

HIGH POWER SERIES

BMPU series AN002 rev AA



Application Note – Parallel and series operations

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1. Introduction

This document describes the procedure for the operation of BMPUs in parallel and in series configurations.

2. Test setup

2.1. Installation setup

The test setup from the power side is done based on the schematic in the figures below:



Figure 2-1 Schematic view of BMPU parallel installation setup



Figure 2-2 Schematic view of BMPU series installation setup

On the AC side, the figure below shows the connector WA042, used to parallelize the BMPUs:



Figure 2-3 Parallel and series test setup - AC connector



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On the DC side,

Connector reference	Reference	Picture
DC parallelization connector	WA040	
DC serialization connector	WA046	

2.2. Communication test setup

Before connecting the low voltage connector, connect the address selectors on the "ADDR SELECT" ports of the BMPUs.

N.B: The BMPU with the address 80 will be the master BMPU.

Also, using an RJ45 cable, connect both BMPUs from their COM PORT A or B.



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Figure 2-4 Communication test setup : example with 2 BMPUs

3. Parallel operation

- 1. Connect the BMPUs to LV power supply and connect the Kvaser device to the master unit.
- 2. Start the BMPU monitor (the graphical user interface).
- 3. Check that on Settings window, in "Device", the Kvaser is detected. If not, click on "Refresh".

Check that the "Slave CAN address" corresponds to the BMPU you want to configure. Check that the "Set-point autosend period" is 50 ms.

Then, click on apply.

ala Advanced	Evenant									
Node information	V Expert \		Status							
DMDU NedelD	111		Standby ower O Charge	🔏 Settings			? ×			Pfc On Orde
SW rev : 2.6.2r B	uild Nb : 20503							DCDC State STANDBY		0 0
Build Date : Tue J	ll 23 16:27:36 2024		Operation Mode	Communication	1 configuration			Configuration		
Node s/n : 341			-	Device :			lada chosa 164	Grada abasa 33		
Firmware validity		Refresh	Vehicle-to-load (V21	Kvaser Leaf Lig	ght v2 S/N: 74623 CH:	0	•	hree phases	Three phases + n	seutral
			G2V / V2G - DC Vol			Ref	resh	CDC config		
Aate Command				Baud Rate :						
StandBy	Power ON	Charge	Measurements	500 kBit/s			•			
	Fault ACK		Live values	Slave CAN address :			id Voltage (Battery) √ Current and Voltage (Grid) √ Current vs Voltage (Battery)			
		Available Power	80 *			HV voltage & current				
et Points Comman	ids		Charging Active Pow							300
AC Active Power IWI 1000.00 \$ 0.0			Discharging Active P	Monitor CAN address :						- 2/5
AC Readive Power [VAR] AC Readive Power [VAR]		Inductive Reactive P	Inductive Reactive P						- 250	
DC Charde Current Limit [A] Caj		Capacitive Reactive P	Set-point autosend period :					- 225		
DC Discharge Current Limit [A]			Available Current			50	ms			- 200 g
DC Outrat Visit		2.00 \$ 0.0	remperature.	Slow Meas Per	iod :					- 175 8
C Outbut Voi	ade IVI	480.00 0 21.6	T1 mos PFC : 1			5600	🗘 ms			- 150
V2L Voltage [V]: 230,0 T2 mos			T2 mos PFC :	PFC :						125
V2L Frequency [Hz]: 50		T4 mos PFC : 1	C opaate p	arameters at the beg	initing of the conti	numcución			- 100
High level log			T5 mos DC :		Silent Mode		Apply			- 75
> 16	:53:00.19 : Commun	ication	T6 mos DC :	17.90	switching mode .	mequeicy no	-16 -7			- 50
port	dosed		T8 mos DC : 34	1.2 °C	Active Bridge :	Battery Side	-18 -			- 25
			T9_xfr: 33	8.4 °C	Vbus Ref :	21.2 V	-22			E 0
			T10_Amb_P: 33	5.4 °C	VDUS :	21.8 √		 Grid Curren 	[A] – Grid Voltage [V]	

4. In the upper bar, click on the "Kp" icon:



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tem Interface Mode Module Help					
5 🐼 😳 🖬 K.,					
ain Advanced Expert					
Node information	Status				
BMPU NodeID : 111 SW rev : 2.6.2r Build Nb : 20503 Build Date : Tue Jul 23 16:27:36 2024	Randbi ower O Charge Safe C Foult PFC State : STANDBY Substate : STANDBY DCDC State STANDBY				
Node s/n : 341	Operation Mode		Grid Configuration	_	
Firmware validity : Refresh	Vehicle-to-load (V2L) G2V / V2G - DC Voltage Control	G2V / V2G - AC Power Control	Single phase - 16A	Single phase - 32 A Three phases + neutral	
Rate Command			DCDC config		
StandBy Power ON Charge	Measurements				
Fault ACK	Live values	e	Current and Voltage (Battery) V Current and	Voltage (Grid) V Current vs Voltage (Battery)	
et Points Commands AC Active Power IV/I AC Active Power IV/I AC Reactive Power IV/AR1 DC Charge Current Limit I/A1	Charging Active Power: 0.0 W Discharging Active Power 0.0 W Inductive Reactive Power: 0.0 VAR Capacitive Reactive Power -10.0 VAR	Voltace : 0.4 V Current : 0.20 A Active Power : -10.0 W Reactive Power : -10.0 V/AR Frequency : 50.0 Hz Power Factor : 0.7162	22 7 20 18 16 14 14 12 10	- 300 - 275 - 250 - 225	
DC Discharge Current Limit [A]	Available Current	Grid Detection Not detected	866	200	
DC Output Voltage [V] 2.00 • 0.0 480.00.00 • 21.6 21.6 22L Voltage [V]: 230,0	T1 mos PFC : 34.6 °C T2 mos PFC : 33.2 °C T2 mos PFC : 35.6 °C	Bettery: Voltage : 0.8 V Current : 0.0 A Power : 0.0 W	Gid Outrent []	175 a 150 a 125 a	
2L Frequency [Hz]: 50	T4 mos PFC: 35.2 °C T5 mos PFC: 35.0 °C T6 mos DC: 34.8 °C T7 mos DC: 34.8 °C T7 mos DC: 34.2 °C T9.wfr: 33.5 °C	DC/DC Switch Frequency : 70.0 KHz Switching mode : Frequency Mo Active Bridge : Battery Side Vbus Ref : 21.4 V	-8 10 10 -10 11 10 -14 10 -14 10 -18 10 -18 10 -18 10 -18 10 -18 10 -19 -19 -19 -19 -19 -19 -19 -19 -19 -19	75 50 25 0	
N	T10_Amb_P: 33.4 °C	Vbus : 21.5 V	- Grid Current [A] - Grid Voltage [V]	

In "0x4100 calibration", change the parameter "0x01 number_of_distant_pu" to the number of distant BMPUs, and press "enter" :

💕 CANopen Device Manager ile	-		\times
Name			^
> 0x2313 FaultCounters			
> 0x2314 LogEntries			
0x2320 VirtualScopeTrigger			0
0x2321 VirtualScopeGetData			
> 0x2322 Virtual Scope Setting			
> 0x2323 Virtual Scope Signal			
> 0x3000 measurements			
✓ 0x4100 calibration			
0x00 max sub-index			52
0x01 number_of_distant_pu			1
0x02 calib_i_batt_offset		0.00	00
0x03 calib_i_batt_gain		1.00	00
0x04 calib_v_batt_offset		0.00	00
0x05 calib_v_batt_gain		1.00	00
0x06 calib_v_batt_ev_offset		0.00	00
0x07 calib_v_batt_ev_gain		1.00	00
0x08 calib_p12V_P_offset		0.00	00
0x09 calib_p12V_P_gain		1.00	00
0x0A calib_t1_mos_PFC_offset		0.00	00
0x0B calib_t1_mos_PFC_gain		1.00	00
0x0C calib_t2_mos_PFC_offset		0.00	00
0x0D calib_t2_mos_PFC_gain		1.00	00
0x0E_calib_t3_mos_PFC_offset		0.00	00
0x0F calib_t3_mos_PFC_gain		1.00	00
0x10 calib_t4_mos_PFC_offset		0.00	00 🔍
ndex Sub-Indi Type Memory Ty Data		1.00	00
0x41 + 0x1 + UInt8 = EEPROM +			
Store parameter Download log		Read	
Restore factory settings Erase log	Upd	late all value	s 🤤
			100%

Important: the number of distant BMPUs is the number of slaves in the system. E.g.: If a system consists of 8 BMPUs, there will be 1 Master BMPU and 7 distant BMPUs. "number_of_distant_pu = 7"

- 5. Click on "Store parameter "to save the configuration.
- 6. Steps from 2 to 5 must be done on all the units composing the system.
- 7. All slaves are controlled by the master BMPU (ADDR80). The setpoints are managed In "Set Points Commands":
 - In G2V/V2G:
 - Set the "DC Discharge Current Limit [A]" to "(number_of_distant_pu +1) × 32A".



- Set the "DC Charge Current Limit [A]" to "(number_of_distant_pu +1) × 30A".
- The "AC Active Power [W]" is the active power setpoint of the global system.
- In V2L:
 - Set "V2L Voltage [V]" and "V2L Frequency [Hz]" to the desired voltage and frequency for AC load supply. Typical values are 230V and 50Hz respectively.
 - Set the "DC Discharge Current Limit [A]" to "(number_of_distant_pu +1) × 32A".
 - Set the "DC Charge Current Limit [A]" to "(number_of_distant_pu +1) × 30A".
 - o On the BMPU with the address of 80, in "State Command", click on "Charge".
 - V2L load connection and disconnection:
 - <u>After 2s</u>, both BMPUs will be in "PFC State: VSI_MODE_CHARGE" and "Substate : VSI_CHARGING".Then, the load can be connected.
 - To stop, the load must be disconnected first, then click on "StandBy" on the interface of address 80.

4. Series operation

In this configuration, the steps from <u>section 3.1</u> apply. In addition, on all BMPUs:

- In "0x4100 calibration", set the parameter "0x3B dcdc_series_mode" to 1, press enter:
- Click on "Store parameter "to save the configuration

