RTCM V2 USER MANUAL FULL DIGITAL

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Changes

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Summary

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1 GENERAL INTRODUCTION

For years, production car uses relays fuses or circuit breakers to protect electrical system from short circuit damages or even fire in case of wiring error.

Such a system is not suitable for racing use. Relays and fuses are exposed to a harsh environment of heat and vibration which can cause unintended electrical shutdowns. Furthermore, fuses and relays wiring are often very complex and make fault tracing complicated, in particular if errors happen on track.

Nowadays, we have for many years done away these vulnerable components and have replaced them with computer-controlled modules.

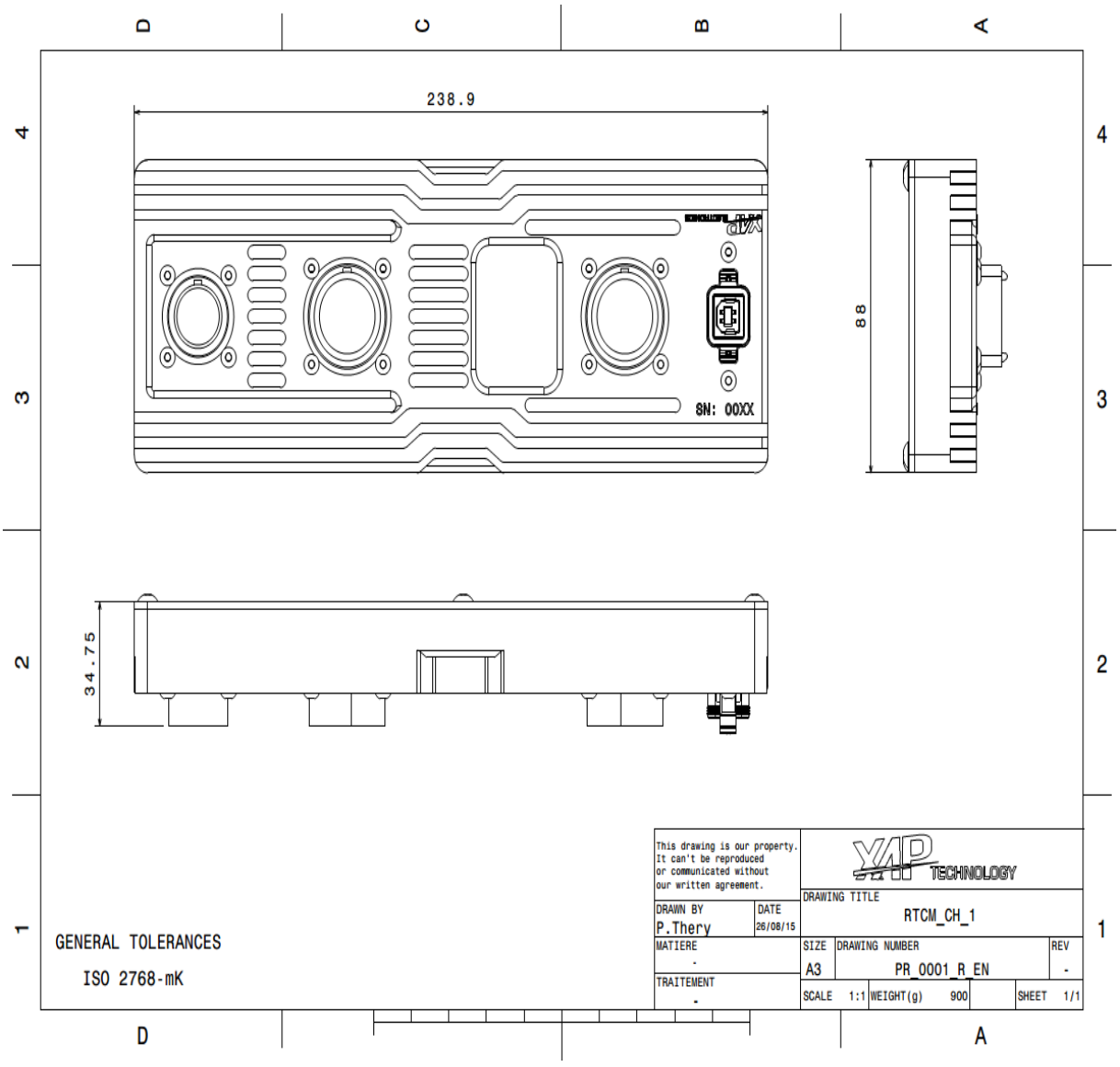
The RTCM Power Module is a microprocessor-controlled module, which is fully configurable, integrates short-circuit protection and auto-rearming outputs. Moreover, the monitoring of input/output states allows the customer to easily diagnose a failure.

Based on our power boxes experience and success, the RTCM is a very powerful, flexible and technically advanced module. It is a huge step ahead of our competitors, in technology, features and very high current handling ability.

The RTCM has a dense concentration of high power circuits and accepts complex order to activate and protect complex electrical systems. This system can receive external order from different management system (ie Engine Control Unit (ECU) or building management system [Illumination (lighting) control, electric power control ,Heating, ventilation and air-conditioning (HVAC),Security and observation, Access control, Fire alarm system] …)

2 HARDWARE SPECIFICATIONS

2.1 Dimensions and installation



RTCM module is delivered with a foam coating on its lower side. It has specially be designed to protect it from hard vibration of a racing car. It is strongly advised to keep it when RTCM installation to avoid any damages.

2.2 Connectors

Here are connectors to be used for the loom connection:

- C1: 451 06RT 14-19 S50 (AMPHENOL)
- C2: 451 06RT 18-32 P50 (AMPHENOL)
- C3: 451 06RT 18-32 PW50 (AMPHENOL)

The contacts used are AWG20 size (Dia 1 mm).

Digital inputs can be wired with AWG 22 or 20 section wires.

Outputs must be wired with AWG18 or 20 section wires depending on DC current.

2.3 Pinout

C1

Pin	Assignment
A	12V_IN
B	12V_IN
C	12V_IN
D	12V_IN
E	12V_IN
F	RELAY_EXT
G	12V_IN
H	12V_IN
J	12V_IN
K	12V_IN
L	12V_IN
M	12V_IN
N	12V_IN
P	12V_IN
R	12V_IN
S	12V_IN
T	12V_IN
U	GND
V	GND

C2

Pin	Assignment
A	MP11
B	MP10
C	MP9
D	MP8
E	MP7
F	MP6
G	MP5
H	MP4
J	MP3
K	MP2
L	MP14
M	MP13
N	MP12
P	HP3
R	HP3
S	CMD_IN4
T	MP1
U	CMD_IN7
V	HP2
W	HP2
X	CMD_IN3
Y	CMD_IN5
Z	CMD_IN1
a	MASTER_OFF
b	CAN1_LOW
c	CAN1_HIGH
d	MASTER_ON
e	CMD_IN2
f	MP15
g	HP1
h	HP1
j	CMD_IN6

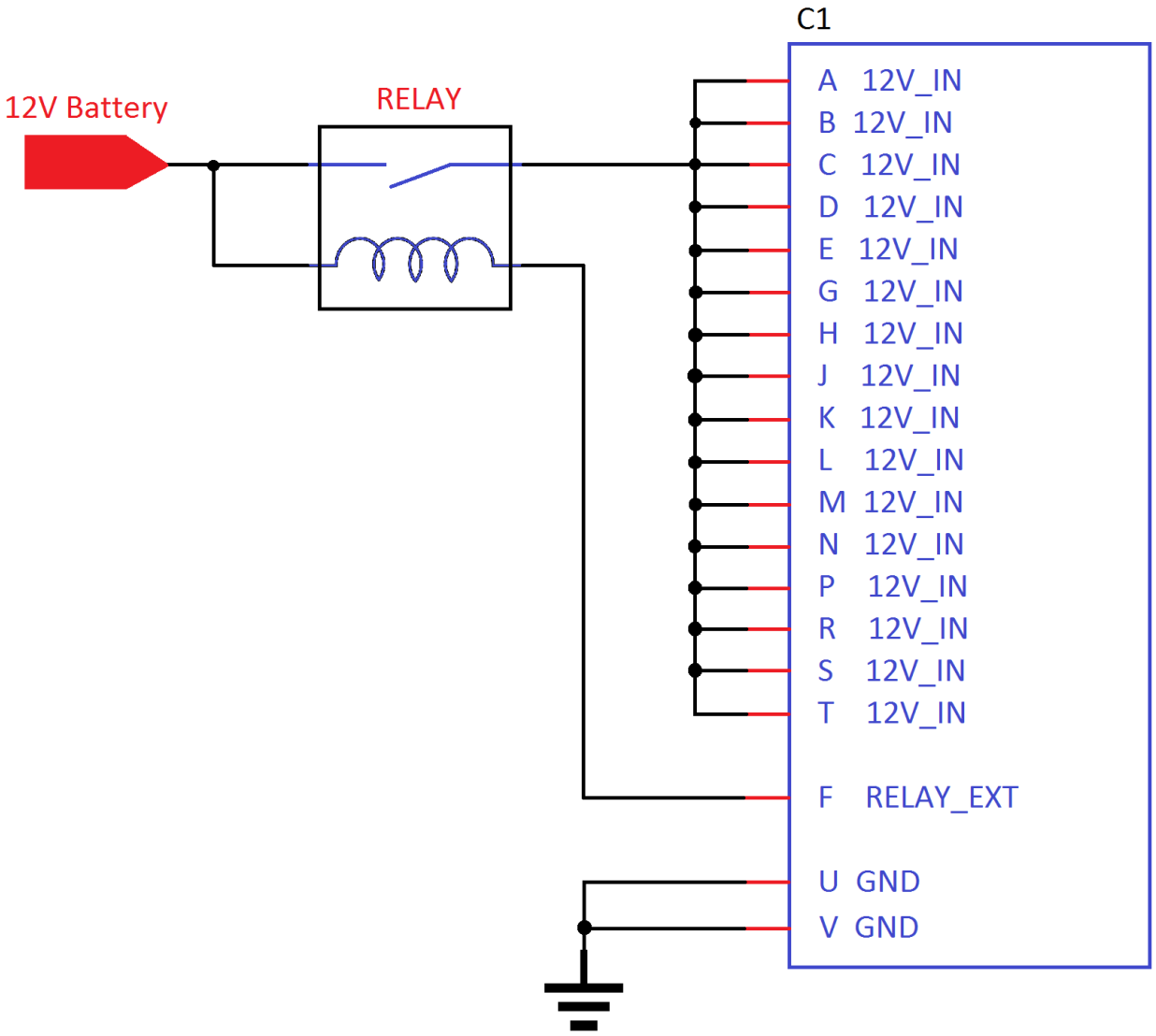
C3

Pin	Assignment
A	AGND
B	MP16
C	HP11
D	HP11
E	HP10
F	HP10
G	HP9
H	HP9
J	HP5
K	HP5
L	HP6
M	HP6
N	HP7
P	HP7
R	HP8
S	HP8
T	MP17
U	CMD_IN8
V	CMD_IN10
W	ANA_IN
X	MP22
Y	MP21
Z	HP4
a	HP4
b	CMD_IN9
c	MP20
d	MP19
e	MP18
f	HP12
g	HP12
h	HP12
j	HP12

2.4 Power Supply

The RTCM is designed to work with an external primary relay to easily turn ON/OFF the system using two buttons: MASTER_ON and MASTER_OFF.

Here is the recommended power supply-wiring diagram:



2.5 Inputs

The RTCM can handle many types of input sources:

- 10 wired digital inputs (internally pulled up, direct connect switch to GND can be used)
- CAN commands (1 CAN Buses)

Command	Connector	Pin	Notes
MASTER_ON	C2	d	Switch to ground to Master_ON
MASTER_OFF	C2	a	Switch to ground to Master_OFF
CMD_IN1	C2	Z	0 to 5V, internally pulled up
CMD_IN2	C2	e	0 to 5V, internally pulled up
CMD_IN3	C2	X	0 to 5V, internally pulled up
CMD_IN4	C2	S	0 to 5V, internally pulled up
CMD_IN5	C2	Y	0 to 5V, internally pulled up
CMD_IN6	C2	j	0 to 5V, internally pulled up
CMD_IN7	C2	U	0 to 5V, internally pulled up
CMD_IN8	C3	U	0 to 5V, internally pulled up
CMD_IN9	C3	b	0 to 5V, internally pulled up
CMD_IN10	C3	V	0 to 5V, internally pulled up
CAN1_HIGH	C2	c	
CAN1_LOW	C2	b	

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2.6 CAN Specification

The two CAN buses are CAN 2.0B compatible and the speed can be set using the configuration tool RTCM_Conf.

The available speeds are:

- 1Mbit/s
- 500kbit/s
- 250kbit/s
- 125kbit/s

CAN 1 does not have an internal termination resistor

2.7 Outputs

The RTCM has **33** fully configurable outputs which are grouped into two categories:

- 22 Medium Power outputs (MP1 to MP22): 25 Amps Max (100A peak allowed for 10µs).
- 12 High Power outputs (HP1 to HP12): 50 Amps Max (100A peak allowed for 10µs).

Here are main features of these outputs (configurable with RTCM_Conf)

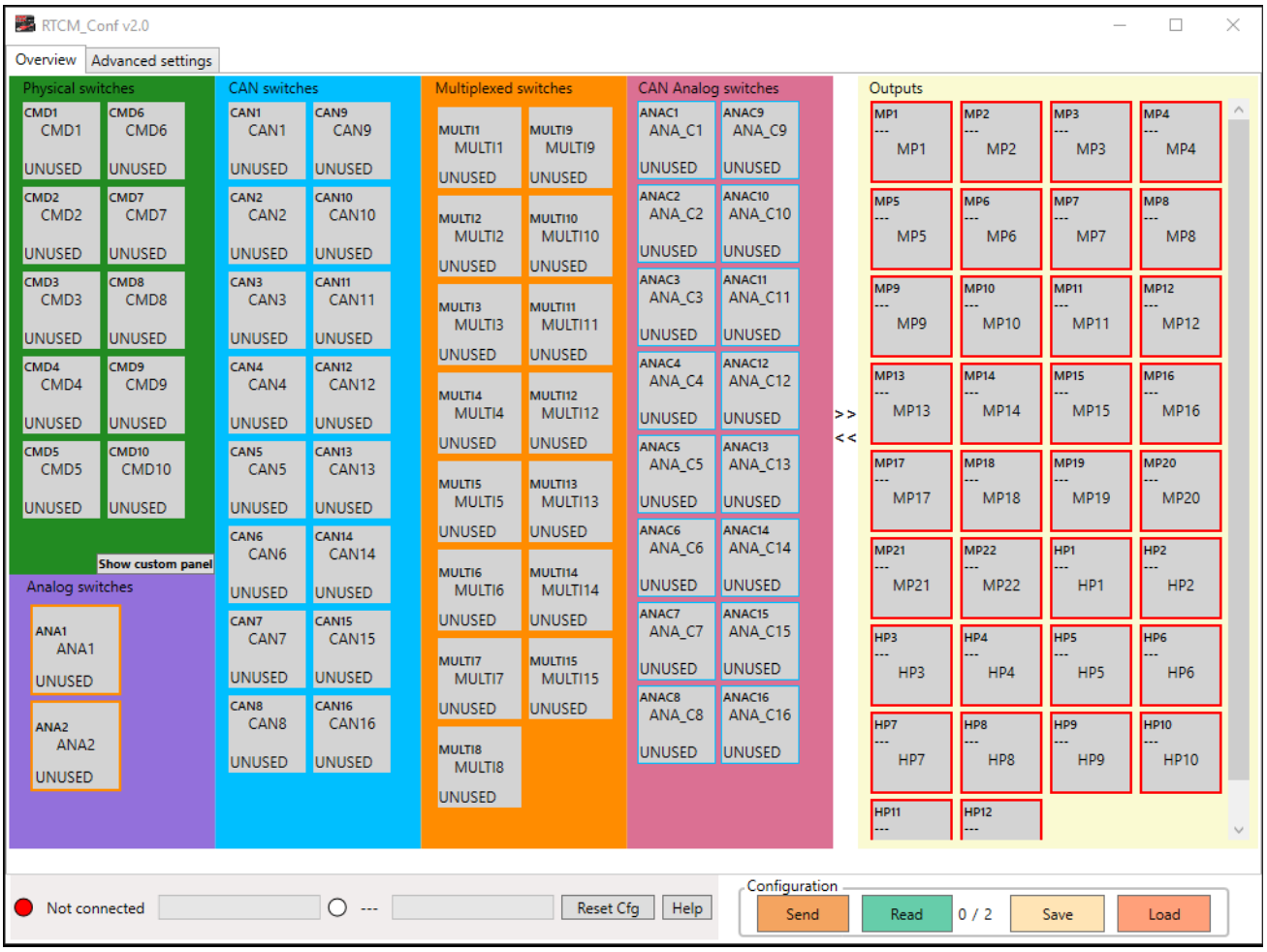
- Can be controlled by any inputs (Digital, Analog, CAN)
- Configurable Over Current Detection threshold
    - 7.5A to 25A with a step of 2.5A for MPx
    - 15A to 50A with a step of 5A for HPx
- Configurable Over Current Detection blanking time (150us, 1.2ms, 10ms, 155ms)
- Configurable Action after Fault detection (Rearm or set OFF)
- Configurable Action after CAN message timeout: 1 second (Rearm or set OFF)
- Current consumption monitoring
- High speed switching

Output	Conn.	Pin	Notes
MP1	C2	T	
MP2	C2	K	
MP3	C2	J	
MP4	C2	H	
MP5	C2	G	
MP6	C2	F	
MP7	C2	E	
MP8	C2	D	
MP9	C2	C	
MP10	C2	B	
MP11	C2	A	
MP12	C2	N	
MP13	C2	M	
MP14	C2	L	
MP15	C2	f	
MP16	C3	B	
MP17	C3	T	
MP18	C3	e	
MP19	C3	d	
MP20	C3	c	7 Amps Max
MP21	C3	Y	
MP22	C3	X	
HP1	C2	h,g	
HP2	C2	W,V	
HP3	C2	R,P	used for wiper => GND Connect possible
HP4	C3	a,Z	
HP5	C3	K,J	
HP6	C3	M,L	
HP7	C3	P,N	
HP8	C3	S,R	
HP9	C3	H,G	
HP10	C3	F,E	
HP11	C3	D,C	
HP12	C3	f,j,h,g	
AGND	C3	A	Analog GND

Note: For wiper applications, it will be needed to connect wiper park on one of RTCM input to make it stop on the zero position.

3 RTCM_CONF: CONFIGURATION TOOL

The RTCM_Conf software can be downloaded at www.xap.fr

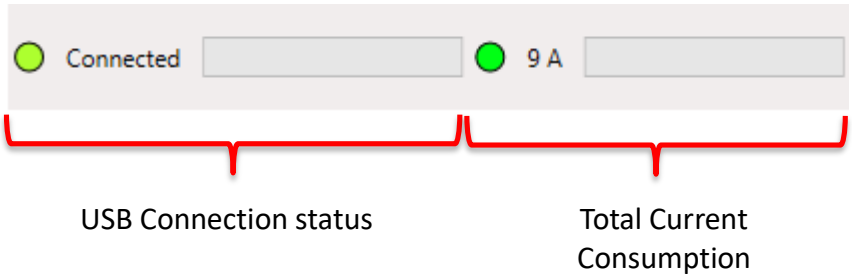


This tool allows user to configure and monitor the RTCM power module.

The communication between RTCM_Conf and a RTCM is established using an AB Type USB cable.

3.1 Status info

A fast monitoring status bar shows USB connexion status and RTCM total current consumption.



3.2 Configuration Actions

Reset Cfg: Reset configuration stored into the RTCM

Help: General Help

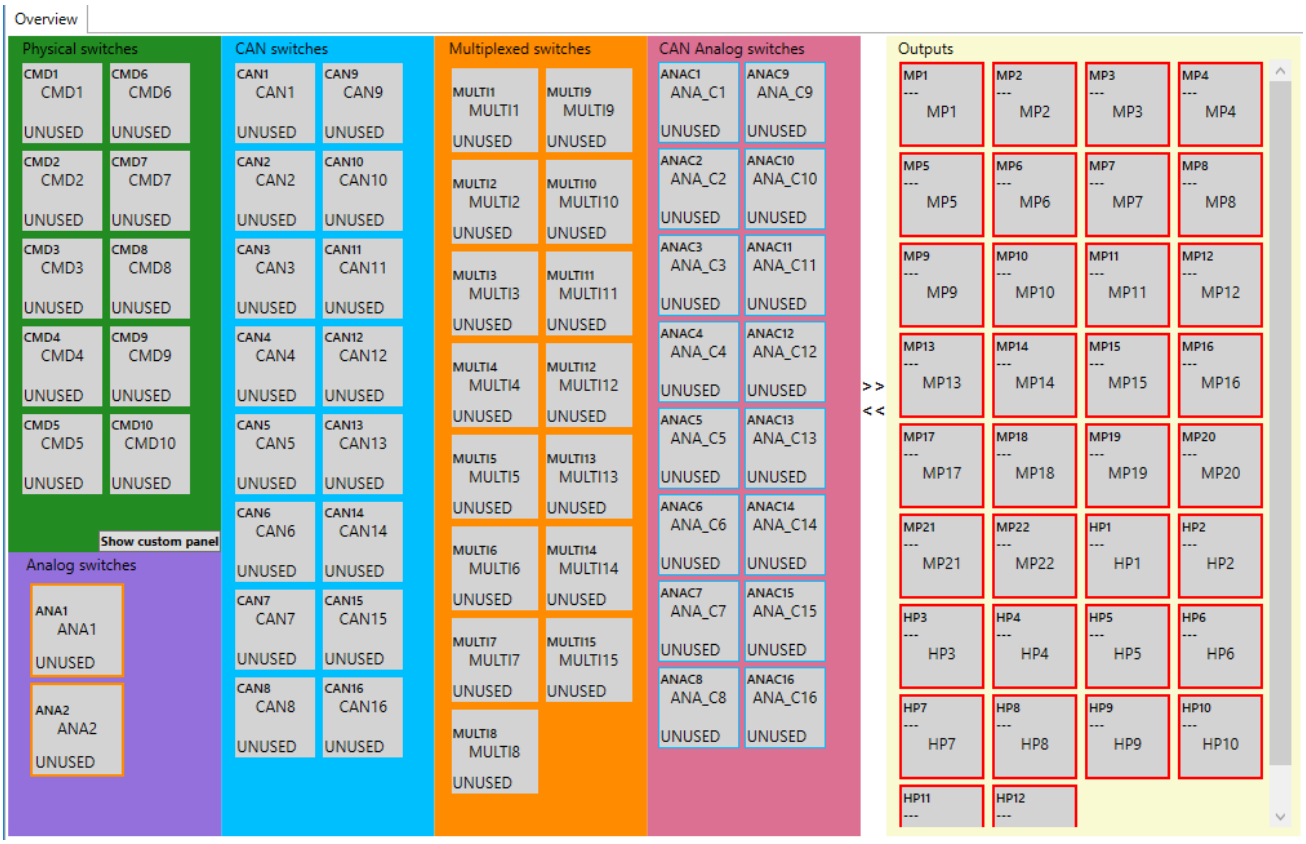
Send: Send the current configuration into the RTCM. It restarts automatically to apply the new configuration

Read: Read the configuration stored into the RTCM and load it onto RTCM_Conf

Save: Save the current configuration into a user defined file.

Load: Load a configuration file onto RTCM_Conf

3.3 Overview



This is the application main windows, which is divided in two areas. The first one for the six types of switches (on the left of the screen) and the second one for the outputs (on the right of the screen). The user can set INPUTS/OUTPUTS name by clicking on them.

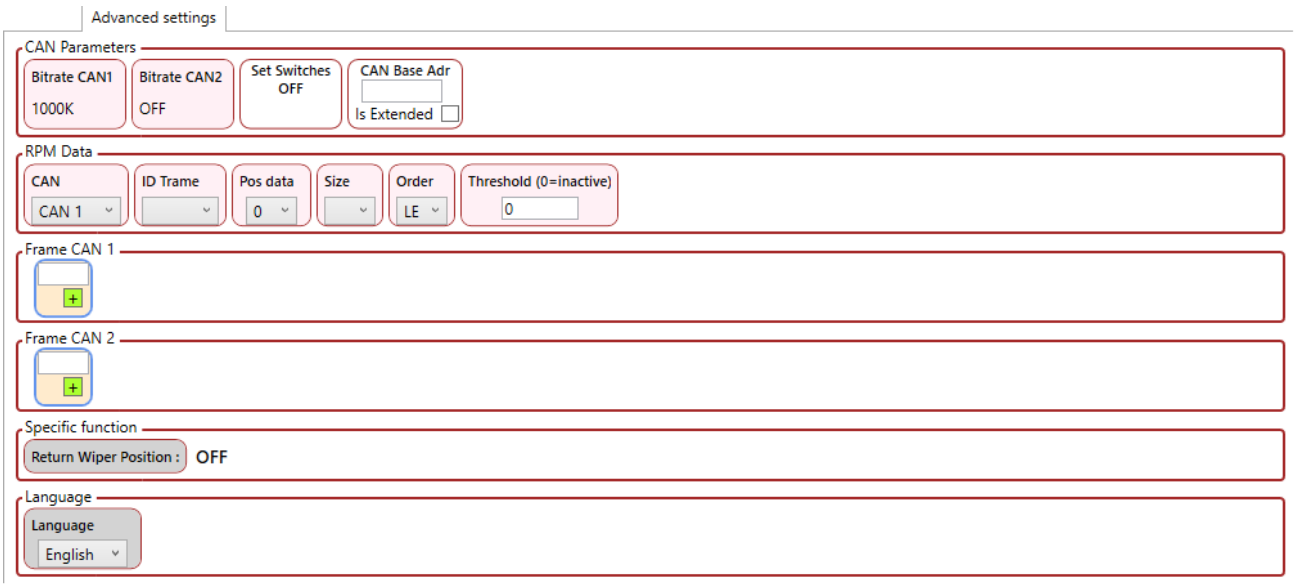
The six inputs categories are:

- 10 Physical switches (some are unused according to the hardware configuration),
- 10 Custom Physical switches (available by clicking on show custom panel),
- 16 CAN binary switches,
- 15 Multiplexed switches (for 5x3 external Multiplexed Keypad PF0329-A),
- 16 CAN Analog switches,
- 2 Analog switches.

Outputs categories are:

- 22 Medium Power outputs (25 Amps Max),
- 12 High Power outputs (50 Amps Max).

3.4 Advanced settings



This windows allows you to configure the CAN bus and other specific parameters of the power box

3.4.1 CAN Parameters:

- **Bitrate CAN1:** Set the CAN1 bus speed (1Mbit/s, 500kbit/s, 250kbit/s, 125kbit/s)
- **Bitrate CAN2:** Set the CAN2 bus speed (1Mbit/s, 500kbit/s, 250kbit/s, 125kbit/s)
- **Set Switches:** Specify on which CAN Bus the 5x3 external Multiplexed Keypad PF0329-A is connected. Set it to OFF if you don't use it.
- **CAN Base Adr, Is extended:** The RTCM sends many CAN messages on CAN1 bus (refer to RTCM CAN protocol description). Those parameters specify the CAN base address of all these outputs CAN messages. By default base address is 0x400.

3.4.2 RPM Data

DO NOT USE

3.4.3 Frame CANx:

The RX CAN id used on each CAN buses will be listed here.

3.4.4 Specific function

- **Return Wiper Position:** If you are using the RTCM to control wipers, this specifies on which Physical switch the Return Wiper Position signal is connected. It allows RTCM to know when to stop wiper motor.

3.4.5 Language

Specify the interface language

3.5 Intputs/outputs configuration

RTCM_Conf allows you to link Inputs and outputs using a wide range of mode and conditions.

Outputs are linked to inputs by a state object we called **TRIGGER**. A trigger can have two states only:

- Trigger ON
- Trigger OFF

Each inputs can manage 3 triggers at most. Those triggers will evolve according to Input configuration. They are then used to specify Outputs behaviour.

INPUTS

The use of triggers to link inputs and outputs allows user to specify advanced output commands.

For example, using triggers, user can set an output ON only if a button is pressed for 2 seconds, or blink the output when the activation input is detected.

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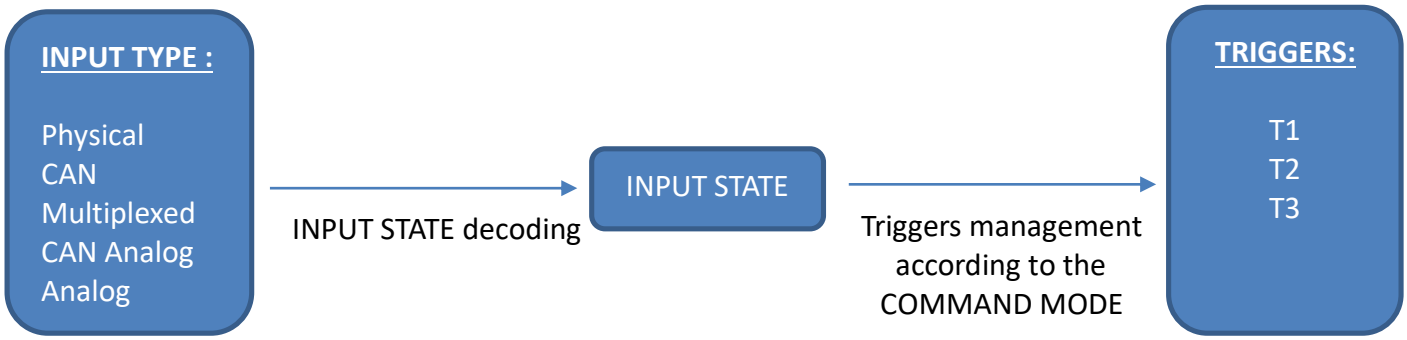
3.5.1 INPUTS Configuration:

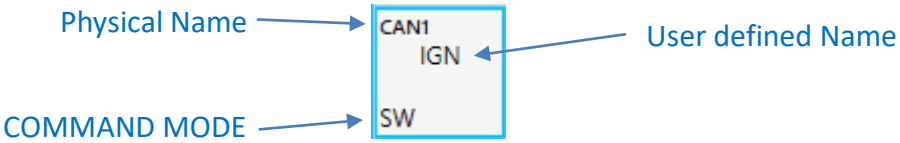
To begin, let's see how an Input operates and how to configure it.

To manage its triggers, an input needs a primary state. Let's call it the **INPUT STATE**. The **INPUT STATE** is a 0/1 value which is decoded differently depending on the **INPUT TYPE**. We will see first how the **INPUT STATE** is decoded, then how it manages triggers



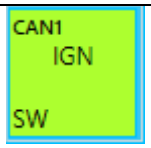
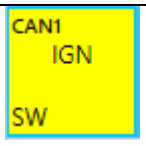
To setup an input, you have to double-click on it, a configuration panel will appear.

3.5.1.1 Overview Informations:



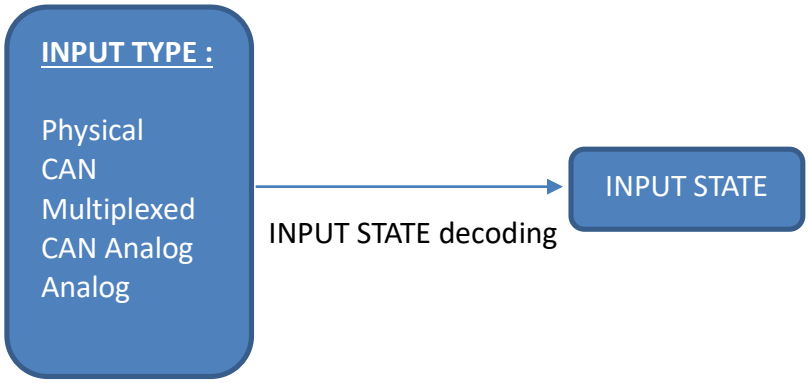
Place the cursor on the Physical Name to display the list of the outputs controlled by this input.

Input information:

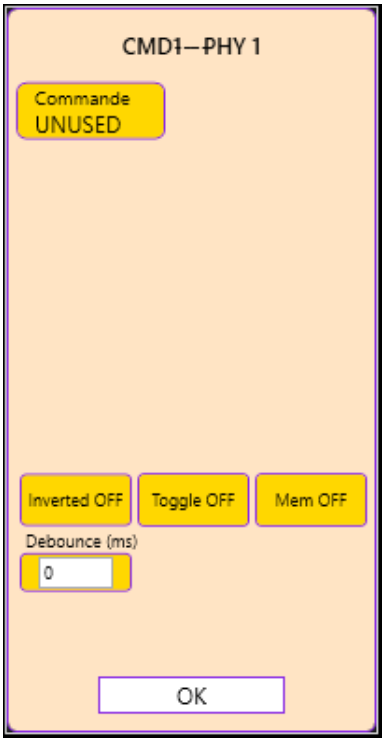
Background Color	Description
	INCATIVE
	ACTIVE
	CAN message not received

3.5.1.2 Input State Decoding

In this part, we will see how the INPUT STATE is decoded according to the input type. This part also describes the additional information for each input type.



3.5.1.2.1 Physical switch:



For physical switches, there is no specific parameter used to decode the INPUT STATE. It takes directly the physical state.

INPUT SIGNAL	INPUT STATE
Button pressed, input connected to GND	1
Button released, input internally pulled to 5V	0

For other displayed parameters, please refer to the Command Modes and Triggers management chapter.

3.5.1.2.2 Custom Physical switch:

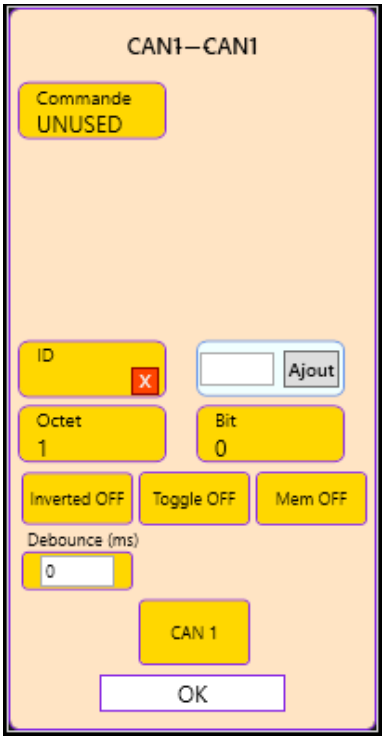
Click on Show custom panel to show Custom Physical Swithes
Those are an extension of physical switches. The desired physical input can be specified.

CMD 1	Click to set the physical input to be connected

INPUT SIGNAL	INPUT STATE
Button pressed, input connected to GND	1
Button released, input internally pulled to 5V	0

For other displayed parameters, please refer to the Command Modes and Triggers management chapter.

3.5.1.2.3 CAN switch



CAN switch allows you to take INPUT STATE from a specific bit of a CAN message.

Here are some parameters you need to set:

CAN 1	Select the CAN bus you want to use
Ajout	Add the desired CAN id to the list (enter HEX value)
ID 100h	Click to select the desired ID
Octet 1	Click to select the byte to be used (0 to 7)
Bit 0	Click to select the bit position (0 to 7)

The INPUT STATE will take the bit value.

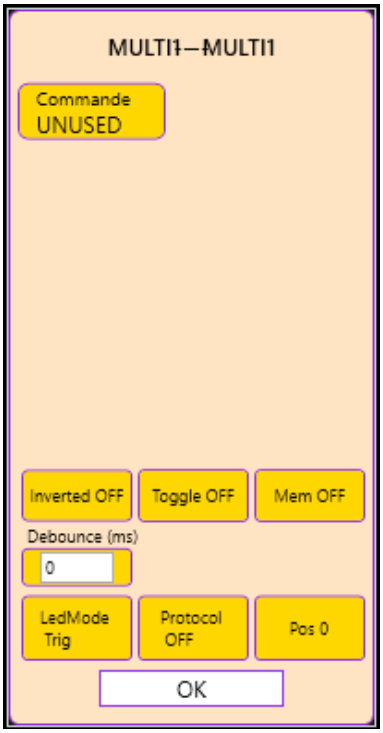
For other displayed parameters please refer to the Command Modes and Triggers management chapter.

3.5.1.2.4 Multiplexed switch

This type is specific to the external 5x3 external Multiplexed Keypad PF0329-A.

This keypad communicates witch the RTCM through CAN (1Mbit/s, CAN1 or CAN2)

Each button of this keypad integrates 3 LEDs which can be controlled by the RTCM (ex: to monitor output state).



For Multiplexed switches, there is no specific parameter used to decode the INPUT STATE. It takes directly the button's state.

BUTTON STATE	INPUT STATE
button pressed	1
Button released	0

However, multiplexed switches have additional parameters, which are not used to decode the INPUT STATE:

LedMode Trig	Specify how the 3 LEDs should behave: - **Trig :** The 3 LEDs will respectively show the 3 triggers state - **Output** : The 3 LEDs will show the state of the output controlled by the respective trigger - **Seq:** Only one led is turn ON according to the triggers manager state (refer to the Command Modes and Triggers management chapter)
Protocol OFF Pos 0	Used to send the button state on the CAN bus, using a specific protocol. Leave it OFF

For other displayed parameters please refer to the Command Modes and Triggers management chapter.

3.5.1.2.5 Analog switches

Analog switches are used to decode the INPUT STATE from a physical analog input. An input voltage (0V to 5V) is read and then converted into 0/1 according to the specified Threshold and Hysteresis

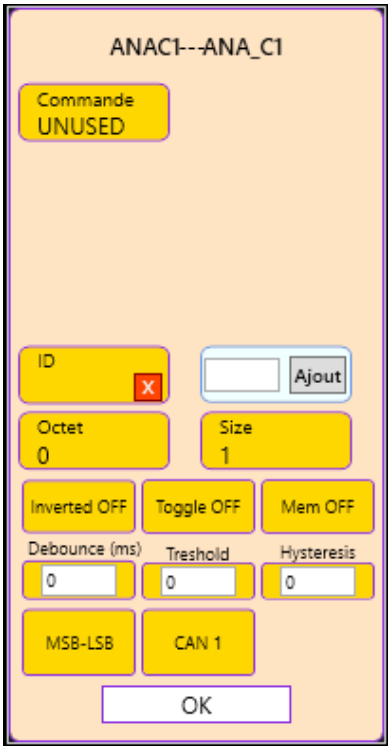
Treshold 0	Specify Threshold value in mV
Hysteresis 0	Specify Hysteresis value in mV

Here is how the INPUT STATE is decoded

Input voltage	**INPUT STATE**
Is greater than Threshold	1
Is less than Hysteresis	0
Otherwise	keep the previous state

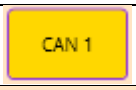
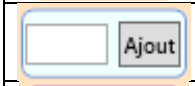
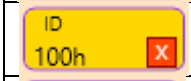
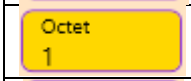
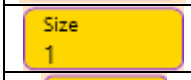
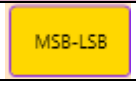
For other displayed parameters please refer to the Command Modes and Triggers management chapter.

3.5.1.2.1 CAN Analog switches

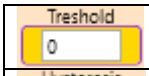
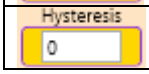


CAN Analog switches operate as Analog Switches, but instead of reading the input value from a physical analog input, the value is read from a CAN message.

Here are the parameters you need to set to extract the input value from the CAN message:

	Select the CAN bus you want to use
	Add the desired CAN id to the list (enter HEX value)
	Click to select the desired ID
	Click to select the data position(0 to 7)
	Click to select the data size (1byte or 2bytes)
	Click to select the order of 2bytes size data

The input data is converted into 0/1 according to the specified Threshold and Hysteresis

	Specify Threshold value (integer)
	Specify Hysteresis value (integer)

Here is how the INPUT STATE Is decoded

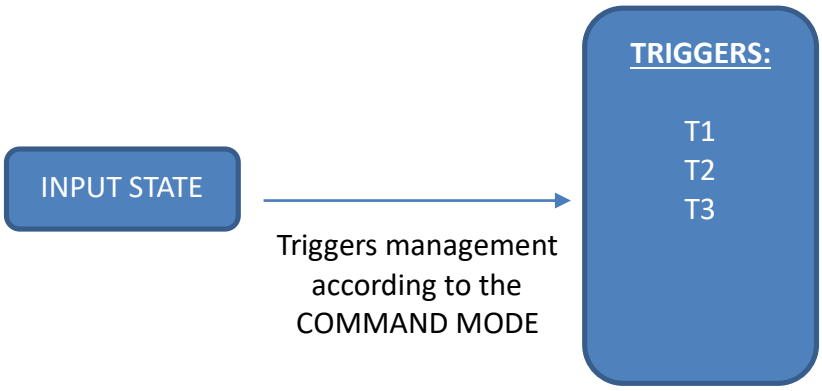
Input value	**INPUT STATE**
Is greater than Threshold	1
Is less than Hysteresis	0
Otherwise	keep the previous state

For other displayed parameters please refer to the Command Modes and Triggers management chapter.

3.5.1.3 Command modes and Triggers management

Once the INPUT STATE is decoded, it will be used to manage triggers, according to the selected Command Mode and few common parameters.

This part describes the operation of the different command mode.



The command mode can be selected by clicking on 

.

Here are the available choices:

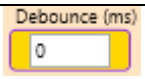
Command Mode	Information
UNUSED	The input is not used
SW	Single trigger command, generally used to control basic ON/OFF outputs
CLIGNO	Single trigger command, generally used to control blinkers
FLASH	Single trigger command, generally used to flash lights
WIPER	Multiple trigger command, used to control wiper
WIPER_INT	Multiple trigger command, used to control wiper with intermittent mode
WASHER	Multiple trigger command, used to control wiper and washer
SEQ	Multiple trigger command, used to control multiple outputs in sequential mode
INC	Multiple trigger command, used to control multiple outputs in incremental mode
CPT	Multiple trigger command, used to control multiple outputs in counter mode

All command modes are detailed below:

3.5.1.3.1 Common parameters

There are common parameters between different modes. These parameters are used to specify whether an additional operation must be performed on the INPUT STATE before it is used to manage triggers.

Here are the common parameters:

	Specify if the INPUT STATE should be inverted before it is used to manage triggers
	This parameter is only used for those modes: SW, CLIGNO. Toggle mode is already active on other command modes. Refer to the Command mode details.
	Set it to ON to save the triggers state when the RTCM turns OFF. The triggers will get saved state when the RTCM will have restarted. Otherwise triggers will be reset at every boot. This parameter is ignored for modes: WIPER, WIPER_INT, WASHER.
	Debounce time: The INPUT STATE must keep the same value during this time to be taken into account by the trigger management

3.5.1.3.2 Triggers Management

Once common parameters are applied to the INPUT STATE, it is used to manage triggers according to the selected Command Mode.

This part describes the triggers behaviour for each command mode.

Each input trigger can be monitored from the configuration panel.

	ACTIVE
	INACTIVE

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3.5.1.3.2.1 SW command mode :

This mode is used to control basic ON/OFF outputs.

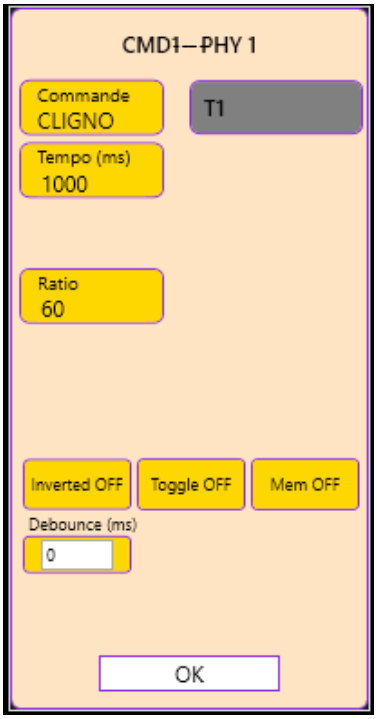
Triggers Description:

T1	Standard ON/OFF trigger

Triggers behaviour:

- If **Toggle** is set to OFF, T1 will directly take the state of the INPUT STATE
- If **Toggle** is set to ON, T1 will toggle its state each time the INPUT STATE describes a rising edge (goes from 0 to 1)

3.5.1.3.2.2 CLIGNO command mode :



This mode is generally used to control blinkers

Triggers Description:

T1	Blinking trigger

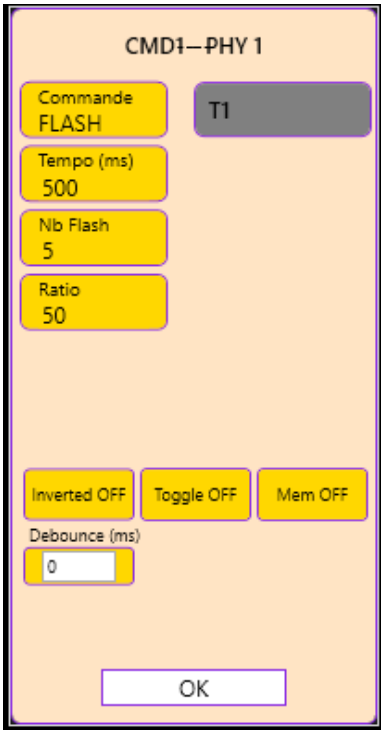
Triggers behaviour:

- If **Toggle** is set to OFF, T1 will blink when INPUT STATE is equal to 1, otherwise T1 remains inactive.
- If **Toggle** is set to ON, T1 will start/stop blinking each time the INPUT STATE describes a rising edge (goes from 0 to 1)

Blinking Parameters:

Tempo (ms) 1000	Specify the blinking period (ms)
Ratio 60	Specify the percentage of ON time (0 to 100). In this example, T1 will periodically be active during 600ms and inactive during 400ms.

3.5.1.3.2.3 FLASH command mode :



This mode is generally used to flash high beams.

Triggers Description:

T1	Flashing trigger

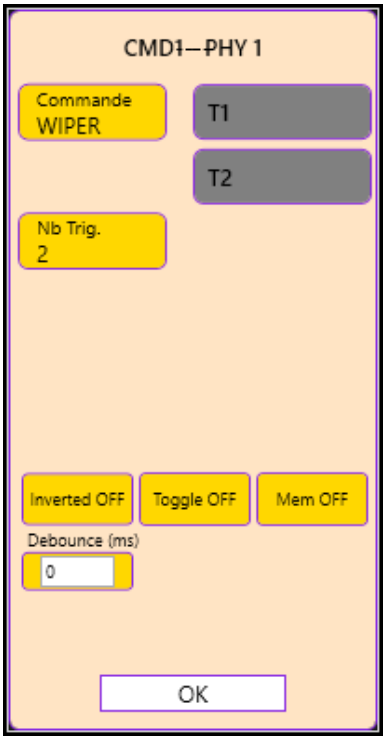
Triggers behaviour:

- T1 will start/stop flashing each time the INPUT STATE describes a rising edge (goes from 0 to 1). T1 automatically stops flashing after the specified number of flash

Blinking Parameters:

Tempo (ms) 1000	Specify the blinking period (ms)
Ratio 60	Specify the percentage of ON time (0 to 100). In this example, T1 will be active during 250ms and inactive during 250ms for each flash
Nb Flash 5	Specify the desired number of flash

3.5.1.3.2.4 WIPER command mode :



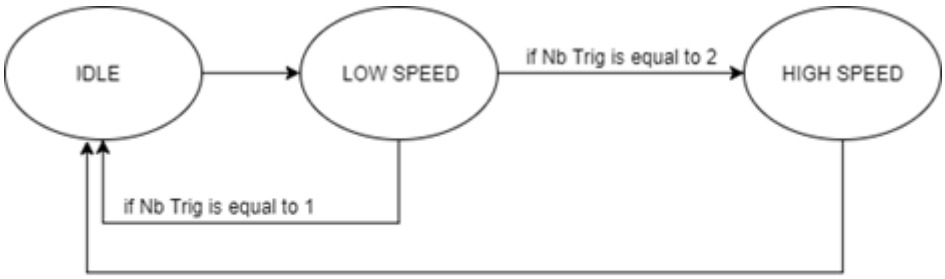
This mode is used to control wiper. If Return Wiper Position is specified in Advanced settings, all outputs controlled by this mode remain active until the wiper return (position zero) is detected.
Moreover, if HP3 is used as wiper output (as recommended), HP3 is automatically connected to GND when wipers need to be stopped.

Triggers Description:

T1	Triger for wiper low speed output
T2	Triger for wiper high speed output

Triggers behaviour:

The input describes the cycle state machine below. It goes to the next state each time the INPUT STATE describes a rising edge (goes from 0 to 1)



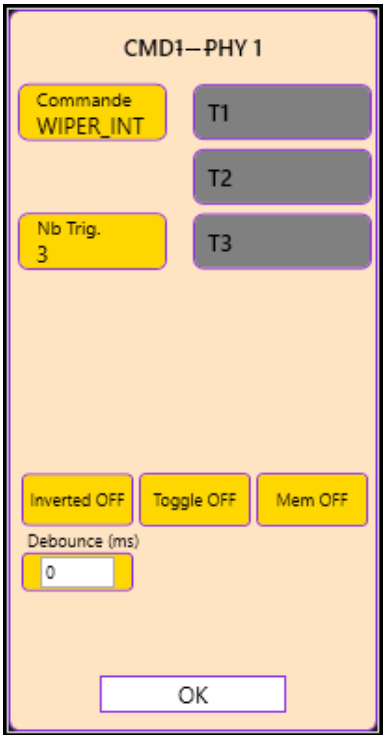
Parameters:

Nb Trig. 2	Specify the number of trigger

Trigger affectation:

STATE	T1	T2
IDLE	0	0
LOW SPEED	1	0
HIGH SPEED	0	1

3.5.1.3.2.5 WIPER_INT command mode :



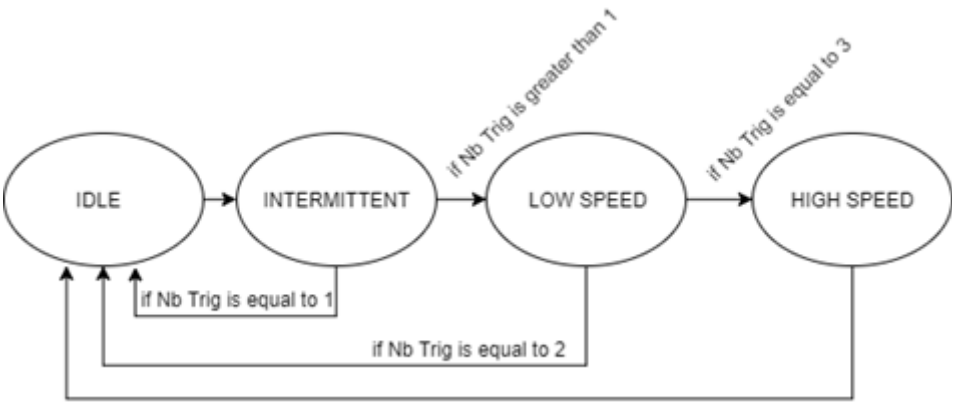
This mode is an extension of WIPER mode, it includes an intermittent mode: the wiper makes one round trip every 4 seconds.

Triggers Description:

T1	Intermittent wiper trigger
T2	Continuous low speed wiper trigger
T3	Continuous high speed wiper trigger

Triggers behaviour:

The input describes the cycle state machine below. It goes to the next state each time the INPUT STATE describes a rising edge (goes from 0 to 1)



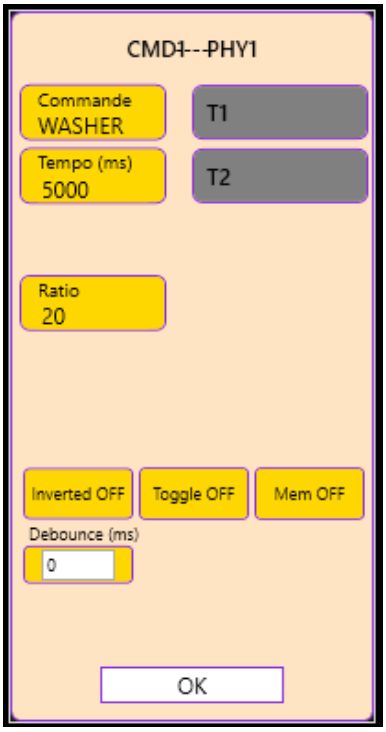
Parameters:

Nb Trig. 2	Specify the number of trigger (ie: number of state)

Trigger affectation:

STATE	T1	T2	T3
IDLE	0	0	0
INTERMITTENT	One round trip every 4 second	0	0
LOW SPEED	0	1	0
HIGH SPEED	0	0	1

3.5.1.3.2.6 WASHER command mode :



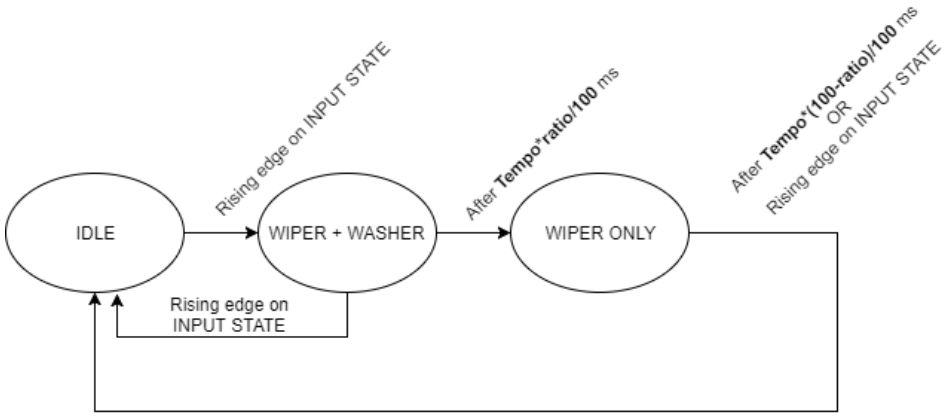
This mode is used to control wiper and washer at the same time.

Triggers Description:

T1	Wiper trigger
T2	Washer trigger

Triggers behaviour:

The input describes the cycle state machine below.



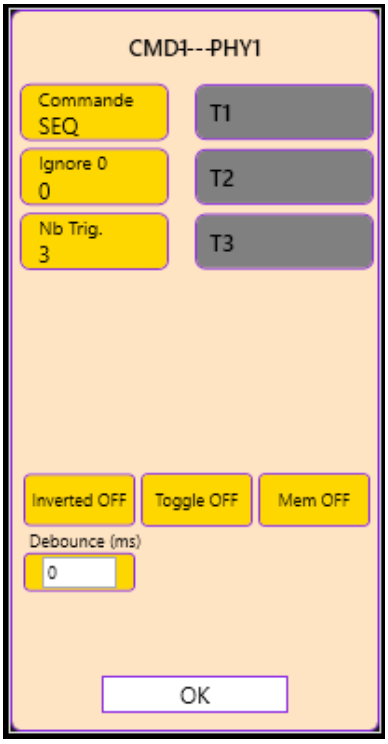
Parameters:

Tempo (ms) 1000	Specify how long the wiper trigger will stay ON
Ratio 60	Specify the percentage of WASHER ON time (0 to 100). In this example, T2 will be active during the first second.

Trigger affectation:

STATE	T1	T2
IDLE	0	0
WIPER + WASHER	1	1
WIPER ONLY	1	0

3.5.1.3.2.7 SEQ command mode :



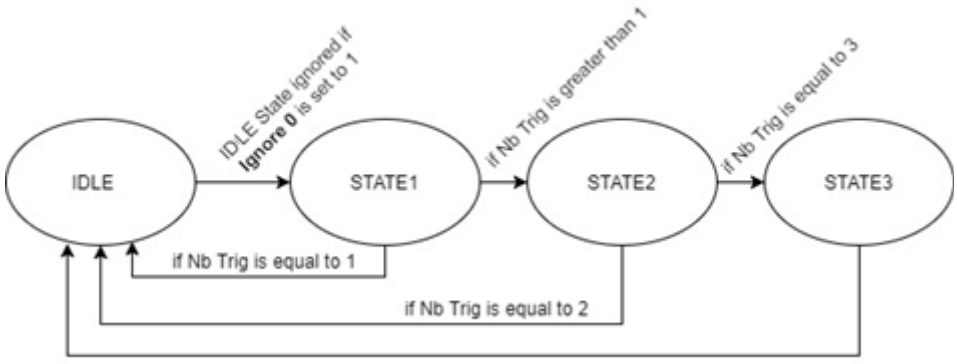
This mode is used to generate at most three triggers in sequential mode: only one at a time is active.

Triggers Description:

T1	Standard ON/OFF trigger
T2	Standard ON/OFF trigger
T3	Standard ON/OFF trigger

Triggers behaviour:

The input describes the cycle state machine below. It goes to the next state each time the INPUT STATE describes a rising edge (goes from 0 to 1)



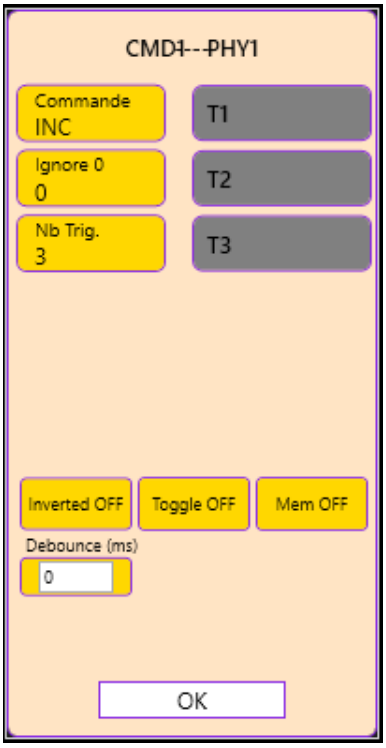
Parameters:

Ignore 0 0	If set to 1, the IDDLE state is ignored, the input directly goes to STATE1
Nb Trig. 2	Specify the number of trigger (ie: number of state)

Trigger affectation:

STATE	T1	T2	T3
IDLE	0	0	0
STATE1	1	0	0
STATE2	0	1	0
STATE3	0	0	1

3.5.1.3.2.8 INC command mode :



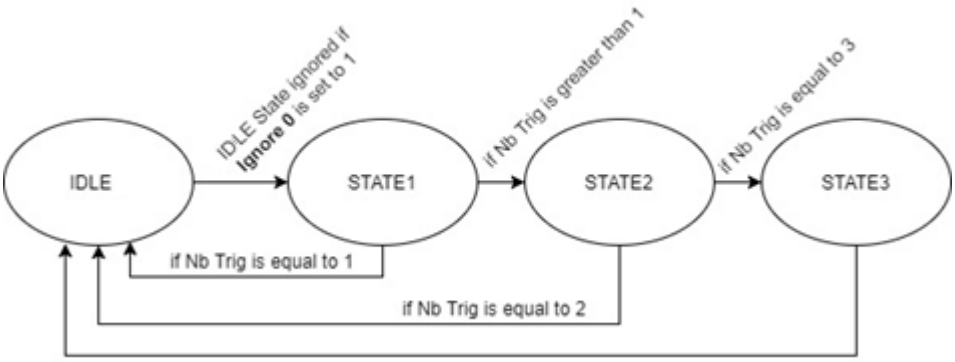
This mode is used to generate at most three triggers in incremental mode.

Triggers Description:

T1	Standard ON/OFF trigger
T2	Standard ON/OFF trigger
T3	Standard ON/OFF trigger

Triggers behaviour:

The input describes the cycle state machine below. It goes to the next state each time the INPUT STATE describes a rising edge (goes from 0 to 1)



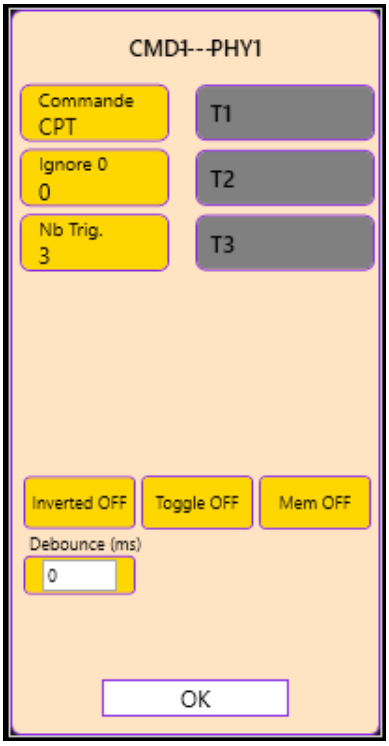
Parameters:

Ignore 0 0	If set to 1, the IDLE state is ignored, the input directly goes to STATE1
Nb Trig. 2	Specify the number of trigger (ie: number of state)

Trigger affectation:

STATE	T1	T2	T3
IDLE	0	0	0
STATE1	1	0	0
STATE2	1	1	0
STATE3	1	1	1

3.5.1.3.2.9 CPT command mode :



This mode is used to generate at most three triggers in counter mode.

Triggers Description:

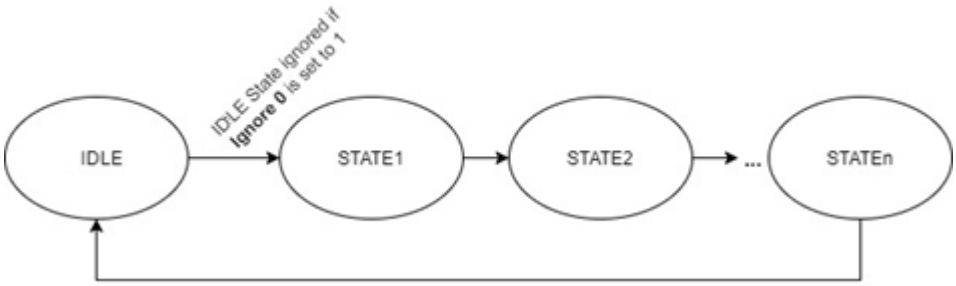
T1	Standard ON/OFF trigger
T2	Standard ON/OFF trigger
T3	Standard ON/OFF trigger

Triggers behaviour:

CPT triggers will describe a counter value which will increment by one each time the INPUT STATE describes a rising edge (goes from 0 to 1). Once the maximum value is reached, the input cycles to the initial state.

The maximum value depends on the number on trigger:

Nb Trig	Maximum counter value
1	1
2	3
3	7



Parameters:

Ignore 0 0	If set to 1, the IDDLE state is ignored, the input directly goes to STATE1
Nb Trig. 2	Specify the number of trigger (ie: number of state)

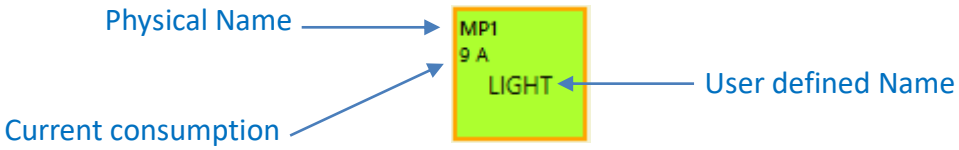
Trigger affectation:

STATE	T1	T2	T3
IDLE	0	0	0
STATE1	1	0	0
STATE2	0	1	0
STATE3	1	1	0
STATE4	0	0	1
STATE5	1	0	1
STATE6	0	1	1
STATE7	1	1	1

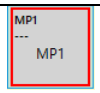
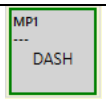
3.5.2 OUTPUTS Configuration:

In this part we will see how to configure outputs and how to link them to the inputs using triggers

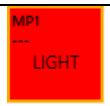
3.5.2.1 Overview Informations:



3.5.2.1.1 Output mode:

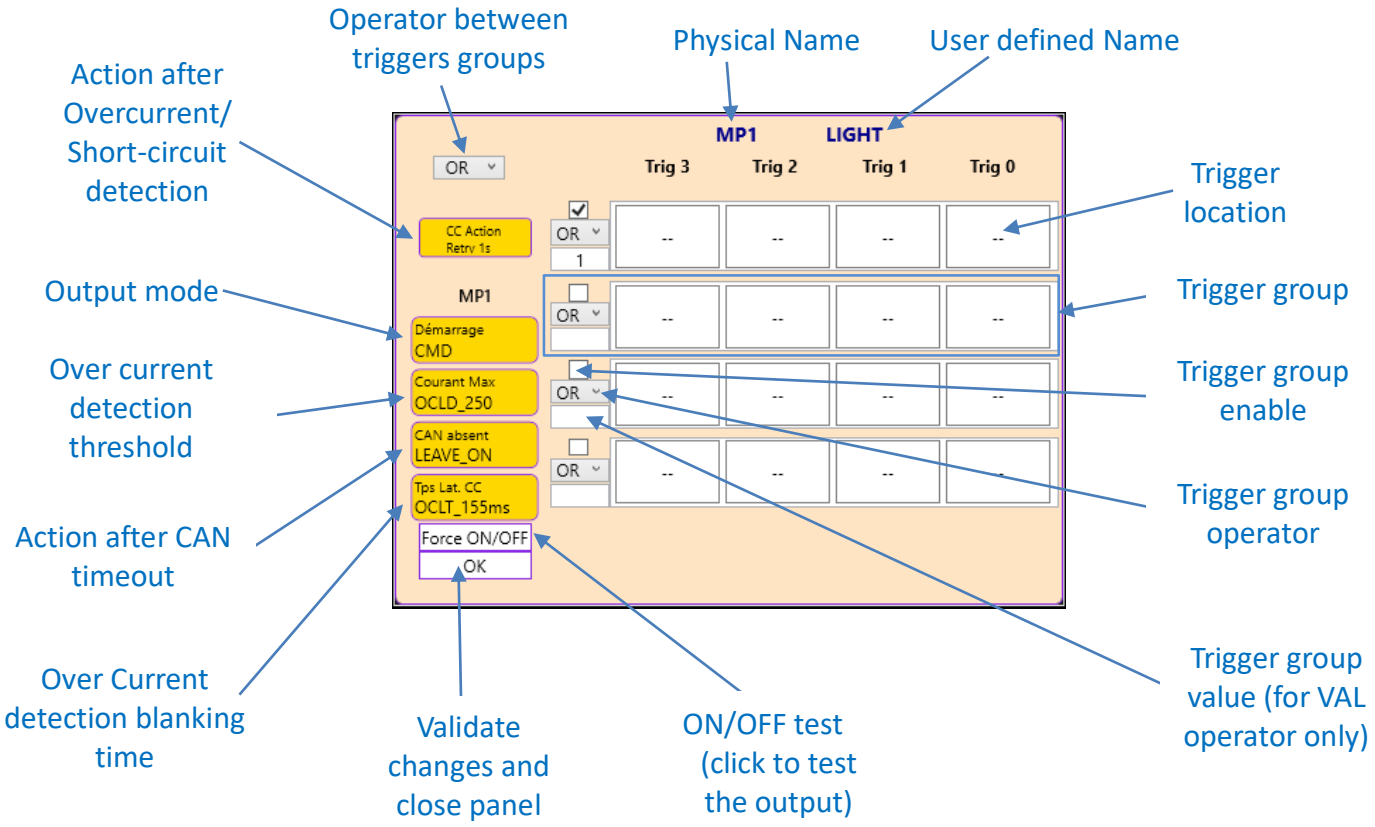
Frame Color	Description
	UNUSED
	AUTO (always ON)
	CMD (controlled by triggers)

3.5.2.1.2 Output state:

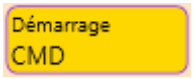
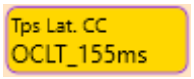
Background Color	Description
	INACTIVE
	ACTIVE
	CAN command not received
	Overcurrent / Short-circuit detected

3.5.2.2 Output configuration panel general description

To open the output configuration panel, double click on the desired output overview cell



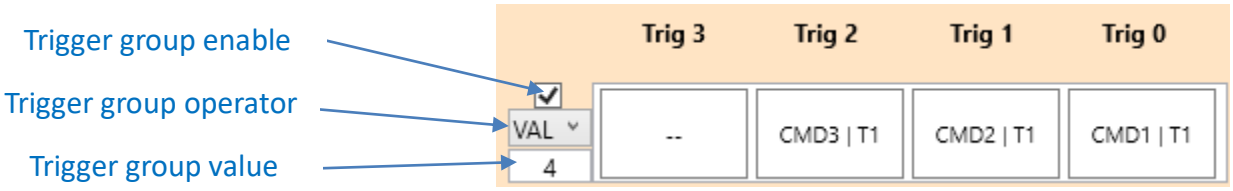
3.5.2.3 Outputs base parameters

	Click to specify the action to be done when an overcurrent/short-circuit is detected on the output : - **Retry 1s** : the output will try to rearm every second - **Retry 3 x 1s**: the output will try to rearm every second. After three failed attempts, the output will stop trying and will stay OFF until next boot. - **Set off:** the output won't rearm and will stay OFF until next boot.
	Click to select the output mode: - **INACTIVE:** the output is unused: stay OFF - **AUTO:** always ON - **CMD:** controlled by triggers
	Click to set the overcurrent detection threshold: - For MPx: 7.5A, 10A, 12.5A, 15A, 17.5A, 20A, 22.5A, 25A - For HPx: 15A, 20A, 25A, 30A, 35A, 40A, 45A, 50A
	Click to specify the action to be done when a CAN message reception timeout (1 second) occurs on one of the linked trigger - **LEAVE_ON:** the output keep its last state - **ON_10S_R:** the output will keep its last state for 10 seconds. If the expected CAN message is still not received after this 10 seconds, the output will turn OFF. The output will retrieve its normal operation when a next valid CAN message is received. - **ON_10S_NR:** the output will keep its last state for 10 seconds. If the expected CAN message is still not received after this 10 seconds, the output will stay OFF until next boot. - **SET_OFF_R:** the output is directly set OFF. It retrieves its normal operation when a valid CAN message is received. - **SET_OFF_NR:** the output will stay OFF until next boot.
	Click the specify the overcurrent blanking time detection (used to allow overcurrent peak): - 150us, 1.2ms, 10ms, 155ms

3.5.2.4 Output triggers configuration

In this part, we will see how to link the input triggers to an output. An output can be controlled by 16 triggers at most: 4 groups of four triggers. This allows user to specify a complex activation condition: when multiple triggers need to be checked.

Triggers are arranged in four groups. Each group will have a state according to its triggers and its configuration:



A trigger group will be ACTIVE/INACTIVE according to its triggers and operator:

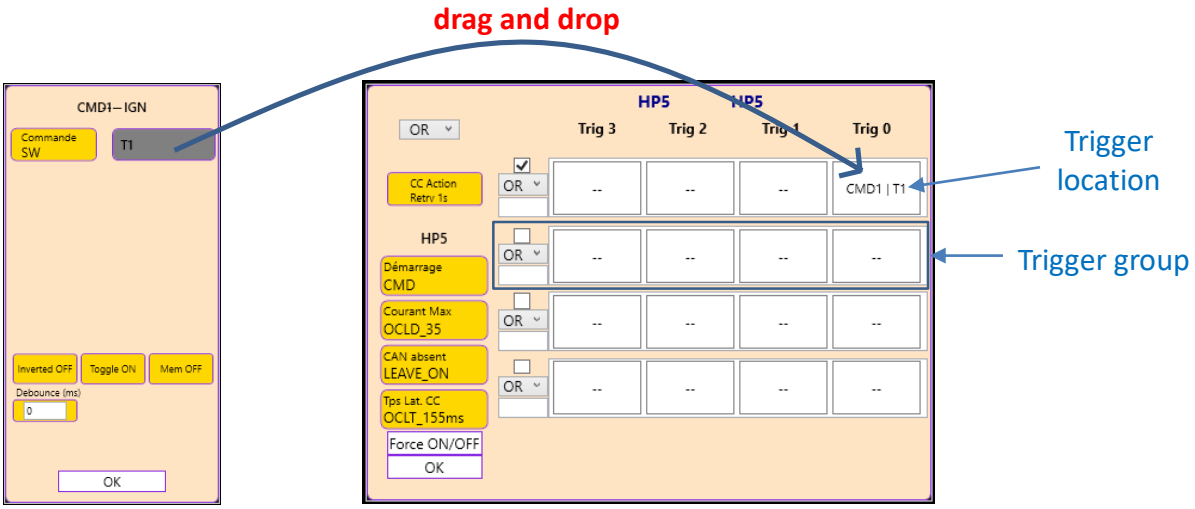
- **OR:** the group is active if at least one trigger is active. The group is inactive if not.
- **AND:** the group is active if all specified triggers are active. The group is inactive if not.
- **VAL:** the group is active if the specified triggers state match to the specified group value (specify a hexadecimal value, Trig 0, Trig 1, Trig 2, Trig 3 states respectively correspond to the bit0, bit1, bit3, bit4 of the value). The group is inactive if not.

  In the example above, the group is active only if CMD3|T1 is active and CMD2|T1 and CMD3|T1 are inactive.

Then an operation OR/AND is done between all enabled groups to determine the output state:

- **OR:** the output is set ON if at least one trigger group is enabled and active, set OFF if not.
- **AND:** the output is set ON if all enabled trigger groups are active, set OFF if not.

To place a trigger into a group, you have to drag-and-drop it from the input panel to the desired trigger location.



You can also monitor triggers and groups states from the output configuration panel

CMD1 | T1	INACTIVE trigger
CMD1 | T1	ACTIVE trigger
-- -- -- CMD1 | T1	INACTIVE group
-- -- -- CMD1 | T1	ACTIVE group

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4 CAN PROTOCOL DESCRIPTION

4.1 CAN PROTOCOL XAP -> System

4.1.1 Frame 0x420: Outputs State + 12V Power

Basic Parameters

ID Hex (Dec)	Rate	Format
0x420(1056)	100 Hz	Big Endian

Detailed Payload Description

Byte	STW Name	External Name	Calibration	Notes
0	MP1 to MP7 state	STATE_MP1_to_MP7	U8 [1/bit]	BIT0: 0 BIT1: MP1 BIT2: MP2 BIT3: MP3 BIT4: MP4 BIT5: MP5 BIT6: MP6 BIT7: MP7
1	MP8 to MP15 state	STATE _MP8_to_MP15	U8 [1/bit]	BIT0: MP8 BIT1: MP9 BIT2: MP10 BIT3: MP11 BIT4: MP12 BIT5: MP13 BIT6: MP14 BIT7: MP15
2	MP16 to HP1 state	STATE _MP16_to_HP1	U8 [1/bit]	BIT0: MP16 BIT1: MP17 BIT2: MP18 BIT3: MP19 BIT4: MP20 BIT5: MP21 BIT6: MP22 BIT7: HP1
3	HP2 to HP9 state	STATE _HP2_to_HP9	U8 [1/bit]	BIT0: HP2 BIT1: HP3 BIT2: HP4 BIT3: HP5 BIT4: HP6 BIT5: HP7 BIT6: HP8

				BIT7: HP9
4	HP10 to HP12 state	STATE _HP10_to_HP12	U8 [1/bit]	BIT0: HP10 BIT1: HP11 BIT2: HP12 BIT3: 0 BIT4: 0 BIT5: 0 BIT6: 0 BIT7: 0
5	Unused	UNUSED	U8[1/bit]	0
6	12V Power	XAP_12V_Power	U16[1mV/bit]	U16 mV
7				

4.1.2 Frame 0x421: Outputs Error State + Temperature

Basic Parameters

ID Hex (Dec)	Rate	Format
0x421(1057)	100 Hz	Big Endian

Detailed Payload Description

Byte	STW Name	External Name	Calibration	Notes
0	MP1 to MP7 error	ERROR_MP1_to_MP7	U8 [1/bit]	BIT0: 0 BIT1: MP1 BIT2: MP2 BIT3: MP3 BIT4: MP4 BIT5: MP5 BIT6: MP6 BIT7: MP7
1	MP8 to MP15 error	ERROR _MP8_to_MP15	U8 [1/bit]	BIT0: MP8 BIT1: MP9 BIT2: MP10 BIT3: MP11 BIT4: MP12 BIT5: MP13 BIT6: MP14 BIT7: MP15
2	MP16 to HP1 error	ERROR _MP16_to_HP1	U8 [1/bit]	BIT0: MP16 BIT1: MP17 BIT2: MP18 BIT3: MP19 BIT4: MP20 BIT5: MP21 BIT6: MP22 BIT7: HP1
3	HP2 to HP9 error	ERROR _HP2_to_HP9	U8 [1/bit]	BIT0: HP2 BIT1: HP3 BIT2: HP4 BIT3: HP5 BIT4: HP6 BIT5: HP7 BIT6: HP8 BIT7: HP9
4	HP10 to HP12 error	ERROR _HP10_to_HP12	U8 [1/bit]	BIT0: HP10

				BIT1: HP11 BIT2: HP12 BIT3: 0 BIT4: 0 BIT5: 0 BIT6: 0 BIT7: 0
5	Unused	UNUSED	U8[1/bit]	0
6	Running Counter	XAP_CNT	U8[1/bit]	0 to 255
7	RTCM Temperature	RTCM_TEMP	I8[1°/bit]	-128 to 127

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4.1.3 Frame 0x423: Outputs current consumption

Basic Parameters

ID Hex (Dec)	Rate	Format
0x423(1058)	1000 Hz	Big Endian

Detailed Payload Description

Byte	STW Name	External Name	Calibration	Notes
0	Frame Index	FRAME_INDEX	U8[1/bit]	0 to 11
1	Current Val 1	CURRENT_VAL1	U16[1deciA/bit]	deciA (Amps*10)
2				
3	Current Val 2	CURRENT_VAL2	U16[1deciA /bit]	deciA (Amps*10)
4				
5	Current Val 3	CURRENT_VAL3	U16[1deciA /bit]	deciA (Amps*10)
6				
7	Unused	UNUSED	U8[1/bit]	0

CURRENT_VAL1, CURRENT_VAL2 and CURRENT_VAL3 values will depend on the value of FRAME_INDEX as shown in the following table:

Frame Index	CURRENT_VAL1	CURRENT_VAL2	CURRENT_VAL3
0	MP1	MP2	MP3
1	MP4	MP5	MP6
2	MP7	MP8	MP9
3	MP10	MP11	MP12
4	MP13	MP14	MP15
5	MP16	MP17	MP18
6	MP19	MP20	MP21
7	MP22	HP1	HP2
8	HP3	HP4	HP5
9	HP6	HP7	HP8
10	HP9	HP10	HP11
11	HP12	0	0

4.1.4 Frame 0x333: Analog Inputs

Basic Parameters

ID Hex (Dec)	Rate	Format
0x333(819)	100 Hz	Big Endian

This frame is sent only when "**Analog Switches**" are used (in RTCM Conf)

Detailed Payload Description

Byte	STW Name	External Name	Calibration	Notes
0	ANA 1	ANA_1	U16[1mV/bit]	U16 mV
1				
2	ANA 2	ANA_2	U16[1mV/bit]	U16 mV
3				
4	Unused	UNUSED	U16[1/bit]	0
5				
6	Unused	UNUSED	U16[1/bit]	0
7				

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