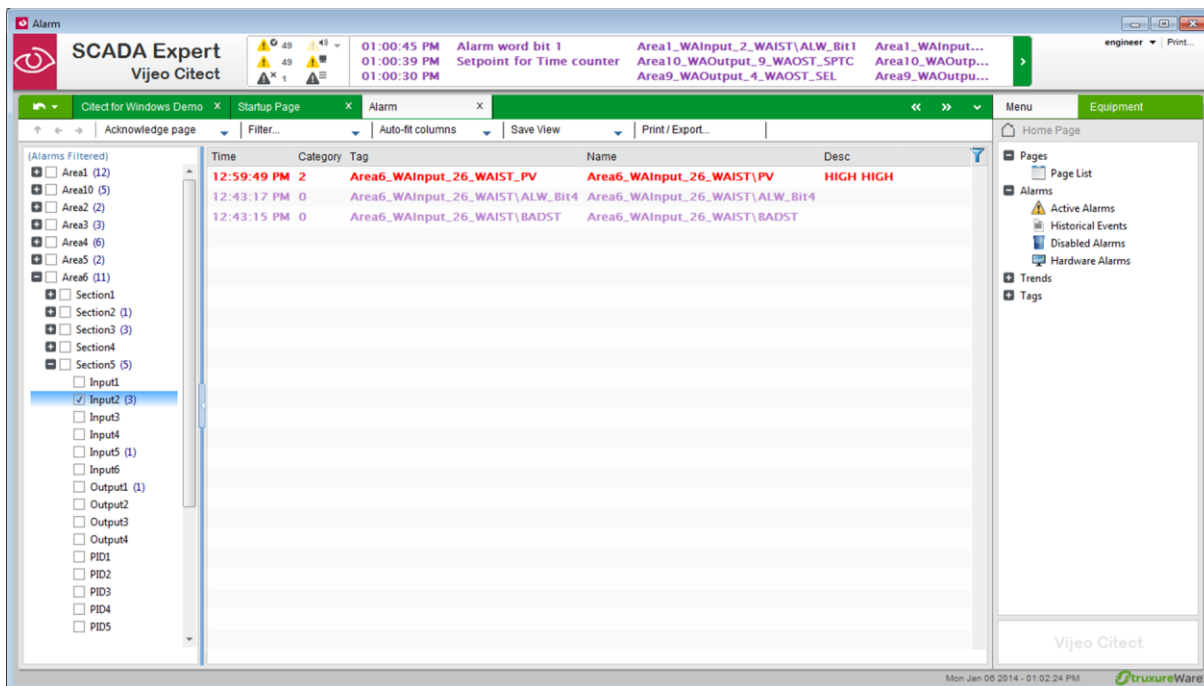
Time	Category	Area	Tag	Name	Desc
11:30:05 AM	1	10	Area10_WAOutput_4_WAOST\BADST	Area10_WAOutput_4_WAOST\BADST	
11:29:42 AM	1	8	Area8_WAInput_27_WAIST_SIM	Area8_WAInput_27_WAIST_SIM	HIGH HIGH
11:29:35 AM	1	8	Area8_WAInput_14_WAIST_SPTC	Area8_WAInput_14_WAIST_SPTC	HIGH HIGH
11:29:04 AM	1	6	Area6_WAOutput_24_WAOST\BADST	Area6_WAOutput_24_WAOST\BADST	
11:28:58 AM	1	6	Area6_WAOutput_17_WAOST\ALW_Bit6	Area6_WAOutput_17_WAOST\ALW_Bit6	
10:57:59 AM	1	5	Area5_WAInput_1_WAIST_SIM	Area5_WAInput_1_WAIST_SIM	HIGH HIGH
10:57:44 AM	1	4	Area4_WPIDCTLAD_21_PV	Area4_WPIDCTLAD_21_PV	HIGH HIGH
10:57:19 AM	1	3	Area3_WAInput_27_WAIST_SP	Area3_WAInput_27_WAIST_SP	HIGH HIGH
10:57:09 AM	1	3	Area3_WAInput_27_WAIST_SIM	Area3_WAInput_27_WAIST_SIM	HIGH HIGH
12:05:33 PM	1	6	Area6_WAInput_16_WAIST_SPTC	Area6_WAInput_16_WAIST_SPTC	HIGH HIGH
10:43:39 AM	1	1	Area1_WAInput_1_WAIST_TCPREWARN	Area1_WAInput_1_WAIST_TCPREWARN	HIGH HIGH

Once the column has been displayed, the data can be sorted by clicking on the name of the column. Clicking on it again will reverse the sorting order.

Alarm Equipment Page

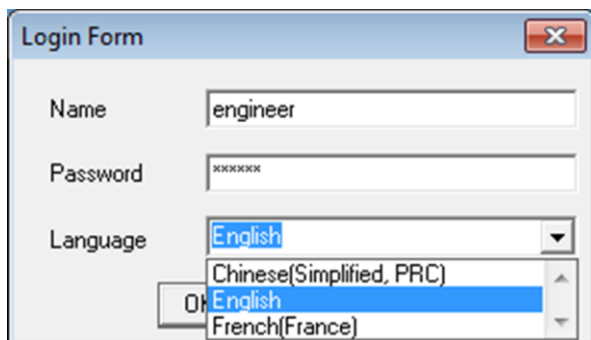
The alarm equipment page displays the equipment hierarchy in a tree view which displays the number of alarms for each piece of equipment. This can also be used to filter the alarm list.

By expanding the tree view, the operator can quickly determine the source of problem areas.



Localization

In Vijeo Citect v7.40, the language that is displayed at runtime can be selected by the operator when logging in.



Upon logging in, any strings that have been marked for translation will automatically be translated into the language selected by the operator.

The alarm page translated into French:

The screenshot shows the SCADA Expert Vijeo Citect Alarm page in French. The main table lists various alarms with the following columns: Durée (Duration), Catégorie (Category), AlmComment (Alarm Comment), Tag, and Nom (Name). The top status bar indicates the current time as 01:16:04 PM and the alarm count as 2. The right sidebar contains navigation options like Pages, Alarms, and Tags.

Durée	Catégorie	AlmComment	Tag	Nom
01:16:04 PM 2	Variable de procédé		Area10_WAInput_15_WAIST_PV	Area10_WAInput...
01:15:41 PM 1	Point de consigne		Area10_WAInput_15_WAIST_SP	Area10_WAInput...
01:15:18 PM 0	Sélectionné pour le mode Maintenance		Area4_WAInput_15_WAIST_SEL	Area4_WAInput...
01:15:17 PM 1	Valeur simulée		Area4_WAInput_15_WAIST_SIM	Area4_WAInput...
01:15:07 PM 1	Valeur simulée		Area4_WAInput_7_WAIST_SIM	Area4_WAInput...
01:14:58 PM 1	Consigne pour compteur de temps		Area2_WAInput_27_WAIST_SPTC	Area2_WAInput...
01:14:50 PM 0	Bit du mot d'alarme 7		Area6_WAInput_40_WAIST\ALW_Bit7	Area6_WAInput...
01:14:46 PM 0	0 bit d'alarme mot		Area6_WAInput_26_WAIST\BADST	Area6_WAInput...
01:14:44 PM 0	4 bits d'alarme mot		Area6_WAInput_26_WAIST\ALW_Bit4	Area6_WAInput...
01:14:38 PM 0	0 bit d'alarme mot		Area6_WAInput_16_WAIST\BADST	Area6_WAInput...
01:14:36 PM 0	Sélectionné pour le mode Maintenance		Area6_WAInput_16_WAIST_SEL	Area6_WAInput...
01:14:19 PM 0	Bit du mot d'alarme 5		Area4_WAInput_13_WAIST\ALW_Bit5	Area4_WAInput...
01:14:15 PM 0	0 bit d'alarme mot		Area4_WAInput_2_WAIST\BADST	Area4_WAInput...
01:13:51 PM 0	Bit du mot d'alarme 2		Area1_WAInput_33_WAIST\ALW_Bit2	Area1_WAInput...
01:13:45 PM 0	Bit du mot d'alarme 5		Area1_WAInput_15_WAIST\ALW_Bit5	Area1_WAInput...
01:13:40 PM 0	Bit du mot d'alarme 7		Area1_WAInput_1_WAIST\ALW_Bit7	Area1_WAInput...
01:12:56 PM 2	Courant de sortie		Area10_WAOutput_4_WAOST_OP	Area10_WAOutp...
01:12:56 PM 1	0 bit d'alarme mot		Area10_WAOutput_4_WAOST\BADST	Area10_WAOutp...
01:12:56 PM 2	Variable de procédé		Area9_WAInput_9_WAIST_PV	Area9_WAInput...
01:12:56 PM 1	Valeur simulée		Area8_WAInput_27_WAIST_SIM	Area8_WAInput...
01:12:56 PM 1	Consigne pour compteur de temps		Area8_WAInput_14_WAIST_SPTC	Area8_WAInput...
01:12:55 PM 0	Consigne		Area6_WPIDCTLAD_18_SP	Area6_WPIDCT...
01:12:55 PM 0	Consigne		Area6_WPIDCTLAD_9_SP	Area6_WPIDCT...
01:12:55 PM 0	Bit du mot d'alarme 3		Area6_WAInput_29_WAIST\ALW_Bit3	Area6_WAInput...

The alarm page translated into Simplified Chinese:

The screenshot shows the SCADA Expert Vijeo Citect Alarm page in Simplified Chinese. The main table lists various alarms with the following columns: 时间 (Time), 分类 (Category), AlmComment (Alarm Comment), 标签 (Tag), and 名称 (Name). The top status bar indicates the current time as 01:16:04 下午 and the alarm count as 2. The right sidebar contains navigation options like 主页 (Home), 报警 (Alarm), and 趋势 (Trend).

时间	分类	AlmComment	标签	名称	描述
01:16:04 下午 2	过程变量		Area10_WAInput_15_WAIST_PV	Area10_WAInput...	高高限
01:15:41 下午 1	设定点		Area10_WAInput_15_WAIST_SP	Area10_WAInput...	高高限
01:15:18 下午 0	维护模式选择		Area4_WAInput_15_WAIST_SEL	Area4_WAInput...	高高限
01:15:17 下午 1	模拟值		Area4_WAInput_15_WAIST_SIM	Area4_WAInput...	高高限
01:15:07 下午 1	模拟值		Area4_WAInput_7_WAIST_SIM	Area4_WAInput...	高高限
01:14:58 下午 1	时间计数器的设定值		Area2_WAInput_27_WAIST_SPTC	Area2_WAInput...	高高限
01:14:50 下午 0	报警字位7		Area6_WAInput_40_WAIST\A...	Area6_WAInput...	
01:14:46 下午 0	报警字位0		Area6_WAInput_26_WAIST\B...	Area6_WAInput...	
01:14:44 下午 0	报警字第4位		Area6_WAInput_26_WAIST\A...	Area6_WAInput...	
01:14:38 下午 0	报警字位0		Area6_WAInput_16_WAIST\B...	Area6_WAInput...	
01:14:36 下午 0	维护模式选择		Area6_WAInput_16_WAIST_SEL	Area6_WAInput...	高高限
01:14:19 下午 0	报警字第5位		Area4_WAInput_13_WAIST\A...	Area4_WAInput...	
01:14:15 下午 0	报警字位0		Area4_WAInput_2_WAIST\BADST	Area4_WAInput...	
01:13:51 下午 0	报警字第2位		Area1_WAInput_33_WAIST\A...	Area1_WAInput...	
01:13:45 下午 0	报警字第5位		Area1_WAInput_15_WAIST\A...	Area1_WAInput...	
01:13:40 下午 0	报警字位7		Area1_WAInput_1_WAIST\ALW...	Area1_WAInput...	
01:12:56 下午 2	电流输出		Area10_WAOutput_4_WAOST_OP	Area10_WAOutp...	
01:12:56 下午 1	报警字位0		Area10_WAOutput_4_WAOST...	Area10_WAOutp...	
01:12:56 下午 2	过程变量		Area9_WAInput_9_WAIST_PV	Area9_WAInput...	
01:12:56 下午 1	模拟值		Area8_WAInput_27_WAIST_SIM	Area8_WAInput...	
01:12:56 下午 1	时间计数器的设定值		Area8_WAInput_14_WAIST_SPTC	Area8_WAInput...	
01:12:55 下午 0	设定点		Area6_WPIDCTLAD_18_SP	Area6_WPIDCT...	
01:12:55 下午 0	设定点		Area6_WPIDCTLAD_9_SP	Area6_WPIDCT...	
01:12:55 下午 0	报警字3位		Area6_WAInput_29_WAIST\A...	Area6_WAInput...	

Conclusion

The management of alarms is one of the more crucial activities that an operator will need to perform on a daily basis. Vijeo Citect v7.40 contains equipment hierarchy and alarm features that allow users to build systems that will enable an operator to quickly identify and action high priority alarms.

This white paper demonstrates that by assigning alarms the correct priorities and by implementing an equipment hierarchy, the user can make use of Vijeo Citect v7.40's alarming features to assist the operator to manage the alarms within their control system. These features include:

- Using the alarm count functionality to allow the operator to quickly identify problem areas
- Using alarm count in conjunction with equipment support to add flashing warning icons next to entities on graphics pages
- Using the alarm equipment to find alarms with a high number of alarms and quickly filtering the alarm display
- Adding commonly used alarm filters to the alarm filter form
- Using the SOE page to identify the events that led up to a deviation from normal operation

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