electronics and software solutions

mTroniX

H-BRIDGE DRIVER

CAN Commands Description

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1. Introduction

2. CAN parameters

Baud rate : **500 Kb**
CAN ID Length : **Normal (11bit)**
Message length : **Always 8 bytes**

At start-up, the H-Bridge drivers automatically identify their position inside their housing rack and assign themselves corresponding RX and TX CAN ID's to which the will listen and respond. Each driver connected to the CAN network can thereby be addressed individually using its individual RX CAN ID, and will always respond with its own individual TX CAN ID.

Slot position	1	2	3	4	5	6	7	8
RX CAN ID (Master->Driver)	**0x7A0**	**0x7A1**	**0x7A2**	**0x7A3**	**0x7A4**	**0x7A5**	**0x7A6**	**0x7A7**
TX CAN ID (Driver->Master)	**0x7B0**	**0x7B1**	**0x7B2**	**0x7B3**	**0x7B4**	**0x7B5**	**0x7B6**	**0x7B7**

The CAN ID = **0x791** can be used to send a broadcast message to all drivers.

The CAN commands transmitted from the master to the drivers have always the same global format:

CAN ID	B0	B1 to B7
RX ID of the target driver	**Command ID**	**Command Parameters**

CAN Command	Command ID
DETECT DRIVERS	0
SET CONTROLS	1
START SENSOR IDENTIFICATION	2
GET SENSOR IDENTIFICATION RESULTS	4
START RESPONSE TIME TEST	3
GET RESPONSE TIME RESULTS	15
GET CALIBRATIONS	5
START HYSTERESIS TEST	16
SET CALIBRATIONS	6
APPLY CALIBRATIONS	7
SET POWER	9
DATA STREAMING SETUP	10
RESET	11
SET PROFILE PARAMETERS FRAME 1	12
SET PROFILE PARAMETERS FRAME 2	13
START PROFILE	14
GET DATA	17
SET CAN TX MODE	26

Command parameter formats depend on the command ID and will be described further in this document.

CAN messages transmitted as command answer or spontaneously by the drivers to the master have always the same global format:

CAN ID	B0	B1 to B7
TX of the target driver	**Command Answer ID**	**Command Answer Parameters**

CAN Command Answer	ID
COMMAND ACKNOWLEDGE	0
STREAMING FAST DATA FRAME	1
STREAMING SLOW DATA FRAME	2
SENSOR IDENTIFICATION RESULTS	3
TEST COMPLETE FRAME	4
DRIVER IDENTIFICATION FRAME	5
CALIBRATIONS	6
RESPONSE TIME RESULTS FRAME	7
DATA	9
TEST_EXECUTION_DATA	11

When a command is received by a driver, it automatically answers with a command acknowledge message to indicate to the master that the command was accepted or rejected. In case the command is rejected, the message contains an error code. Subsequent command-specific messages will be sent by the driver asynchronously.

A new command can't be sent to a driver while for the previous command hasn't been acknowledged.

Error Code	Description
0	ERROR_NONE
1	ERROR_SYSTEM_FAULT
2	ERROR_COMMAND_START_FAILED
3	ERROR_INVALID_CONTROL_MODE
4	ERROR_CONTROL_PARAM_OUT_OF_RANGE
5	ERROR_SENSOR_IDENT_REQUIRED
6	ERROR_SENSOR_IDENT_ABORTED
7	ERROR_RESPONSE_TIME_ABORTED
8	ERROR_RESPONSE_TIME_LOWER_THRESH_NOT_REACHED
9	ERROR_RESPONSE_TIME_UPPER_THRESH_NOT_REACHED
10	ERROR_SENSOR_RANGE_ERROR
11	ERROR_INCOHERENT_DOWNLOAD_FRAME_ORDER
12	ERROR_INVALID_CAL_TYPE
13	ERROR_INVALID_CAL_BYTES_NUM
14	ERROR_INVALID_CAL_BYTES_RECEIVED
15	ERROR_CAL_DOWNLOAD_CHECKSUM_ERROR
16	ERROR_NO_VALID_CAL_DOWNLOADED
17	ERROR_CAL_EEPROM_ERROR

18	ERROR_INVALID_PROFILE_TYPE
19	ERROR_INCOHERENT_SET_PROFILE_PARAMS_FRAME_ORDER
20	ERROR_PROFILE_START_VALUE_OUT_OF_RANGE
21	ERROR_PROFILE_SINE_RANGE_OUT_OF_RANGE
22	ERROR_PROFILE_SINE_AMPLITUDE_OUT_OF_RANGE
23	ERROR_INVALID_TEST_CONTROL_COMMAND
24	ERROR_INVALID_TEST_COMMAND_TEST_NOT_RUNNING
25	ERROR_INVALID_TEST_COMMAND_TEST_RUNNING
26	ERROR_PROFILE_ABORTED
27	ERROR_PROFILE_PARAMS_NOT_SET
28	ERROR_CONTROL_LOCKED
29	ERROR_HYSTERESIS_ABORTED
30	ERROR_DATA_TX_IN_PROGRESS
31	ERROR_RESPONSE_TIME_UPWARD_START_ABOVE_LOWER_THRESH
32	ERROR_RESPONSE_TIME_UPWARD_LOWER_CALC_THRESH_NOT_REACHED
33	ERROR_RESPONSE_TIME_UPWARD_UPPER_CALC_THRESH_NOT_REACHED
34	ERROR_RESPONSE_TIME_DOWNWARD_LOWER_CALC_THRESH_NOT_REACHED
35	ERROR_RESPONSE_TIME_DOWNWARD_UPPER_CALC_THRESH_NOT_REACHED
36	ERROR_RESPONSE_TIME_DOWNWARD_START_BELOW_UPPER_THRESH
37	ERROR_INVALID_PROFILE_LINE
38	ERROR_INVALID_PROFILE_ELEMENT_TYPE
39	ERROR_PROFILE_PARAM_1_OUT_OF_RANGE
40	ERROR_PROFILE_PARAM_2_OUT_OF_RANGE
41	ERROR_PROFILE_PARAM_3_OUT_OF_RANGE
42	ERROR_PROFILE_PARAM_4_OUT_OF_RANGE
43	ERROR_PROFILE_PARAM_5_OUT_OF_RANGE
44	ERROR_PROFILE_PARAM_6_OUT_OF_RANGE
45	ERROR_PROFILE_EMPTY
46	ERROR_PROFILE_INVALID_FORWARD_LOOP
47	ERROR_PROFILE_INVALID_LOOP_NUMBER
48	ERROR_PROFILE_INVALID_LINE_NUMBER
49	ERROR_INVALID_BINARY_FILE_TYPE
50	ERROR_INVALID_CAl_FLASH_CONTROL_COMMAND
51	ERROR_INVALID_FPGA_BACKUP_SECTOR_CHECKSUM_ERROR
52	ERROR_INVALID_FPGA_FILE_SIZE
53	EGR_ERROR_SEQUENCE_DATA_BUFFER_OVERFLOW
55	EGR_ERROR_SEQUENCE_CHECKSUM_ERROR
56	EGR_ERROR_SEQUENCE_UNKNOWN_ELEMENT
57	EGR_ERROR_SEQUENCE_RUNNING
58	EGR_ERROR_SEQUENCE_EMPTY
59	EGR_ERROR_SEQUENCE_TOO_MANY_ELEMENTS
60	EGR_ERROR_PROFILE_TOO_MANY_ELEMENTS
61	EGR_ERROR_PROFILE_INVALID_INT_SENSOR_IDENT_LOOPS_INDEX
62	EGR_ERROR_SEQUENCE_NOT_RUNNING
63	EGR_ERROR_PROFILE_TOO_MANY_LOOP_ELEMENTS
64	EGR_ERROR_NO_SEQUENCE_TRIGGER_INPUT
65	EGR_ERROR_INVALID_CAN_TX_MODE

3. CAN commands description

3.1 Command: DETECT DRIVERS

FUNCTION: To identify the drivers present and ready on the CAN network

Command Frame Format (Master→Driver):

	Value	Description
ID	**0x791**	Broadcast ID
B0	**0**	Command ID
B1..B7	0	Don't care

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**0**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

Command Answer Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**5**	Frame ID
B1	**Software version**	Bit7..Bit5 : Software version major Bit4..Bit0 : Software version minor
B2	**FPGA version**	Bit7..Bit5 : FPGA code version major Bit4..Bit0 : FPGA code version minor
B3..B7	0	Don't care

3.2 Command: DATA STREAMING SETUP

FUNCTION: the drivers can automatically send some system parameters with a specific period, this command should be used to adjust the streaming parameters.

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**10**	Command identifier
B1	**Streaming status**	Streaming enabled(1) or disabled (0)
B2	**Streaming period mult.**	2ms streaming period multiplier (ex. 5 = 10ms, 200 = 400ms, ..)

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**10**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

If data streaming is enabled, one streaming framing will be sent at a fixed period of 256ms containing only slow-changing data, and another containing potentially fast-changing data at periods specified in the streaming setup frame.

Slow (fixed 256ms) Streaming Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**2**	Frame ID
B1	**System States**	Bit 0 : Power supply enabled/disabled status Bit 1..7 : Unused
B2	**System status and power supply voltage (MSB)**	Bit 7..4 : Current system execution status : 0 = STATUS_IDLE 1 = STATUS_SENSOR_IDENT 2 = STATUS_RESPONSE_TIME 3 = STATUS_APPLYING_CALS 4 = STATUS_PROFILE 5 = STATUS_HYSTERESIS 6 = STATUS_SENDING_DATA 7 = STATUS_HYSTERESIS_ACTIVE_PART Bit 3..0 : Supply voltage Upper Quartet (unsigned 12 bits, millivolts x 0.1)
B3	**Supply voltage (LSB)**	Supply voltage Least Significant Byte (unsigned 12 bits, millivolts x 0.1)

B4	**Board temperatures**	Bit 7..4 : Temp. index (looping from 0 to 4) : 0 = UHBD board overtemp 1 = HBridge plus overtemp 2 = HBridge minus overtemp 3 = UMPBX power supply overtemp 4 = UMPBX proc overtemp Bit 3..0 : Temperature Upper quartet (raw 12 bit AD counts format)
B5	**Board temperature LSB**	Temperature LSB (raw 12bit AD counts format)
B6	**System errors**	Bit 0 : Overtemp error 0 Bit 1 : Overtemp error 1 Bit 2 : Overtemp error 2 Bit 3 : Overtemp error 3 Bit 4 : Overtemp error 4 Bit 5 : Overtemp error 5 Bit 6 : Overtemp error 6 Bit 7 : unused
B7	**Profile status**	Profile execution status : 0 = PROFILE_STATUS_IDLE 1 = PROFILE_STATUS_START 2 = PROFILE_STATUS_RUNNING 3 = PROFILE_STATUS_PAUSED 4 = PROFILE_STATUS_COMPLETE 5 = PROFILE_STATUS_ABORTED

Custom-period Streaming Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**1**	Frame ID
B1	**Position ratio (LSB)**	Position ratio feedback LSB (signed, percent x 10)
B2	**Pos. ratio (MSB) and PWM DC applied (MSB)**	Bit 7..4 : Position ratio feedback upper quartet (signed 12bit, percent x 10) Bit 3..0 : PWM duty cycle upper quartet (signed 12bit, percent x 10)
B3	**PWM DC applied (LSB)**	PWM duty cycle LSB (signed 12bit, percent x 10)
B4	**Current RMS (MSB)**	RMS current feedback MSB (signed 16bit, milliamps)
B5	**Current RMS (LSB)**	RMS current feedback LSB (signed 16bit, milliamps)

B6	**Sensor voltage (MSB)**	Sensor voltage feedback MSB (unsigned 16bit , millivolts)
B6	**Sensor voltage (LSB)**	Sensor voltage feedback LSB (unsigned 16bit , millivolts)

3.3 Command: RESET

FUNCTION: Aborts any running process (test, profile,…) and turns the driver back to normal control

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**11**	Command ID
B1..B7	**0**	Don't care

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**11**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

This command has no answer.

3.4. Command : START SENSOR IDENTIFICATION

FUNCTION: This command should be sent to starts a sensor range identification test

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**2**	Command ID
B1..B4	**Loops**	Number of times the test has to be repeated (32bit)
B5	**Auto send test results**	0 = Don't send test results 1 = Automatically send test results at the end of the test
B6	**NA**	Not used
B7	**Custom Cals / Trigger Type**	Bit 0 : 0 = Use regular cals, 1 = Use custom cals Bit 7..1 : 0 = No output trigger, 1 = Output trigger generated at test start, 2 = Output trigger generated at test end

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**2**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

The following frame is sent each time the test is (re-) started in a test loop (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**11**	Frame ID
B1	**0**	Don't care
B2..B5	**Test loop counter**	Test loop counter (zero-based)
B6..B7	**0**	Don't care

Command Answer Frame Format (Driver→Master) sent when the test is complete:

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**4**	Frame ID
B1	**2**	Original command ID
B2	**Error code**	Test execution error code
B3..B7	**0**	Don't care

If the 'Auto Send Test Results' bit was set in the command arguments, the test results frame will be sent after each test (see next command for test frame format)

3.5. Command : GET SENSOR IDENTIFICATION RESULTS

FUNCTION: This command should be used to get the test results after a sensor identification test has been made.

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**4**	Command ID
B1..B7	**0**	Don't care

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**4**	Acknowledged command ID
B2	**0**	Command error code
B3..B7	**0**	Don't care

Command Answer Frame Format (Driver→Master) :

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**3**	Frame ID
B1	**Sensor Voltage Max (MSB)**	Sensor voltage recorded when max. PWM was applied MSB (16bit, millivolts)
B2	**Sensor Voltage Max (LSB)**	Sensor voltage recorded when max. PWM was applied LSB (16bit, millivolts)
B3	**Sensor Voltage Min (MSB)**	Sensor voltage recorded when min. PWM was applied MSB (16bit, millivolts)
B4	**Sensor Voltage Min (LSB)**	Sensor voltage recorded when min. PWM was applied LSB (16bit, millivolts)
B5..B7	**0**	Don't care

3.6. Command : START RESPONSE TIME TEST

FUNCTION : This command should be sent to starts a response time test.

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**3**	Command ID
B1..B4	**Loops**	Number of times the test has to be repeated (32bit)
B5	**Auto send test results**	0 = Don't send test results 1 = Automatically send test results at the end of the test
B6	**NA**	Not used
B7	**Custom Cals / Trigger Type**	Bit 0 : 0 = Use regular cals, 1 = Use custom cals Bit 7..1 : 0 = No output trigger, 1 = Output trigger generated at test start, 2 = Output trigger generated at test end

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**3**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

The following frame is sent each time the test is (re-) started in a test loop (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**11**	Frame ID
B1	**0**	Don't care
B2..B5	**Test loop counter**	Test loop counter (zero-based)
B6..B7	**0**	Don't care

Command Answer Frame Format (Driver→Master) sent when the test is complete:

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**4**	Frame ID
B1	**3**	Original command ID
B2	**Error code**	Test execution error code
B3..B7	**0**	Don't care

If the 'Auto Send Test Results' bit was set in the command arguments, the test results frame will be sent after each test (see next command for test frame format)

3.7. Command : GET RESPONSE TIME TEST RESULTS

FUNCTION : This command should be used to get the test results after a response time test has been made.

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**15**	Command ID
B1..B7	**0**	Don't care

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**15**	Acknowledged command ID
B2	**0**	Command error code
B3..B7	**0**	Don't care

Command Answer Frame Format (Driver→Master), a series of 3 frames is sent :

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**7**	Frame ID
B1	**0**	Frame counter
B2..B3	**Response Time Up**	Response time measured in the upward direction (16bit, milliseconds x 10)
B4..B7	**Speed Up**	Valve speed measured in the upward direction (32bit float)

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**7**	Frame ID
B1	**1**	Frame counter
B2..B3	**Response Time Down**	Response time measured in the downward direction (16bit, milliseconds x 10)
B4..B7	**Speed Down**	Valve speed measured in the downward direction (32bit float)

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**7**	Frame ID
B1	**2**	Frame counter
B2	**Units ID**	Units of the speed results (0 : Degrees/s, 1 : Radians/s, 2 : Millimeters/s, 3 : Inches/s)
B3..B7	**0**	Don't care

3.8. Command : START HYSTERESIS TEST

FUNCTION : This command should be sent to starts a hysteresis test. Regarding the large number of test results to be sent, no dedicated command is foreseen to send the hysteresis test results, the 'get data' command should be used instead.

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**16**	Command ID
B1..B4	**Loops**	Number of times the test has to be repeated (32bit)
B5	**Auto send test results**	0 = Don't send test results 1 = Automatically send test results at the end of the test
B6	**NA**	Not used
B7	**Custom Cals / Trigger Type**	Bit 0 : 0 = Use regular cals, 1 = Use custom cals Bit 7..1 : 0 = No output trigger, 1 = Output trigger generated at test start, 2 = Output trigger generated at test end

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**16**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

The following frame is sent each time the test is (re-) started in a test loop (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**11**	Frame ID
B1	**0**	Don't care
B2..B5	**Test loop counter**	Test loop counter (zero-based)
B6..B7	**0**	Don't care

Command Answer Frame Format (Driver→Master) sent <u>when the test is complete</u>:

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**4**	Frame ID
B1	**16**	Original command ID
B2	**Error code**	Test execution error code
B3..B7	**0**	Don't care

If the 'Auto Send Test Results' bit was set in the command arguments, the test results frame will be sent after each test (see 'get data' command description)

3.9. Command : GET DATA

FUNCTION : This command should be used to upload predefined data from the driver (ie hysteresis test results or sampling data).

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**17**	Command ID
B1	**Data ID**	Data identifier 0: Custom, 1: Hysteresis test ALL results, 2 : Hysteresis sampling data, 3 : Response time sampling data, 4: Hysteresis test PWM results, 5: Hysteresis test POS results, 6: Hysteresis test CURRENT results
B2..B3	**Custom Data Address**	Custom data start address if custom data type selected, don't care otherwise
B4..B6	**Custom Data Num.**	Custom data num. if custom data type selected, don't care otherwise
B7	**Custom Data Type**	Custom data type 0 = RAM data, 1 = SAMPLE data if custom data type selected, don't care otherwise

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**17**	Acknowledged command ID
B2	**0**	Command error code
B3..B7	**0**	Don't care

A series made of a header frame and multiple data frames (number depends on the number of data bytes to send) are sent successively (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**9**	Frame ID
B1	**0**	Frame counter
B2	**Data ID**	Data identifier
B3..B5	**Data num.**	Number of data bytes that will be sent
B6..B7	**Sampling period**	Sampling period if Sampling data, 0 if RAM Data

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**9**	Frame ID
B1	**X**	Frame counter. Counter loops back to 10 (not to 0 !) after 255
B2..B7	**Data bytes**	Data bytes (or zero to fill last frame)

Depending on the requested Data ID, the provided data can have the following format :

Data ID = 1 (Hysteresis test ALL results) : Total 87 bytes

Pos.	Element	Type	Units	Bytes
1	PWM Value Up Breakpoint 1	Signed 16bit	% x 10	2
3	PWM Value Up Breakpoint 2	Signed 16bit	% x 10	2
…	…	…	…	…
41	PWM Value Up Breakpoint 21	Signed 16bit	% x 10	2
43	PWM Value Down Breakpoint 1	Signed 16bit	% x 10	2
…	…	…	…	…
83	PWM Value Down Breakpoint 21	Signed 16bit	% x 10	2
85	Avg. Current during Hold Period	Signed 16bit	mA	2
87	Last Error	Unsigned 8bit	/	1

Note : a PWM value of 1023 means PWM_UNKNOWN

Data ID = 2 (Hysteresis sampling data) : TO DO

Data ID = 3 (Response time sampling data) : TO DO

Data ID = 4 (Hysteresis test PWM results) : Total 84 bytes

Pos.	Element	Type	Units	Bytes
1	PWM Value Up Breakpoint 1	Signed 16bit	% x 10	2
3	PWM Value Up Breakpoint 2	Signed 16bit	% x 10	2
…	…	…	…	…
41	PWM Value Up Breakpoint 21	Signed 16bit	% x 10	2
43	PWM Value Down Breakpoint 1	Signed 16bit	% x 10	2
…	…	…	…	…
83	PWM Value Down Breakpoint 21	Signed 16bit	% x 10	2

Note : a PWM value of 1023 means PWM_UNKNOWN

Data ID = 5 (Hysteresis test Position results) : Total 84 bytes

Pos.	Element	Type	Units	Bytes
1	Pos Value Up Breakpoint 1	Signed 16bit	% x 10	2
3	Pos Value Up Breakpoint 2	Signed 16bit	% x 10	2
…	…	…	…	…
41	Pos Value Up Breakpoint 21	Signed 16bit	% x 10	2
43	Pos Value Down Breakpoint 1	Signed 16bit	% x 10	2
…	…	…	…	…
83	Pos Value Down Breakpoint 21	Signed 16bit	% x 10	2

Note : a Pos value of 1023 means POS_UNKNOWN

Data ID = 6 (Hysteresis test Current results) : Total 84 bytes

Pos.	Element	Type	Units	Bytes
1	Current Value Up Breakpoint 1	Signed 16bit	mA	2
3	Current Value Up Breakpoint 2	Signed 16bit	mA	2
…	…	…	…	…
41	Current Value Up Breakpoint 21	Signed 16bit	mA	2
43	Current Value Down Breakpoint 1	Signed 16bit	mA	2
…	…	…	…	…
83	Current Value Down Breakpoint 21	Signed 16bit	mA	2

Note : a Current value of 30000 means CURRENT_UNKNOWN

3.10. Command : SET CONTROL

FUNCTION : This command should be used to set the control mode (PWM duty cycle, Current, Position Ratio) and parameter

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**1**	Command ID
B1	**Control Mode**	0 : PWM control mode, 1 : Current control mode, 2 : Position control mode
B2..B3	**Control Parameter**	If Control mode = 0, Control parameter is PWM duty cycle (signed 16 bit, % x 10, [-1000..1000]) i.e. 503 is 50.3% If Control mode = 1, Control parameter is current limit (signed 16 bit, Milliamps, [-15000..15000]) If Control mode = 2, Control parameter is position ratio (unsigned 16 bit, % x 10, [0..1000])
B4..B7	**NA**	Not used

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**1**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

This command has no answer.

3.11. Command : SET PROFILE PARAMETERS

FUNCTION : This command should be used to download a profile made of a succession of individual control commands.

In this particular case, the command message is made of two frames !

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**12**	Command ID
B1	**Profile Line**	Profile line were this command should be placed (1..50)
B2	**Command Type**	See description below
B3..B7	**Command params part 1**	First part of the command parameters (PB0..PB4)

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**13**	Command ID
B1..B7	**Command params part 2**	Second part of the command parameters (PB5..PB11)

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**13**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

This command has no answer.

Depending on the command type, the command parameters have the following format :

Command ID	Command	Parameters
0	**NONE**	PB0..PB11 : Not used
1	**PWM DIRECT**	PB0..PB1 : PWM duty cycle (signed 16bit, % x 10, [-1000..1000]) PB2..PB3 : Hold time (unsigned 16bit, milliseconds, [0..60000]) PB3..PB11 : Not used
2	**PWM SINE**	PB0..PB1 : PWM start duty cycle (signed 16bit, % x 10, [-1000..1000]) PB2..PB3 : sine start angle (unsigned 16bit, deg x 10, [0..3600]) PB4..PB5 : sine end angle (unsigned 16bit, deg x 10, [0..3600]) PB4..PB5 : sine duty cycle amplitude (unsigned 16bit, % x 10, [0..2000]) PB6..PB7 : sine period (unsigned 16bit, milliseconds, [0..60000]) PB8..PB11 : Not used

3	**PWM RAMP**	PB0..PB1 : PWM start duty cycle (signed 16bit, % x 10, [-1000..1000]) PB2..PB3 : PWM end duty cycle (signed 16bit, % x 10, [-1000..1000]) PB4..PB5 : Ramp time (unsigned 16bit, milliseconds, [0..60000]) PB6..PB11 : Not used
4	**PWM SINE RAMP**	PB0..PB1 : PWM start duty cycle (signed 16bit, % x 10, [-1000..1000]) PB2..PB3 : PWM end duty cycle (signed 16bit, % x 10, [-1000..1000]) PB4..PB5 : Ramp time (unsigned 16bit, milliseconds, [0..60000]) PB6..PB7 : sine start angle (unsigned 16bit, deg x 10, [0..3600]) PB8..PB9 : sine duty cycle amplitude (unsigned 16bit, % x 10, [0..2000]) PB10..PB11 : sine period (unsigned 16bit, milliseconds, [0..60000])
5	**POS DIRECT**	PB0..PB1 : Position ratio (unsigned 16bit, % x 10, [0..1000]) PB2..PB3 : Hold time (unsigned 16bit, milliseconds, [0..60000]) PB3..PB11 : Not used
6	**POS SINE**	PB0..PB1 : start pos. ratio (unsigned 16bit, % x 10, [0..1000]) PB2..PB3 : sine start angle (unsigned 16bit, deg x 10, [0..3600]) PB4..PB5 : sine end angle (unsigned 16bit, deg x 10, [0..3600]) PB4..PB5 : sine duty cycle amplitude (unsigned 16bit, % x 10, [0..2000]) PB6..PB7 : sine period (unsigned 16bit, milliseconds, [0..60000]) PB8..PB11 : Not used
7	**POS RAMP**	PB0..PB1 : Start pos. ratio (unsigned 16bit, % x 10, [0..1000]) PB2..PB3 : End pos. ratio (unsigned 16bit, % x 10, [0..1000]) PB4..PB5 : Ramp time (unsigned 16bit, milliseconds, [0..60000]) PB6..PB11 : Not used
8	**POS SINE RAMP**	PB0..PB1 : Start pos. ratio (unsigned 16bit, % x 10, [0..1000]) PB2..PB3 : End pos. ratio (unsigned 16bit, % x 10, [0..1000]) PB4..PB5 : Ramp time (unsigned 16bit, milliseconds, [0..60000]) PB6..PB7 : sine start angle (unsigned 16bit, deg x 10, [0..3600]) PB8..PB9 : sine duty cycle amplitude (unsigned 16bit, % x 10, [0..2000]) PB10..PB11 : sine period (unsigned 16bit, milliseconds, [0..60000])

3.12. Command : START PROFILE

FUNCTION : This command should be used to launch the execution of the downloaded profile

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**14**	Command ID
B1	**0**	Not used
B2	**Line number**	Number of profile lines to execute
B3..B6	**Loops**	Number of time the profile has to be executed (unsigned 32bit)
B7	**0**	Not used

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**14**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

This command has no answer.

3.13. Command : SET POWER

FUNCTION : This command should be used to turn on /off the main power supply and adjust the output voltage

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**9**	Command ID
B1	**Power Status**	0 : Off, 1 : On
B2..B3	**Output voltage**	Output voltage (unsigned 16bit, millivolts, [6000..26000])
B4..B7	**NA**	Not used

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**9**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

This command has no answer.

3.14 Command : SET CAN TX MODE

FUNCTION : This command should be used to set the CAN transmission mode :

Normal mode (continuous mode), messages are sent when ready
Period mode, message are sent one by one with a given delay between transmissions

Command Frame Format (Master→Driver):

	Value	Description
ID	**RX CAN ID**	Driver's RX CAN ID
B0	**26**	Command ID
B1	**CAN TX Mode**	0 : Normal, 1 : Periodic
B2	**TX Period Prescaler**	In periodic mode, TX period multipler of 2 ms
B3..B7	**NA**	Not used

Acknowledge Frame Format (Driver→Master):

	Value	Description
ID	**TX CAN ID**	Driver's TX CAN ID
B0	**0**	Frame ID
B1	**9**	Acknowledged command ID
B2	**Error code**	Command error code
B3..B7	**0**	Don't care

This command has no answer.