DMMD –Digital Torque Control Module

Using the picoamps DMMD your e-bike will react like a gas bike. In combination with the picoamps SENS-50 current sensor a digital microprocessor controls the motor current and thus the torque with respect to the throttle opening. The response characteristics of the module can easily be adapted to the special needs of the driver by selecting software parameters.

When used in an open loop control configuration without current sensor the throttle response of your e-bike can be adapted to your needs in a wide range.

The DMMD offers three digital interfaces, that can be used to select between up to 8 predefined settings to achieve the desired module characteristics. Alternatively, these interfaces can be used as outputs for control or indicator signals.

Das picoamps DMMD is available for two battery voltage ranges:

DMMD-15:   Battery voltage range 5 V … 15 V
DMMD-120:   Battery voltage range 10 V … 120 V

The module comprises security shut down features in the case of cable breaks and power supply irregularities.
It comes in a robust waterproof aluminum case.

NOTE: No general operating license available, yet.

Example: control of the motor current of an e-bike (e.g. ZERO, QVR):

In this application the control loop is closed using an external current sensor that directly senses the motor current. The throttle opening is transferred to a desired current value by an internally stored characteristic curve. The digital I-type controller sets its output to the motor controller such that eventually the sensed motor current is identical to the desired value.

For safety reasons, when releasing the throttle the module output will immediately follow to avoid unwanted delay in retardation.

In this example the three universal interfaces are used to select between different internal characteristic curves and thus scale the maximum available torque at full throttle (see table).
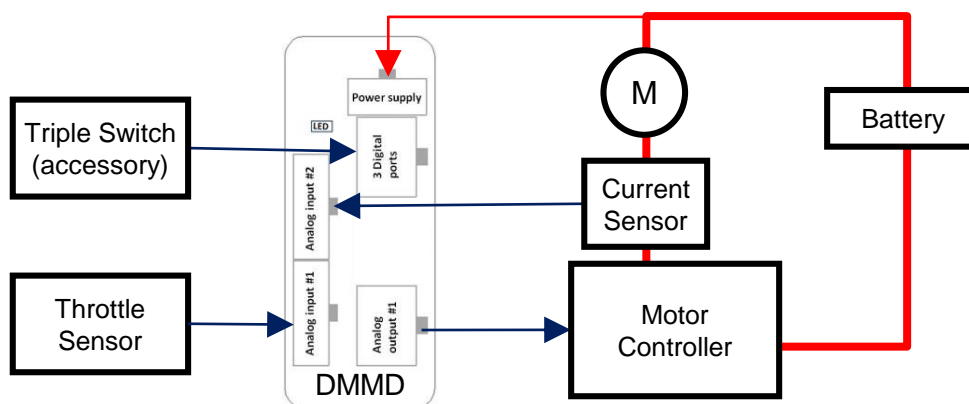
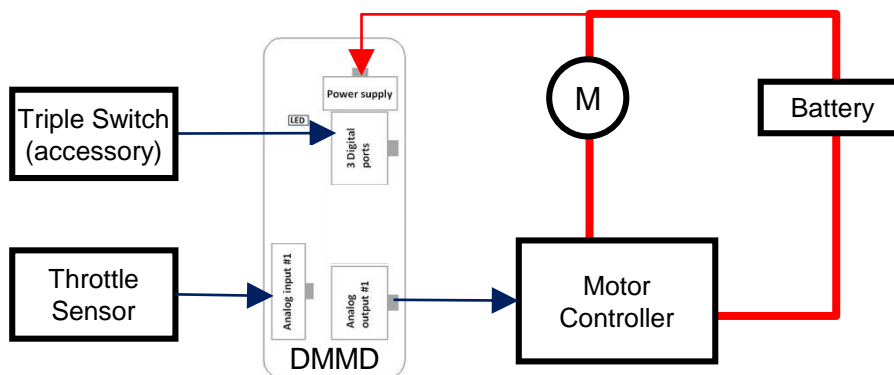| Switch to GND			Function
IO1	IO2	IO2	Torque at full throttle
open	open	open	100% *)
1 of 3 switches closed			77%
2 of 3 switches closed			54%
closed	closed	closed	34%

*) default setting without switch

Example: control of the motor current of an e-bike (e.g. ZERO, QVR):

In this open loop application the input signal of the throttle sensor is transferred to the output signal for the motor controller using a special PI-type algorithm. The output signal reaches the final value that corresponds to the throttle position after the setting time of the controller, where torque adjusting range[**] and setting time can be selected.

The selected time constants can be substantially shortened by a quick sequence of partially closing and full opening the throttle.

For safety reasons, when releasing the throttle the module output will immediately follow to avoid unwanted delay in retardation.

In this example the three universal interfaces are used to select between different torque adjusting ranges and setting times of the PI-type control algorithm (see table).

Switch to GND		Time constant (I)
IO1	IO2	0% to100% [sec]
open	open	3.5 (slow) *)
open	closed	2.3
closed	open	1.5
closed	closed	0.8 (fast)

Switch to GND	Adjusting range
IO3	/ throttle signal
open	small 45% *)
closed	large 80%

*) default setting without switch

[**] Adjusting range: Percentage of the full throttle range to cover the range of 0 … 100% torque
Setting time: time that elapses from opening throttle until steady state of the output signal

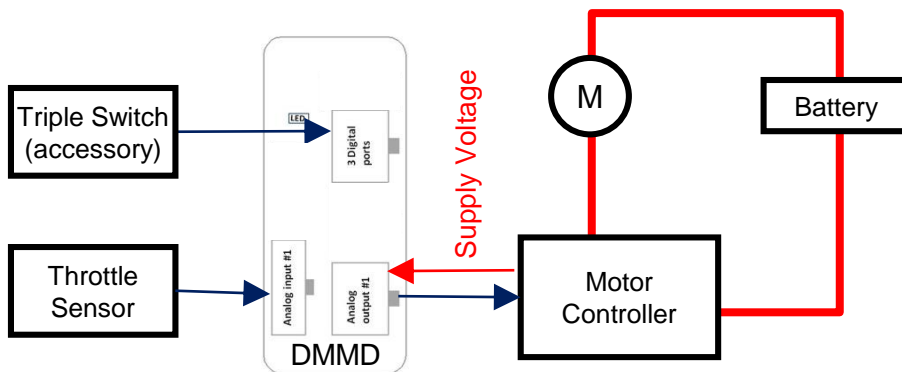**Example: control of the motor current of an e-bike (OSET):**

In this open loop application the input signal of the throttle sensor is transferred to the output signal for the motor controller using a special PI-type algorithm. The output signal reaches the final value that corresponds to the throttle position after the setting time of the controller, where torque adjusting range[**] and setting time can be selected.

The selected time constants can be substantially shortened by a quick sequence of partially closing and full opening the throttle.

For safety reasons, when releasing the throttle the module output will immediately follow to avoid unwanted delay in retardation.

In this example the three universal interfaces are used to select between different torque adjusting ranges and setting times of the PI-type control algorithm (see table).

In the OSET application the DMMD is directly powered from the motor controller using the output connector.

Switch to GND		Time constant (I)
IO1	IO2	0% to100% [sec]
open	open	3.5 (slow) *)
open	closed	2.3
closed	open	1.5
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[**] Adjusting range: Percentage of the full throttle range to cover the range of 0 ... 100% torque
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Response time:
- Realized sensor sample rate: 2 kHz, realized controller response time: 0,5 msec controller response time depends on implemented algorithm

Analog input (2 ports):
- Input signal range: 0V … 4.4V
- Integrated power supply for sensors (4.2V max, depending on supply current)
- Sensor types: Hall throttle, resistor throttle, current sensor, others on request
- Supervisory function and safety shutdown for input failures, e.g. irregular input values or cable break

PWM/analog output (2 ports):
- Output signal range: 0V … 4.4V
- Output signal shaping can be defined by software algorithm and mapping tables
- Internal low pass filter for PWM/analog conversion can be enabled by software
- Optional power supply for DMMD

Digital ports (3 ports):
- Digital input, e.g. for parameter selection
- Digital output, e.g. for indicator or switching signals
- Optional internal weak pull-up enabled by software
- Optional internal pull-down resistors

Power supply:
- Voltage range: 5V … 15V (DMMD-15) emergency power down default below 4.7V
- Voltage range: 10V … 120V (DMMD-120) emergency power down default below 10V

Status LED (2 LED):
Two LED can be used to display special states of operation e.g.:
- Green: throttle max value and setting not default
- Red: Error indicator and safety shutdown due to cable brake, irregular sensor signal or initial signal, battery voltage to low
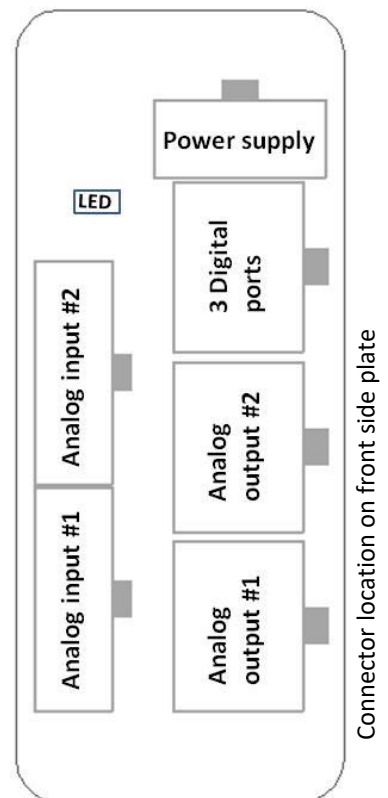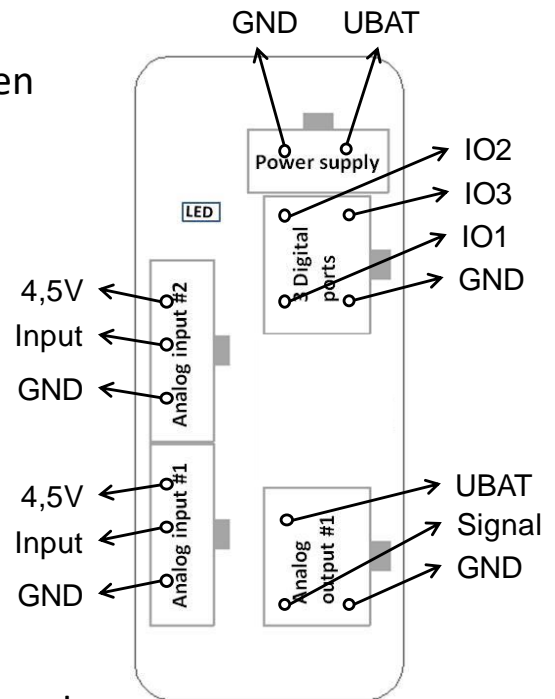
Input Output and Selection Cables:

- Cable lengths default 40 cm with Open cable tails on system side

- Customer specific on system side on request
- Customer specific cable lengths on request

External Switches:

- Single handle bar switches
- Customer specific switch type on request

External Current Sensor: SENS-50

- Current Range: 0 … 400 A (optional up to 600 A)
- Minimum response time: 5 µsec
- Sensor supply voltage: 3V … 5,5 V
- Temperature range: -40°C … 150°C
- Isolation Power to Signal pins: > 600V
- Dimensions: 30 mm x 64 mm x 15 mm
- Power flange: 2 mm thick, outer Ø 22 mm, drill Ø 8.0 mm

Price List *

Product	Details	€ net
DMMD-15	Supply Voltage 5 V … 15V Software included, w/o Cables , to be selected	75,--
DMMD-120	Supply Voltage 10 V … 120 V Software included, w/o Cables, to be selected	90,--
Software	Closed loop I-type	19,50
	Customer specific throttle mapping	19,50
	Current mapping for customer sensor	on request
	Open loop PI-type	19,50
	Customer specific PI settings	19,50
Cable accessories	Single cable 40 cm with connector on module side (input, output or selection cable) without connector on system side	5,--
	Cabling for OSET and ALLTRAX motor controller	20,--
	Customer specific connector on system side	on request
External Switch	Single pole handle bar Switch	24,--
	Customer specific switches	on request
SENS-50	Current sensor up to 400 A	50,--

* All prices in € exclusive VAT and shipping.
Price list is not legally binding and may be subject to change without prior notice.
Prices for resellers on request
Additional product variations and modifications on request