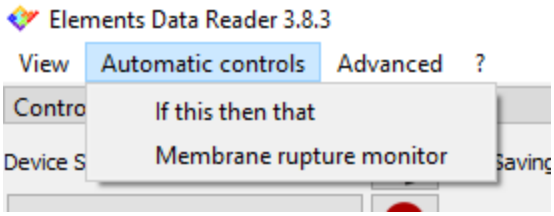
Quick Guide

elements
enabling technologies for Life Science

Automatic controls



Revision History

Date	Version	Description
09/04/2021	1.1	Updated contacts
26/05/2020	1.0	First version of document

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Automatic controls overview

The Automatic controls menu offers some features that once enabled take actions when some specific conditions are met, independently of the user intervention. This is particularly useful for actions that must be performed as soon as possible when required, or that must be performed several times and would otherwise require the user to be always ready to click some buttons for a prolonged time.

In particular EDR offers these predefined online analyses selectable from the Automatic controls menu:

- If this then that;
- Membrane rupture monitor.

New automatic controls requests

It is possible to suggest new automatic controls to be added in the next software releases.

To do so write to support@elements-ic.com and provide:

- A brief explanation of the automatic control;
- A minimum set of specifications (e.g., parameters settable by the user, useful noise reductions or spurious data rejection, etc.);
- A sample recording with expected actions taken by the automatic control (e.g., pointing out that at a specific time of the recording something happens that should be detected, in order to trigger the desired action, etc.);
- If available, any useful reference is very welcome (e.g., reference to paper/book, code/pseudocode, etc.).

Automatic controls common features

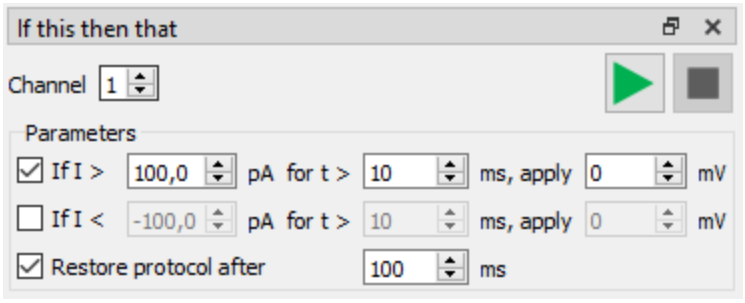
Control buttons

Each automatic control is available from the Automatic controls menu, and appears as a floating widget that can be docked. All automatic controls have common buttons respectively to start and to stop the control . As long as the start button is not pressed no action is taken by the automatic control.

Automatic controls description

If this then that

The “If this then that” control can be used to automatically apply a specific voltage when the current exceeds a given threshold.



The Channel field can be used to select a specific current channel to monitor, or it can be set to

in order to monitor all channels.

It is possible to set 2 distinct conditions with 2 different voltage levels. The first condition allows setting a specific voltage level if the current gets higher than a given threshold for more than a given amount of time. The time threshold is used to reject spurious current events, but on the other hand it can be set to 0 in order to catch even the shortest current spike above the selected current threshold. The second condition works the same exact way, but it is used to catch events where the current gets lower than a specific threshold. The checkboxes on the left of the conditions must be checked to enable either of the two conditions monitoring.

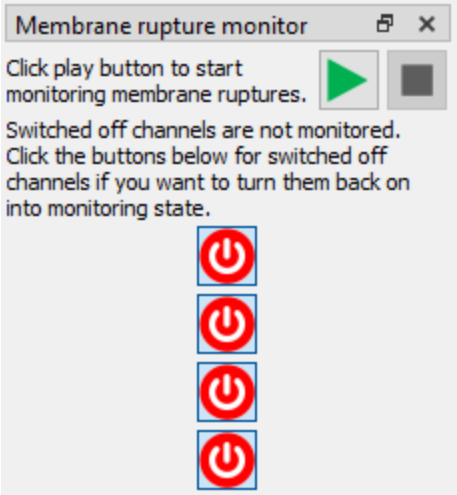
NOTE: If both conditions monitoring are enabled it is possible to create an unstable oscillation, i.e. if condition 1 sets a low voltage that triggers condition 2, which in turn sets a high voltage that triggers condition 1, and so on.

NOTE: Since the control is performed by the software the application of the selected voltage is not instantaneous, but it can take 50-100ms from the current event to the corresponding voltage application. This delay can increase at sampling rates lower than 10kHz.

The voltage automatically applied by the “If this then that” control is kept indefinitely, until the user applies another voltage protocol, even if the control is turned off with the stop button. However, it is possible to automatically restore the voltage protocol that was performed before the control intervenes. This can be done by ticking the checkbox in the last row: in this case the voltage protocol being performed is restored after the automatic voltage application, when a given amount of time has elapsed. This feature can be useful in some situations, for example for nanopore declogging: the automatic control can be used to apply a very negative voltage to unclog the nanopore when a low current is detected for a prolonged time, and then the experimental condition can be restored without any intervention of the user.

Membrane rupture monitor

The “Membrane rupture monitor” control can be used to automatically switch off saturating current channels when lipid bilayer membranes break. This can be particularly useful in multichannel devices, where a saturating channel can induce interferences on nearby channels, so switching it off as soon as possible can preserve the quality of data acquired in channels connected to intact membranes.



The control has a button for each current channel that can be clicked directly by the user (in which case it works the same exact way as switch off buttons near the current plots), or that is automatically triggered by the control when a persisting saturation is detected, once the start button is pressed.
The buttons can have 3 different icons:

- Switched on channel: the current channel is working normally and the “Membrane rupture monitor” control is not enabled, so only the user can turn the channels on and off;
- Monitored channel: the current channel is working normally and the “Membrane rupture monitor” control is enabled, so it can turn channels off it they saturate (the user can switch the channels on and off as well);
- Switched off channel: the current channel is switched off, so no potential is applied to it and it won’t be recorded if a recording starts.

The meaning of the icons can be quickly checked by hovering the mouse over the buttons.
NOTE: Since switched off channels are not recorded, channels that are switched off before a recording starts cannot be switched back on until the recording ends.