

blue PiraT2

Complex Triggers User Guide

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3. Overview

With the “Complex Triggers” feature of the blue PiraT2 the following functions are available:

- Setting Triggers with the Remote Control
- Setting Triggers with the Logger
- Configure an “Event” that will cause an “Action”
- Support for CCP/XCP Events (requires CCP or XCP license)

Since FW 1.8.1 there are 2 Complex Triggers included into the firmware.

If you need up to 50 Complex Triggers you can upgrade this feature with a license.

4. System requirements

Control Unit

A Laptop or a PC is used to configure the devices by a software client. It also allows to save the recorded data and to use them offline.

blue PiraT2

The blue PiraT2 is an optimized data logger developed by Telemotive AG. The communication of bus systems and control units are monitored and relevant data can be recorded very precisely with the blue PiraT2. The collected data are stored on the blue PiraT2 and can be downloaded to a PC

The complex triggers function works on any blue PiraT2 system with an actual software version. It is necessary to purchase a special license for this function. For further information about license and license handling please read the blue PiraT2 - User Guide.

This manual refers to the following software versions:

- Data logger firmware V01.09.01
- Client V1.9.1

Software updates are frequently available in the blue PiraT Service Center. Please make sure to have a current software version installed

5. Trigger Functions

5.1. Trigger Events

Following event functions are available:

1. Activate a function key (F1...F10) on the Remote Control. The following conditions are available:
 - Key pressed
 - Key released
2. Press the "Trigger" button.
3. Digital input signal on the blue PiraT2 data logger with a defined signal level. The following conditions are available:
 - Digital input active
 - Digital input inactive
4. CAN-signals meet a configurable condition. The following inequalities are available:
 - less than (<)
 - less than or equal (<=)
 - greater than (>)
 - greater than or equal (>=)
 - equal (=)
 - not equal (!=)

It is possible to combine different events with logical operations (complex event). There is no limit in the number of combined events.

The following logical operations are available:

- AND (&)
- OR (|)
- NOT (!)

Example for a complex event:

((CAN2.signal1 <= 10) & (CAN1.signal2 = 30)) | (RC.F1 = PRESSED)

5.2. Trigger Action

The following trigger actions are available:

- Set marker
- Send CAN message
- Append info entry to data overview
- Display message in the Remote Control
- Set digital output #1 to #3 active
- Set digital output #1 to #3 inactive
- Display Remote Control Monitor
- Execute CCP/XCP Action

6. Configuration

To configure the complex trigger feature, a connection to the data logger is required. Please connect the data logger to your computer and start the client.

In the client choose the sub menu "Trigger" from the logger configuration menu.

The complete data logger configuration can be managed by following buttons:

- Default configuration Loads a default configuration
- Load from file: Loads data from a locally stored configuration file
- Save as file: Saves configuration data to a local file
- Write to data logger: Sends the configuration data to the connected data logger.

Note:

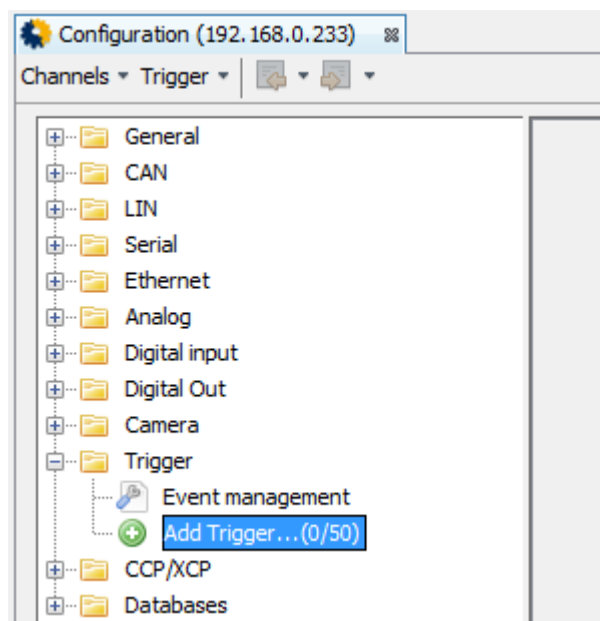
The configuration is applied immediately!

6.1. Configuration menu

If the license has been installed correctly, the selection tree on the left hand side shows the entry "Trigger" In the trigger configuration you'll find three parts:

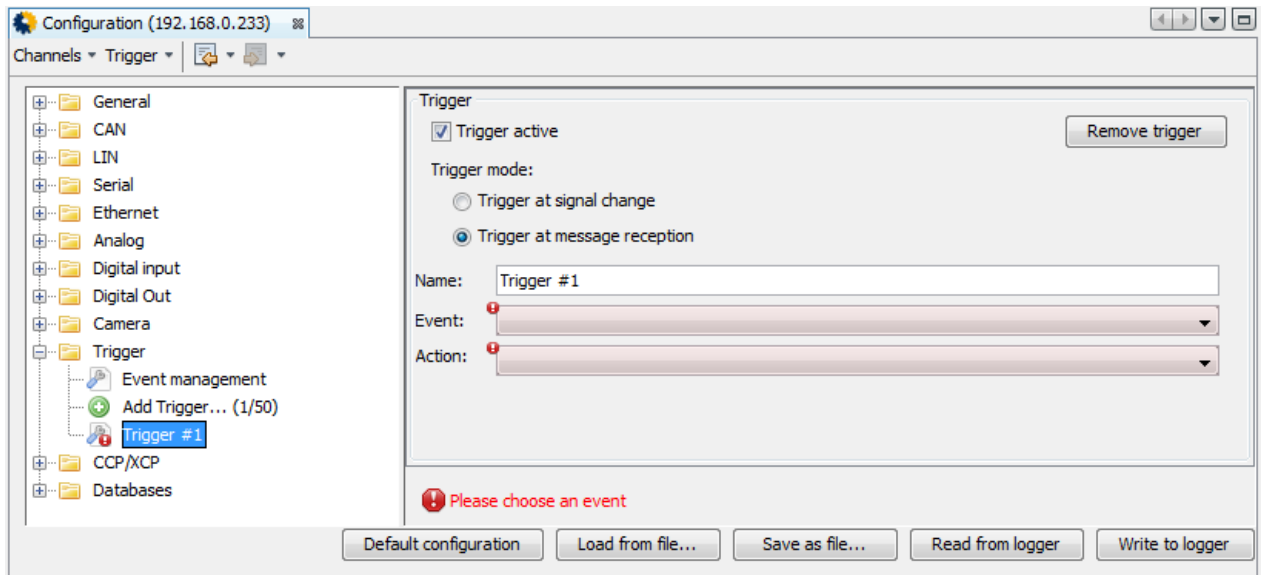
- New trigger
- Trigger #x
- Event management

With the selection of the [Add Trigger... 0/50] button, it is possible to configure up to 50 different triggers with valid license. Without license there are 2 trigger available.



6.2. General Trigger configuration

By double clicking the button [Add Trigger...] a new Trigger will be shown in the list (e.g. Trigger #4). The red "exclamation mark" reminds a not configured trigger. Select e.g. "Trigger #4" to configure it.



6.2.1. Trigger state

Each trigger can be configured to be active or inactive. If a trigger is inactive, its parameters are still kept in the configuration, but the data logger does not execute the trigger.

6.2.2. Trigger mode

Each trigger has two different modes of evaluating the trigger condition:

- Trigger at signal change: - The trigger occurs only if there is a change in the signal value and the event conditions are corresponding. This trigger condition mode is applicable for periodic signals (i.e. CAN signals), where only one trigger is required for the first time the event condition is true.
- Trigger at message reception: - The trigger occurs every time a signal message was received and the event conditions are corresponding. This trigger mode is applicable if every reception of a message should cause a new trigger. (default trigger mode)

6.2.3. Trigger name

The name of the trigger can be changed by the user. The new trigger name is displayed in the selection tree on the left hand side. The number of characters for the trigger name is limited to 50.

6.2.4. Trigger "event" and "action"

The trigger function is defined by an event and a following action. Events and actions can be defined and changed by the user in any sequence.

6.2.5. Removing the trigger

The button "Remove this trigger" deletes the marked trigger.

6.3. Configuration of single events

6.3.1. Event „Key stroke“

The event “Key stroke” is defined by selecting the Trigger button (Logger or Remote Control) or the Remote Control function keys F1 to F10. The key status can be “pressed” or “released”. These parameters have to be selected by the user.

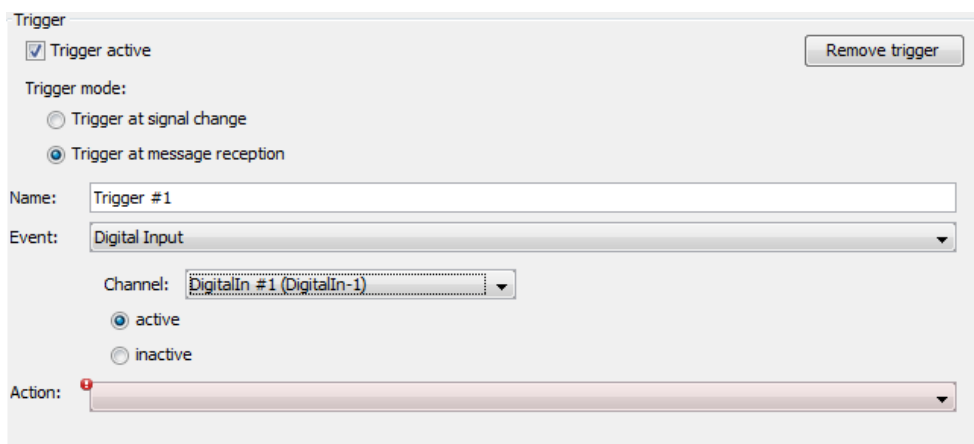


The screenshot shows a configuration window titled "Trigger". It includes a "Remove trigger" button in the top right. The "Trigger active" checkbox is checked. Under "Trigger mode:", "Trigger at message reception" is selected. The "Name:" field contains "Trigger #1". The "Event:" dropdown is set to "Key stroke". The "Key:" dropdown is set to "Trigger (Remote Control or Logger)". Under the key status, "pressed" is selected. The "Action:" field is empty.

The related action is executed once when the event condition key “pressed” or key “released” changes into the status “true”. A connected blue PiraT remote control is required for an event with a function key.

6.3.2. Event “Digital Input”

The event digital input is completely defined by selecting the channel and the signal status “active” or “inactive”. This parameter has to be selected by the user.



The screenshot shows a configuration window titled "Trigger". It includes a "Remove trigger" button in the top right. The "Trigger active" checkbox is checked. Under "Trigger mode:", "Trigger at message reception" is selected. The "Name:" field contains "Trigger #1". The "Event:" dropdown is set to "Digital Input". The "Channel:" dropdown is set to "DigitalIn #1 (DigitalIn-1)". Under the signal status, "active" is selected. The "Action:" field is empty.

The condition “active” is true, when the voltage level of the digital input correspond to the chassis ground (KL31).

The condition “inactive” is true, when the voltage level of the digital input correspond to the battery voltage (KL30).

The related action is executed once when the event condition “active” or “inactive” change into the state “true”.

There is only a single digital input port available in the actual blue PiraT2 hardware. The pin assignment is listed in blue PiraT2 – User Guide - Pinning.

6.4. Configuration of complex events

The trigger functionality offers the possibility to combine different single events to a logical expression, a so called “complex event”. One complex event can start only one action. Different complex events can be configured to realize different actions.

The screenshot shows the 'Trigger' configuration window. It has a 'Trigger active' checkbox checked. Under 'Trigger mode', 'Trigger at message reception' is selected. The 'Name' field contains 'Trigger #1'. The 'Event' dropdown is set to 'Complex event'. Below it is an empty 'Expression' text box with an 'Insert element...' button. At the bottom, the 'Action' dropdown is empty. A 'Remove trigger' button is in the top right corner.

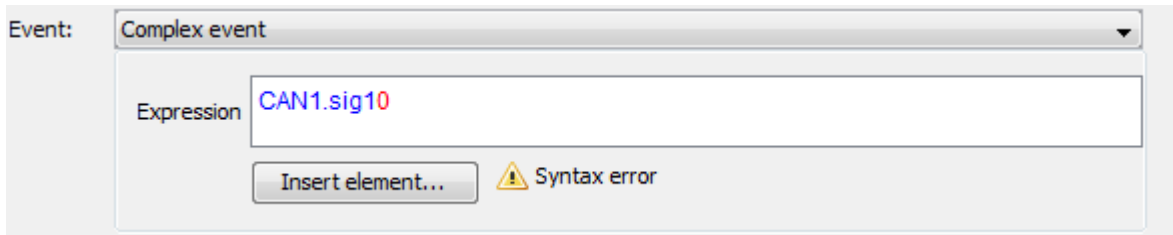
The user has to select the “Complex event” in the first configuration step. Afterwards, the empty input field “Expression” appears. The user can now insert different event conditions by the “Insert element” button. It is also possible to generate only one event condition for a complex event.

6.4.1. Event Collection

The different basic events are selected with the “Insert element” button

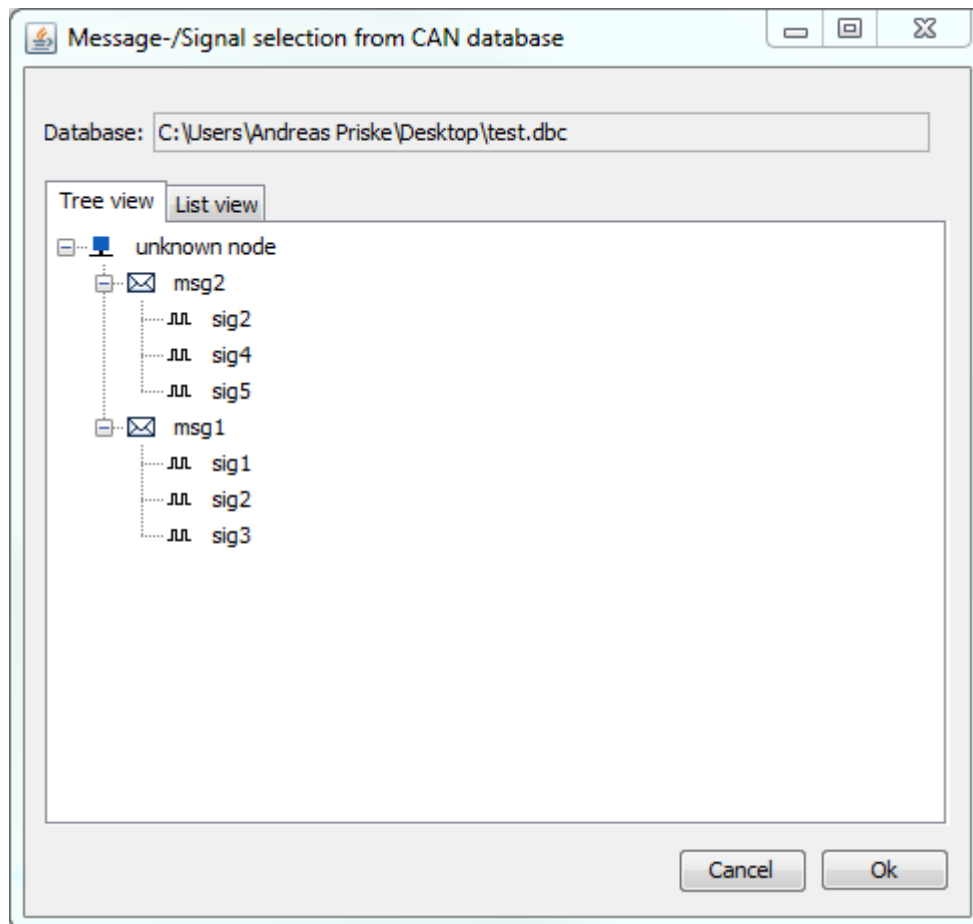
This screenshot shows the same 'Trigger' configuration window as above, but with the 'Insert element...' button clicked. A context menu is open over the 'Expression' field, listing event options: 'CAN-Signal', 'Remote control function key pressed', 'Remote control function key released', 'Digital input #1 active', and 'Digital input #1 inactive'. To the right of the menu is a list of CAN bus identifiers from 'CAN 1' to 'CAN 14'. At the bottom of the window, there is a red error message: 'Please select an event and an action for this trigger'. Several utility buttons are visible at the very bottom: 'Default configuration', 'Load from file...', 'Save as file...', 'Read from logger', and 'Write to logger'.

The selected event is inserted on the current cursor position. Inserted events are displayed in a blue text color. Error and warning messages are displayed in a red text color. Once an event has been inserted, it can be deleted but not modified by the user.



6.4.2. CAN-Signal

CAN-Signals are selected in the dialog „Signal selection from CAN database“

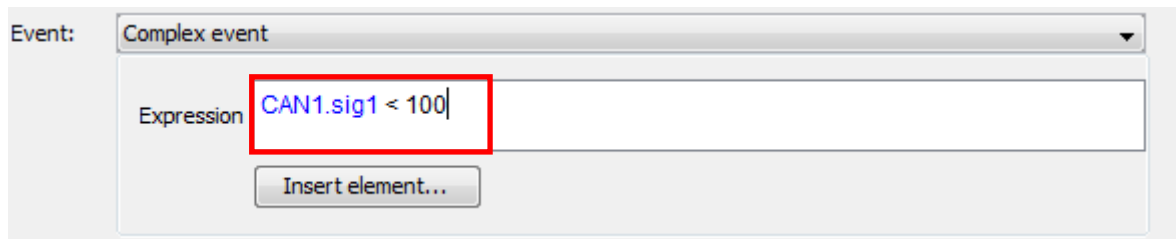


After the CAN signal selection, the CAN signal in the expression field is displayed in the following format.

CAN<channel number>.<signal name>

It is not possible to edit the signal name or channel number.

To complete the event condition, the user has to insert an operator and behind a reference value (i.e., a scaled decimal value) by the PC keyboard. It is not possible to change this order.



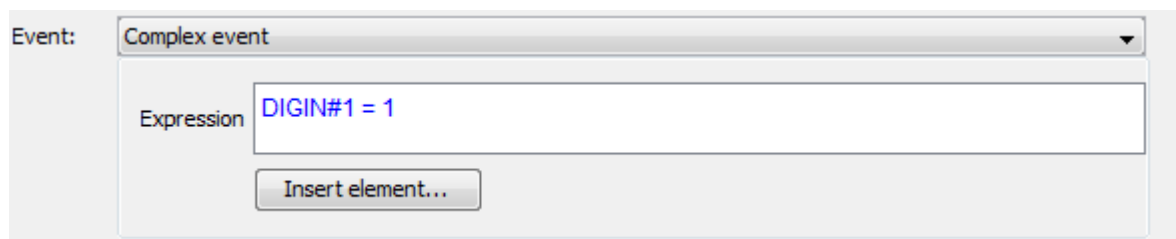
6.4.3. Digital Input

Two options are available for the digital input signals.

- "Digital Input #1 active"
- "Digital Input #1 inactive"

The event conditions are automatically generated and displayed in the expression field. There is no additional user input required. The event conditions are displayed in the expression field as followed:

- DIGIN#<channel number> = 1
- DIGIN#<channel number> = 0



Actually there is one digital input port available in the current blue PiraT2 hardware.

- DIGIN#1 = 0 ⇔ Digital Input #1 inactive
- DIGIN#1 = 1 ⇔ Digital Input #1 active

It is not possible to edit the digital input event in the expression field after it has been added.

6.4.4. Remote control function key

Two options are available for the Remote control function keys F1 to F10.

- "Remote control function key pressed" → "F<key number>"
- "Remote control function key released" → "F<key number>"

The event conditions are automatically generated and displayed in the expression field. There is no additional user input required.

- PRESSED → function will be done by pressing the button
- RELEASED → function will be done by releasing the button

The event conditions are displayed in the expression field as followed:

- RC.F<key number> = PRESSED
- RC.F<key number> = RELEASED

It is not possible to edit the digital input event in the expression field after it has been added.

6.4.5. Complex Event (Range of operators)

The following compare operations, logical operations, and numerical characters are available to combine different single events to a valid complex event expression:

Logical operations:

- & logical AND combination
- | logical OR combination
- ! negation of events expressions

Compare operations / inequalities:

- < less than
- <= less than or equal
- > greater than
- >= greater than or equal
- = equal
- != not equal

Alphanumerical characters:

- 0 to 9 compare value

Characters:

- (and) brackets for event expressions
- . and , dot and comma for floating point expressions dot- and comma-character will be processed equivalent. The presentation depends on the language settings chosen during the Client installation.

The user has to enter the compare operators, logical operators and characters by the keyboard into the expression field. The configuration can be changed any time by the user.

Note:

It is not possible for the user to insert a space-character. Space-character are inserted automatically to improve the readability.

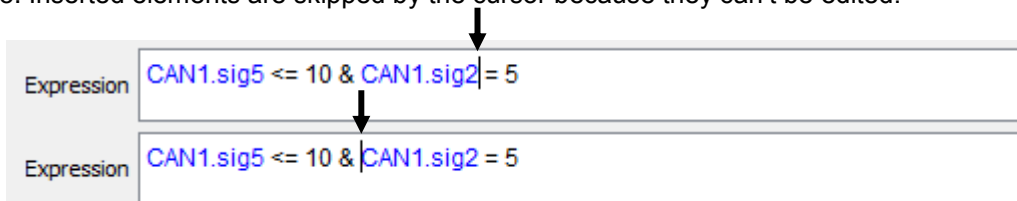
The single event conditions of a complex event expression are processed by a defined priority list:

operation	description	priority
()	bracket open / close	1 (high)
!	NOT	2
<, <=, >, >=, =, !=	compare	3
&	logical AND, OR	4 (low)

- Mismatch of open and closed parenthesis (The number of opened parenthesis is not equal to the number of closed parenthesis)
- CAN signal parameters doesn't match the selected CAN database (After the CAN database has been changed, the selected CAN signals are not available in the new database)
- Syntax error - (Compare operators or logical operators are missing or event conditions are used not correctly)

6.4.7. Cursor position

The cursor can be moved by the user either with the arrow keys of the PC keyboard or with the PC mouse. Inserted elements are skipped by the cursor because they can't be edited.

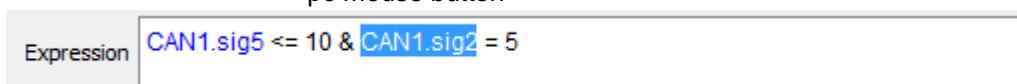


The cursor can also be placed with the left mouse button. When clicking onto an element the cursor is placed on the left side of the element.

6.4.8. Deleting events, characters and operators

Events, characters and operators can be marked and/or deleted as followed:

- backspace button the event, character or operator on the left hand side of the cursor is marked and/or deleted
- delete button the event, character or operator on the right hand side of the cursor is marked and/or deleted
- PC mouse events, characters or operations are marked with the pressed left pc mouse button



All elements of a complex event expression can be marked and deleted individually or altogether. A single event (CAN signal, function key and digital input) can be deleted only at once.

6.4.9. Changing CAN databases

If the CAN database is changed before loading the configuration or during configuration of the trigger parameter, the display in the expression field is updated automatically. The signal name of the new CAN database is displayed. The old signal name is kept in case the CAN signal is not listed in the new CAN database or the CAN database was deactivated. In this case, the CAN signal is displayed in red color.

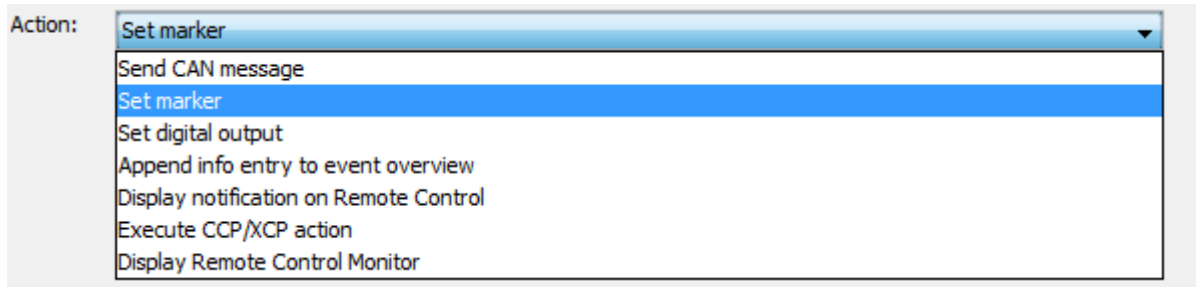
Example:

1. The expression field contains "CAN1.clampstatus = 3". It is a CAN signal from the database with the CAN-ID 0x480, data bit 0-7, which was used during CAN signal configuration
2. The user switches to a new CAN database
3. In the new database the CAN signal with the CAN-ID 0x480 and the data bit 0-7 is named "clampstatus_new".

4. In the expression field the new signal name is automatically updated to "CAN1.clampstatus_new = 3".
5. Now, the user deactivates the CAN database in the configurator
6. In the expression field the signal name changes to "CAN1.clampstatus_new = 3"

6.5. Configuration of trigger action

After the configuration of the trigger event, the selection of the trigger action is required.

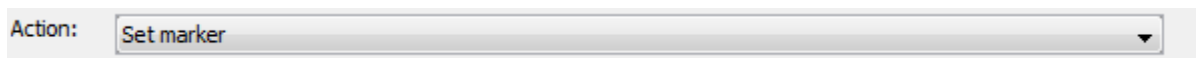


The required trigger action can be selected in the dropdown menu "Action". The following trigger actions are available:

- Display Remote Control Monitor (extra license required)
- Send CAN message
- Set marker
- Set digital Output
- Append info entry to data overview
- Display message in the Remote Control
- Execute CCP/XCP action

6.6. Setting a marker

The behavior of the action "Set marker" is identical to the behavior when the user triggers a marker by the front panel button or by the remote control marker button.



There is no additional user input required for this action. The following steps are done by setting a marker:

- Recording the time stamp and the marker counter to the trace data
- Increase the marker counter by one
- Optical and acoustic feedback from the remote control
- Write marker info to the data overview
- Switch the front panel marker LED on(single flash?)

6.6.1. Sending a CAN message

After selecting the trigger action „Send CAN message” additional parameters have to be set by the user.

Action: Send CAN message

Channel: CAN-HS #1 (HSCAN-1)

Name:

CAN ID (Hex): 00 Base (11 Bit) Extended (29 Bit)

DLC: 8

Datenbytes (Hex): 0 0 0 0 0 0 0 0

Load from Database...

The CAN message parameters can be selected manually or automatically by using the CAN database. You can also choose between 11bit and extended 29bit CAN identifier length.

Warning – using this function can influence the vehicle network significantly. When using this function a person must be aware of the consequences sending the specified CAN messages.

6.6.2. Append info entry to data overview

For the action “Append info entry to the data overview”, it is possible to configure a user defined message with included CAN signals. The message is limited to a maximum of 75 characters.

Action: Append info entry to event overview

Line 1

Insert Element...

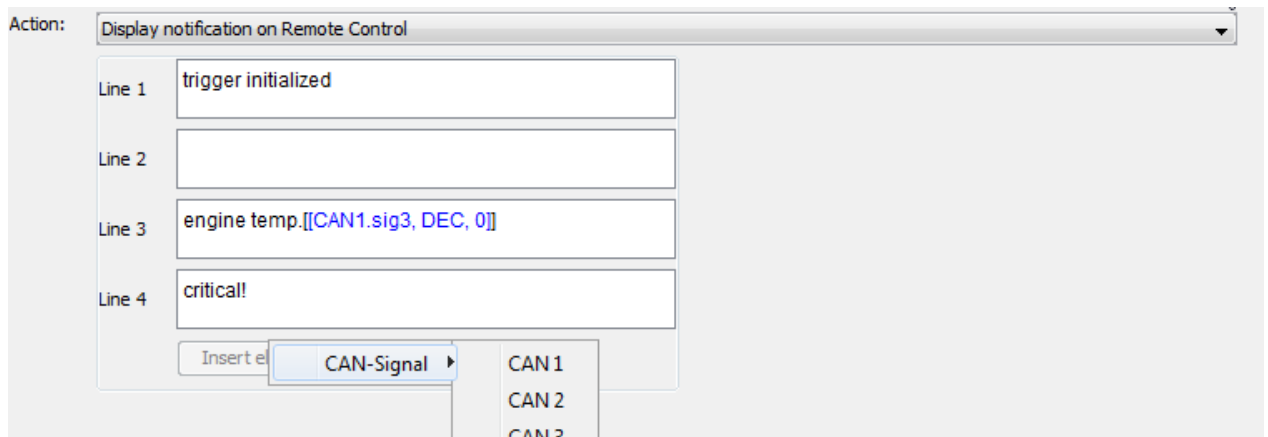
CAN-Signal ▶

- CAN 1
- CAN 2
- CAN 3
- CAN 4

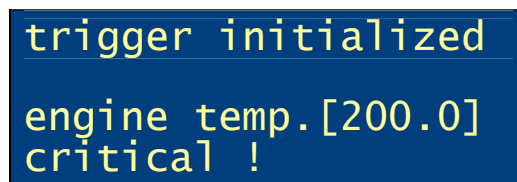
The message is displayed in the event overview during the download or format conversion process of the trace data.

6.6.3. Info display to the remote Control

For the action “Display message in the remote control” it is possible to configure a user defined message with included CAN signals. For the info display there are 20 characters per line and total 4 lines available.



The message is displayed for 4 seconds. The previous remote control screen is displayed after this time has passed. If an additional complex trigger or a marker is executed during this, the current message is overwritten by the new one.



6.6.4. Digital output active / inactive

It is possible to switch a digital output on with the action "Set digital output". The level of the output signal then corresponds to the power supply level (KL30). The digital output has a maximal load of 100mA.

This action also allows switching off a digital output. The off level of the output signal is 0V (KL31).



There is no additional user configuration required for this trigger action.

6.6.5. Remote Control Monitor

Selected CAN signals can be displayed online in the remote control with the trigger action "Remote Control Monitor".

This trigger action is only available if the License "Remote Control Monitor" is installed. The user manual "Remote Control Monitor" describes the configuration and the functionality of this license.

6.6.6. CCP/XCP

Name: CCP Trigger

Event: Complex event

Expression: RC.F1 = PRESSED

Insert element...

Action: Execute CCP/XCP action

It is possible to define a CCP/XCP action. If you define an Action with the Name e.g. "CCP Trigger" you can use this action in the CCP/XCP menu as "Start or Stop Event". For further information please have a look at the CCP/XCP users guide.

6.7. Event Manager

With the event manager you can manage the list of created events. You can define new events (button: "New event"), delete old events (button: "Delete event") and save the new event (button: "Save event").

Name	Expression
Trigger	RC.F1 = PRESSED
Trigger Event 2	RC.F1 = RELEASED

New event Delete event

Name: Trigger Event 2

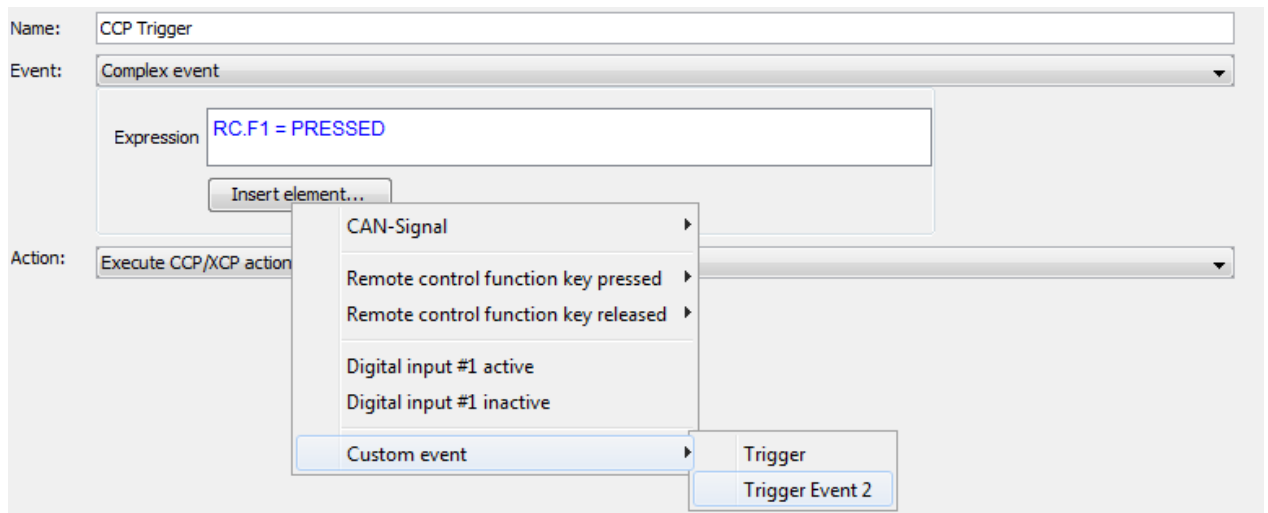
Event

Expression: RC.F1 = RELEASED

Insert element...

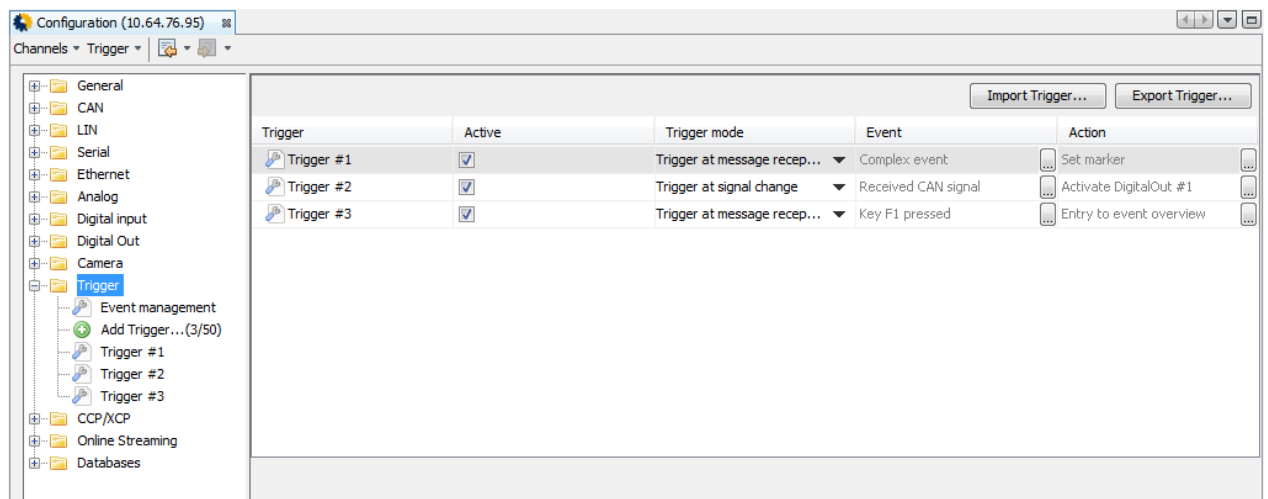
Workflow:

1. Press: "New Event"
2. Give "New Event" a name (e.g. Trigger Event 2)
3. Define an Expression in the "Expression" field using the "Insert element..." button.
4. Press: "Save Event"
5. Then go to the main menu and add a new trigger
6. For the "Event" choose "Complex event". By using the "Insert element..." button the "Custom Event" (Trigger Event 2) can be included as configured before in the event manager.



6.8. Trigger Overview

To manage your trigger as fast as possible we included the trigger overview. You can reach the trigger overview over the submenu "Trigger".



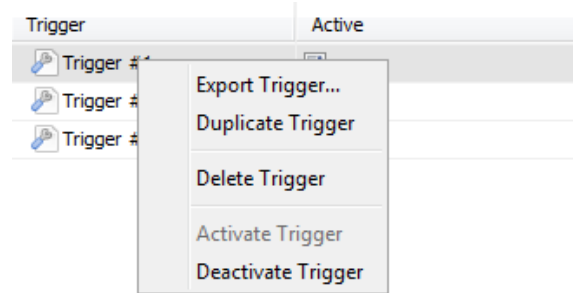
The trigger overview contains the important informations about the trigger settings. With most operating systems and software programs, whenever you need to select everything, the shortcut key CTRL + A will select all files or text.

If you need to select multiple files that are all grouped together, you have to select the first trigger entry and hold the Shift key. While holding the key down click the last trigger entry. This will select all the trigger entries in-between the first and last line.

If there multiple trigger entries you want to copy but they are not grouped together, you have to select the first trigger and then press and hold the CTRL key. While holding down the CTRL key, select each of the trigger entries you wish to select.

The following options are available over the context menu:

- Import / Export Trigger
- Duplicate Trigger
- Delete Trigger
- Activate / Deactivate Trigger



6.8.1. Import / Export Trigger

The import and export support functions perform any tasks needed to process load and store external trigger.

- The import function imports trigger by converting from external *.zip archive to the internal format.
- The export function exports trigger by converting from the internal format to the external *.zip archive.
- The rest of the logger configuration will stay untouched. Import trigger from offline configurations is working as well.

Note:

If you import Trigger with a existing Trigger name (e.g. Trigger-001) there are 2 Trigger with the same name in the overview and you should delete or rename one of them. Otherwise you have no chance to filter the Trigger in the traces.

6.8.2. Duplicate Trigger

If you need to make a duplicate of a trigger entry the blue PiraT 2 Client will create a new Trigger with the same properties like the source trigger. To identify a duplicated trigger the name of the duplicated trigger will looks like this.

<Source trigger name> #y_Copy<id>

7. Limits of trigger functionality

The following points should be considered with regard to the trigger function execution:

The trigger function is only available after the data logger startup is complete.

In certain disadvantageous cases, it is possible that there is a maximum time delay of 200 milliseconds between event and action, caused by a high bus- and system-load.

The user can configure up to 50 independent trigger events and trigger actions. Such a configuration can cause a high system load in the blue PiraT2 trigger system. This could result in a data processing problem and possibly in partially loss of the data recording. To avoid this situation, a trigger denouncing mechanism is implemented. The trigger denouncing is able to handle

temporary high trigger load inside a limited time period with the condition “maximum number of triggers within the defined time”. The trigger denouncing condition is different for each trigger action and is not changeable.

Action	Debouncing conditions (max. values)
Set marker	10 marker per 2 seconds
Display message in the Remote Control	1 display messages per 400milliseconds
Append info entry to data overview	100 entries per 10 minutes
Send CAN message	10 CAN-signals per 1 milliseconds
Set digital Output active / inactive	10 switching operations per 1 milliseconds
Display Remote Control Monitor	update of the CAN signal values in 1 seconds

Triggers are eliminated if the number of triggers exceeds the debouncing level inside the measurement time. In this case a warning message is appended to the data overview. The warning messages are created in an interval of 60 seconds. The warning message contains the name of the causing trigger action and the number of the missing triggers.

Example warning message in the data overview:

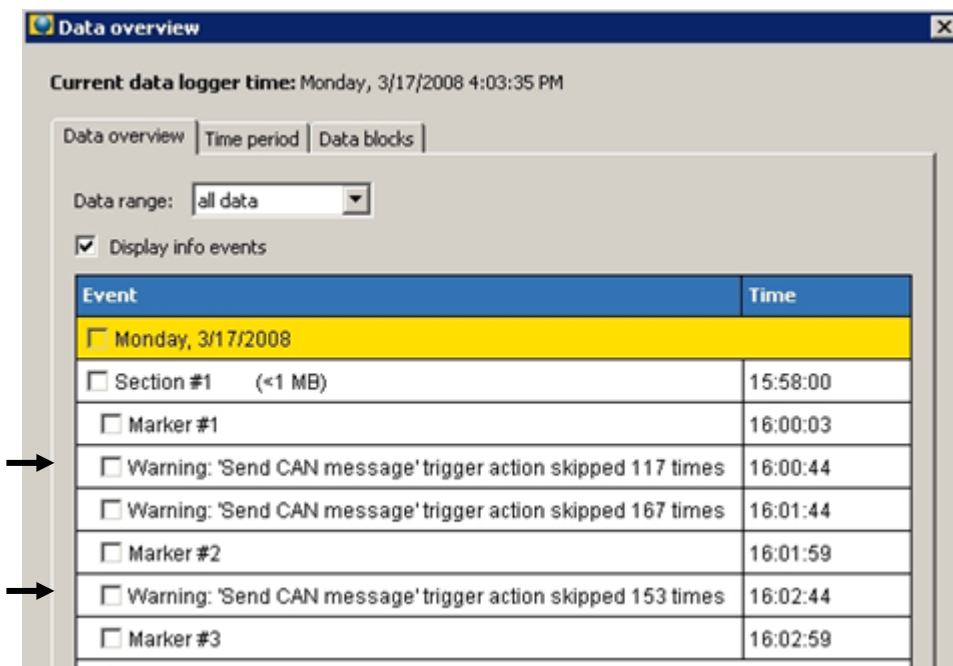
Warning:

'trigger action name' trigger action skipped n times

Trigger action name:

- Set marker
- Display message in the Remote Control
- Append info entry to data overview
- Send CAN message
- Set digital output active / inactive
- Display Remote Control Monitor
- n: number of the skipped trigger actions

The counter for missing triggers is reset to zero after each startup of the data logger.



8. Contact



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