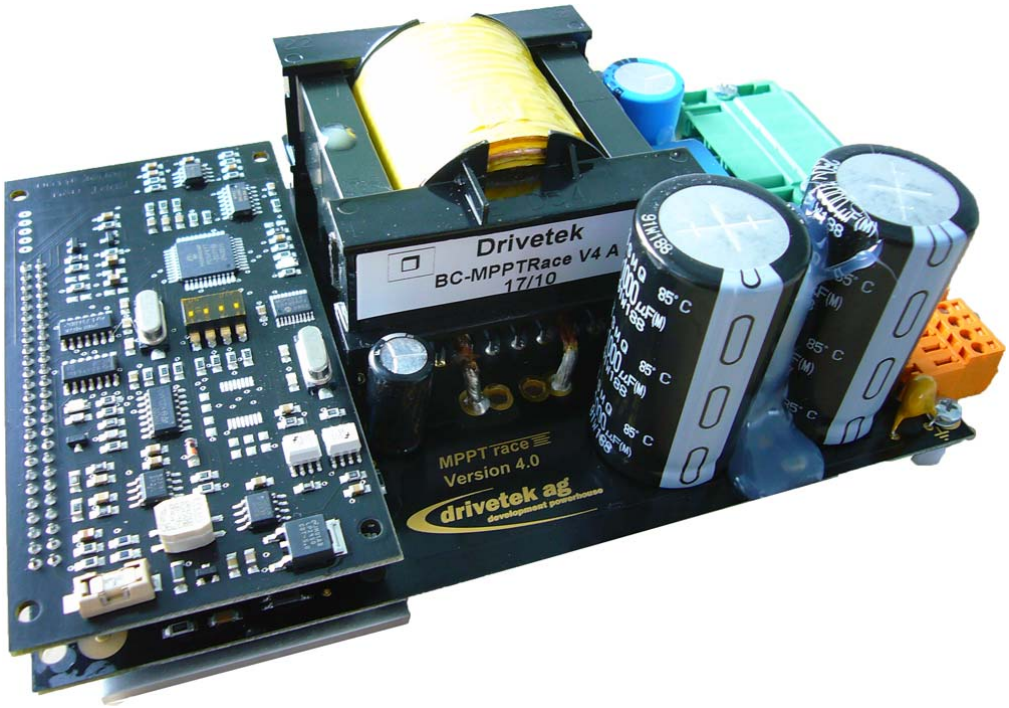
User Manual MPPT Race Version 4



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Quick Start

- Connect PV Panel (input voltage > 36V)
- Leave the output open
- The MPPT starts up
- The output is precharged to approx. 3/4 of Uoutmin
- If you are using CAN, you can get the mppt's status information like actual mppt state, Uin, Uout, Iin and pcb temperature (see CAN Communication)
- Connect the DC-Bus to the output (at least Uoutmin as specified in the order form)
- The MPPT starts tracking

Start-Up and Reset

If there are more than 36 V_{DC} connected to the input as well as open reset inputs, the supply module begins to generate the needed on-board voltages, and the whole system will start up in a well defined state. This process is called start-up.
The user can enforce a shut-down of the converter by simply shorting Pin1 and 2 (use a simple switch) of the reset-connector (see Terminal assignment).

Battery Detection

The MPPT begins tracking upon detection of a battery. Therefore, the output capacitor is considered empty at the start-up, due to its self-discharge. If a battery is connected to the output now, the capacitor short-circuits the battery and an electric arc will result.
To forestall this unpleasant event, a precharge function is implemented. The MPPT automatically precharges the output capacitor at the start-up to ¾ of the minimal end of discharge voltage. As soon as the output voltage reaches at least the minimal end of discharge voltage level the MPPT starts with a “delta-test” to make sure a battery is connected. It turns the PWM on for a short period of time and compares the delta of the output voltage. If the delta is small enough, the MPPT starts the tracking algorithm. Otherwise the MPPT rests in the “no battery connected state” until the “delta-condition” is true.

Battery end of charge level

If the battery reaches the end of charge voltage (as specified in the order form) the mppt stops tracking to protect the battery from being overcharged. As soon as the voltage drops again below the end of charge level, the mppt starts tracking again.

Load drop / Output Shutdown Voltage

A sudden load drop (battery disconnected from the mppt’s output) during normal operation on a boost-converter is a critical event because the output voltage will rise very fast. The MPPT-Race limits the output voltage during a load drop to 236V or less. The customer has to take care that if a sudden load drop can appear, the system has to withstand the guaranteed maximum output voltage of 236V.

Over temperature

An overheating of the semiconductors is, within the allowed domain, extremely improbable.
Nevertheless, if the cooler overheats due to any thinkable reason, the converter would immediately shutdown. After the cooler has cooled down, the overheat shutdown is reset. This procedure can take a few minutes. Do not foreshorten this waiting time by switching off the MPPT!

CAN Interface Supply

The CAN-driver circuit has to be powered externally (see Terminal assignment).

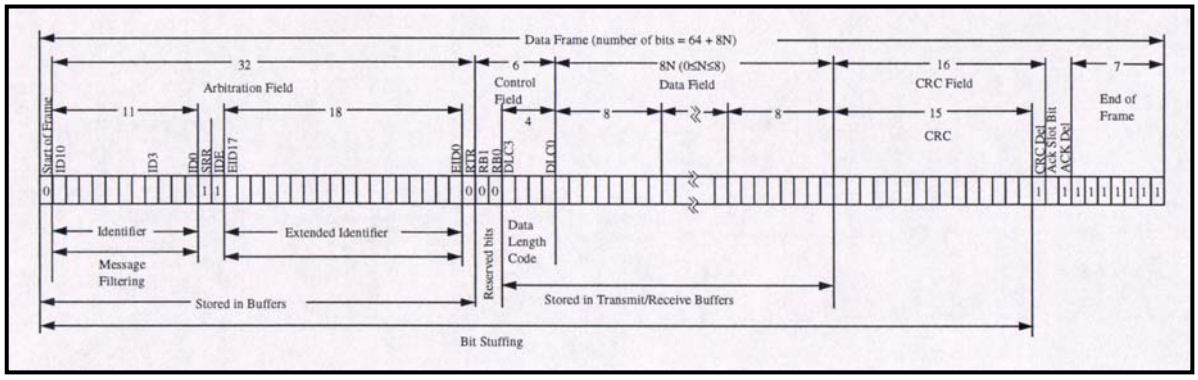
CAN Communication

Features

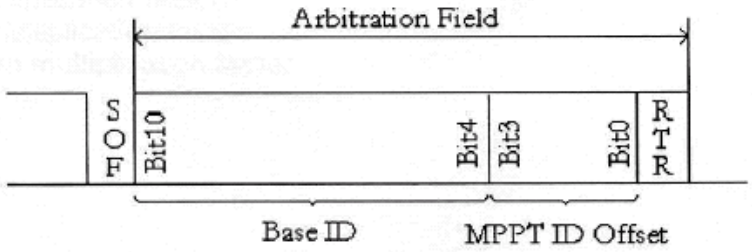
- ✓ Full CAN V2.0A
- ✓ ID standard
- ✓ Nominal Bit rate 125 kbit/s
- ✓ Bus terminated on MPPT (124 Ohm)

CAN Message Frame Description

The type of message used in this application is a standard data frame. Data frames consist of Arbitration Fields, Control Fields, Data Fields, CRC Fields, a 2 bit Acknowledge Field and an End of Frame.



Standard Data Frame

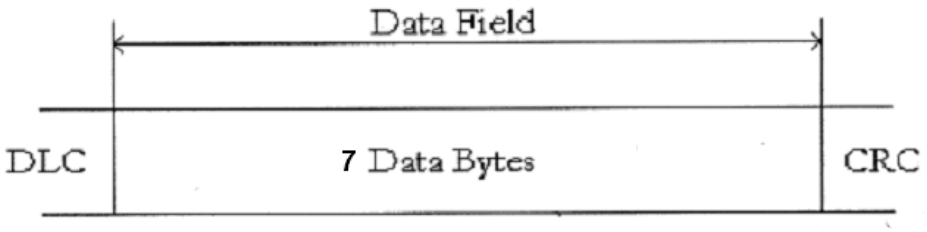


Bits 10-4: **Base ID** 1110001 for Master Request Frame
1110111 for MPPT Answer Frame

Bits 3-0: **MPPT ID offset** Available range: 0001-1111

Note: All MPPT IDs must be different.
Bit 3 to 0 correspond to the DIP- Switch setting on the MPPT

Structure of the Identifier Field



Name	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
BYTE1	BVLR	OVT	NOC	UNDV	x	x	MSB Uin*	
BYTE2	LSB Uin*							
BYTE3	x	x	x	x	x	x	MSB Iin*	
BYTE4	LSB Iin*							
BYTE5	x	x	x	x	x	x	MSB Uout*	
BYTE6	LSB Uout*							
BYTE7	T_{amb}[°C]**							

BVLR: Battery Voltage Level Reached Flag
0: $U_{out}<U_{outmax}$ 1: $U_{out}=U_{outmax}$

OVT: Overtemperatur Flag
0: T_{cooler} < 95 °C *** 1: $T_{cooler} \geq 95$ °C

NOC: No Charge Flag
0: Battery is connected 1: No Battery is connected

UNDV: Undervoltage Flag
0: $U_{in} > 26$ V 1: Uin ≤ 26 V

* Number of amperes or volts per LSB are client specific.
** Steps of 5 °C.
*** Once the OVT-Flag is set, there is a hysteresis of about 8 °C until the OVT-Flag is reseted

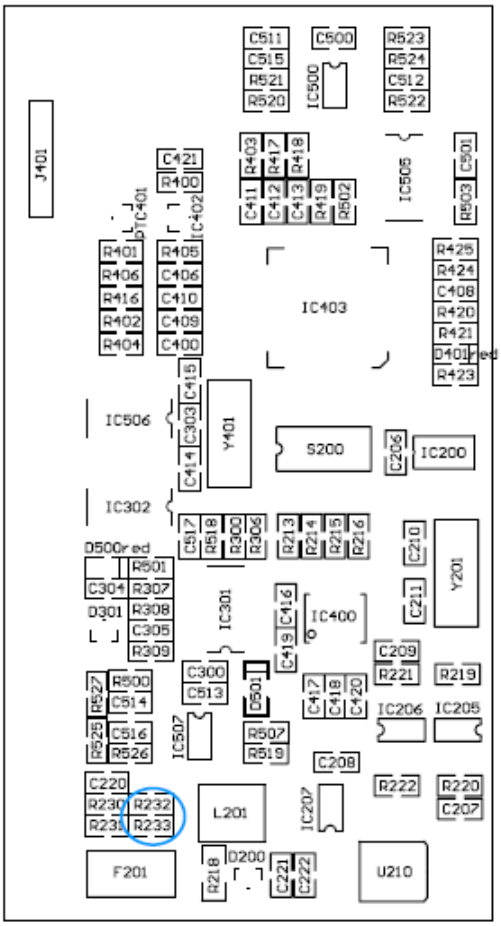
Structure of MPPT Answer Data Field

CAN Id Determination

The CAN Id is set with the 4 Position DIP-Switch on the control board.

SW Nb. 1 -> Bit 0 of MPPT CAN ID
...
SW Nb. 4 -> Bit 3 of MPPT CAN ID

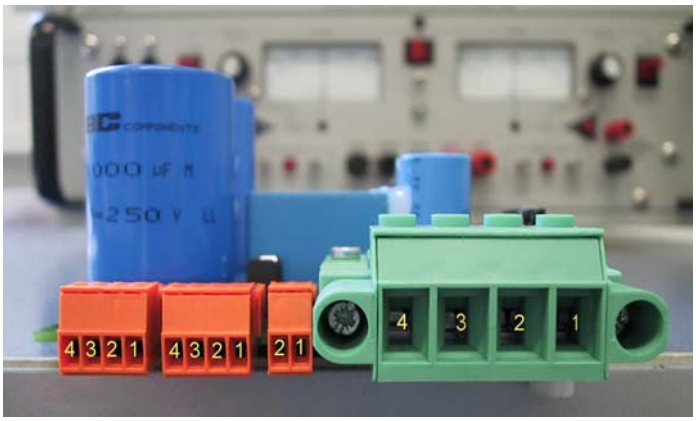
Removing On Board CAN Termination



If you use more than two MPPT Race on the CAN Bus, remove the CAN-Termination (R232 and R233, 62 Ohm) on all MPPT's except the first and the last unit on the CAN-Bus.

Terminal assignment

1 2 3 4	Panel minus Panel Plus Battery + Battery -
1 2 3 4	CAN In Ground**** CAN In Low**** CAN In High**** CAN In Supply Voltage****
1 2 3 4	CAN Out Ground**** CAN Out Low**** CAN Out High**** CAN Out Supply Voltage****
1 2	Shutdown +*** Shutdown -***



Connector Front side view:
Interface Connector (left) and Power Connector (right)

The Panel minus input must not be short-circuited to Power GND. Otherwise, no more panel current and power is measured.

****CAN voltages are galvanic separated from Power GND.
***By simply connecting Pin1 and 2 (use a simple switch, the Tracker is shut down). Drawback: There is no galvanic separation between the GND and the PowerGND, so use a switch for each tracker individually

*LED signalling**

LED 1 (close to PIC)	LED 2 (PWM)	Description
on	**off**	Error state. At least one of the following conditions is true: -no battery connected -battery level reached -over temperature
flashing	**on**	under voltage
flikering	**on**	tracking mode

* Use CAN to get more detailed information about the MPPT state.

Spare Parts

Part Description	Part Number	Manufacturer
Output Fuse	0215012.MXP	Littelfuse
Green Power Connector	PC 4 HV/4-STF-7.62	Phoenix
Orange CAN Connector	BL 3,5/4	Weidmüller