Technical Information Sheet

TIS#: 289, Issue 1
Date: 10/27/06
Issued by: Chris Coogan

Subject
This Technical Information Sheet describes an application utilizing the Timestamp Math Channel function available in 5000 and 6000 Series recorders fitted with any Math, Totalizer, Counter (MTC) option.

Software and Hardware Used

Eurotherm Chessell 5000 Series recorder with version 3.4.4 firmware or greater OR
Eurotherm Chessell 6000 Series recorder with version 4.0 firmware or greater, both with
- Any MTC option – at least 5 Math Channels are required
- Timers option
- User Screen option

Eurotherm Chessell 5000 Series Configuration Editor Version 3.4.4 or greater OR
Eurotherm Chessell 6000 Series C-Edit Version 4.0 or greater
Eurotherm Chessell 5000 Series Bridge Software version 3.4.4 or greater OR
Eurotherm Chessell 6000 Series Bridge Software 4.0 or greater
Dell Inspiron 8200 laptop, 1GB RAM
Microsoft Windows XP Professional, Version 5.1 (build 2600, xpsp_sp2_gdr.050301-1519 : Service Pack 2)

Introduction

Some process applications require the specific time that a process value maximum or minimum occurred during a specific time interval. The specific time interval could be a batch, a day, a week, a month, etc. Depending on the time interval, not only is the specific time of the process value maximum or minimum required, but the specific date may also be required. Utilizing Eurotherm's Review application CSV Export feature, the CSV option of the 5000 and 6000 Series recorders or Eurotherm's Report 5000 application with any spreadsheet or database application, it is possible to determine the specific date and time a process value maximum or minimum occurred. Review exported CSV data, the CSV option of the recorders, or Report 5000 provide date and time stamped process values. Most spreadsheet and database applications provide MAX and MIN functions that can be used to determine not only the process value maximum or minimum, but the specific date and

time as well. While the preceding is possible, it does require the use of several applications; it is performed off-line from the recorder and the process; and it is not real-time. By utilizing Math channels and Math channel functions available within the 5000 and 6000 Series recorders, it is possible to implement an on-line, real-time determination of a process value maximum or minimum within the recorder without the use of additional applications. This is the subject of this Technical Information Sheet (TIS).

5000 or 6000 Series Implementation Overview

For the purpose of this Technical Information Sheet, the date and time of a process value maximum will be determined. The specific time interval will be 1 day. The term recorder and recorder configuration used in the following discussion, refer to either a 5000 or a 6000 Series recorder and its associated configuration. The following discussion is based on a 6000 Series recorder. When implemented in a 5000 Series recorder, there will be small differences in the recorder configuration, i.e. 5000 Series Events and Alarms only have two Jobs where as the 6000 has four Jobs per Event or Alarm; Channel Descriptor (Tag Names) are shorter in the 5000 Series than the 6000 Series. Lastly, the screen shots in the following discussion are from the 6000 Series C-Edit application.

The functions provided by the Math Channels of the recorders' MTC Option form the basis of the recorder configuration needed to implement the determination of the date and time a process value maximum occurred. One function provided by a Math Channel is the Channel Maximum function. This function provides the maximum value the Math Channel input has reached since last reset. A Math Channel configured with this function will provide the maximum value. In order to determine the date and time, two other Math Channels with the Timestamp function are required. When a Math Channel configured with the Timestamp function is triggered, the current number of milliseconds since 12:00 AM on January 1, 1970 appear as the Math Channel value. The Math Channel provides PV formats of Date and Time; thus, two Math Channels will provide a specific date and time associated with a process value maximum. In order to trigger the Timestamp Math Channels when the Channel Maximum Math Channel updates with a new maximum value, two additional Math Channels are required. One Math Channel with a Subtract function and one Math Channel with a Sample and Hold function will provide the simple trigger logic required.

Also required is a recorder Timer, to provide the necessary timing of the specific time interval; and an Event to provide initial conditioning of the Channel Maximum and Sample and Hold Math Channels.

Example 5000/6000 Series Configuration

Figure 1 below graphically depicts the recorder configuration in block diagram form. Example 5000 Series and 6000 configurations are attached to this Technical Information Sheet. The following describes the recorder configuration in detail.

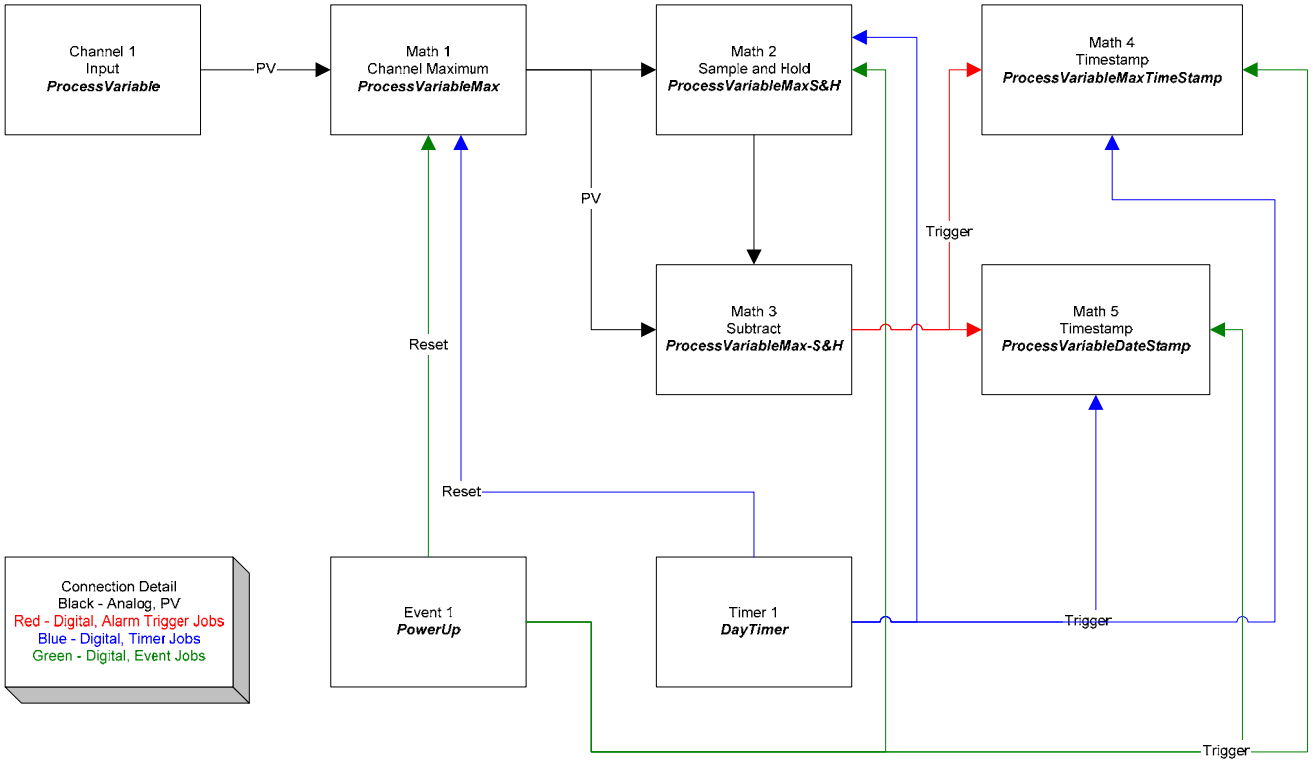


Figure 1 – Block Diagram of Example Recorder Configuration

Channel 1

Input Channel 1, ***ProcessVariable***, is the process variable whose maximum value is to be determined along with the date and time of the maximum. The Input type and scale do not matter. For the purposes of this Technical Information Sheet, the Input type is Slave Comms with a scale of 0-2000 °C. Input Channel 1 does not have any configured Alarms or Jobs. This may not be the case in a production environment. The PV signal from the ***ProcessVariable*** Input Channel feeds Math Channel 1, ***ProcessVariableMax***.

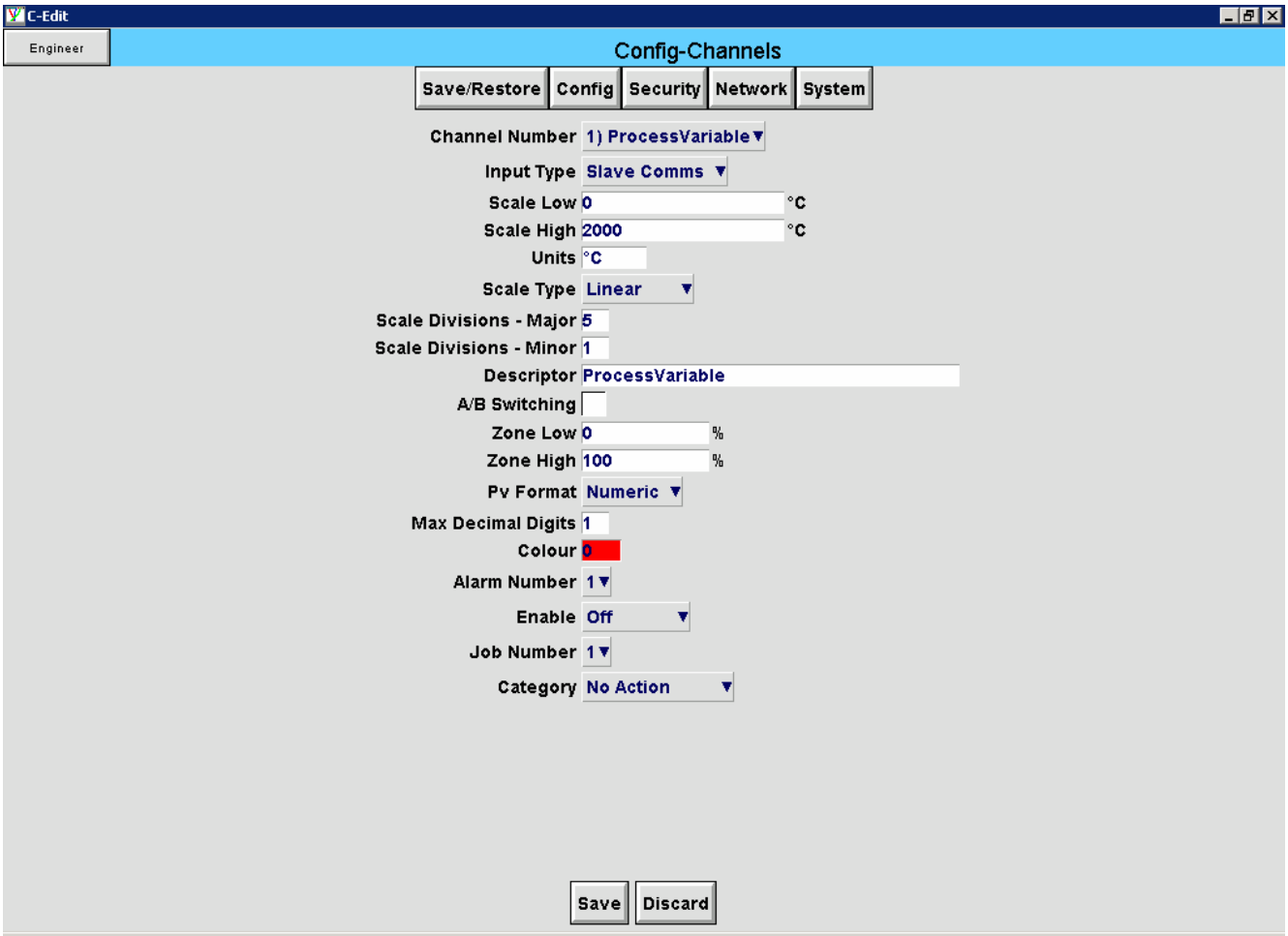


Figure 2 - Input Channel 1 Configuration

Math 1

Math Channel 1, ***ProcessVariableMax***, takes the PV signal from Input Channel 1 and performs a Channel Maximum function. The channel is scaled 0-2000 °C to match Input Channel 1. Math Channel 1 does not have any configured Alarms or Jobs. This may not be the case in a production environment. The PV signal from the ***ProcessVariableMax*** Math Channel feeds Math Channel 2, ***ProcessVariableMaxS&H***, and Math Channel 3**,** ***ProcessVariableMax – S&H***. Timer and Event Job signals to trigger the Channel Maximum Reset function come from Timer 1, ***DayTime***r, and Event 1, ***PowerUp***.

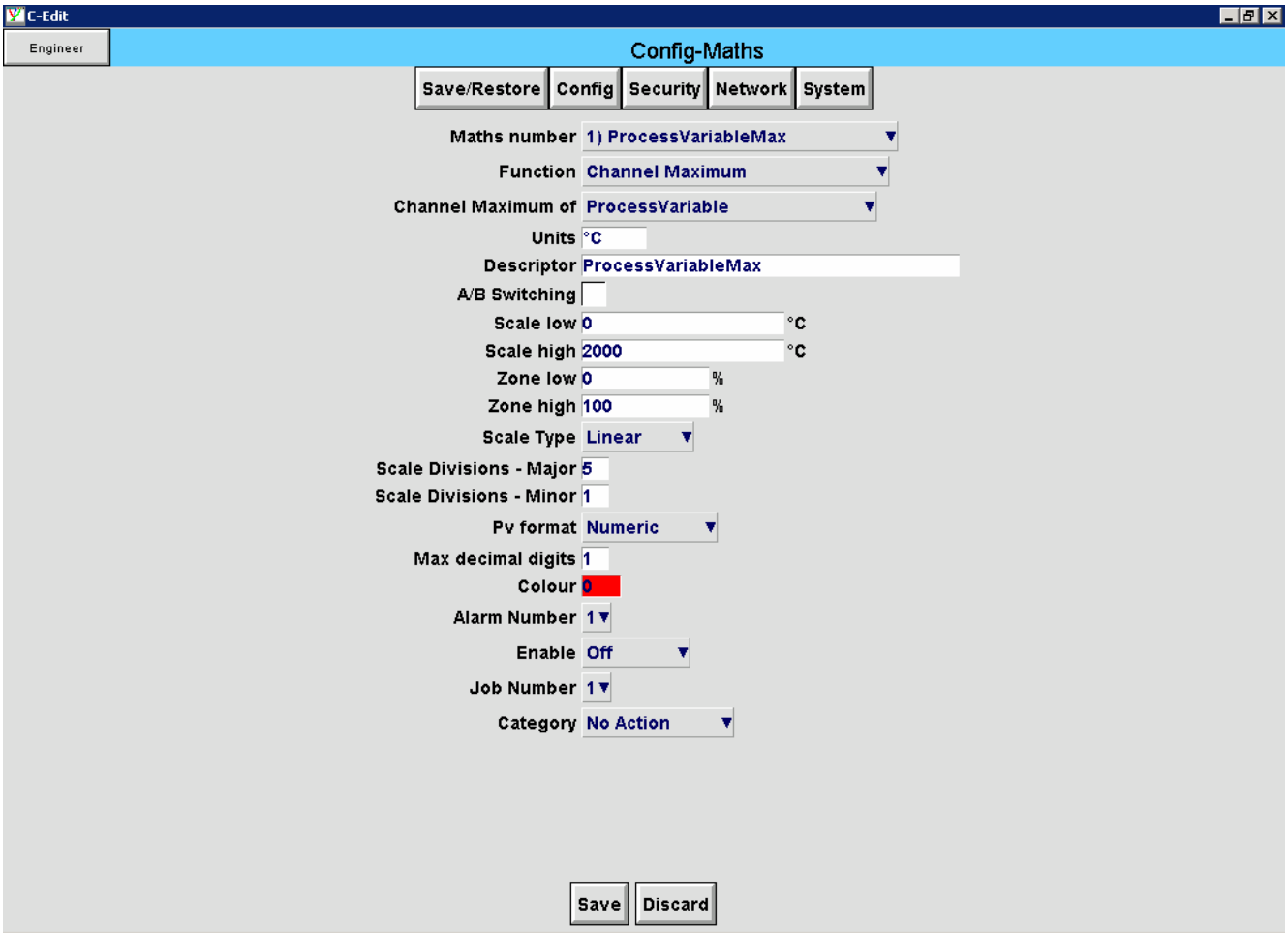


Figure 3 – Math Channel 1 Configuration

Math 2

Math Channel 2, ***ProcessVariableMaxS&H***, takes the PV signal from Math Channel 1 and performs a Sample and Hold function. The channel is scaled 0-2000 °C to match Input Channel 1. Math Channel 2 does not have any configured Alarms or Jobs. Timer and Event Jobs signals to trigger the Sample and Hold sample function come from Timer 1, ***DayTime***r, and Event 1, ***PowerUp***. The PV signal from the ***ProcessVariableMaxS&H*** Math Channel feeds Math Channel 3, ***ProcessVariableMax – S&H***.

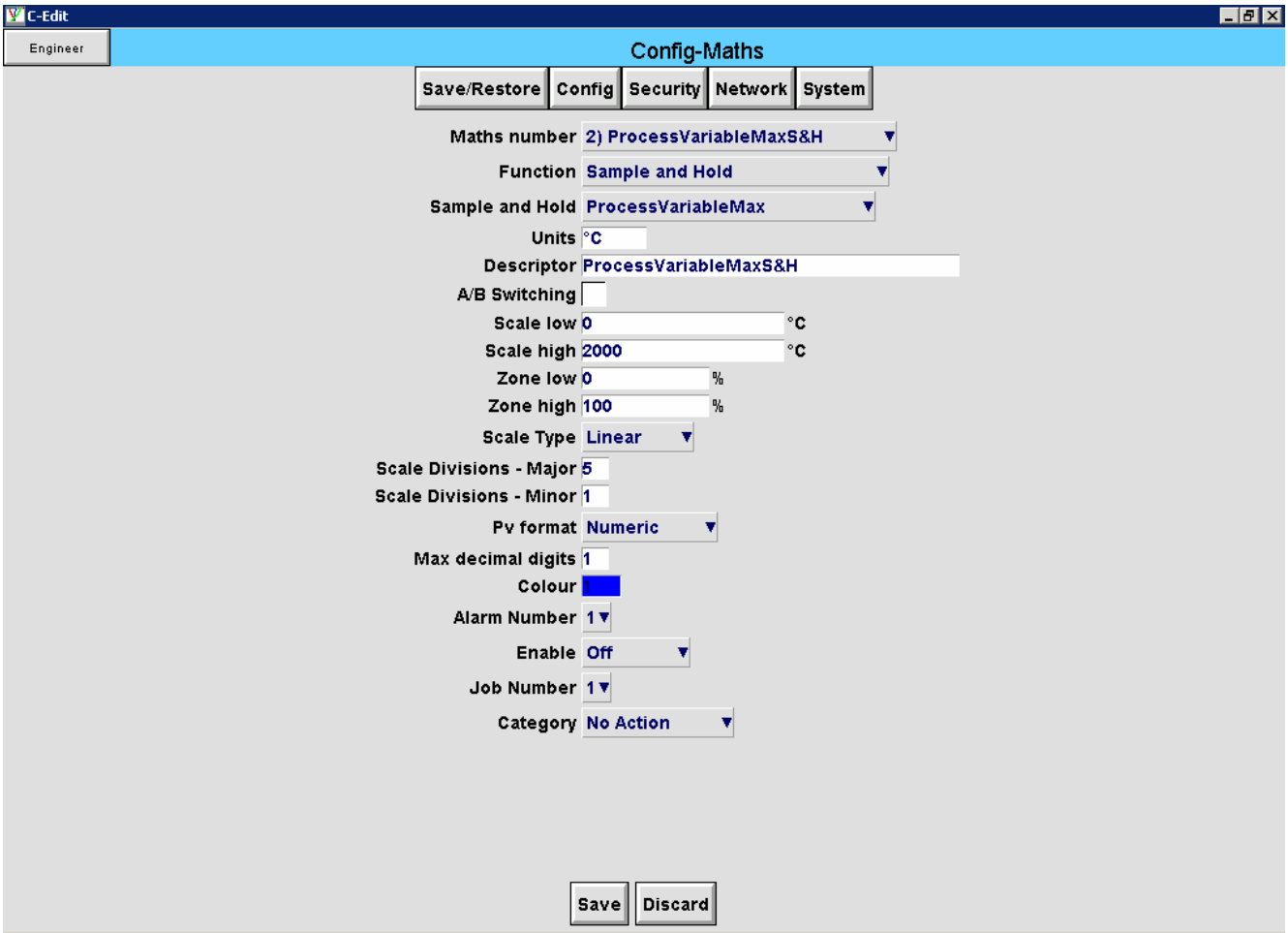


Figure 4 - Math Channel 2 Configuration

Math 3

Math Channel 3, ***ProcessVariableMax - S&H***, takes PV signals from Math Channel 1 and Math Channel 2 and performs a simple Subtract function, ProcessVariableMax – ProcessVariableMaxS&H. The channel is scaled 0-2000 °C to match Input Channel 1. Math Channel 3 has one configured Alarm and three configured Jobs. Alarm 1 is configured as a Deviation Out Trigger alarm with a Constant Reference Setpoint of 0°C, a Deviation of 0.1 °C, no Hysteresis, and no Dwell. Alarm 1 Job 1 is configured to Trigger Math Channel 2, ***ProcessVariableMaxS&H*** on Active. Alarm 1 Job 2 is configured to Trigger Math Channel 4, ***ProcessVariableMaxTimeStamp*** on Active. Alarm 1 Job 3 is configured to Trigger Math Channel 5, ***ProcessVariableMaxDateStamp***, on Active. The PV signal of ***ProcessVariableMax – S&H*** does not feed any other Channel.

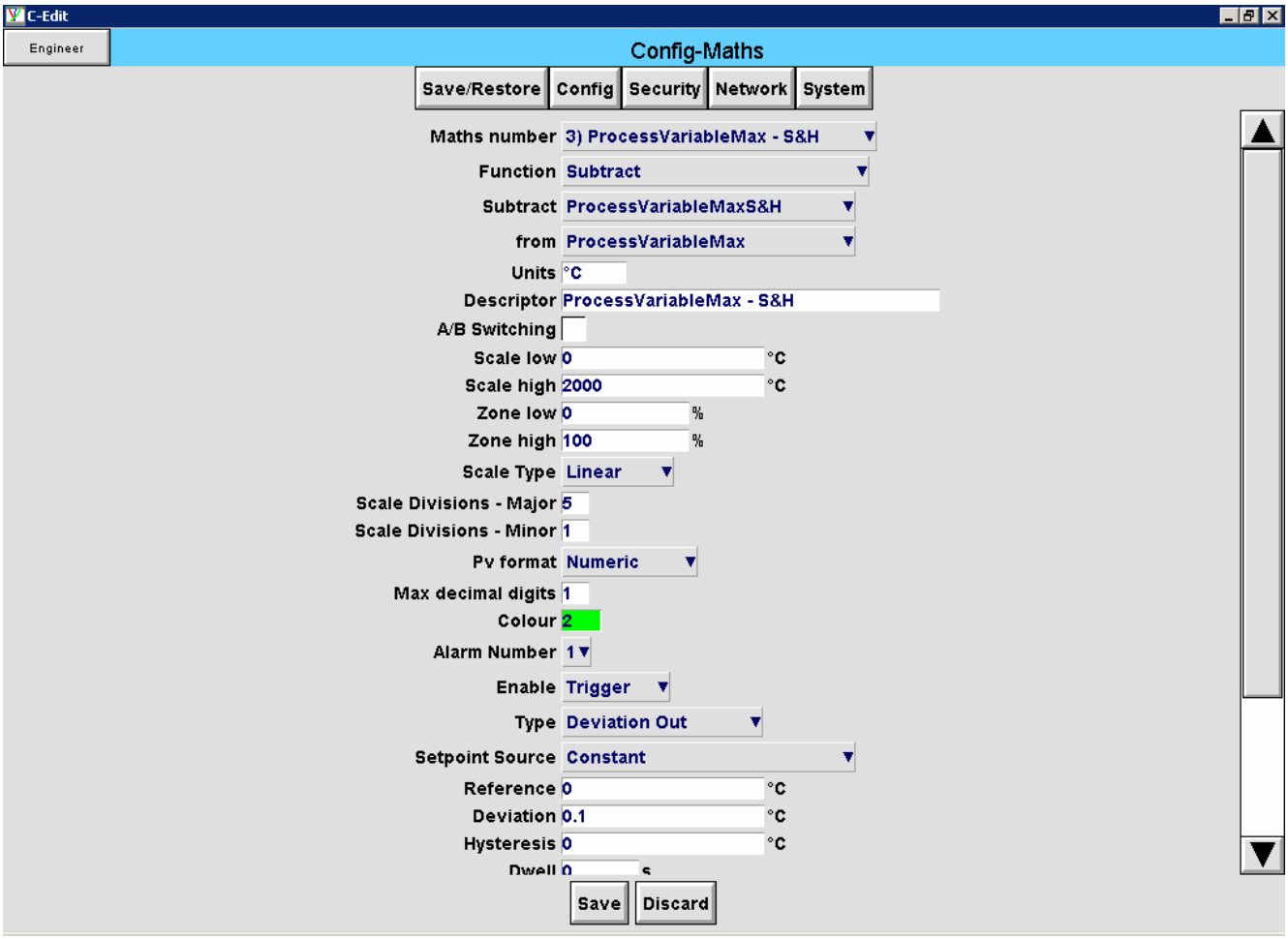


Figure 5 - Math Channel 3 Configuration

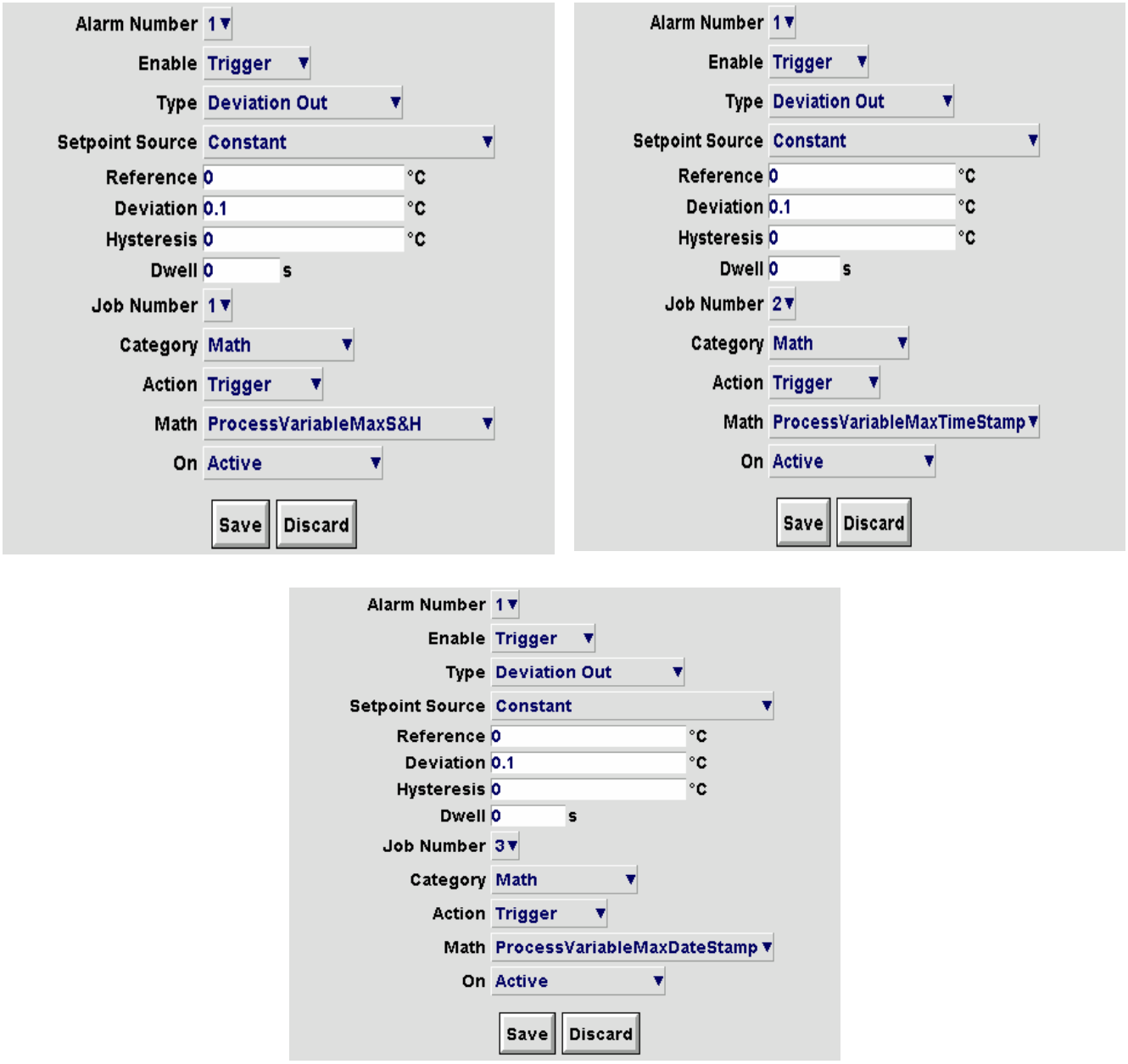


Figure 6 - Math Channel 3 Alarm and Job Configuration

Math 4

Math Channel 4, ***ProcessVariableMaxTimeStamp,*** takes no PV signals from any other Math Channel, nor does this Channel feed any other Channel. No Alarms or Jobs are configured on the ***ProcessVariableMaxTimeStamp*** Channel. Math Channel 4 performs a Timestamp function where the PV parameter of this Math Channel is displayed as the real-time when the Channel is triggered. The Pv format parameter of this channel, configured

as Time, indicates that this Math Channel is to display real-time. Timer, Event, Alarm Job signals to trigger the Timestamp function come from Timer 1, ***DayTime***r, Event 1, ***PowerUp,*** and Math Channel 3, ***ProcessVariableMax – S&H***.

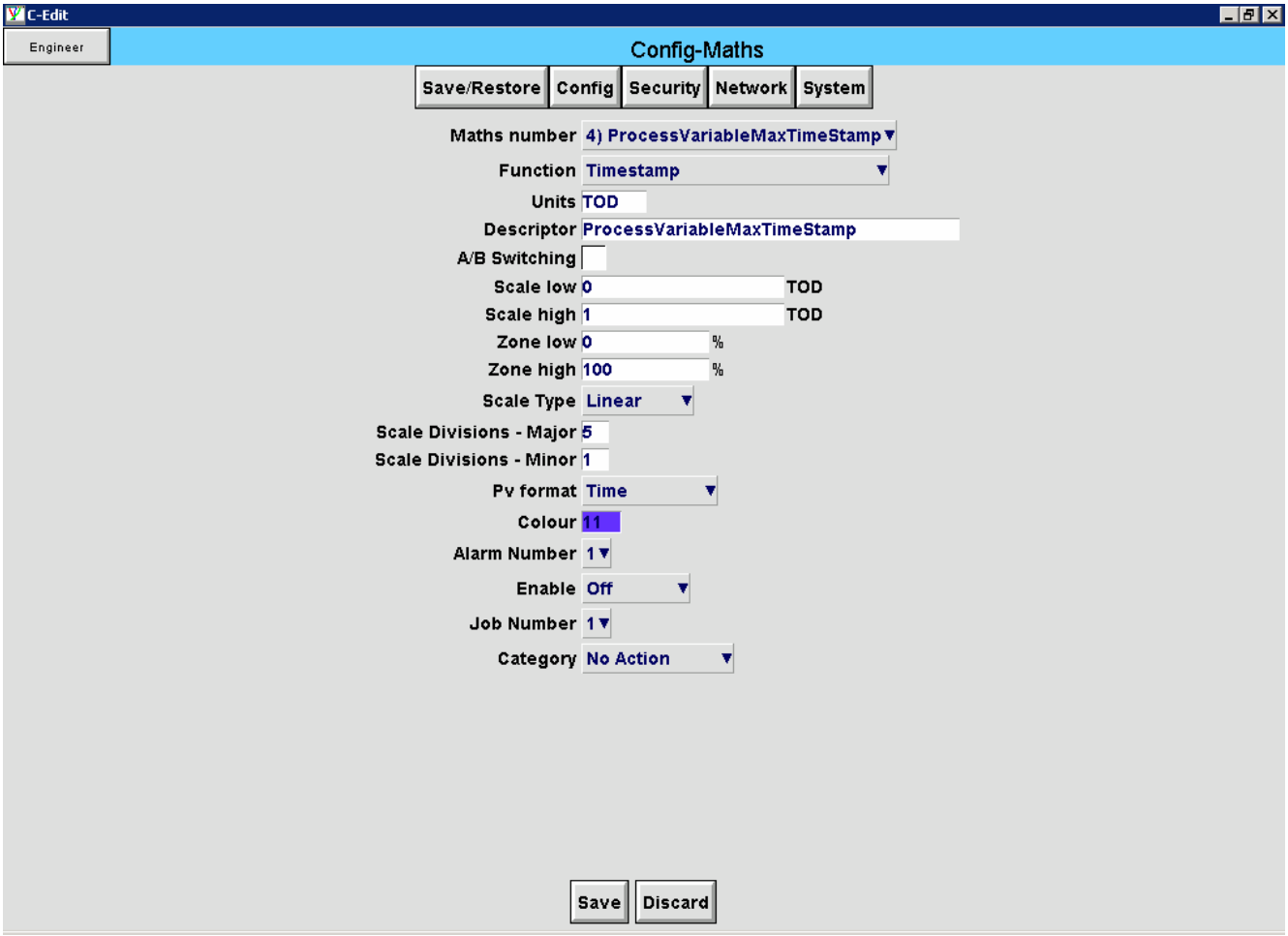


Figure 7 – Math Channel 4 Configuration

Math 5

Math Channel 5, ***ProcessVariableMaxDateStamp,*** takes no PV signals from any other Math Channel, nor does this Channel feed any other Channel. No Alarms or Jobs are configured on the ***ProcessVariableMaxDateStamp*** Channel. Math Channel 5 performs a Timestamp function where the PV parameter of this Math Channel is displayed as the current date when the Channel is triggered. The Pv format parameter of this channel, configured as Date, indicates that this Math Channel is to display the current date. Timer, Event, and Alarm signals to trigger the Timestamp function come from Timer 1, ***DayTime***r, Event 1, ***PowerUp,*** and Math Channel 3, ***ProcessVariableMax – S&H***.

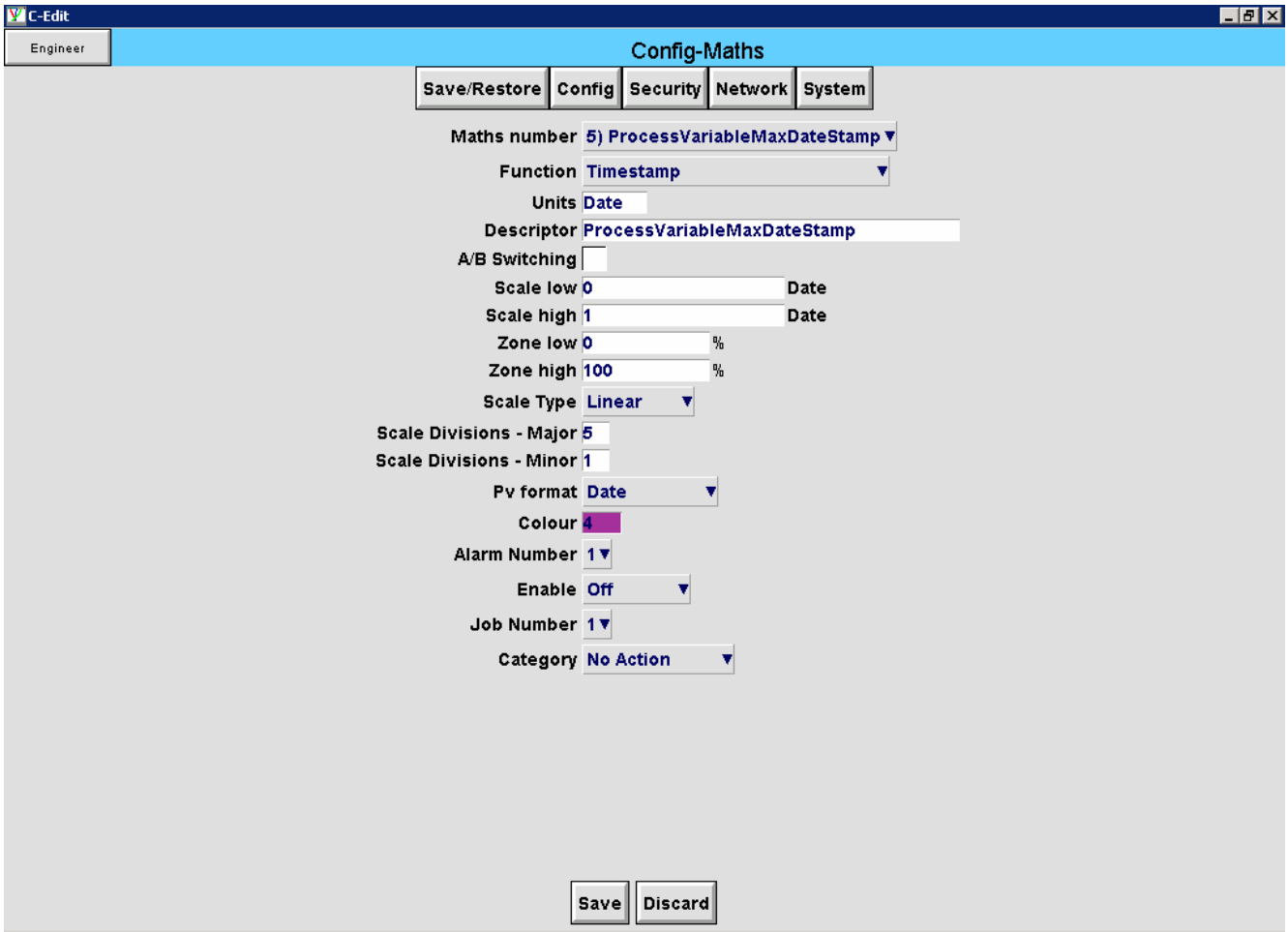


Figure 8 – Math Channel 5 Configuration

Timer 1

Timer 1, ***DayTimer,*** takes no input signals, but this Timer does feed Job signals to several other Channels. Timer 1 is configured as a self-starting Timer which starts on Any Day of Any Month at 11:59:59 PM and runs for 1 second. Timer 1 has four configured Jobs. Job 1 is configured to Reset Math Channel 1, ***ProcessVariableMax*** on Active. Job 2 is configured to Trigger Math Channel 2, ***ProcessVariableMaxS&H*** on Inactive. Job 3 is configured to Trigger Math Channel 4, ***ProcessVariableMaxTimeStamp*** on Inactive. Job 4 is configured to Trigger Math Channel 5, ***ProcessVariableMaxDateStamp***, on Inactive.

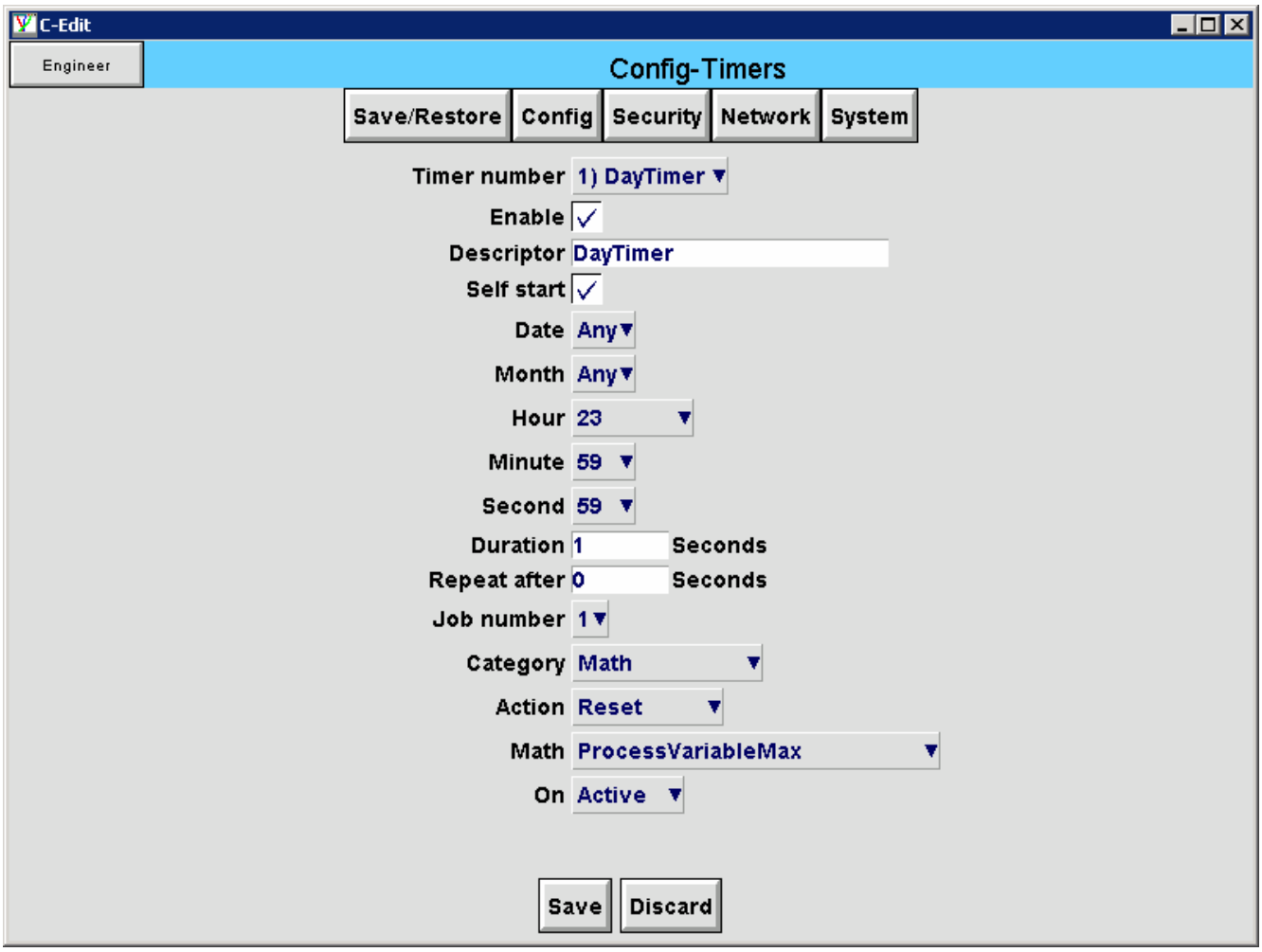
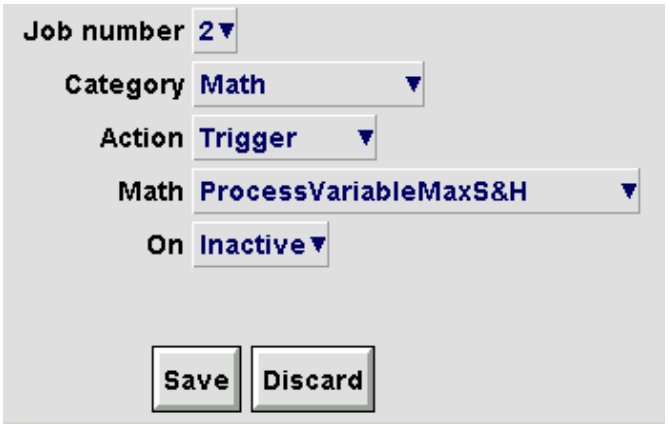
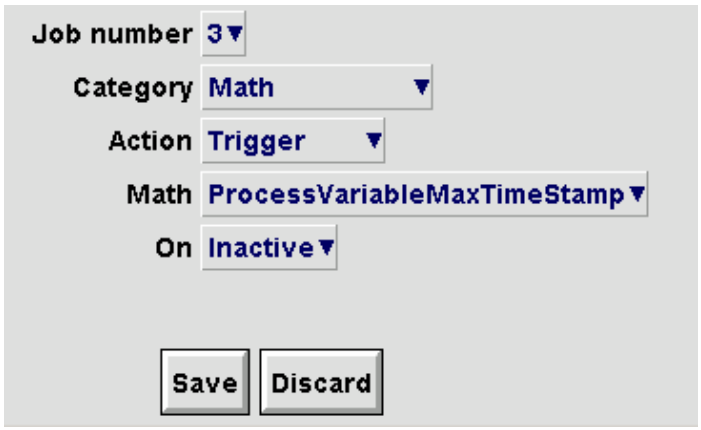


Figure 9 – Timer 1 Configuration





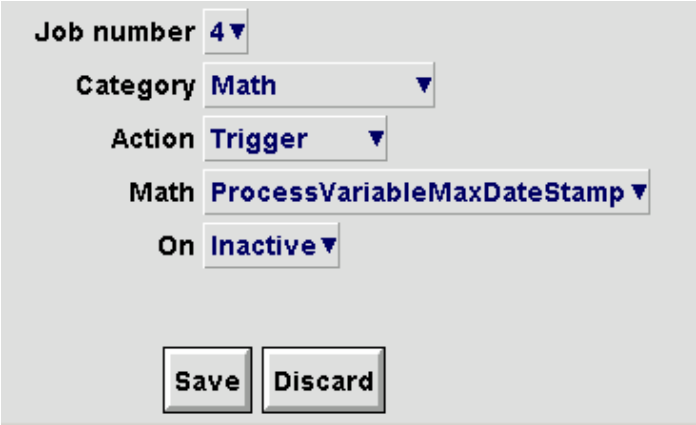


Figure 10 - Timer 1 Job Configuration

Event 1

Event 1, ***PowerUp,*** takes 1 Event input signal, Power Up, and this Event feed Jobs signals to several other Channels. Event 1 is configured to execute once on recorder power up. Event 1 does have four configured Jobs. Job 1 is configured to Reset Math Channel 1, ***ProcessVariableMax*** on Active. Job 2 is configured to Trigger Math Channel 2, ***ProcessVariableMaxS&H*** on Active. Job 3 is configured to Trigger Math Channel 4, ***ProcessVariableMaxTimeStamp*** on Active. Job 4 is configured to Trigger Math Channel 5, ***ProcessVariableMaxDateStamp***, on Active.

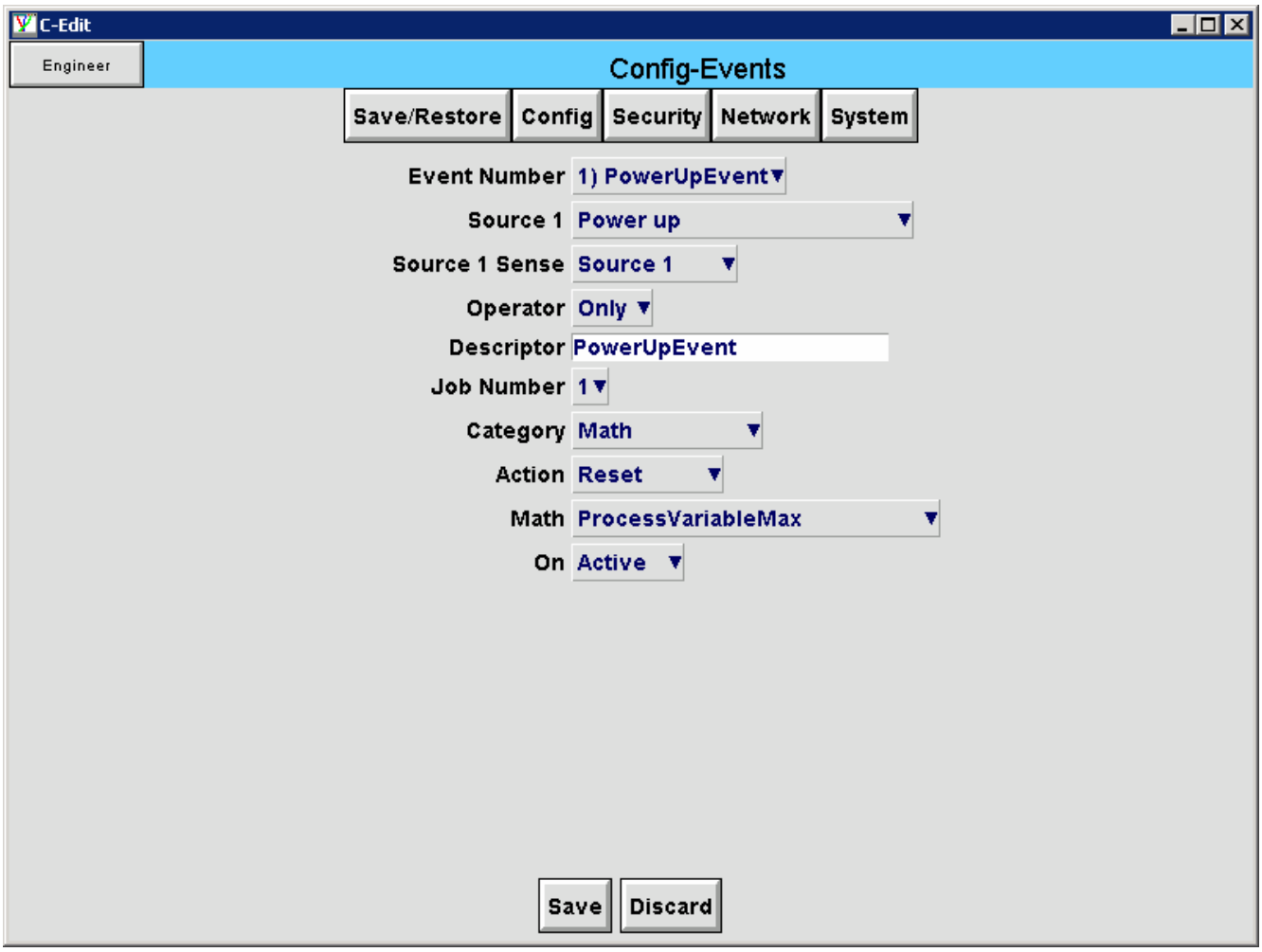
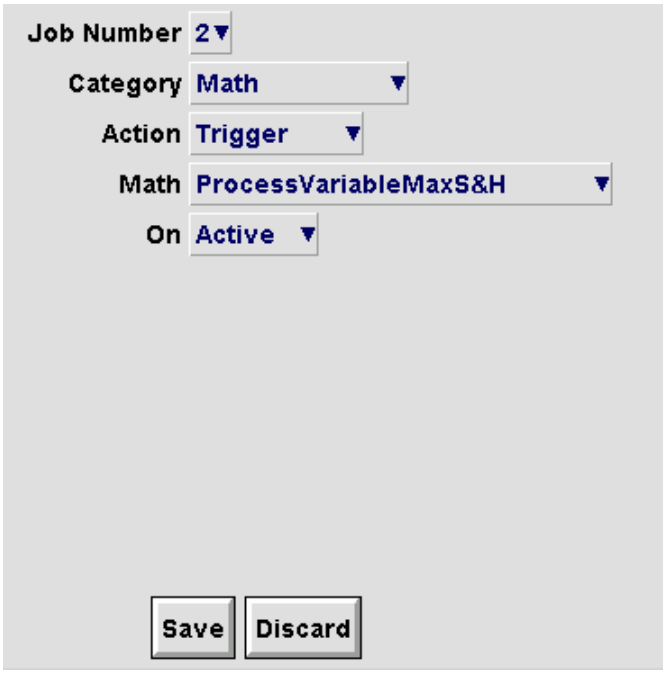


Figure 11 – Event 1 Configuration



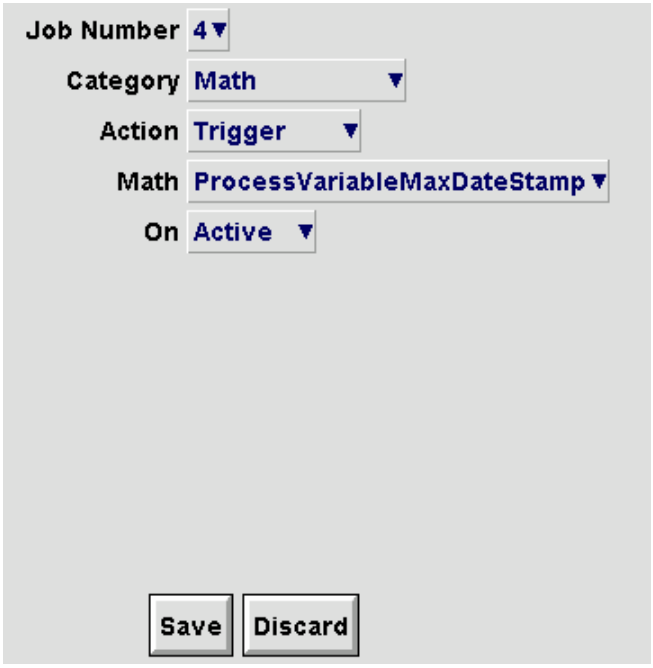


Figure 12 - Event 1 Job Configurations

Theory of Operation Overview

At some point during the recorder power up sequence, Event 1 will become active. When Active, Event 1 Jobs will execute and reset the Channel Maximum, Math Channel 1; trigger the Channel Maximum Sample and Hold, Math 2; trigger the Channel Maximum Timestamp Time Channel, Math 4; and trigger the Channel Maximum Timestamp Date Channel, Math 5. After execution of these Jobs, the Channel Maximum and the Channel Maximum Sample and Hold will have the same, current Process Variable input value. The Timestamp Time Math Channel will have the real-time value when Event 1 was triggered. The Timestamp Date Math Channel will have the current date value when Event 1 was triggered. At this time, the Channel Maximum recorder configuration is initialized and operational.

If the Process Variable input value increases from its initial Event 1 reset value, the Channel Maximum function of Math Channel 2 will update with a new maximum value. The subtract function of Math Channel 3 will execute, and if the Process Variable input value increase is greater than 0.1 °C, Math Channel 3 Alarm 1 will become active. When Math Channel 3 Alarm 1 is active, Jobs 1, 2 and 3 of Alarm 1 will execute. Job 1 triggers Math Channel 2 to sample and hold the new maximum value. Job 2 triggers Math Channel 4 to capture the current real-time value of the new maximum value. Job 3 triggers Math Channel 5 to capture the current date value of the new maximum value. Because of Math Channel 2 sampling and holding the new maximum input value, the result of the subtract function of Math Channel 3 will be zero. Alarm 1 will no longer be Active, and Math Channel 3 is again ready for a new maximum input value. If the Process Variable input value increases beyond its current maximum value, the preceding process will repeat resulting in a new Process Variable maximum value, and associated Date and Time Timestamp.

Timer 1 automatically executes once a day, on any day, of any month at 11:59:59 PM for 1 second. Timer 1 has Jobs that reset the Channel Maximum, Math Channel 1; trigger the Channel Maximum Sample and Hold, Math 2; trigger the Channel Maximum Timestamp Time Channel, Math 4; and trigger the Channel Maximum Timestamp Date Channel, Math 5. These are the same Jobs executed by Event 1 at recorder power up. Similar to Event 1, these Jobs initialize the Channel Maximum function for the next day.

Example 5000 Series SFC User Screen

A sample 6000 Series User Screen demonstrating the Channel Maximum with Date and Time Stamp function is shown in Figure 13. The User Screen is relatively simple. It contains a Group Vertical Trend object where the Group being trended contains just the ***ProcessVariable*** Input Channel. The User Screen also contains three Channel Numeric objects of the ***ProcessVariableMax***, ***ProcessVariableMaxDateStamp***, and ***ProcessVariableMaxTimeStamp*** Math Channels. The three Channel Numeric objects indicate that a ***ProcessVariable*** Input Channel Maximum of 500.0 °C was reached on 10/27/06 at 7:43:55 AM. The Vertical Trend object indicates that the temperature has increased twice and decreased once. The last temperature increase was to the maximum of 500.0 °C, and the temperature decrease did not change the Channel Maximum as expected.

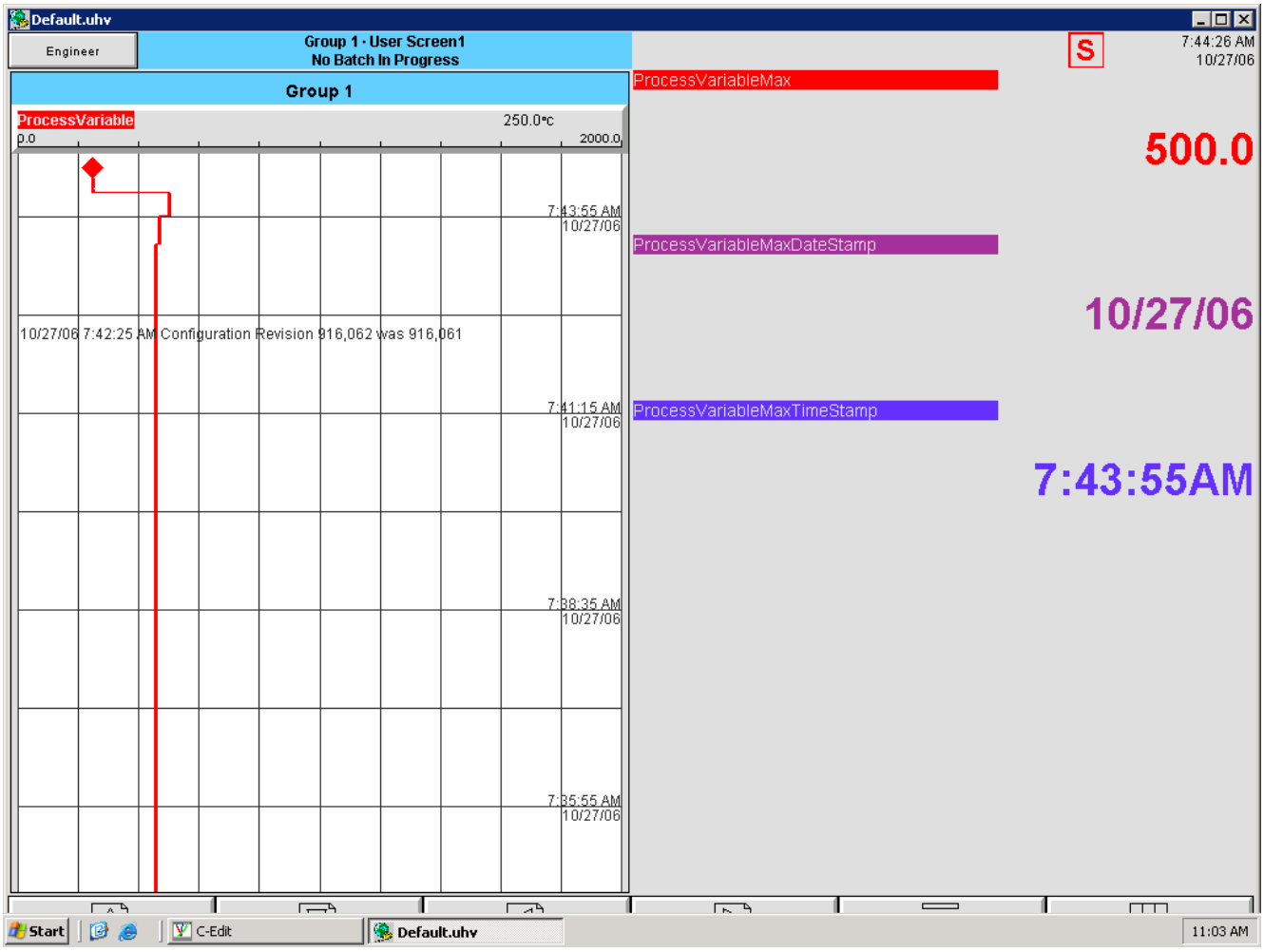


Figure 13 - Sample User Screen

Conclusion

This Technical Information Sheet demonstrated that it is possible to implement a Channel Maximum with Maximum Date and Time Stamp function in a 5000 or 6000 Series recorder. Implementation of this function is relatively simple and may be useful in process applications that require a real-time, on-line, determination of a process value maximum. Implementation of this function would also eliminate the requirement for off-line software applications and procedures. The function is not limited to determination of a Channel Maximum. The function could be modified to implement a Channel Minimum function with minor changes to the supplied recorder configuration. Additionally, the function could be modified to implement determination of an external, digital event occurrence.