

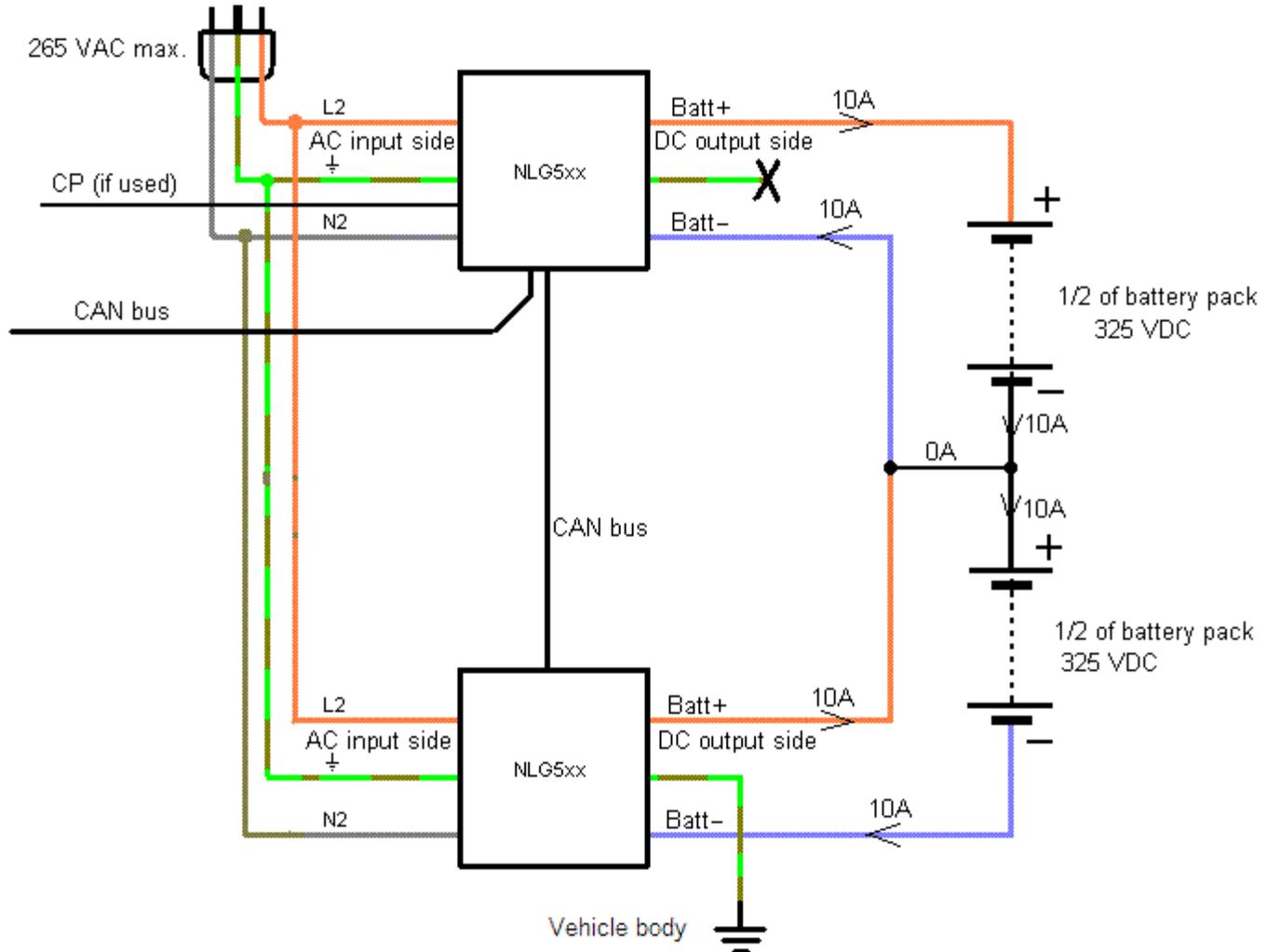


# Application Note MMC\_004

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## Series Connection of two BRUSA NLG5xx battery chargers with tap to the middle of the battery pack

Often maximum output voltage of a single charger is not enough to fulfill requirements for given battery. The diagram below depicts generic schematic for connecting two chargers in series to double total output voltage (and output power along) of a single unit. It is assumed a user has access to electrical middle of the battery pack. Typically entire pack is consists of a few lower voltage modules so tapping does not present an issue and is cleanest way to charge high voltage battery with two chargers. Essentially each charger charges its own half of the battery. On the example below two NLG513-xx chargers with 520VDC max output are arranged in series connection to charge 650VDC battery:



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Note that this is not complete electrical schematic as CP, CAN and other interface connections are not shown.

Tapping to the middle of the battery pack yields two 325VDC halves of the 650 VDC battery. Output of each charger is connected to its 325V section as if the other 325 section does not exist since given charger does not "see" the battery half the other charger is connected to. In the example above the charging current is set to 10A; and you can see that essentially it flows from one battery into another. This means the tapping wire carries no load (current is zero amps) and can be thin small gauge wire rated for lower than max charging current. The role of this connection is to establish and maintain regulation passing small currents in both directions averaging zero net current.

Normally chargers will be working in CAN mode where CAN bus is connected to both chargers programmed to send/receive same type of values under different CAN IDs so the BMS can distinguish which charger it is talking to. In case of automatic mode each charger must be programmed with the same charging profile meant for 325V battery and both chargers must be turned on at the same time. Each charger will finish charging of its half of the battery when it is full, and more often than not it will happen with small time difference. This is expected (for instance if halves are at slightly different temperatures) and is good. You would not want to interrupt charger #2 if charger #1 finished charging its battery half - this will leave half-packs unbalanced as first half is full but you did not allow the second half to get full if it's charger still was running. If you let each charger to completely charge its own battery half, both halves will be equally full even if completion happened at different times. Ultimately your goal is to have each half to receive equal amount of charge to be at the same SOC level, and this does not necessary translates to identical charging time. Just make sure loaded charging profiles and temp sensors arrangement (if used) are identical. This is easily accomplished as you can save profile loaded to a charger as a file using supplied ChargeStar software and load the same file into another charger.

**WARNING:** for any type of connection always observe precharging requirements for initial connection to the battery, see application note MMC\_006 for details. Failure to precharge charger's output may cause hardware damage and is not covered by warranty.

