RIPE ENERGY
The Power Conversion Company

PSBC Family Technical Reference

Covers firmware up to and including revision 30

WARNING
Read this before using the PSBC

Safety ground must always be connected before input power. See section 2 - Grounding and safety for more details.

The voltages inside this equipment are sufficiently high to endanger human life. There are no operator serviceable parts inside. Only qualified service personnel with proper training are allowed to open the unit.

Operator must be careful when touching the PSBC due to possible high surface temperature.

For questions regarding PSBC or this document, contact RIPEnergy:

Web site: https://www.ripenergy.ch/

E-mail: info@ripenergy.ch

Document revision	Date (yyyy-mm-dd)	CO number
A	2019-01-03	See last section
B	2019-02-08	See last section
C	2019-03-14	See last section
D	2020-03-18	See last section

Table of contents

1. General description

1.1 Scope

This Technical Reference describes the PSBC family of power supplies, their capabilities, technical data, mounting instructions and operating instructions. The table below lists the units covered by this document.

Part no.	Description	Comment
807100	PSBC-Mil 1200 AC/DC	
	PSBC-Mil 1500 AC/DC	
807110	PSBC-Mil 2400 AC/DC	
807112	PSBC-Mil 2400 AC/DC	Version MK2
807105	PSBCDI-Mil 12V	
	PSBCDI-Mil 24V	
	PSBCDI-Mil 36V	
807114	PSBC-Mil 2400/48 AC/DC	
	PSBC-Mil 2000/80 AC/DC	

1.2 Intended use

This document has been written to assist field personnel and system integrators in correct and safe operation.

Sections 2 and 3 describes physical configuration and how to physically mount and connect the PSBC.

Sections 5 through 13 describes all the configuration options available.

Section 15 describes the PSBC Communication Kit, and the various software utilities available.

Section 16 describes the different firmware revisions, and known issues. It is highly recommended to browse through the known firmware issues section and check if any of the issues are relevant for the intended use.

1.3 Glossary/abbreviations

Term	Definition
AC	Alternating Current
DC	Direct Current
NTC	Negative Temperature Coefficient. A resistor that have a resistance that decreases when temperature increases is called an NTC. In this document NTC specifically means the cable assembly used to measure battery temperature.
PFC	Power Factor Correction
Shutdown	PSBC has turned off its DC output and most of its internal circuitry. Display, alarm outputs and RS-485 communication is still active.
CC	Constant Current
CV	Constant Voltage
CCU	The PSBC Config Utility
CLU	The PSBC Logging Utility
CCK	The PSBC Communication Kit
Firmware	The firmware in a PSBC unit
UPort	Moxa UPort 1150I (USB to RS-485 converter)

1.4 PSBC models

For performance data, see the datasheets.

To see the default settings of a unit, use the PSBC Config Utility (see section 15.4).

1.5 General information

PSBC is a family of compact AC/DC power supplies/battery chargers.

PSBC is designed for supplying power to sensitive electronics, with or without backup battery.

The input current of PSBC is power factor corrected and designed for optimum adaptation to weak power sources such as portable generators. The inrush current limiters at the input ensure low start-up current. The efficiency is very high due to the soft switching converter technology.

A two digit display shows the value of the output voltage and output current. An error code will be shown in this display if the unit shuts down.

PSBC is optimal for charging of secondary batteries. The output voltage can be temperature compensated to ensure optimum charging of Lead-acid batteries. The inrush current limiter at the output ensures low current spike when connecting the output to the batteries. A battery or another voltage source (e.g. another PSBC) can be connected to the DC output at all times, also when the AC input is not powered.

The signal connectors provide several I/O signals: Alarm relay outputs, external battery temperature sensing and a RS-485 bus for interconnection of multiple PSBCs in a redundant system with active load sharing. The RS-485 bus can also be used for communication between PSBC(s) and a computer.

The speed of the fan is controlled continuously as a function of internal temperature. The fan runs at full speed for 5 seconds every time the units is started up, to indicate that the fan is working.

NOTE: The fan only runs for 5 seconds when the unit is started up from completely stopped (display dark). When the unit is started up by pressing the DC OUT ON/OFF-button or sending a command on the RS-485 bus, the fan only starts if the unit is hot.

The unit is protected from over-voltage, short circuit, over-current, over-temperature and wrong polarity battery connection at output. The fan motor is protected against damage if the fan is blocked. Note that the fan blades may be damaged if a screwdriver or similar is inserted while the fan is running.

PSBC can be mounted in any direction and in a 19” rack.

1.6 Additional information about Dual Input types

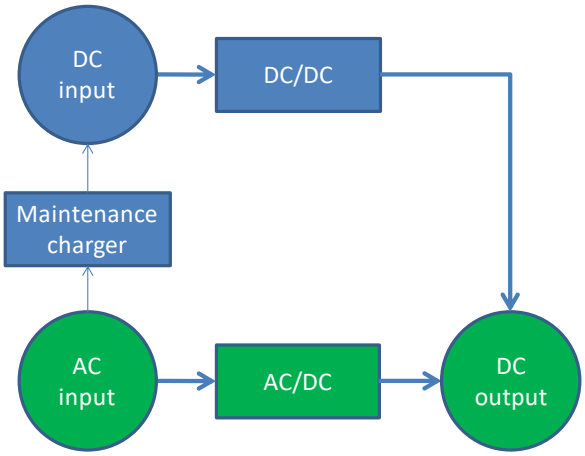
The Dual Input types:

- Retains all functionality of the "regular" PSBC types
- Adds a DC input, and can be powered by AC, DC, or both
- Adds a small maintenance charger to charge batteries connected to the DC input

If both AC and DC input is available, the PSBC will be powered from AC. Switching between AC and DC input is seamless:

- The DC output does not have any switching spikes or drop in voltage
- If the unit is charging a battery on the output, the charging process is not affected

Block schematics:



The green blocks are present in all PSBCs. The blue blocks are present in Dual input models only. DC input, AC input and DC output are all galvanically insulated from each other.

The arrows show all the possible power flows. The following modes are possible:

Situation		Converters active		
DC output	**Inputs available**	**AC/DC**	**DC/DC**	**Maintenance charger**
Off	AC only			
Off	DC only			
Off	AC and DC			Depending on setup (see section 12.3.1)
On	AC only	X		
On	DC only		X	
On	AC and DC	X		Depending on setup (see section 12.3.1)

DC output: See section 3.5.2.

Inputs connected: "Available" here means connected and input voltage within range, and for the AC input (3.5.1), the circuit breaker must also be on.

2. Grounding and safety

2.1 Grounding

PSBC has Touch Currents above 3.5mA. For this reason, the unit must be grounded whenever AC voltage is applied. If not, dangerous voltage/currents may be present if the housing is touched.

There are several ways to ground the unit:

- By using the ground pin on the AC connector
- By connecting a ground wire to the ground tab (front center of unit)
- By connecting a ground wire to one of front or rear bracket screws
- By mounting the unit in a metal rack or similar

All the listed methods are good, and the methods can combined for extra safety.

However, many countries have specific requirements for ground. In some cases some of these methods may not be considered safe. See below for European regulations.

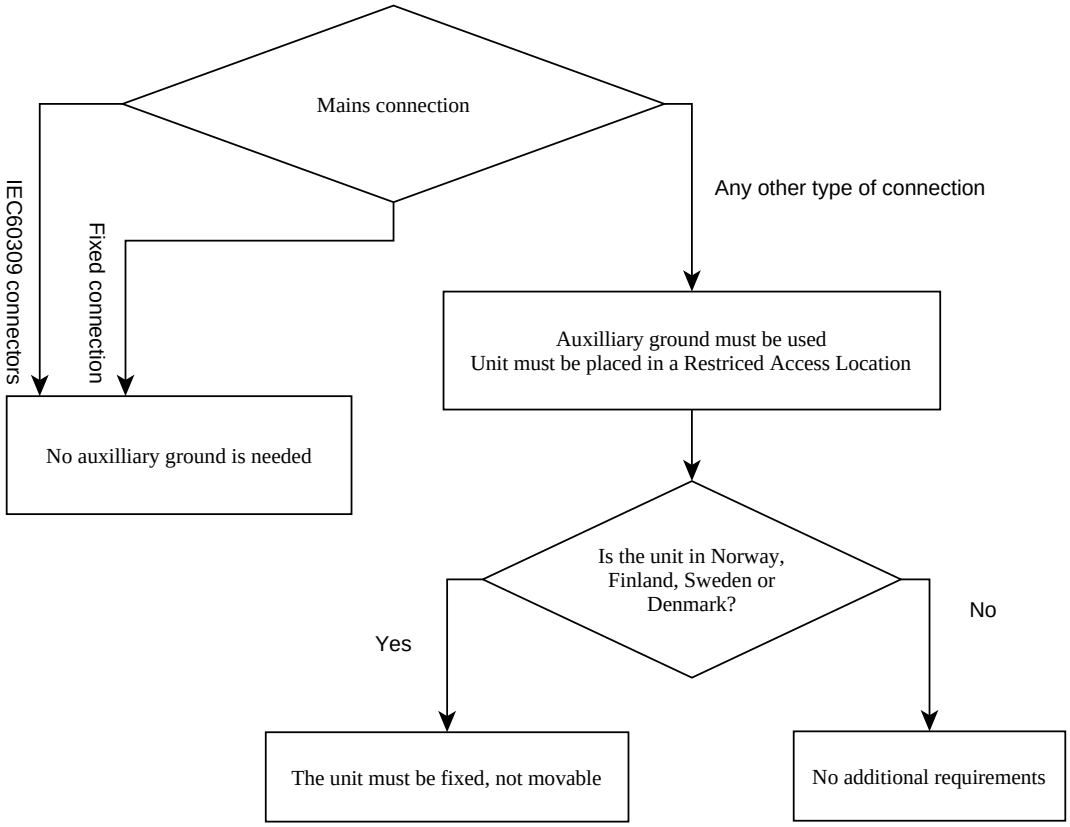
2.2 European/EU safety regulations

NOTE: While RIPEnergy has done its best to supply correct information about safety regulations, it is the responsibility of the customer to make sure that all relevant laws and regulation are followed.

We assume here that the AC input cable is always connected to ground.

Whether auxiliary ground is required is dependent of the type of connector on the AC input cable. We are here not talking about the end of the cable connecting to the PSBC, but the other end.

Flowchart for determining if auxiliary ground is required for PSBC:



Explanation of terms used in the flowchart:

Item	Explanation
Mains connection	This requirements is not directly related to PSBC or the AC connector on PSBC, but dependent on how the AC cable from PSBC is connected to the mains.
IEC60309 connectors	IEC60309 connectors or a comparable national standard. These are connectors typically used in an industrial environment. Note that you can't just add a pair of IEC60309 connectors to the middle of the AC cable. It is the connection to the installation that matters.
Fixed connection	The AC cable is "permanently" connected to the mains, without pluggable connectors. E.g. screw terminals.
Any other type of connection	This includes normal wall sockets that are common on homes and offices. The requirement for auxiliary grounding is that the grounding in these types of connectors is not considered 100% safe. Industrial connectors or fixed installations are considered safe.
Auxiliary ground	Any grounding of the PSBC, other than the ground in the AC cable.
Restricted Access Location	A location for equipment where both of the following limitations apply: • access can only be gained by personnel who have been instructed about auxiliary ground • access is through the use of a tool/key or other means of security, and is controlled by the authority responsible for the location.
Norway, Finland, Sweden or Denmark	These countries have stricter regulations than the rest of the EU. Any unit with touch current above 3.5mA must be permanently mounted. The unit can't be movable.

2.3 Touch current (Leakage current)

Touch current and Leakage current are synonyms.

This section applies if one phase conductor is connected to ground. This is common in many applications.

The input AC filter on PSBC has 73nF±20% in each phase to ground. See section 3.9.1 for more details.

Formulae for calculating leakage current for any line voltage/frequency:

$$I_{Leakage} = \frac{U_{Line} \cdot f_{Line}}{2180}$$ (typical, ±20% tolerance)

U_{Line} is line voltage in Volts

f_{Line} is line frequency in Hertz

$I_{Leakage}$ is leakage current in milliamps

Some examples:

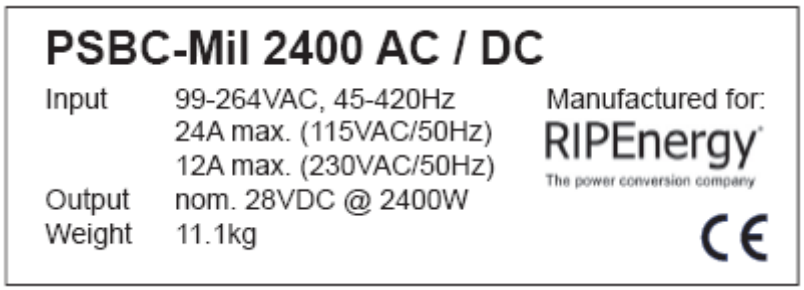
Line voltage	Line frequency	Typical leakage current
230V	50Hz	5.3mA
230V	60Hz	6.3mA
230V	400Hz	42mA
115V	50Hz	2.6mA
115V	60Hz	3.2mA
115V	400Hz	21mA

3. Description

3.1 Product label

The PSBC is equipped with a product label on both sides. The product label contains information on type of equipment, manufacturer and part number.

Example product label:



3.2 Serial number label

The serial number is located at the front of the unit, above the circuit breaker. The format of the serial number is fixed:

- 5 digits serial number (leading zeroes as necessary)
- Dash
- Hardware revision consisting of 1 digit and 1 letter

The serial number is unique for all PSBCs with the same part number. PSBCs with other part numbers may use the same serial number. Different hardware revisions of the same part number do not reuse serial numbers.

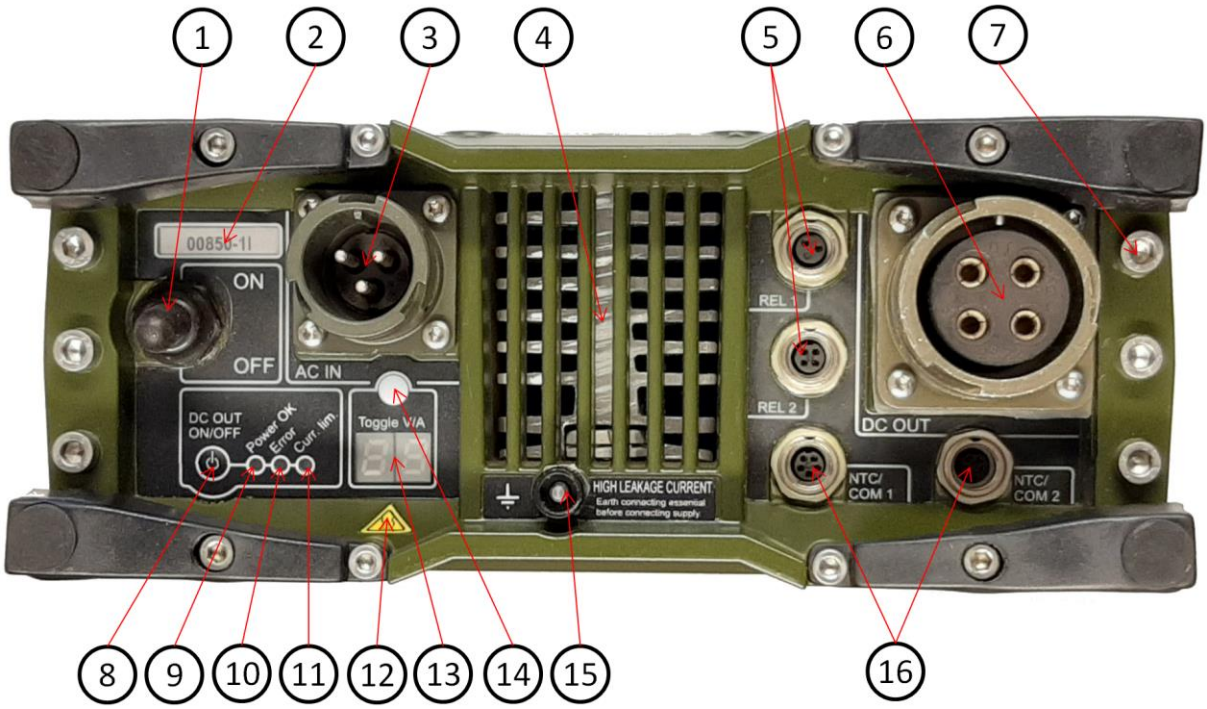
In other words: The part number and the serial number (without the hardware revision) is both sufficient and necessary to uniquely identify the unit.

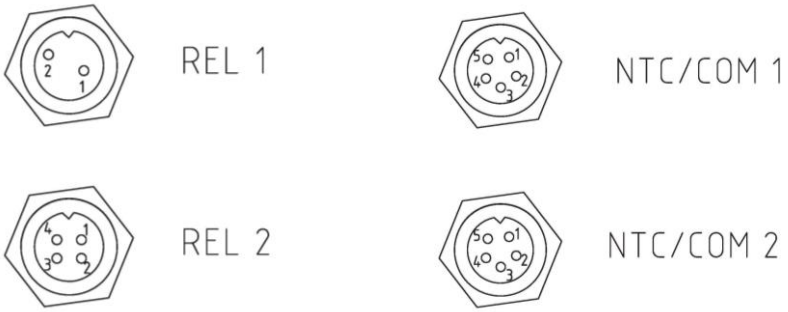
The hardware revision does not specify the firmware revision. The firmware revision may change independently of the hardware revision. See section 5 for how to determine the firmware revision.

Example: 00123-1F

“00123” is the serial number. “1F” is the hardware revision of the unit.

3.3 Physical layout





1 AC input switch/circuit breaker
2 Serial number label
3 AC input connector
4 Air outlet
5 Alarm relay output connectors
6 DC output connector
7 M5x12 Hex socket screw
8 DC OUT ON/OFF-button
9 Green Power OK LED
10 Red Error LED
11 Yellow Current limit LED
12 Hot surface warning
13 LED display
14 Toggle V/A- button
15 Ground tab
16 Communication and NTC connector

NOTE: The Red Error LED was marked with Shutdown on older units. Also see section 3.6.2 firmware differences in LED control.

3.4 Connectors

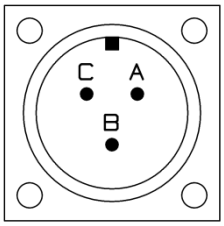
For type numbers of connectors, see datasheets.

Drawings of connectors are as seen from the front of the PSBC.

3.4.1 AC input connector

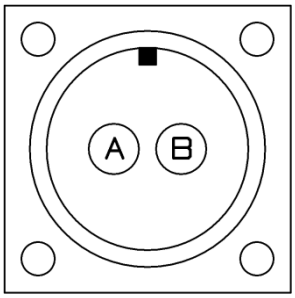
Two different AC input connectors are used. The pinout is the same on both connectors.

NOTE: The line and neutral pins on the AC input are equivalent. It is no problem to swap the pins.



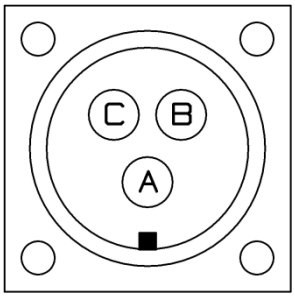
Pin	Function
A	Line
B	Neutral
C	Safety ground

3.4.2 2-pin DC output connector



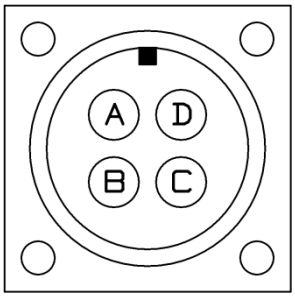
Pin	Function
A	DC positive
B	DC negative

3.4.3 3-pin DC output connector



Pin	Function
A	DC positive
B	DC negative
C	Not used

3.4.4 4-pin DC output connector



Pin	Function
A and B	DC positive
C and D	DC negative

3.4.5 DC input connectors (Dual Input types only)

The DC input has separate connector for positive and negative connection. The two connectors are of the same type, but with different coding, so that it is not possible to swap the positive/negative connections.

3.4.6 REL 1 and REL 2

Connector	Pins	Function
REL 1	1 and 2	Alarm relay 1
REL 2	1 and 2	Alarm relay 2
REL 2	3 and 4	Alarm relay 3

The lines are galvanically isolated from all other lines. Ratings:

Pin	Max voltage
Relay pin to chassis	100V
Pin to pin, between relays	100V
Pin to pin, one relay	50V

Maximum current 50mA.

If the relays are connected to a high power circuit, it is recommended to use series resistors to protect the relays.

Examples of high power circuits are the DC output of a PSBC, or a battery.

3.4.7 Signal connectors NTC/COM1 and NTC/COM2

These two connector are connected in parallel, and are equivalent. Either connector can be used.

Pin	Function
1 and 2	NTC connection
3	RS-485 Data+ / Non-inverting
4	RS-485 Data- / Inverting
5	Not used

Notes:

- These signals are **not** galvanically isolated from the DC output.
- Many manufacturers of RS-485 equipment use the terms A and B for the two RS-485 signals. However, the manufacturers do not agree about which pin is A and which is B.
- The reference (ground) for the RS-485 bus is the negative DC output pin(s). If using the RS-485 bus, make sure that all equipment connected to the bus have a common reference. It is not recommended to put switches or circuit breakers in the negative DC output wires. If switches or circuit breakers are used, place these in the positive wire.

3.4.8 Signal connector NTC/REM (Dual Input only)

Pin	Function
1 and 2	NTC connection
3	Remote sense positive
4	Remote sense negative
5	Remote sense return. Connected internally to DC input negative. Make sure that external connections does not allow large current to flow in this pin.

3.4.9 Signal connector REL (Dual Input only)

Pin	Function
1 and 2	Alarm relay DI 1
3 and 4	Alarm relay DI 2

The lines are galvanically isolated from all other lines. Ratings:

Pin	Max voltage
Relay pin to chassis	100V
Pin to pin, between relays	100V
Pin to pin, one relay	50V

Maximum current 50mA.

If the relays are connected to a high power circuit, it is recommended to use series resistors to protect the relays.

Examples of high power circuits are the DC output of a PSBC, or a battery.

3.4.10 Ground connector

The ground tab is a M4 bolt. Use a suitable spade tongue terminal.

3.5 ON/OFF control

The start-up time depends on input voltage; typical start up time is 4.5s at 115V AC and 3.5s at 230V AC.

3.5.1 AC input

The AC input has a circuit breaker. This can also be used as an on/off switch.

This circuit breaker disconnects the AC input on both live and neutral.

Ground is always connected.

3.5.2 DC output

The DC output have a DC OUT ON/OFF-button. This button turns off the DC output only. The front display will still be active, and it is still possible to communicate with the unit over the RS-485 bus.

Pressing the button will switch PSBC “OFF” and the error code E0 will be shown in the display. Pressing the button again will switch PSBC “ON” again.

The inrush limiter at the output is enabled when the unit is in shutdown, avoiding high peaks of charging current when connecting the DC output cable to the battery.

3.5.3 DC input (Dual Input only)

The DC input has a DC ON/OFF-button. When the button is pressed, the green or the red LED will flash for 1 second:

LED	Description
Green LED flashes	The DC input has been turned on
Red LED flashes	The DC input has been turned off

Note that the DC input will not necessarily turn on, even if the green LED flashes. Other conditions (low input voltage, high temperature) may prevent the DC input from starting.

3.6 Front display

3.6.1 7-segment display

The operator may push the Toggle V/A-button to show:

- The output current
- The output voltage
- Any alarms that are present. If multiple alarms are present, the Toggle V/A-button must be pressed several times to show all alarms

The display will go back to show output current (in a normal operation) or an error code (in shut down) after 10 seconds.

The description of the error codes are found section 9.1.

The upper left decimal dot:

- Turns on if the unit is master in current sharing
- On a single unit with default settings this dot will turn on a few seconds after startup
- When several units are connected in parallel with current share cables, only 1 unit (per power group) will have this dot on

The lower right decimal dot:

- Normally dark
- If the Display-button is pressed to show output voltage, this dot will turn on to indicate that voltage is shown, not current.

It is also possible to have the upper two dots flash alternately by sending a command to the unit (used to identify the unit if several units are connected to a computer).

3.6.2 Indicators

The LED indicators with function are described in the table below.

LED	Description
Green	No error conditions present, and the unit is operating
Green flashing	No error conditions present, and the unit is operating. Alternate current limit is active. See section 11.1.
Red	There are one or more error conditions preventing the unit from starting. If the operator has pressed the DC OUT ON/OFF-button, this is considered to be an error condition.
Red flashing	The unit has a warning present (C2 to CF). Red flashing overrides red solid.
Yellow	Unit is in current limit (C1), or in the process of starting up (C0).

Firmware revision L and older had different LED control (units manufactured before approx. August 2012):

LED	Description
Green	No error conditions present, and the unit is operating
Red	There are one or more error conditions preventing the unit from starting. If the operator has pressed the DC OUT ON/OFF-button, this is considered to be an error condition.
Yellow	One or more cautions are present.

NOTE: The text on the red LED indicator was different on older units. See section 3.3.

3.6.3 Indicators (Dual Input)

PSBC Dual Input has 3 additional LED indicators:

LED	Description
Green	The DC input is ready
Red	There are one or more error conditions preventing the DC input from operating. If the operator has pressed the DC ON/OFF-button, this is considered to be an error condition.
Yellow	The maintenance charger is charging

3.7 Mounting instructions

PSBC is equipped with 8 mounting holes (4 on each side) in the back plate and 6 mounting holes (3 on each side) on the front. The holes are threaded for M5 mounting bolts with maximum tread length of 18mm, see drawing P01D18. Standard brackets are available for both front and back plates.

3.8 Operating instructions

3.8.1 General

PSBC has a default set of settings at delivery. See section 5 for details about how to change the settings.

WARNING

All PSBCs connected to the same RS-485 bus (by using parallel cables) MUST have the negative pins of DC outputs connected together.

WARNING

When connecting or disconnecting the AC input or DC output cable, always make sure that the unit is shut down (green LED not lit), either by turning off the circuit breaker or by pressing the DC OUT ON/OFF-button.

DANGER

It is VERY IMPORTANT that if several PSBCs are using active current sharing, the DC outputs of all the PSBCs must be connected together at all times. If not, an overcharge of the batteries can occur with acid leakage and explosive hazard. See section 8 for details.

3.8.2 Mounting PSBC

(1) Consult battery manufacturers' technical data sheet for recommended charging voltage. Check that the output voltage of the PSBCs are set to value recommended by battery manufacturer. Adjust the output voltages if necessary, as described in section 5. If temperature compensated charging will be used, see section 8.3.

(2) Fasten the PSBCs in the mechanical fixture. Make sure that all bolts are fastened.

(3) Fasten a grounding wire (minimum 2.5mm^2 copper wire or equivalent) with the nut in front. Use separate grounding wires for every PSBC.

(4) Make certain that both the air inlet at the back of PSBCs and the exhaust opening at the front are free of obstructions to the airflow.

(5) Make certain the AC circuit breakers are in "OFF" position.

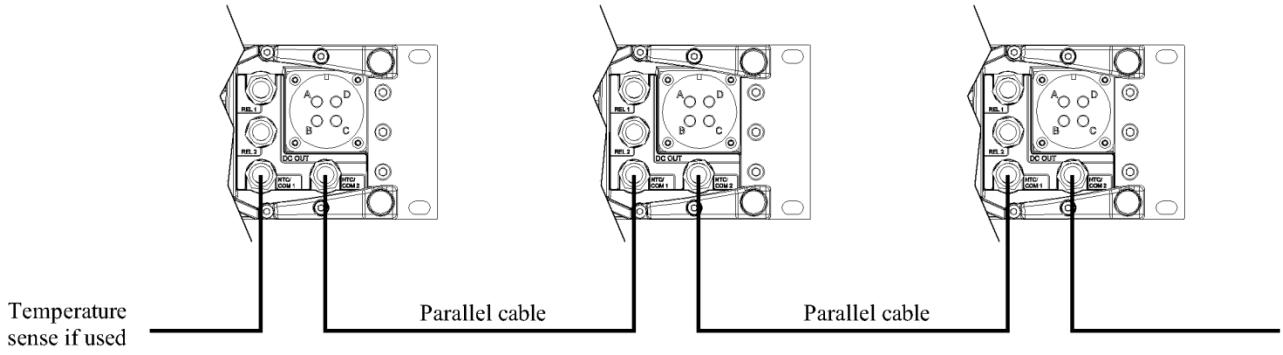
(6) Connect the AC input cables. Connect the DC output cables, make sure the polarity is correct. Make sure that the connectors are properly tightened.

(7) If active current sharing is required, daisy-chain together all the PSBCs via the NTC/COM1 and NTC/COM2 using current share cables. Termination resistors are rarely required, but if very long parallel/communication cables are used, termination resistors may be required. The NTC has a termination resistor built in, so when the NTC is used the chain is already terminated at one end. Cables and termination resistors are supplied by RIPEnergy.

(8) Connect the NTC cable (if used) to the NTC/COM connector (1 or 2). Make sure that the NTC has good thermal connection to the battery, the positive or negative terminal is normally a good choice. When several units are daisy changed, the NTC must be connected to one end of the chain. The NTC is supplied by RIPEnergy.

(9) Turn the AC circuit breakers to the "ON" position. The PSBCs will be fully operational within 5 seconds.

(10) The installation is now complete and the PSBCs are ready for use.



No configuration is required for operating several PSBCs in parallel. For details about active current sharing, see section 8.2.

NOTE: RIPEnergy can supply parallel cables. On the standard parallel cable the shield is terminated at one end only. Cables with shield terminated at both ends are also available. In some cases the doubly terminated cable will result in better EMC. However, there is a risk in using doubly terminated cables. The safety ground currents and the DC output current may (partly) flow in the parallel cable shield, and cause problems. If using doubly terminated cables, verify that these issues do not cause any problems. If you are unsure, use cables terminated on one end only.

WARNING

All PSBCs in a system must be connected through the RS-485 cables to share the load current equally. PSBCs connected to same load without being daisy-chained will not share the load and will not have temperature compensation of output voltage, even when a NTC is connected, but otherwise they will be fully operational. There is a risk of malfunction and danger for the batteries if PSBCs in a system are connected together with the RS-485 without the DC Output cables connected together. RIPEnergy recommends that the DC output cables are similar (length and cross-section), as this will make system response to load changes better.

3.8.3 3-phase operation

If several units are connected in a delta configuration to a 3-phase grid, no special considerations are needed.

If several units are connected in a star configuration to a 3-phase grid, the neutral wire from the grid must be used. It is not permissible to use a star configuration on a grid that does not have a neutral conductor.

In all cases the voltage seen by the units must be within 99-276Vrms.

It is recommended to use active current sharing to balance the load on each phase. Note however, that active current sharing does not necessarily share current for dynamic loads, only average current is shared. After a significant load change, it may take up to one minute for the active current sharing to equalize the load currents.

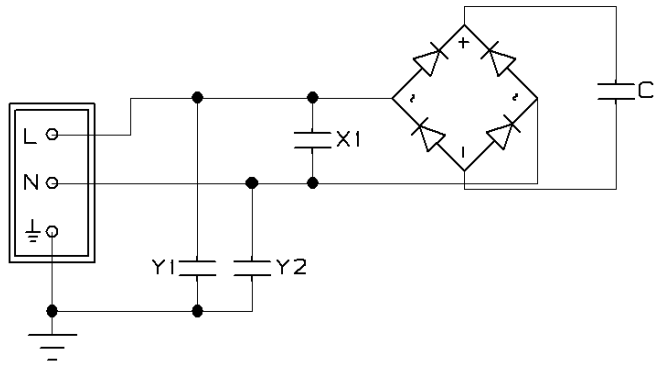
3.9 Description of filters

This section is a simplified overview of the filters used. Only capacitances line-to-line and line-to-chassis are included. Capacitors after inrush limiter circuitry are not included.

All capacitance values are nominal, and have ±20% tolerance.

All ground symbols refers to the PSBC chassis.

3.9.1 AC input filter

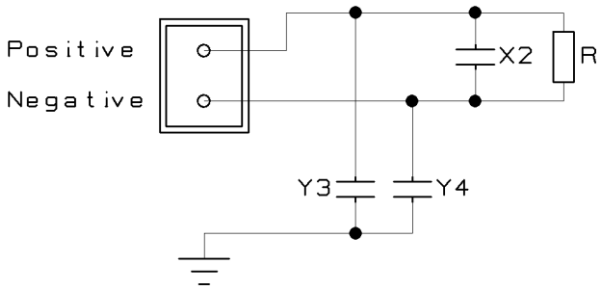


Component	Value
Y1 and Y2	73 nF
X1	10.7 µF
C	4.4 µF
X1+C	15.1 µF

For inrush calculations, use X1+C as capacitance.

For reactive current calculations, use only X1.

3.9.2 DC output filter

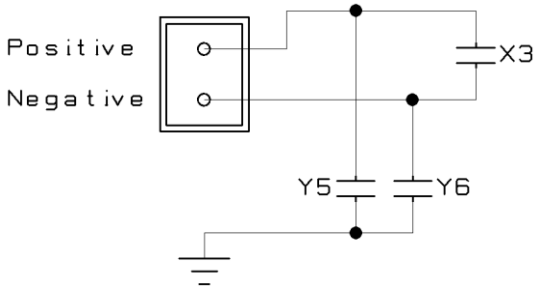


Component	Value
Y3 and Y4	6.3 µF
X2	30 µF
R	See table below

Resistor R represent the leakage of the DC output when the unit is shut down.

Nominal output voltage of unit	Approx. value of R	Approx. leakage current at nominal voltage
28V	10kΩ	2.8mA
48V	25kΩ	1.9mA

3.9.3 DC input filter (Dual Input only)



Component	Value
Y5 and Y6	2.36 µF
X3	220 µF

3.10 Change of fan

PSBC is equipped with a fan blowing air through the cooling channel.

A change of fan can be performed in field:

(1) Remove the fan guard by unscrewing the 4 screws.

(2) Disconnect the fans DC supply connector.

(4) Install the new fan and the fan guard in the opposite sequence. Make sure the cables do not obstruct the fans. Make sure that the cable is not squeezed between the main housing and the fan housing.

3.11 DC output overvoltage protection

The DC output is protected from over voltages caused by a malfunction of the PSBC. The protection circuitry shuts down the unit if the DC output voltage rises above these levels:

Nominal output voltage of unit	OVP level
28V	36.0V to 37.3V
48V	65.0V to 73.0V

3.12 Idle current consumption, AC input

This is the same for all PSBC models when running from AC.

When turning the unit off with the toggle switch, both line and neutral are disconnected, so the current/power is zero.

AC input current/power under these conditions:

- The AC toggle switch turned on
- The unit is turned off with the DC OUT ON/OFF button
- The fan is not running

AC voltage	Line current @ 50Hz	Line current @ 60Hz	Power
120V	0.36A	0.43A	4.3W
240V	0.70A	0.84A	4.5W

These values are typical, and not guaranteed. With the fan running at max speed, add around 0.1A and 20W.

Most of the current is reactive. This is mainly caused by the capacitors in the AC filter.

3.13 Idle current consumption, DC input (Dual Input only)

DC input current/power under these conditions:

- The AC toggle switch turned off, or AC is disconnected
- The DC input unit is turned off with the DC IN ON/OFF button

Part number	Description	Input power/current Independent of input voltage
807105	PSBCDI-Mil 12V	110mA
	PSBCDI-Mil 24V	3.5W
	PSBCDI-Mil 36V	4W

These values are typical, and not guaranteed.

4. RS-485 bus

The PSBC has a RS-485 bus. This can be used to control and monitor the unit:

- Output voltage and current limit can be set
- Unit can be turned on and off
- Fan speed can be controlled
- Display and alarm relays can be controlled
- Current status can be read (Error codes, output voltage, input voltage, internal temperature, battery temperature etc...)
- All setup of PSBC can be done over this bus

PSBC has a simple proprietary protocol. This protocol is used for communication between several units, and for communication with external equipment.

Documentation of this protocol is available from RIPEnergy.

5. How to configure the unit

There are three ways to configure the units:

- By using the front panel (see section 5.1)
- By using the PSBC Config Utility (see section 15.4)
- By sending commands over the RS-485 bus (see section 3.13)

If the front panel is used, only a small subset of the parameters can be changed. All parameters can be changed by using the PSBC Config Utility or sending commands on the RS-485 bus.

RIPEnergy recommends using the PSBC Config Utility to configure PSBC, as the front panel method has these limitations:

- The front panel can only configure a small subset of the parameters
- All other parameters will keep their existing values
- It is not possible to reset all settings to default values
- The front panel interface is quite cryptic

5.1 Front panel setup

To enter the configuration mode:

- Turn off the unit with the circuit breaker
- Wait until the display is shut down
- Press and hold both the DC OUT ON/OFF and Toggle V/A-button
- Turn on the unit with the input power switch
- Release both the DC OUT ON/OFF and Toggle V/A-button immediately after the display lights up

You will now see a short sequence on the display to indicate that you are entering the configuration mode. After this sequence, a number is shown in the display. This is the firmware revision. 1= revision a, 2 = revision b and so on. Press Toggle V/A to enter configuration mode.

The following parameters can be adjusted:

Parameter	Description	Description
P1/P2	Nominal output voltage	See section 7.1.1
P3	Current limit	See section 7.1.2
P4/P5	AC input	See section 7.2
P6	Active current sharing	1: Unit is set as automaster 2: Unit is set as slave 3: Unit is set as master 4: Unit does not participate in current sharing See section 8.2
P7	Power group	1-15 See section 8.1
P8	3-stage mode	See section 10.3.1
P9	NTC mode	See section 8.3.4

Since there are only two digits on the display, some values have been split into two parameters.

Nominal output voltage is on the form XX.YY, where XX is P1 and YY is P2.

Example: To select 27.50V, set P1 to 27 and P2 to 50.

Minimum input voltage is on the form XXY, where XX is P4 and Y is P5.

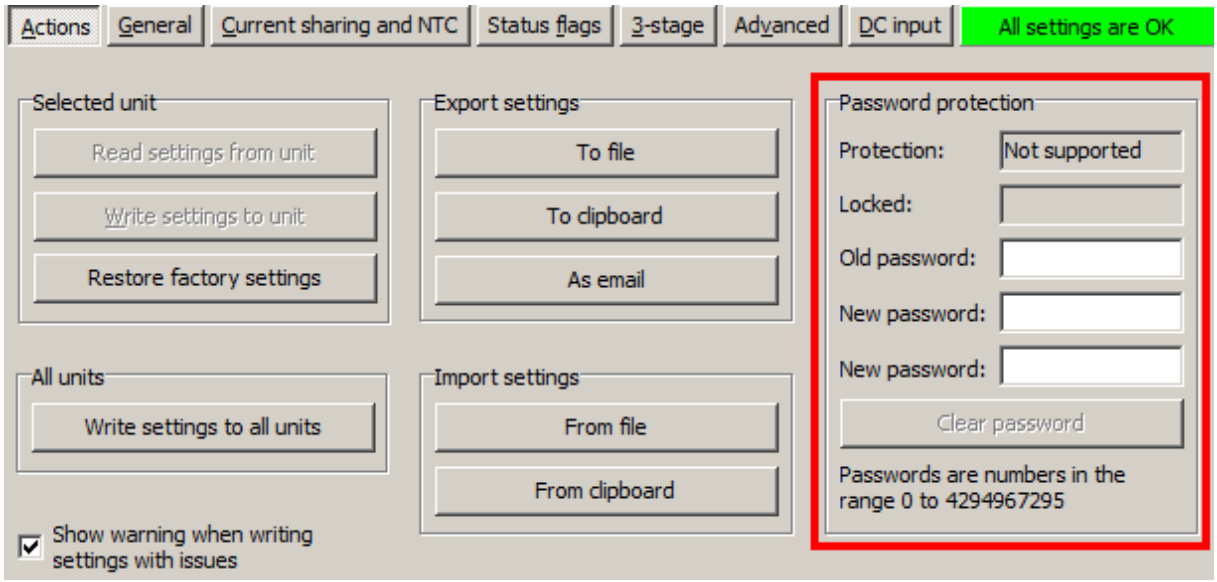
Example: To select 185V minimum input voltage, set P4 to 18 and P5 to 5.

For each parameter to adjust:

- Press Toggle V/A until the parameter to be changed is shown
- Then press DC OUT ON/OFF-button once to show the current value. Press DC OUT ON/OFF repeatedly to select new value. Hold DC OUT ON/OFF to fast forward through values
- When the parameter has the correct value, press Toggle V/A to store the value

Exit configuration mode by either holding the Toggle V/A-button for 2 seconds (display must show P1-P9), or by turning the unit off with the power switch and waiting until the display turns off.

6. Password protection



It is possible to password protect the settings and the firmware, so that the settings and the firmware can't be changed without knowing the password.

WARNING!

If you password protect the PSBC, and then forget the password, the PSBC must be serviced by RIPEnergy personnel. It is not possible for the end user to remove or change the password without knowing the current password.

6.1 Description

Glossary:

Term	Explanation
Password	A number in the range 0 to 4294967295
Protected	The unit has a password other than zero
Locked	The unit is protected, and has not yet received the correct password

If the unit is password protected, the password must be provided when you:

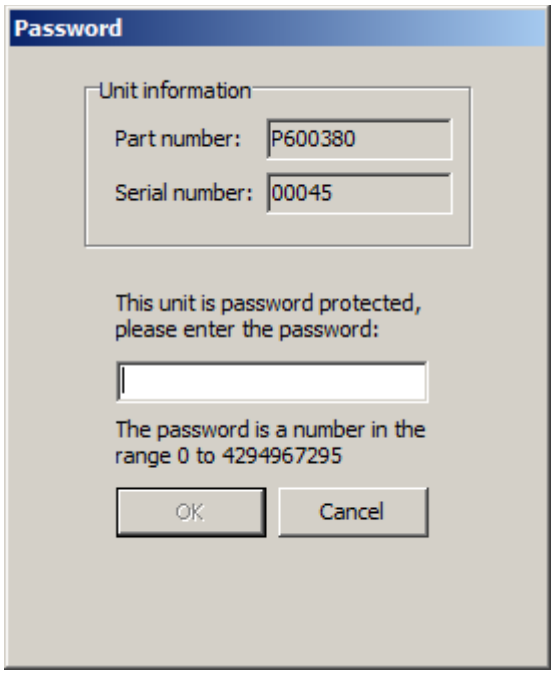
- Write new settings (it is always possible to read out the current settings)
- Update the firmware
- Want to change or clear the password

Also, the front panel setup is disabled on a protected unit. Note that the front panel setup can also be disabled without setting a password, see section 7.7.3.

It is not possible to unlock a unit front the front panel.

When the PSBC starts up, it is locked if it is protected.

The PSBC Config Utility will ask for the password if needed:



If you send the wrong password, you can retry infinitely many times.

When the password is accepted, the unit is unlocked, and it is now possible to write new settings and update the firmware.

With the PSBC Config Utility you can modify or clear the password.

6.2 Some recommendations

Do not use the password protection feature unless you really need it.

If you only want to prevent accidental changing of settings or firmware, use a weak password, e.g. one digit only. This makes it easy to guess the password if it is lost.

If you also want to prevent intentional changing of settings or firmware, use a stronger password, e.g. at least 4 digits. If we assume that a user can enter a new password every 2 seconds, it will take on average 3 hours to find a 4-digit password.

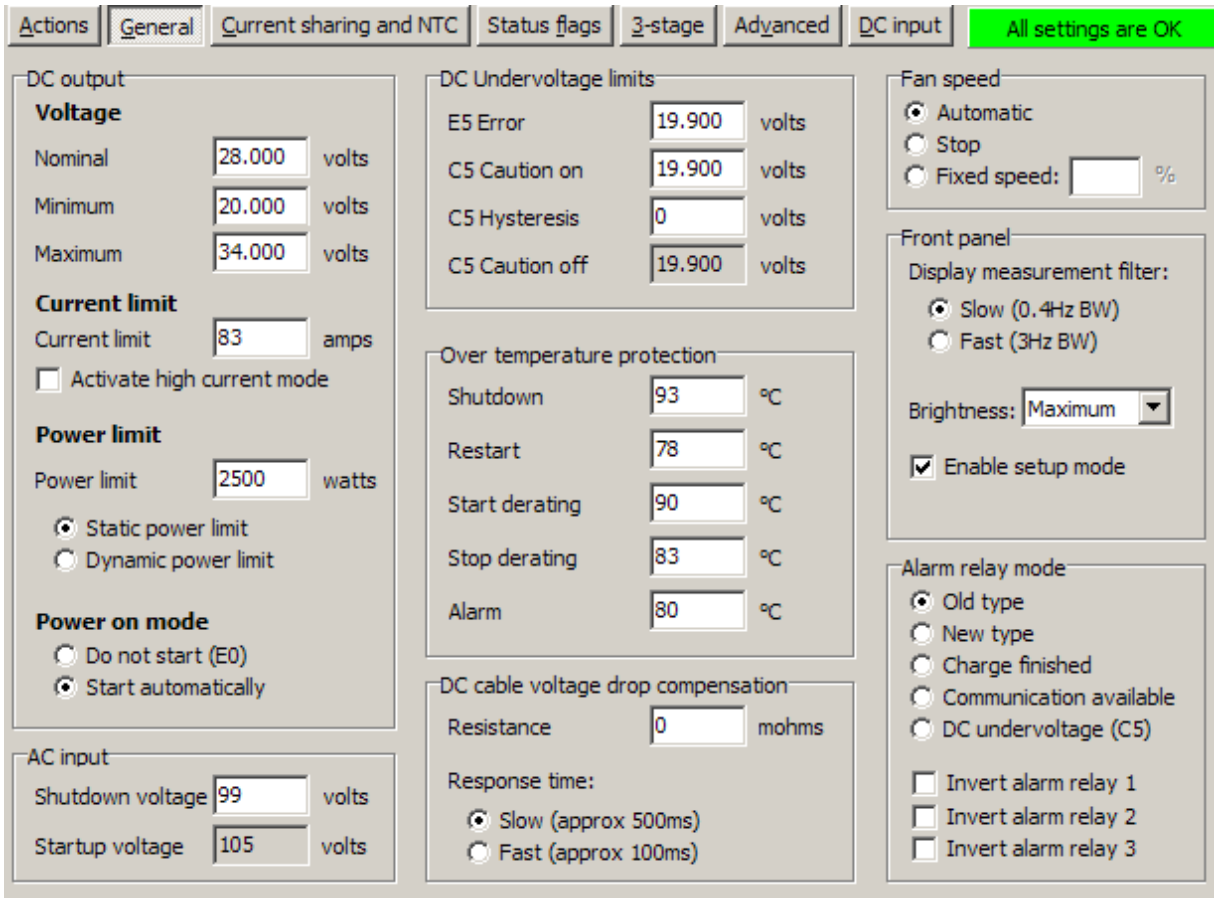
If you also want to prevent someone from guessing the password by making software that quickly sends password to the unit, use this table to select your security level:

Digits	Average time to guess password
2	5 seconds
3	1 minute
4	8 minutes
5	1.4 hours
6	14 hours
7	6 days
8	2 months
9	1.6 years

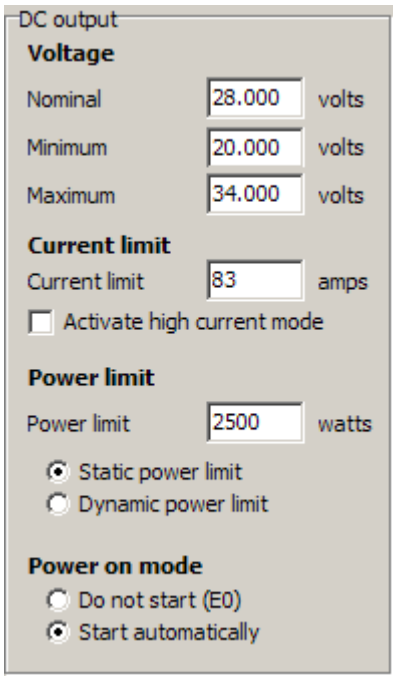
This table assumes that 10 password are checked every second. This is approximately the maximum number of messages that the PSBC can process per second.

If you are password protecting many units, either use the same password for all the units, or make a simple system so that the password can be calculated from the serial number of the unit.

7. General settings



7.1 DC output



7.1.1 Voltage

Settings	Description
Nominal output voltage	This is the nominal output voltage. This setting may be adjusted by the following functions: • Active current sharing (section 8.2) • Temperature compensated charging (section 8.3) • DC cable voltage drop compensation (section 13)
Minimum/maximum output voltage	Sets the limits for output voltage. No matter what combination of values is chosen for nominal output voltage, current sharing etc, the output voltage will never be set outside min/max.

7.1.2 Current limit

See section 14 for details about how the PSBC selects the current limit.

Settings	Description
Current limit	This is the current limit for the unit.

High current mode

If high current mode is activated, the unit will at start up selecting the maximum current limit (not the specified current limit).

If the actual load current is more than the user selected current limit, a 5 minute timer is started.

When this timer runs out, the current limit is reduced to the user specified current limit, and a 15 minute timer is started.

When this timer runs out, the current limit is again increased to the maximum current limit.

Notes:

- It does not matter how long the load current is above the user specified current limit, the two timers will always run for 5 and 15 minutes.
- Only the current limit is modified. The power limit is not affected by activating the high current mode. Make sure that you have selected a power limit high enough for the high current mode.
- When the chassis temperature is above 70 ºC, the high current mode is automatically deactivated.

7.1.3 Power limit

Using this function guarantees that output power is never above the power limit. Note that the maximum AC input power will be somewhat higher than the selected power limit, because of the efficiency of the unit.

Glossary for this section:

Term	Definition
U_{ref}	The output voltage reference, after adjusting for NTC temperature, active current sharing etc. But before adjusting for power limit.
I_{ref}	The current limit, after adjusting for derating, high current mode etc. But before adjusting for power limit.

Static power limit

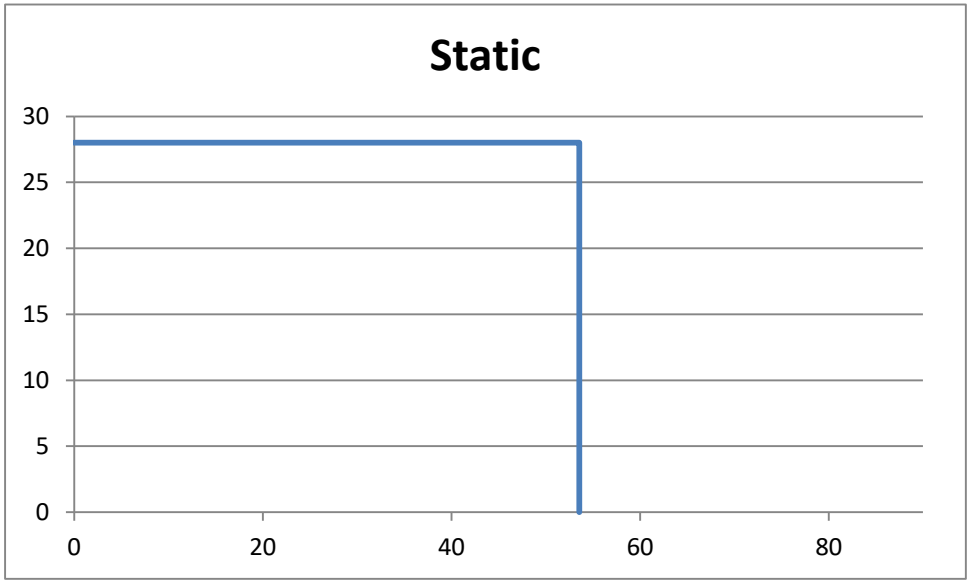
If the U_{ref} and I_{ref} results in a maximum power above the power limit, the current limit will be reduced:

$$I_{ref} = \frac{\text{Power limit}}{U_{ref}}$$

Note that this mode does not increase the current limit if the output voltage is lower than U_{ref} because the load is pulling the output voltage down.

Example

Output characteristic with output voltage 28V, current limit set to 83A, power limit set to 1500W:

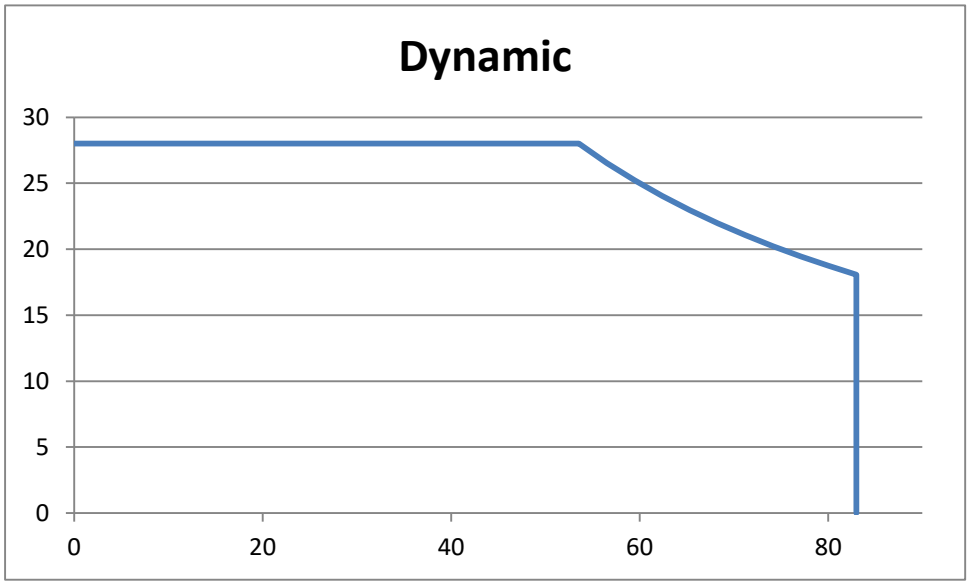


The output power is 1500W at the corner of the graph. As the output voltage is pulled lower by the load, the output power is reduced.

Dynamic power limit

Dynamic power limit is similar to static, except that as the output voltage becomes lower because of the load, the current limit is dynamically increased.

Output characteristic with output voltage 28V, current limit set to 83A, power limit set to 1500W:



The output power is 1500W in the curved section of the graph. Only when the output voltage is pulled lower than 18V by the load is the output power reduced.

Note that this mode does not respond very fast to load changes. During load changes the output power may be lower for a few hundred milliseconds.

This mode is suitable for charging batteries. When the battery is deeply discharged, the charge current is increased compared to Static mode.

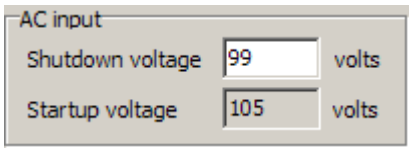
NOTE: If the load is constant power (it increases the input current as the voltage is reduced), the dynamic mode is not recommended.

7.1.4 Power on mode

If “Do not start” is selected, the unit will not automatically start up when the input voltage is applied. The operator must press the DC OUT ON/OFF-button, or a start command must be sent on the RS-485 bus.

If “Always start” is selected, the unit will automatically start up.

7.2 AC input

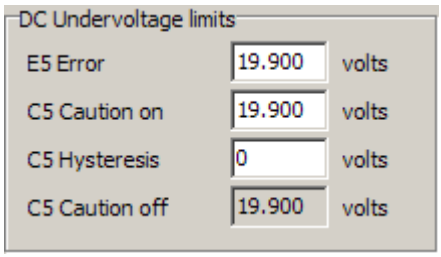


If the input voltage drops below the shutdown voltage, the unit will shut down. If the input voltage increases above the startup voltage, the unit will start up.

The shutdown voltage range is 99 to 249V.

The startup voltage is fixed at 6V above the shutdown voltage, and is not editable.

7.3 Undervoltage limits



NOTE: This functionality is only active while PSBC is operational. Neither alarms will be active when PSBC is in shutdown.

7.3.1 Error E5

If the status flag E5 “Output undervoltage” is enabled, the PSBC will shut down if the output voltage is below the "E5 error" value for more than 1 second. This can be used as an overload shutdown.

Unless E5 is set to latching, the PSBC will start up again immediately.

7.3.2 Caution C5

The caution C5 “Output undervoltage” will turn on if **all** of these conditions are present:

- Status flag C5 “Output undervoltage” is enabled
- The DC output is on
- The output voltage is below the "C5 caution on" value

C5 will turn off if **any** of these conditions are present:

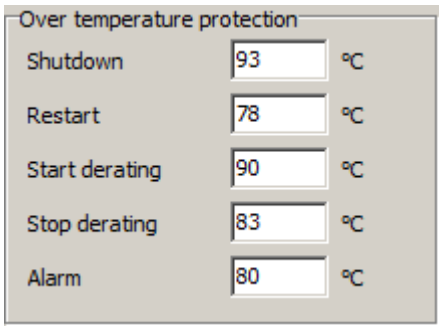
- The DC output is off (unit is in shutdown)
- The output voltage is above the "C5 caution off" value

The "C5 caution off" value is the sum of the values "C5 caution on" and "C5 hysteresis".

Even if E5/C5 are not enabled, the undervoltage limits must be set and be within min/max values.

NOTE: There is no 1 second delay on C5, as there is on E5.

7.4 Over temperature protection



Glossary for this section:

Term	Description	Default value	Valid range
Shutdown temperature	The temperature that the unit will shut down	93 ºC	-128 to 93 ºC
Restart temperature	The temperature that the unit will start up	78 ºC	-128 to 92 ºC
Start derating temperature	The unit will enter derating mode above this temperature	90 ºC	-128 to 127 ºC
Exit derating temperature	The unit will exit derating mode below this temperature	83 ºC	-128 to 126 ºC
Alarm temperature	Alarm C4 will be activated above this temperature	80 ºC	-128 to 127 ºC
DCL	Derated Current Limit	See table below	

Additional restrictions:

- The restart temperature must be lower than the shutdown temperature
- The exit derating temperature must be lower than the start derating temperature

Note that the alarm temperature can be set higher or lower than all the other temperature limits. So it is possible to have the alarm trigger at a higher temperature than the shutdown temperature. And if the derating temperature is set higher than the shutdown temperature, derating is effectively disabled.

DCL for the different PSBC variants:

PSBC	**DCL**
PSBC-Mil 2400 AC/DC	65 amps
PSBC-Mil 1200 AC/DC PSBCDI-Mil 1200	33 amps
PSBC-Mil 2400/48 AC/DC	33 amps
PSBC-Mil 2000/80 AC/DC	20 amps

The DCL is not adjustable.

The PSBC is protected against overheating. The protection works in three stages:

Alarm: When the chassis temperature exceeds the alarm temperature, caution C4 is activated. This is an alarm only, the PSBC does not change behavior at this stage.

Derating: When the chassis temperature exceeds the start derating temperature, caution C7 is activated. If the current limit is set to a level higher than DCL, the current limit is reduced to DCL. Note that if the load current is already below DCL, the only consequence is that caution C7 is activated.

Shutdown: When the chassis temperature exceeds the shutdown temperature, error E4 is activated and the PSBC will shut down.

If the current limit is set to the DCL or lower: there will be no derating. However, caution C7 is still activated when the chassis temperature exceeds the start derating temperature. This can be used as a warning that thermal shutdown is imminent.

If caution C7 is disabled, all the derating functionality is disabled. The unit will deliver full power up to the shutdown temperature.

7.4.1 Firmware revision S and older

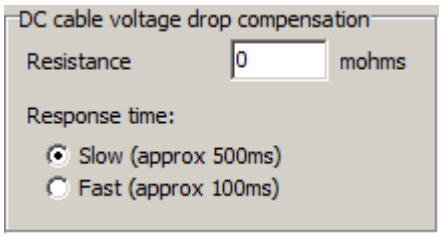
The derating logic was improved in firmware revision T. Operation in revisions up to and including S:

PSBC	Difference
PSBC 2400	When the output current is less than approx. 70 amps, there is no derating. The unit will bypass the derating stage and go straight into shutdown. Even at full load, there is no guarantee that all units will enter derating before shutting down.
PSBC 1200	There is no derating functionality. The unit will bypass the derating stage and go straight into shutdown.

No other PSBC variants has been delivered with revision S or older.

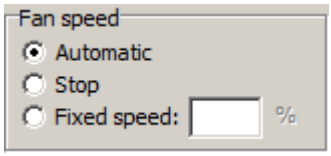
If it is required that the unit enters derating before shutting down, upgrade to firmware T or higher.

7.5 DC cable voltage drop compensation



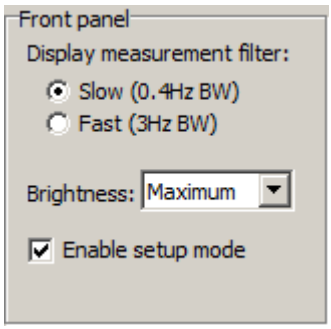
See section 13.

7.6 Fan speed



Use this if you want the fan to run at a fixed speed, or if you do not want the fan to start automatically.

7.7 Front panel



7.7.1 Display measurement filter

The filter bandwidth used for the current/voltage indication can be selected between 0.4Hz and 3Hz.

7.7.2 Brightness

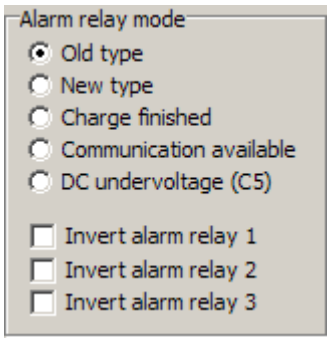
The front panel display can be dimmed, or turned completely off. The 1 second LED test at startup is always at full brightness.

NOTE: At the lowest brightness settings, the refresh rate is low. Some users may observe an unstable display.

7.7.3 Enable setup mode

If front panel setup is enabled, the user can change settings as described in section 5.1.

7.8 Alarm relay mode



See section 3.4.6 for pinout and relay ratings.

7.8.1 Modes

This table lists the conditions that turns on (closes) the three alarm relays:

Alarm mode	Name	Available from firmware	Alarm relay 1	Alarm relay 2	Alarm relay 3
0	Old type	G	Any caution is active	Unit is shut down	Unit is operational
1	New type	M	The caution C0 or C1 is active	Any of the cautions C2 to CF are active	
2	Charge finished	M	The 3-stage charging is in the float stage, and the unit is operational		
3	Communication available	X	Communication is available (internal electronics is active)		
4	Output undervoltage	30	The caution C5 is active		

The old type is default, and the others are selectable.

7.8.2 Inverting the alarm relays

This functionality was introduced in firmware revision 30.

Each alarm relay can have inverted functionality. This means that the relay changes from normally open to normally closed.

NOTE: This only inverts the relays as long as the internal electronics has power (AC voltage above approx. 40V). When the internal electronics shuts down (display goes dark), all three alarm relays will always be open, independent of all settings.

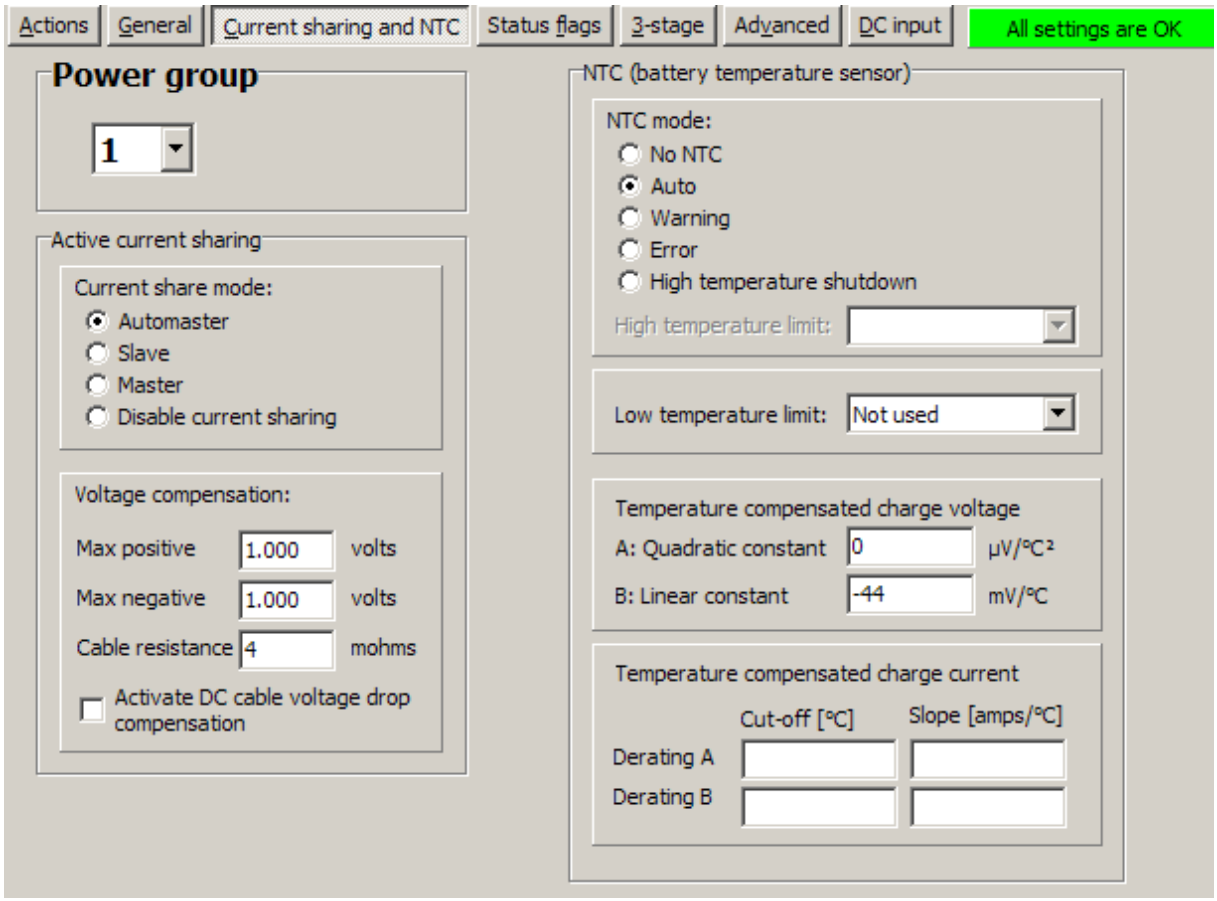
7.8.3 Additional alarm relays on Dual Input variants

See section 3.4.9 for pinout and relay ratings.

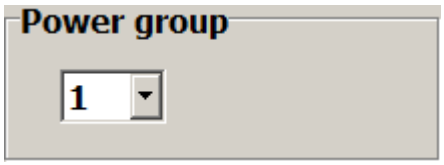
There are no selectable alarm modes on the DC input section.

Relay	Closes when
Alarm relay DI 1	There is a caution present
Alarm relay DI 2	DC input is ready (same as green LED)

8. Current sharing and NTC



8.1 Power group



It is possible to have several “groups” of PSBCs connected to the same bus, and have active current sharing within each group.

Each power group will have each own current share master, and the slaves in each power group will ignore messages coming from the masters in the other power groups.

All units are assigned to power group 1 as default. Up to 15 power groups can be set, but it is not recommended to have more than 3 power groups active on the same bus.

Example:

- Three PSBCs are connected in parallel to charge a battery, and active current sharing is required
- Two more PSBCs are used to power an auxiliary load. These two units must also have active current sharing
- The units that charge the battery are not connected in parallel with the AUX units
- All units must be connected to the same RS-485 bus, as there is some other equipment that needs to communicate with all 5 units
- The auxiliary load draws a constant current of 100A

Here is an example of what may happen unless power groups are used in this situation:

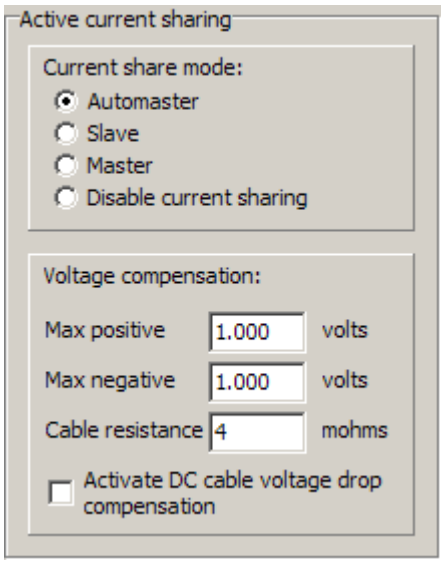
Assume that one of the AUX PSBCs is acting as master.

The current share master will report 50A (half of aux load of 100A). As the batteries are charged, the charge current will after a while go towards zero. The three charger units will see that the master has a higher current, and adjust the output voltage up to try to equalize the load currents. After a while the three charger units will have adjusted the output voltage to the maximum (which is default 1V up). The charging voltage is now higher than it should be, and the batteries are overcharged. This can cause acid leakage and explosive hazard.

Other unwanted behavior will also be seen, depending on which units is master, and which units have high/low load.

In the example above, power groups must be used. The three charger units can be assigned to power group 1, and the two aux units can be assigned to power group 2.

8.2 Active current sharing



For the setting “Activate DC cable voltage drop compensation”, see section 13.

8.2.1 Overview

Active current sharing is used to make sure that multiple PSBCs connected in parallel share the load current equally. This is achieved by having one unit assigned as current share master, and all the other units assigned as Current share slaves. See section 3.8.2 for how to physically connect a parallel system.

The master periodically sends out a message containing its current. The slaves listens for these messages, and if the current on the slaves deviates from the master current, the slaves adjust the output voltage slightly to equalize the load currents.

8.2.2 Glossary/abbreviations

Term	Definition
Set up as automaster	A unit set up to be master automatically
Set up as master	A unit set up to be current share master
Set up as slave	A unit set up to be current share slave
Set up as no current sharing	A unit set up to ignore active current share altogether
Acting as master/active master	A unit that is currently acting as current share master. The unit will have the upper left dot in the 7-segment display lit.
Acting as slave	A unit that is currently acting as current share slave

8.2.3 Automatic master selection

This is the default setting, and in most situation this is preferred.

All units are set up as automasters.

With automatic master selection the units will automatically negotiate, and select one active master. This process takes 10 to 30 seconds.

If the active master for any reason shuts down, one of the other units will automatically become master. When the unit starts up again, it will join the system as slave.

8.2.4 Manual master/slave selection

If for some reason automatic master selection is not wanted, the units can be set to master and slaves manually. See section 3.13 for details about how to set up the units to master and slaves.

One unit is set up as master, and all the others are set up as slaves. The unit set up as master will always be master, and the other units will be slaves. If the active master shuts down, the slaves will no longer actively share the load current.

8.2.5 Hybrid modes

In this mode units set up as masters, automasters and slaves are mixed.

When the units negotiates for master role, then units set up as masters will always “win” over the units set up as automaster. If several units are set up as master, these units will negotiate automatically to be the active master.

If all of the units set up as master for some reason shuts down, one of the automaster units will become the active master. If a unit set up as master starts up again, it will take over the role as active master, and the automaster unit will become slaves.

Most combinations of automasters, masters and slaves are allowed. The only requirement to achieve active current sharing is that at least one unit is set up to be master or automaster. If this requirement is fulfilled, the system will always end up with exactly one active master.

8.2.6 Why use manual selection of master?

Normally, manual master/slave selection is not necessary. Here is one example where manual selection may be desired:

One unit is close to the battery/load, and another unit is connected by long cables with significant voltage drop.

If the unit with long cables is acting as master, the voltage at the load/battery will have a significant voltage drop, as the slave with short cables will lower its output voltage to share current equally.

However, if the unit close to the load/battery is acting as master, the slave with long cables will increase its output voltage to compensate for the voltage drop.

In this case the unit with short cables should be set up as master, and the other as slave or automaster.

If several units have short cables, and several units have long cables:

The units with short cables should all be set up as masters. The units with long cables should all be set up as automasters. With this setup, it is guaranteed that one unit is always acting as master, and if any units with short cables are operational, one of those will be the master.

8.2.7 Maximum/minimum voltage compensation

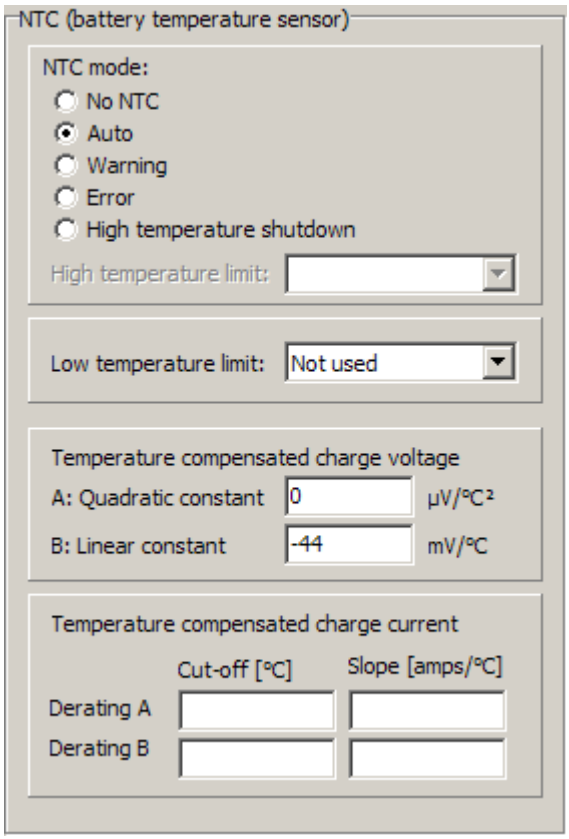
It is possible to select how much a unit acting as slave is allowed to increase or decrease its output voltage. The default is maximum 1V up or down. Maximum increase or decrease can be set individually, in the range 0 to 3V. Note that the minimum/maximum voltage set in section 7.1.1 can also limit the maximum range. Whichever limit is more strict will decide the valid range.

If there is significant and very different voltage drop in the cables from the units to a common connection, it may be necessary to increase the maximum compensation voltage.

If the output voltage needs to be very precise, it may be necessary to decrease the maximum compensation voltage.

For charging of lead-acid batteries and powering most equipment, the default value is a good compromise.

8.3 Temperature compensated charging



8.3.1 Glossary

Term	Definition
Nominal voltage	See sections 7.1.1 and 10.3.7.
$V_{MaxTemp}$	Output voltage at 85 °C battery temperature

8.3.2 General description

If temperature compensation is to be used, one and only one NTC must be used per power group. Each power group must have a separate NTC.

An NTC may be connected to either NTC/COM1 or NTC/COM2, but not both.

If several PSBCs are used in the system, all the PSBCs must be connected with parallel cables (this will also result in active current sharing).

The unit with the NTC connected will adjust its charging parameters according to the battery temperature, and also send messages to all the other units about the battery temperature.

Units without NTC directly connected will use the information in the NTC-messages to adjust the charging parameters.

The NTC is functional in the range -65 °C to +125 °C. An NTC below -65 °C will be seen as a missing NTC. An NTC above +125°C will be seen as a shorted NTC.

NOTE: An NTC cable that is damaged so that there is no connection to the NTC will be seen as a disconnected NTC.

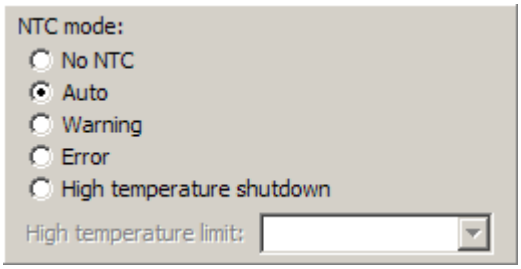
8.3.3 Max length of NTC cable

If the NTC cable has high resistance, the PSBC will measure the battery temperature incorrectly. The error is higher at high temperature.

With the NTC cable supplied by RIPEnergy, cables length up to 15 meters will give negligible measurement errors.

At 70 meters, the measurement will be about 5 °C wrong at +85 °C. The PSBC will read 5 °C lower than actual temperature.

8.3.4 NTC mode



Mode 0: No NTC

In this mode there is no temperature compensated charging. Any connected NTC is ignored. Any incoming NTC-messages are ignored.

Mode 1: Automatic

If the NTC is connected and operational, the units will deliver temperature compensated charging as explained below.

If the NTC is disconnected, the units will deliver nominal output voltage and charge current. No alarm is active.

If the NTC is connected but has a malfunction, the units will deliver $V_{MaxTemp}$ and nominal charge current. Alarm Cd is issued.

Mode 2: Warning

If the NTC is connected and operational, the units will deliver temperature compensated charging as explained below.

If the NTC is disconnected or has a malfunction, the units will deliver $V_{MaxTemp}$ and nominal charge current:

- If the NTC is disconnected, alarm CC is issued
- On all other NTC errors, Cd is issued

Mode 3: Error

If the NTC is connected and operational, the units will deliver temperature compensated charging as explained in mode 2.

If the NTC is disconnected or has a malfunction, the units will shut down:

- If the NTC is disconnected, alarm EC is issued
- On all other NTC errors, Ed is issued

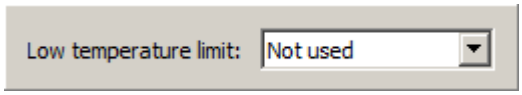
Mode 4-16: High temperature shutdown

This is the same as mode 3, except that in addition the battery temperature is monitored for over-temperature.

If the battery temperature rises above the value in the table below the units will shut down, and alarm E9 is issued.

NTC mode	Max battery temperature	
	Celsius	Fahrenheit
4	40 °C	104 °F
5	45 °C	113 °F
6	50 °C	122 °F
7	55 °C	131 °F
8	60 °C	140 °F
9	65 °C	149 °F
10	70 °C	158 °F
12	75 °C	167 °F
13	80 °C	176 °F
14	85 °C	185 °F
15	90 °C	194 °F

8.3.5 Low temperature shutdown



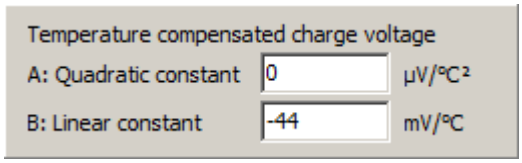
An under-temperature shutdown can be selected, from -60 °C to +10 °C, in 5 °C increments. If the function is activated, and the battery temperature drops below the selected threshold, the unit will shut down with alarm E9.

8.3.6 Temperature compensated charge voltage

Glossary for this section:

Value	Explanation
U_{NOM}	Nominal output voltage.
A	Quadratic voltage compensation, in µV/ºC^2
B	Linear voltage compensation, in mV/ºC
T	The temperature in ºC
U_{COMP}	Compensation voltage
U_T	Charge voltage at temperature T

8.3.7 How temperature compensation works



The compensation voltage is calculated with this formulae:

$$U_{COMP} = 0.000001 \cdot A \cdot T^2 + 0.001 \cdot B \cdot (T - 25°C)$$

Where:

- A (quadratic constant) and B (linear constant) are parameters selected by the user
- T is the measured temperature in degrees Celsius

NOTE: The quadratic term is added relative to 0 °C. The linear term is added relative to 25 °C. This means that if both A and B are non-zero, neither 0 °C nor 25 °C will result in nominal output voltage.

Within the range -65 °C to +85 °C the output voltage is adjusted according to the formulae above. Above +85 °C the compensation voltage is equal to the compensation at +85 °C. This is called $V_{MaxTemp}$.

Some examples with default compensation values (A=0V/°C^2 and B=44mV/°C):

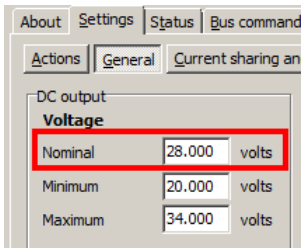
Battery temperature	Compensation voltage
-65	+3.96
-40	+2.86
0	+1.10
25	0
50	-1.10
85	-2.64
125	-2.64

If compensation results in a output voltage below minimum output voltage, voltage will be set to minimum output voltage. If compensation results in a output voltage above maximum output voltage, voltage will be set to maximum output voltage.

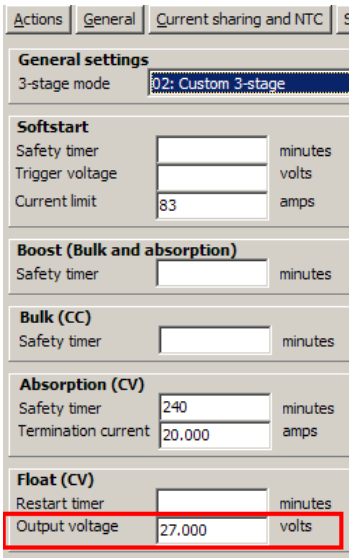
8.3.8 How to calculate nominal output voltage

This section explains how to calculate the nominal charge voltage to enter into the PSBC, based on values from the battery datasheet.

If 3-stage charging is not used, and during the bulk/absorptions stages in 3-stage charging, the nominal output voltage is this voltage:



During the float stage in 3-stage charging, the nominal output voltage is this voltage:



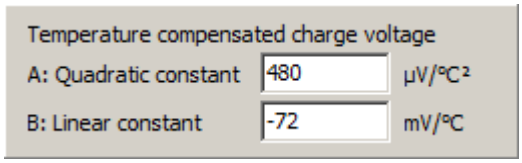
We will use Hawker/Enersys Cyclon/Genesis/Armasafe batteries as an example. According to the application manual for these batteries, the cycling (absorption) charge voltage per cell should be:

$$U_T = 0.00004T^2 - 0.006T + 2.5745$$

For a 28V battery (12 cells in series) this is:

$$U_T = 0.000480T^2 - 0.072T + 30.894$$

A and B can be used directly, only scaled for µV and mV:



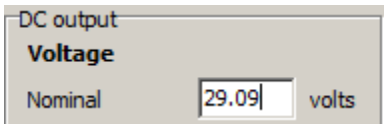
From the formulae above, we see that the charge voltage at 0 °C is 30.894V.

You calculate the nominal (boost in this case) voltage with this formulae:

$$U_{NOM} = U_T - 0.000001 \cdot A \cdot T^2 - 0.001 \cdot B \cdot (T - 25°C)$$

Any temperature can be used, but we will use T=0 °C for convenience.

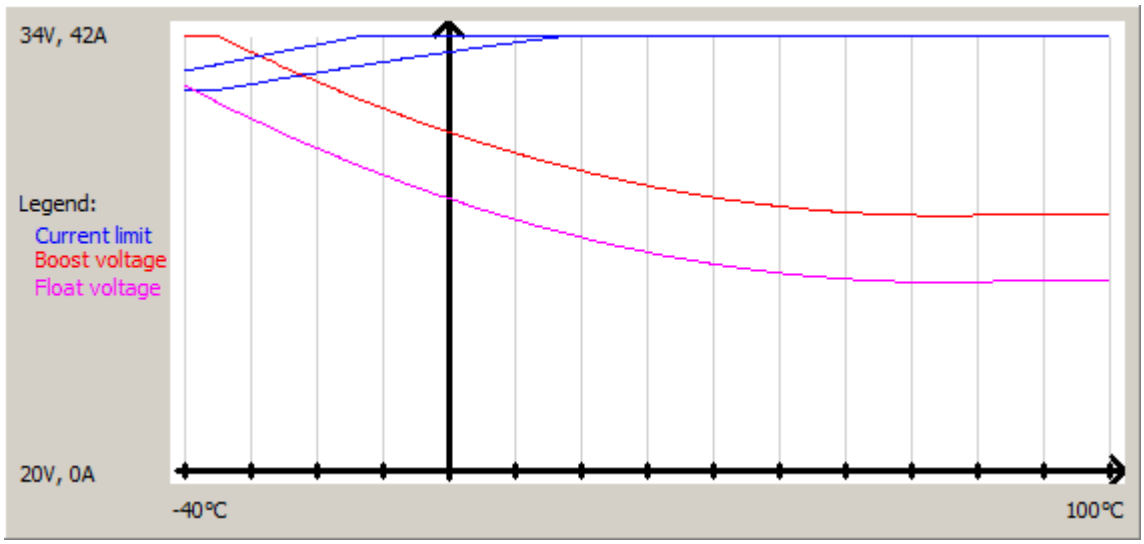
$$U_{NOM} = U_T - 0.001 \cdot B \cdot (0°C - 25°C) = U_T - 0.001 \cdot (-72) \cdot (-25°C) = 29.094$$



The calculation will have to be repeated for the float charge voltage, which equals 26.934V.

If the NTC is disconnected or faulty, the battery will now be charged correctly at 32 ºC only.

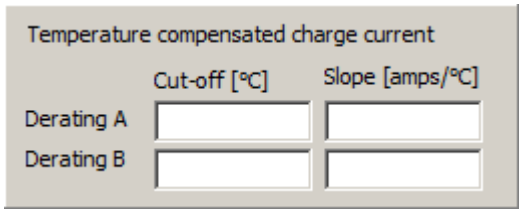
It is recommended to use the helper to check that the output voltage as function of temperature looks correct:



We also see that the output current is limited at low temperatures. This is because the charge voltage at low temperatures is so high that the power limit (section 7.1.3) limits the maximum current.

8.3.9 Temperature compensated charge current

See section 14 for details about how the PSBC selects the current limit.



It is possible to lower the current limit at high and/or low battery temperatures.

Two separate derating curves may be added. These are called derating A and derating B. Each has two parameters:

- Cut-off temperature [°C]
- Slope [amps/°C]

The cut-off temperature sets the temperature at which the current limit will be reduced to zero. The slope sets how fast the current limit will be increased from the cut-off temperature. A positive slope means that the current limit will increase with increasing temperature.

For each derating the current limit is derated according to this function:

$$Derated\ current\ limit = (Battery\ temperature - CutOff\ temperature) \cdot Slope$$

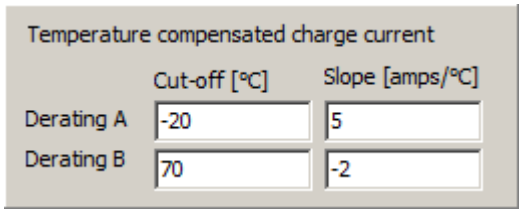
The actual current limit will be the minimum of these three values:

- Normal current limit
- Derated current limit A
- Derated current limit B

However, the charge current will not be reduced below the minimum current limit.

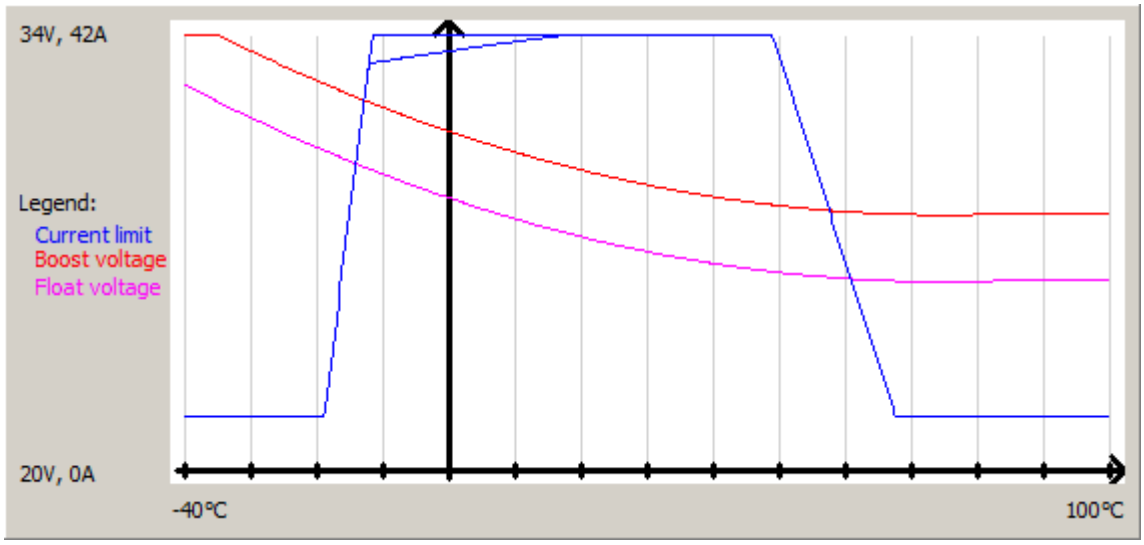
Example 1

The following values are selected:



Derating	Description
Derating A	Limits the charge current at low temperatures
Derating B	Limits the charge current at high temperatures

The charge current will now be:



The voltage is compensated with the same values as in section 8.3.8.

At temperatures between -20 °C and -12 °C, derating A is in effect. When the temperature goes down to -20 °C, the derating formulae results in zero amps (but the PSBC can't go lower than 5 amps).

At temperatures between +49 °C and +70 °C, derating B is in effect.

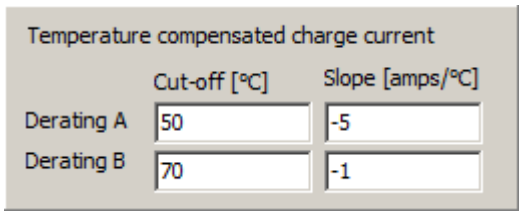
Since Slope A has a high value, the derating curve at low temperatures is steep. Slope B has a lower value, and the curve at high temperatures is not so steep.

The A and B values could be swapped, with exactly the same result.

The current limit in bulk/absorption charging is also limited by the power limit (section 7.1.3), see the tilted blue line inside the red ellipse:

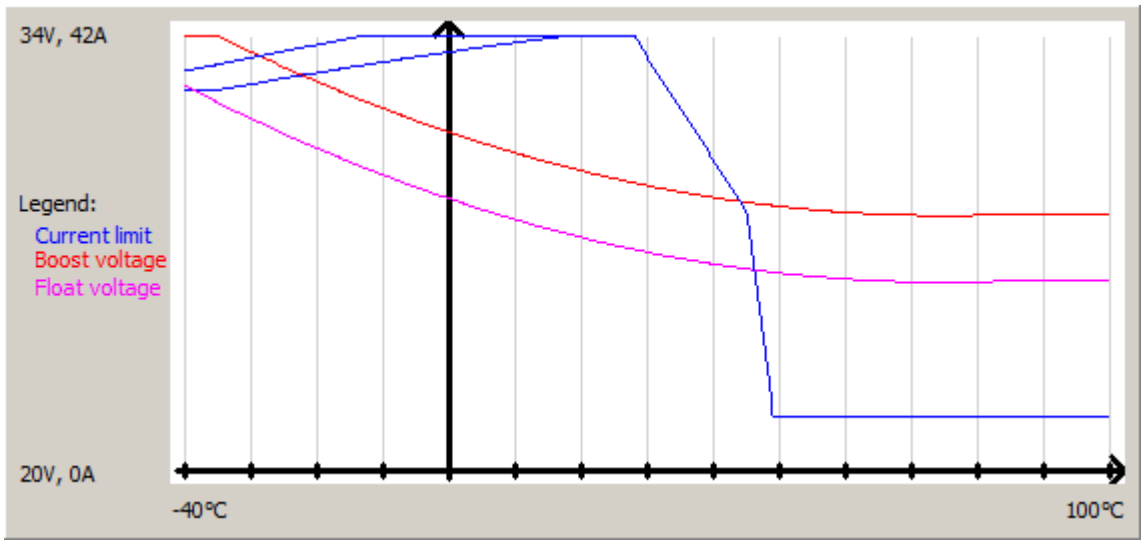
Example 2

The following values are selected:



Both derating A and B is now used limit the charge current at high temperatures. There is no derating at low temperatures.

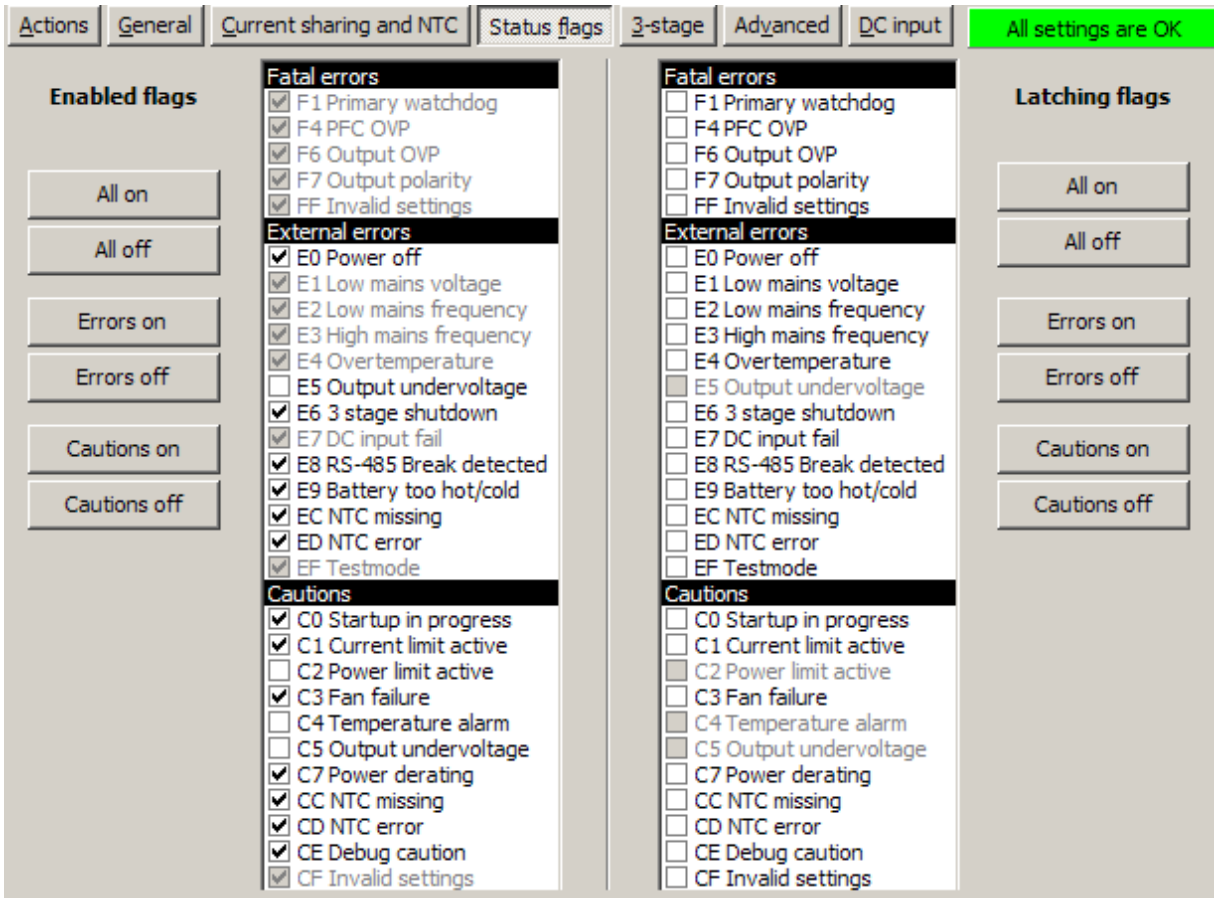
The charge current will now be:



PSBC will now start to derate the current limit “slowly” at 28 °C, and then “faster” at 45 °C.

Again, the A and B values could be swapped, with exactly the same result.

9. Status flags (error codes)



9.1 General description

The Error Codes will be shown in the display when PSBC is in an abnormal situation. The first letter in the code describes what sort of abnormality is present:

- F means Fatal Error. These errors should be rare, and will in some cases indicate that there is a problem with the unit.
- E means External Error. These are errors that are caused by something external to the unit.
- C means Caution. Cautions does not prevent the unit from starting.

For all F-errors: Turn off the input power switch, wait until the display goes out, and start the unit again. If this does not clear the error, the unit may have a malfunction. The details are found in the tables on the next pages.

Code	Input/output affected	Fatal error	Section
F1	All	The primary microcontroller has had a watchdog reset	
F4	AC input	The PFC-stage has had an overvoltage condition	
F6	DC output	The DC output has had an overvoltage condition. Make sure that there is no external power source that pulls the output voltage high.	
F7	DC output	Reverse polarity of battery connected to the DC output	
FF	All	Invalid settings are stored in non-volatile RAM. Try to write new User settings. If this does not help, the unit must be serviced	
Code		**External error**	
E0	DC output	The operator has pressed the DC OUT ON/OFF-button, or a command on the RS-485 bus has turned off the unit. Press the button to start the unit again.	3.5.2
E1	AC input	The line voltage is too low	7.2
E2	AC input	The line frequency is too low	
E3	AC input	The line frequency is too high	
E4	All	The unit has shut down due too high temperature	7.4
E5	DC output	The DC Output has a undervoltage condition	7.3
E6	DC output	3-Stage charging is in shutdown stage	10
E7	DC input	The DC input of PSBC DI is not operational. More details related to the DC input can be retrieved with the PSBC Config Utility. This error cannot occur if the unit is not a Dual Input.	
E8	DC output	RS-485 break detected	11.3
E9	DC output	The NTC indicates that the battery is too hot	8.3
EC	DC output	The NTC is missing or too cold	8.3
Ed	DC output	The NTC is shorted, too hot, or some other problem	8.3
EF		Reset is pending. The unit will shut down, and then reset	

Code		Caution	
C0		Start-up/shutdown is in progress	
C1		The unit is in current limit If this caution is disabled, this does not mean that the current limit functionality is disabled. It only means the unit ignores that the current limit is active. Do not disable this caution if 3-stage charging is used, as the 3-stage charging uses this caution to change between bulk and absorption modes.	7.1.2
C2		The unit is in power limit	7.1.3
C3		The fan has failed	3.10
C4		The unit has temperature above the warning threshold	7.4
C5		The DC output has an undervoltage condition	7.3
C7		The unit has high temperature, and the output current limit is lowered to protect itself If this caution is disabled, the derating functionality is also disabled. If the temperature rises, the unit will bypass the derating stage, and go straight into shutdown.	7.4
CC		The NTC is missing or too cold	8.3
Cd		The NTC is shorted, too hot, or some other problem	8.3
CE		(factory use only)	
CF		Invalid settings are stored in non-volatile RAM. Try to write new User settings. If this does not help, the unit must be serviced	

For the DC output to be enabled:

If the unit is not a Dual Input:

- No F-errors or E-errors can be present

If the unit is a Dual Input:

- No errors related to the DC output can be present
- Either all errors related to the AC input, or all errors related to the DC input must be not present (i.e. either the AC input or the DC input must be operational)

9.2 Configuring status flags

Many of the status flags can be individually disabled. For example, if the functionality for output undervoltage shutdown (see section 7.3) is not wanted, flags E5 and C5 can be disabled.

These error flags are critical to protect the PSBC, and can't be disabled:

- F1 Primary watchdog
- F4 PFC OVP
- F6 Output OVP
- F7 Output polarity
- FF Invalid settings are stored in non-volatile RAM
- E1 Low mains voltage
- E2 Low mains frequency
- E3 High mains frequency
- E4 Overtemperature
- E7 DC input voltage fail
- EF testmode (factory use only)
- CF Invalid settings are stored in non-volatile RAM

All errors and cautions can be individually set to latching. The latching functionality is disabled for the first 5 seconds after the unit is powered up, to ensure that no intermittent errors during startup prevents the unit from starting. After 5 seconds, any flags that are set to latch will not turn off when the error condition goes away. This can be used to prevent a unit from starting up automatically after a shutdown. To clear all the latched flags, the unit must be reset by either of these methods:

- Sending a reset command on the RS-485 bus
- Switching off the input power by using the AC circuit breaker or external power switch, and waiting for the display to go dark before switching on again

NOTE: If an alarm that is set to latch occurs during operation, there is no way to later directly determine whether the error condition is still present, or if the alarm is turned on because of a previous error condition.

9.3 Additional error codes for Dual Input

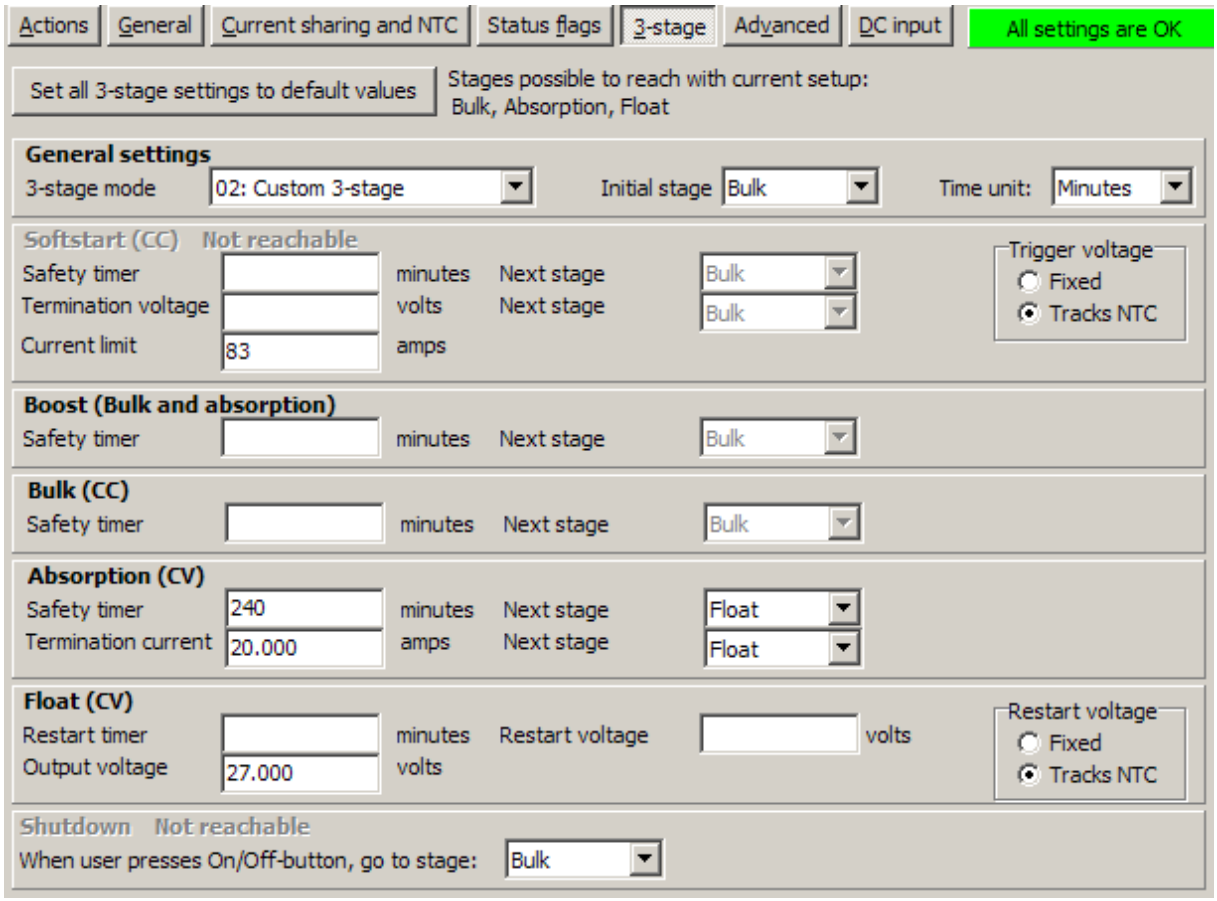
The DC input section of the Dual Input has its own set of error codes. These errors can prevent the DC input from starting and/or prevent the maintenance charger from starting.

Note that it is not possible to read out these error codes on the display of the unit. These errors are only available when querying the unit status on the RS-485 bus. Use the PSBC Config Utility to read out these errors (see section 15.4.5).

Code	Affects	Fatal error	Section
FF	Both	Invalid settings are stored in non-volatile RAM. Try to write new User settings. If this does not help, the unit must be serviced	
Code		**External error**	
E0	DC input	The DC input is disabled. Possible causes: • The operator has pressed the DC OUT ON/OFF-button • DC input undervoltage condition has turned on this error (if this function is activated) Press the button to start the unit again.	3.5.3 12.1.4
E1	DC input	The DC input voltage is too low (or wrong polarity)	12.1.1 12.1.2
E2	Both	The DC input voltage is too high	
E4	Both	The DC input has too high temperature	12.2
E9	Charger	The NTC indicates that the battery is too hot	12.3.2
EC	Charger	The NTC is missing or too cold	12.3.2
Ed	Charger	The NTC is shorted, too hot, or some other problem	12.3.2
EF	Both	Reset is pending. The DC input section will shut down, and then reset	
Code		**Caution**	
C5		The DC input voltage is lower than the set threshold. This can be used as a warning that shutdown is imminent.	12.1.3
CC		The NTC is missing or too cold	12.3.2
Cd		The NTC is shorted, too hot, or some other problem	12.3.2

There no is latching functionality or possibility to enable/disable on these errors, like there is on the errors described in section 9.1.

10. 3-stage charging

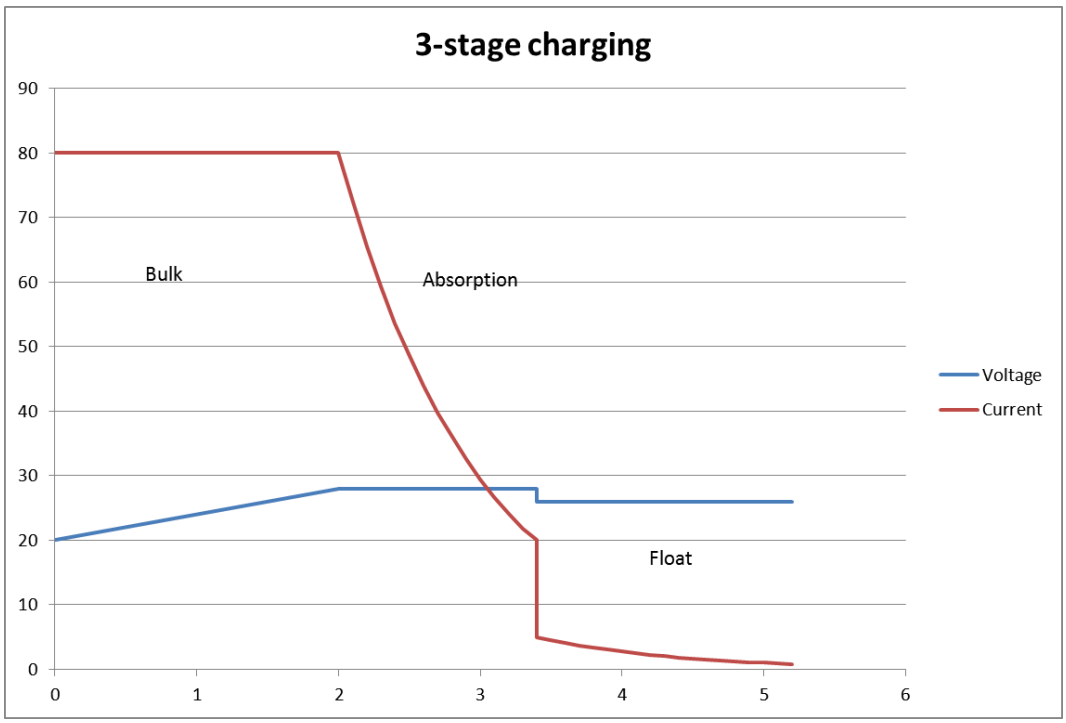


10.1 General description

3-stage charging can be very complex, so let's start with a simple example. The system is configured as follows:

- 3-stage mode 3 (see section 10.3.1) is enabled on PSBC
- A discharged battery is connected to the PSBC
- No load is connected
- PSBC is started by turning on the input circuit breaker

A typical 3-stage charging profile:



When the PSBC starts up, it is in Bulk mode (CC). In this mode, normal output voltage and current limit is active. Since the battery is empty, PSBC will enter current limiting mode (CC mode). When the battery is being charged, the battery voltage will increase slowly.

When the battery voltage increases up to the set output voltage, PSBC switches to Absorption mode (CV). In this mode, the battery charge current is controlled by the battery, not by PSBC.

When the charging current reaches a set value (20A in the example above) the battery is fully charged, and PSBC switches to Float charging (CV). In this mode, the output voltage is a little lower than in Absorption mode.

The values for the current limit in Bulk, the output voltage in Absorption and Float, and the current threshold for switching to Float can all be configured. There are also many more settings for fine tuning the charging process, and for handling errors during charging.

NOTE: The stages bulk and absorption are together termed "boost charging".

10.2 Using 3-stage charging

If two or more units are connected in parallel, active current sharing must be used to ensure correct operation. See sections 3.8.2 and 8. To ensure that active current sharing is always operational, it is recommended that no units are set to be slaves. Set all units to either automaster or master (Automatic or hybrid mode).

NOTE: All units working in parallel must have the same 3-stage settings.

3-stage charging can be combined with temperature compensated charging. See section 8.3.

10.3 Parameters

Charge current in Bulk is Current limit in section 7.1.2.

Output voltage in Absorption is nominal voltage in section 7.1.1.

Parameters below are described as if the user is using the PSBC Config Utility, provided by RIPEnergy. The valid ranges are given in the PSBC Config Utility, and in the RS-485 protocol specification.

NOTE: There are some known issues with 3-stage charging. Read all relevant items in section 16.2 before setting up 3-stage charging.

10.3.1 3-stage mode

3-stage mode	Description
1	3-stage charging is disabled
2	Custom 3-stage settings are enabled. In this mode, all settings can be specified
3 to 23	Standard 3-stage settings are enabled. In this mode, none of the 3-stage settings can be changed

Factory defaults for custom 3-stage (mode 2) is the same as mode 13.

With 3-stage mode 3 to 23, only basic 3-stage functionality is enabled:

- PSBC starts up in Bulk stage
- Absorption safety timer is 4 hours. Charger enters float charge on timeout
- Absorption termination current is 24.1% of maximum current limit. PSBC switches to float charge when the output current drops below this value
- Float voltage is set according to table below

All PSBC with the same nominal output voltage has the same float voltage for the different modes, but PSBCs with different nominal voltage has different values:

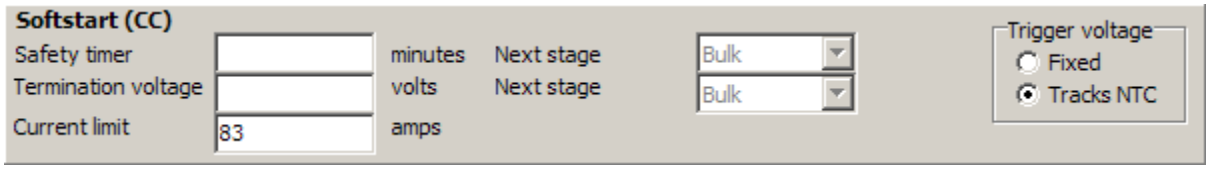
3-stage mode	Float voltage		
	28V	48V	80V
3	26.0	52.0	65.00
4	26.1	52.2	65.25
5	26.2	52.4	65.50
6	26.3	52.6	65.75
7	26.4	52.8	66.00
8	26.5	53.0	66.25
9	26.6	53.2	66.50
10	26.7	53.4	66.75
11	26.8	53.6	67.00
12	26.9	53.8	67.25
13	27.0	54.0	67.50
14	27.1	54.2	67.75
15	27.2	54.4	68.00
16	27.3	54.6	68.25
17	27.4	54.8	68.50
18	27.5	55.0	68.75
19	27.6	55.2	69.00
20	27.7	55.4	69.25
21	27.8	55.6	69.50
22	27.9	55.8	69.75
23	28.0	56.0	70.00

NOTE: If a mode other than mode 2 (custom settings) is selected, all the settings for mode 2 is still stored. If mode 2 is selected by using the front panel or otherwise, all previously selected settings for mode 2 will now be active.

10.3.2 Initial stage

This is the stage PSBC enters on startup.

10.3.3 Softstart



This stage is similar to the Bulk stage, but a lower current limit can be specified.

Safety timer

This sets the time limit for how long PSBC is allowed to stay in Softstart continuously. This timer is reset when PSBC enters Softstart.

If left blank, the timer is disabled.

If the timer is used, it must also be specified what stage the charger should switch to when the timer expires.

Termination voltage

The Termination voltage is used to change to another stage when the DC output voltage rises above this value.

If left blank, the Termination voltage is disabled.

If the Termination voltage is used, it must also be specified what stage the charger should switch to when the output voltage rises above the Trigger voltage.

If the setting “Trigger voltage Fixed” is chosen, the Trigger voltage is used as is.

If the setting “Trigger voltage Tracks NTC” is chosen, the Trigger voltage is adjusted according to the NTC (if connected).

Current limit

This sets the current limit when in the Softstart stage. Note that this is a derating function. The Softstart stage cannot increase the current limit, only lower it.

See section 14 for details about how the PSBC selects the current limit.

10.3.4 Boost

Safety timer

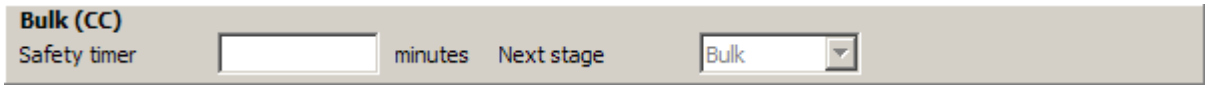
This sets the time limit for how long PSBC is allowed to stay in Bulk and Absorption continuously. This timer runs as long as PSBC is in the Bulk or Abs stage and is only reset when Float or Shutdown is entered.

If left blank, the timer is disabled.

If the timer is used, it must also be specified what stage the charger should switch to when the timer expires.

Do not choose Bulk or Absorption. If these are selected, the timer is effectively disabled.

10.3.5 Bulk



Safety timer

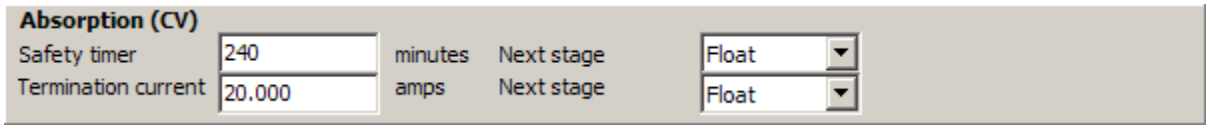
This sets the time limit for how long PSBC is allowed to stay in Bulk continuously. This timer is reset when PSBC enters Bulk.

If left blank, the timer is disabled.

If the timer is used, it must also be specified what stage the charger should switch to when the timer expires.

Do not choose Bulk or Absorption. If these are selected, the timer is effectively disabled.

10.3.6 Absorption



Safety timer

This sets the time limit for how long PSBC is allowed to stay in Absorption continuously. This timer is reset when PSBC enters Absorption.

If left blank, the timer is disabled.

If the timer is used, it must also be specified what stage the charger should to switch when the timer expires.

Do not choose Bulk or Absorption. If these are selected, the timer is effectively disabled.

Termination current

This sets the charge current that indicates that the battery is fully charged. Note that PSBC measures the output current. If a load is connected, the termination current must be set to the sum of the battery charge current limit and the load current. If the load current varies significantly, it should normally be set according to minimum load current. In this case an Absorption safety timer should also be specified.

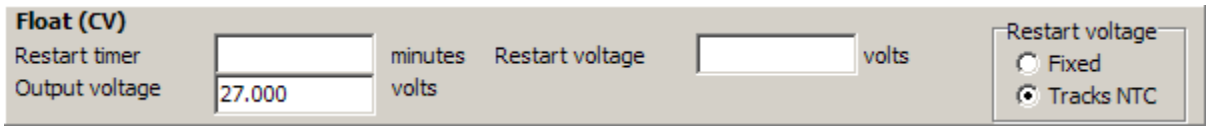
If left blank, the termination current is disabled.

If the termination current is used, it must also be specified what stage the charger should switch to when the load current drops below the termination current.

Do not choose Bulk or Absorption. If these are selected, the termination current is effectively disabled.

NOTE: The current specified is per PSBC. E.g., if 3 PSBC are connected in parallel, specify one third of the total termination current.

10.3.7 Float



Output voltage

This is the output voltage while in Float stage.

It is allowed to set Float voltage to be the same as the Absorption voltage. This effectively disables 3-stage charging, but may be used in conjunction with alarm relay mode “Charge finished” to indicate end of charge (see section 7.8).

In any case, if an NTC is connected, the output voltage is adjusted according to the NTC temperature.

Restart timer

This setting is used to periodically boost charge the batteries. In most cases this is not necessary.

This sets the time limit for how long PSBC is allowed to stay in Float continuously. This timer is reset when PSBC enters Float.

If the timer expires, the PSBC will enter Bulk mode.

If left blank, timer is disabled.

Restart voltage

If the PSBC output voltage drops below this value, PSBC switches to Bulk mode. This is used to top up the battery if the load temporarily draws more current than the PSBC can deliver.

If the setting “Restart voltage Fixed” is chosen, the Restart voltage is used as is.

If the setting “Restart voltage Tracks NTC” is chosen, the Restart voltage is adjusted according to the NTC (if connected).

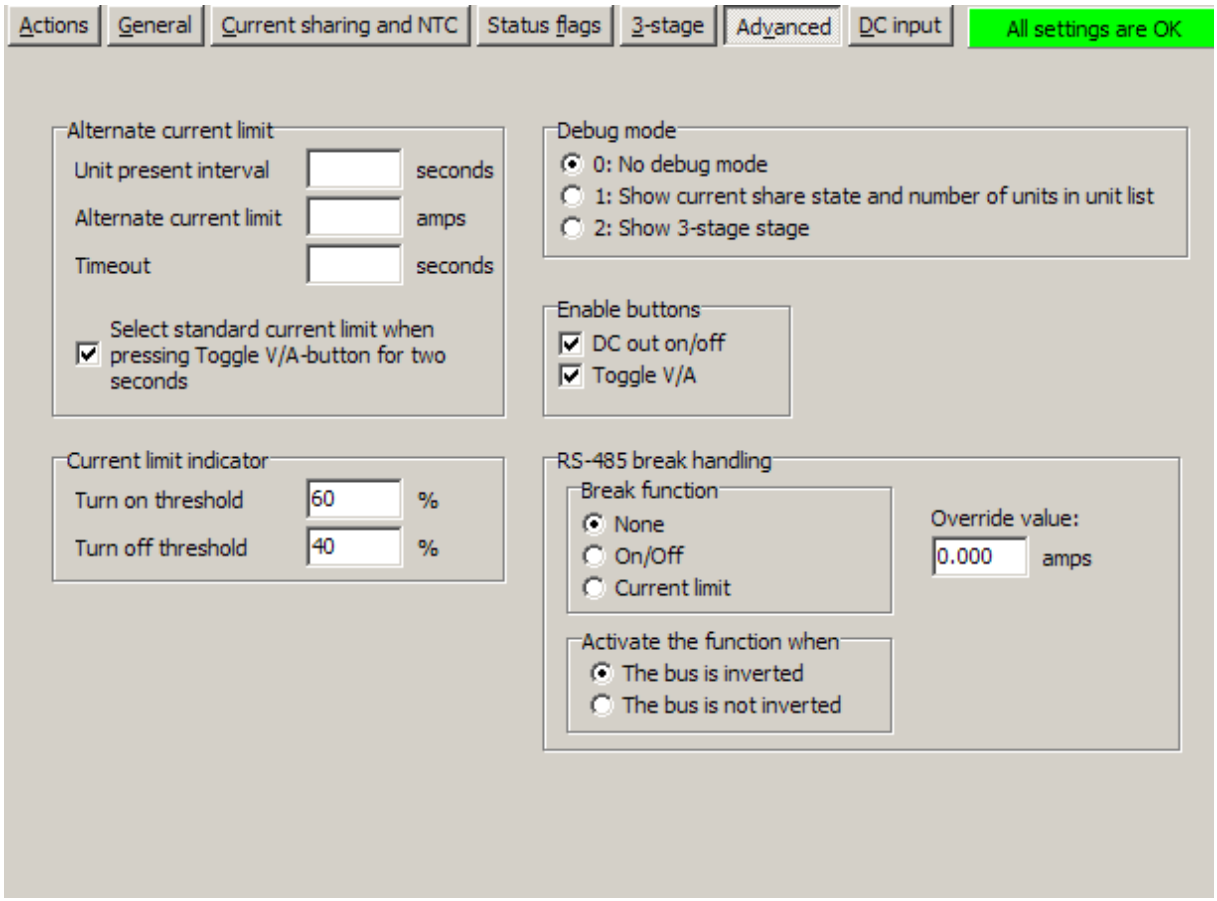
10.3.8 Shutdown

Restart stage

Normally set to Shutdown. This means that it is impossible to exit shutdown without turning the unit completely off.

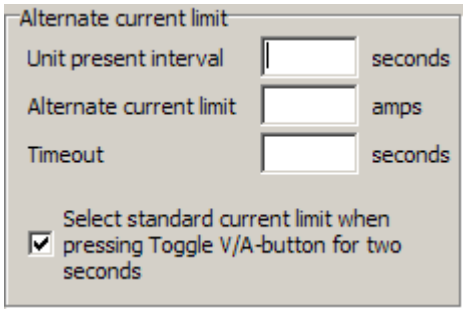
If any other stage is selected, the user can press the DC OUT ON/OFF-button twice to restart the charging in the specified mode.

11. Advanced



11.1 Alternate current limit

See section 14 for details about how the PSBC selects the current limit.



In this section, any reference to "regular current limit" means the current limit described in section 7.1.2.

This is used to automatically change the current limit depending on whether a single unit or multiple units are active.

11.1.1 Unit present interval

If this parameter is used, the unit will send out a UnitPresent-message every specified time interval.

NOTE: The interval is extended randomly with up to 0.3 seconds. This to prevent two units from sending messages exactly in sync for prolonged periods.

The UnitPresent message indicates to other units that this unit is present.

It is generally not recommended to set the interval shorter than 2 seconds. This is especially important if any of these functions are used:

- Active current sharing (section 8.2)
- Temperature compensated charging (section 8.3)
- Any other communication on the bus

11.1.2 Alternate current limit

If this parameter is used, the unit will start up with this regular current limit. If a UnitPresent-message is received, the unit will change to the regular current limit.

11.1.3 Alternate current limit timeout

If this parameter is used, the unit revert to alternate current limit if a UnitPresent-message has not been received in the specified time interval.

If used, it is recommended to set the timeout to minimum 0.5 seconds longer than Unit present interval, so that a single UnitPresent message can be lost without any consequences.

11.1.4 Select standard current limit when pressing the Toggle V/A-button

If this is enabled, the operator can select the regular current limit by pressing the Toggle V/A-button for minimum 2 seconds.

11.1.5 Notes

As long as the alternate current limit is active:

- The green LED will be flashing
- If the Toggle V/A-button is pressed for 2 seconds, the regular current will be selected (if enabled)

You want low current limit when a unit is alone, and high current limit with several units

Set the alternate current limit to the low value, and the regular current limit to the high value.

In case of communication problems, and several units present:

- Some units may be in low current limit
- The load may not get enough current
- You will not overload your source

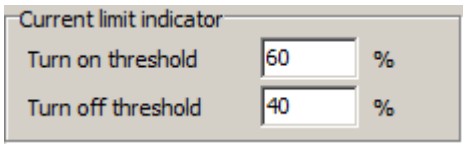
You want high current limit when a unit is alone, and low current limit with several units

Set the alternate current limit to the high value, and the regular current limit to the low value.

In case of communication problems, and several units present:

- Some units may be in high current limit
- You may overload your source
- The load will always get enough current

11.2 Current limit indicator



These settings set the thresholds for turning on and off the current limit flag (C1).

C1 is updated every 100ms. In this 100ms period the load may change several times, and the percentage of time the unit is in current limit is measured during the 100ms period.

If the unit is in current limit for more or the same as the turn on threshold, the current limit flag will be turned on.

If the unit is in current limit for less or the same as the turn off threshold, the current limit flag will be turned off.

If the unit is in current limit for less than the turn on threshold, but more that the turn off threshold, the current limit flag will be unchanged.

Use wide limits for a more stable current limit flag.

Use narrow limits if you want the current limit flag to follow the load quickly.

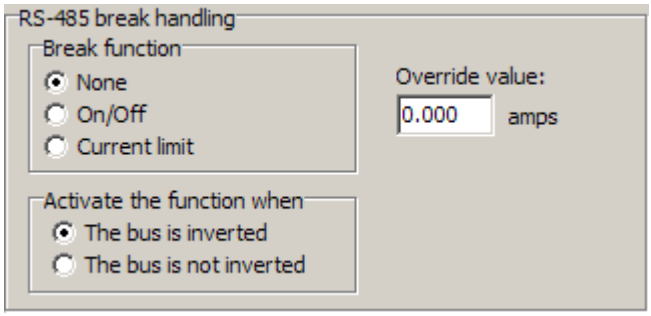
Set both limits to low values if you want to see every time the unit is briefly in current limit.

Set both limits to high values if you want to see current limit when the unit is in current limit for most of the time.

NOTE: It is almost never necessary to change these settings from the default values.

11.3 RS-485 break handling

See section 14 for details about how the PSBC selects the current limit.



It is possible to use the RS-485 port as a general digital input, while at the same time using the bus as a communication bus.

This can be used if it is for some reason not practical to send regular RS-485 command over the bus.

If a “break” (inverted bus) is applied to the bus, this can be detected to activate various functions.

There are three different functions that can be assigned to this:

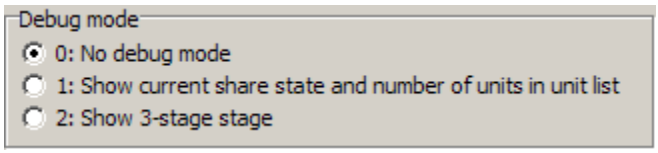
Function	Description	Use of override value
None	None	Not used
On/off	The PSBC will shut down with error code E8	Not used
Current limit	The PSBC will select the specified current limit	Current limit

The "Activate the function when" selection was introduced in firmware revision 30. Earlier firmware always uses the "The bus is inverted" option.

Activate the function when	Description
The bus is inverted	The selected function is activated when the bus is inverted
The bus is not inverted	The selected function is activated when the bus is not inverted

The bus is normally not inverted. To invert the bus, an external circuit must be added. See white paper “PSBC Series - Using the RS-485 port as an input” for more details about this function.

11.4 Debug modes



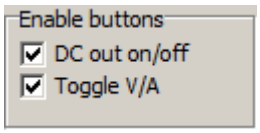
Normally, mode 0 should be selected. The various debug modes are designed for use in a lab environment only.

Mode	Description
0	No debug mode active, normal operation
1	Show current share state and number of units in unit list in the display. The left digit will show the current share state of the unit: • 2: Unit is slave • 3: Unit is master • 4: Unit is not participating in current sharing The right digit will show how many units that are participating in current sharing. Note that if DC cable voltage drop compensation is not activated (section 13), the number will not always be correct.
2	Show current share state and 3-stage charging in the display. The left digit will show the current share state of the unit, same as for debug mode 1. The right digit will show the current 3-stage charging stage: • S: Softstart stage • b: Bulk stage • A: Absorption stage • F: Float stage • E: Shutdown • -: Unknown stage

The Toggle V/A button can be pressed to show normal information, but the display will revert to showing debug information after 10 seconds.

No other functionality is affected.

11.5 Enable buttons



11.5.1 DC OUT ON/OFF

The DC OUT ON/OFF button can be enabled or disabled.

Note that this button can effectively also be disabled by disabling error E0 (see section 9.2). However, disabling error E0 will also make it impossible to stop the PSBC by sending a command on the RS-485 bus. For this reason it is recommended to disable the button, and leave E0 enabled.

11.5.2 Toggle V/A

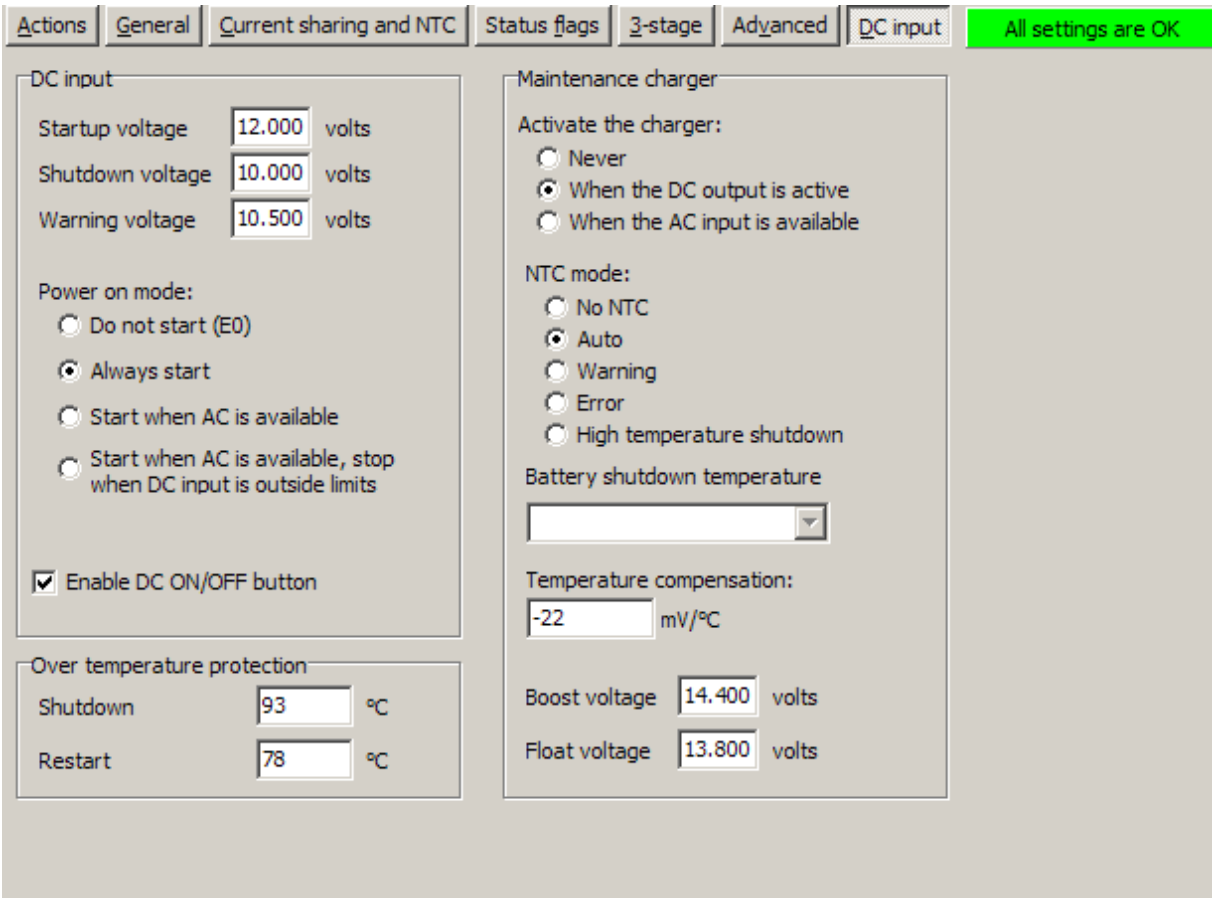
The Toggle V/A button can be enabled or disabled.

It generally not recommended to disable this button. If it is disabled it is not possible to read out all error codes that may be present.

Note that disabling the Toggle V/A button will only disable the selection of the display. The button is also used by the alternate current limit function (section 11.1.4). This functionality is not affected by enabling/disabling the Toggle V/A button.

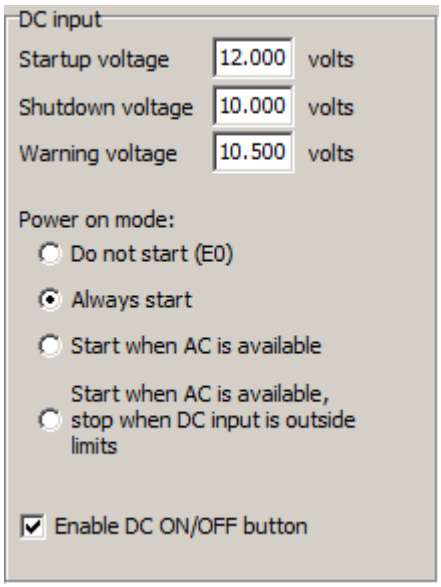
12. DC input

These settings are only available on Dual Input models.



When referring to error codes and cautions in this section, it means the errors described in section 9.3.

12.1 DC input



12.1.1 Startup voltage

The DC input will not activate until the input voltage is above this level

12.1.2 Shutdown voltage

The DC input will shut down when the input voltage is below this level

12.1.3 Warning voltage

Caution C5 will be turned on when these conditions are both present:

- The DC input voltage is below the warning voltage
- The DC input is started

12.1.4 Power on mode

Do not start (E0)
When this mode is selected, the DC input will not start until the operator has pressed the DC ON/OFF button.

Always start
The DC input will start when possible.

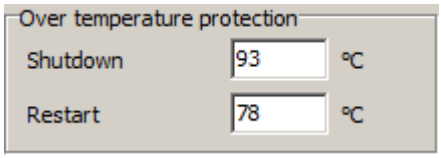
Start when AC is available
The same as "Always start", except that the DC input will not start until AC is available, and within limits.
This prevents the PSBC from starting up from DC only. This setting is suitable when the PSBC is primarily used on AC, and DC is only used as a backup.

Start when AC is available, stop when DC input is outside limits
The same as "Start when AC is available", except that when the DC input for some reasons shuts down, the AC input must present before the DC input is activated again.

12.1.5 Enable DC ON/OFF button

If this setting is disabled, the DC ON/OFF button does nothing.
Note that if Power on mode is set to "Do not start (E0)", and the button is disabled, it is impossible to start the DC input. Only the maintenance charger will work.

12.2 Over temperature protection

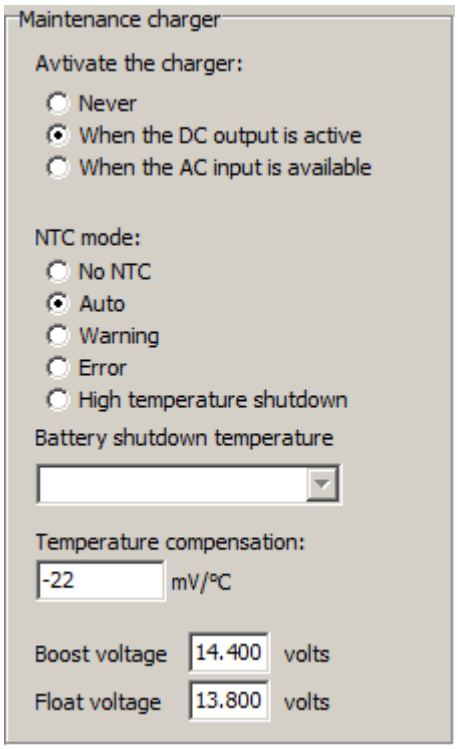


This is similar to the protection described in General settings (see section 7.4), except that these values are specific for the DC input section.

Normally, the Shutdown and Restart values would be set to the same values as the settings described in General settings.

The DC input section has its own temperature sensor. Even if the values are the same as in General settings, the DC input will not shutdown at exactly the same temperature as the AC input/DC output section.

12.3 Maintenance charger



12.3.1 Activate the charger

Setting	Description
Never	The maintenance charger is disabled
When the DC output is active	Both the AC input and the DC output must be active for the charger to run. Anything that causes the DC output to shut down (see section 9.1) will also stop the maintenance charger.
When the AC input is available	Only the AC input must be active for the charger to run. The state of the DC output is ignored.

12.3.2 NTC mode/Battery shutdown temperature/Temperature compensation

See description of the different modes in section 8.3. The functionality for the maintenance charger is a simplified version of the DC output temperature compensation.

Note that the maintenance charger does not share the measured battery temperature when several units are connected in parallel. Every unit must have a separate NTC connected to the NTC/REM input.

12.3.3 Boost/float voltage

The maintenance charger has simplified 3-stage charging.

The charger will always start up in Bulk mode, and change to Absorption charging when the charger reaches the chosen Boost voltage.

When the charger has been in the Absorption stage for 2 hours, it will switch to Float charging. It will not change back to bulk charging until the charger is stopped and restarted.

13. DC cable voltage drop compensation

This functionality was introduced in firmware revision W, and improved in revision 27.

Limitation in revisions W to Z:

- The function can only be used on a single unit. The function will generally not function correctly if two or more units are connected in parallel.

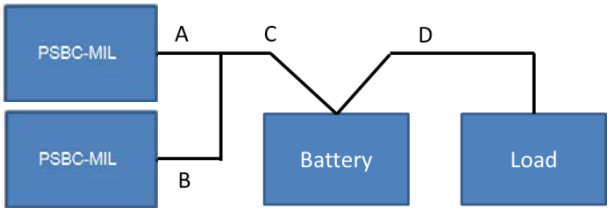
In revision 27 and up, it works with up to 6 units in parallel. More units can be used, but as more units are added, the compensation will be more and more off. Consult RIPEnergy if using more than 6 units in parallel.

This function is primarily meant to ensure that the charge voltage stays constant when charging lead-acid batteries with varying charge/load currents.

The compensation does not respond very fast to load current changes. If the load suddenly changes, the voltage at the load will initially change just as much as with the output compensation set to zero.

13.1.1 Some practical considerations

First we will consider the ideal setup to get the battery charging voltage correct:

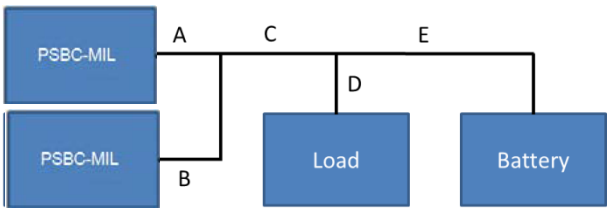


If the PSBCs are given the resistance of cables A, B and C, the battery will always have the correct voltage. The PSBCs will measure the currents in cables A and B, and from this the current in cable C is known. The load current will not affect the voltage at the battery.

The cable C may be omitted, and the cables A and B may be connected directly to the battery (equivalent to the cable C having zero resistance). The result will still be perfect.

Any other setup will result in more or less incorrect compensation. This has to be evaluated in each setup.

One example of a “bad” setup:



With this setup, the PSBCs does not know the current in cable D and E, they only know the current in cable A, B and C. If the total resistance of cable C and E is given to the PSBCs, and

the load is zero, the battery will get correct voltage. But when the load starts to draw current, the PSBCs will compensate as if all the current is drawn by the battery. The voltage at the battery will now be too high. For this reason it is in this case recommended to only compensate for the voltage drop in cables A, B and C.

Note that in many “bad” setups, the compensation will be close to correct. In the picture above, if cable E has very low resistance, or if the load current is always small, the compensation will be close to correct.

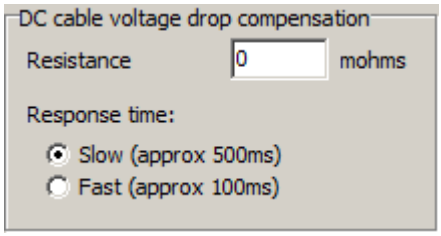
Cable resistance varies significantly over temperature. It will not be possible to compensate 100% correctly at all temperatures.

This table show approximately the relative resistance of copper, with 20 °C as the base point:

Celsius	Fahrenheit	Relative Resistance
-55	-67	0.70
-40	-40	0.76
-20	-4	0.84
0	32	0.92
20	68	1.00
50	122	1.12
85	185	1.26

As both over- and under-compensation can be unfortunate, it is impossible for RIPEnergy to give a recommendation for all systems. But it should normally be safer to undercompensate, so if in doubt use the smallest resistance (shortest and coldest cable) that can occur.

13.1.2 Single unit mode



This mode is selected if Current Share Mode is set to Disable current sharing. See section 8.2.

A cable resistance can be specified. Default is 0mΩ, valid range is -327.68mΩ to +327.67mΩ.

With a positive value, the output voltage will be increased when the load current increases. This can be used to counteract the effect of long cables. If the value is set equal to the actual cable resistance, the voltage at the load will be the same, independent on load current.

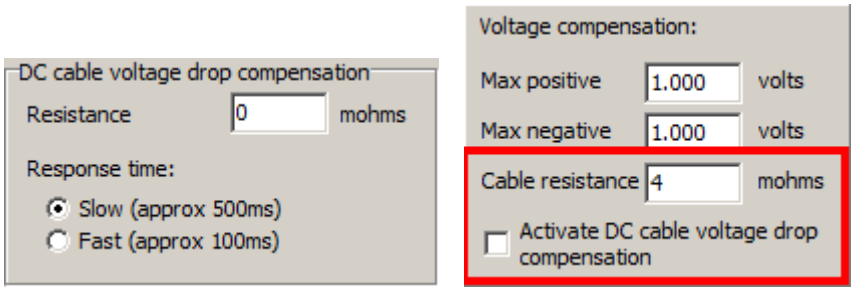
With a negative value, the output voltage will be lowered as the load current increases. This simulates the effect of long cables, and can be used for passive current sharing (e.g. if parallel cables for some reason can't be used).

The compensation can be set to fast or slow:

Mode	DC current measurement used	Compensation speed
Slow	Filtered	approx. 500ms
Fast	Unfiltered	approx. 100ms

Selecting fast will make the unit respond faster to load changes, but if the load is fluctuating rapidly, this may make the output very "nervous". In most situations, it is recommended to set the speed to slow.

13.1.3 Multiple units mode



This mode is selected if Current Share Mode is not set to Disable current sharing (Even if only a single unit is actually used). See section 8.2.

It is essential that parallel cables are used. Without parallel cables, the units will not share the current, and the compensation will be incorrect.

The voltage drop compensation will activate a few seconds after the active current sharing has started. The output voltage will be adjusted approx. 1-2 seconds after load changes.

Two values must be specified:

Name	Description	Range	Default value
Rs	Resistance from the unit to the DC cable common point	0 mΩ to +655.35 mΩ	1 mΩ
Rc	Resistance from the DC cable common point to the battery	-327.68 mΩ to +327.67 mΩ	0 mΩ

The value Rc is the same as the single value used in the single unit mode. However, the fast/slow option is not used.

The Rs settings is used for two purposes:

- Compensate for voltage drop in the cables (this can be enabled or disabled separately)
- Adjust the speed of the active current sharing

If voltage drop compensation is not used, set the resistance Rc to the actual resistance of the cable from the PSBC to the common point. If the resistance is not known, or if the speed of the active current sharing is not critical, use the default value of 1mΩ. Never set this value to more than twice the actual cable resistance. This can result in unstable current sharing. If in doubt, choose a low value. Remember that cable resistance can change significantly over temperature, see section 13.1.1

Important note

If the DC cables from the PSBCs to the common point (Rs) have significantly different resistance, the PSBC with the highest cable resistance **must** be master. This means that the units must be manually assigned master/slave roles.

If two units are used, this setup is recommended:

- The unit with the highest cable resistance is set to Master
- The unit with the lowest cable resistance is set to Auto

This setup is compatible with 3-stage charging. If the “high-resistance” unit shuts down, the other unit will take over as master and continue 3-stage charging. When the “high-resistance” unit start up again, it will take over as master.

If three or more units are used, this setup is recommended:

- The unit with the highest cable resistance is set to Master
- The unit with the second highest cable resistance is set to Auto
- The other units are set to Slave

This setup will ensure that the unit with the highest resistance is master, as long as either of the two highest resistance units are operational. 3-stage charging is also always operation in this case. Only when both the two highest resistance units shut down will voltage drop compensation and 3-stage charging no longer work.

If these guidelines are not followed, the DC voltage can be increased to a value that is too high in some cases.

14. DC output current limit selection

The DC output current limit functionality is quite complicated. There are many settings that affects the current limit.

The current limit is dynamically updated based on the settings and measured values.

The current limit is updated 10 times a second.

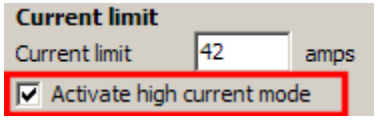
The current limit is selected in two stages:

- Stage 1 select one of four current limits
- Stage 2 applies various derating functions

14.1 Stage 1 - Select current limit

14.1.1 Priority 1 - High current mode

See section 7.1.2 for details about the high current mode.

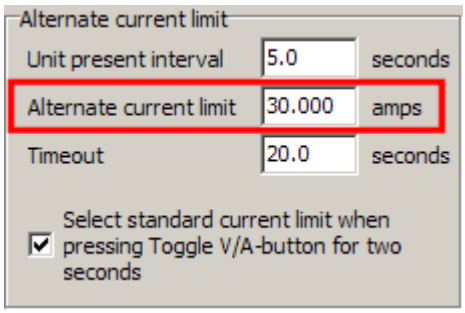


If high current mode is activated, and the 5 minute timer has not expired, the maximum current the unit can deliver is selected as the current limit. Priority 2 and up is not used.

14.1.2 Priority 2 - Alternate current limit

See section 11.1 for details about the alternate current limit.

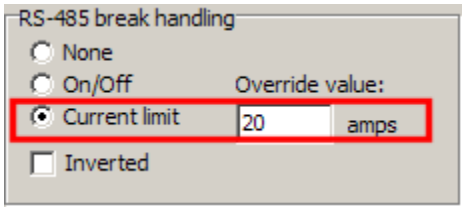
If the alternate current limit is used, and the unit has not received a UnitPresent message, the specified alternate current limit is selected. Priority 3 and up is not used.



14.1.3 Priority 3 - RS-485 break handling

See section 11.3 for details about RS-485 break handling.

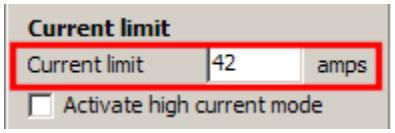
If the RS85 break handling is set to Current limit, and RS-485 bus is in break, the specified current limit is selected. Priority 4 is not used.



14.1.4 Priority 4 - Regular current limit

See section 7.1.2 for details about the regular current limit.

If none of the other current limits are selected, the regular current limit is selected.



14.2 Stage 2 - Derating

After the current limit has been selected in stage 1, several derating functions may lower the current limit. These derating functional can only lower the current limit, not increase it.

There is no priority here as in stage 1. The derating function that commands the lowest current limit "wins".

Derating function	Section
Temperature compensated charge current	8.3.9
Softstart	10.3.3
Over temperature protection	7.4
Power limit	7.1.3

15. PSBC Communication Kit

15.1 Introduction

15.1.1 What is included in the PSBC Communication Kit

- Moxa UPort 1150I with CD, manual and accessories
- Communication cable
- Information sheet describing where to find all software and documentation

15.1.2 What the PSBC Config Utility (CCU) does

- View/change the settings of PSBCs
- View status of PSBCs during operation
- Send commands to the PSBC
- Update the firmware to a different revision

15.1.3 What the PSBC Logging Utility (CLU) does

- View status of several PSBCs during operation
- Send commands to the PSBC
- Log status data to file

15.1.4 Computer requirements

- Windows 2000 or newer. Both 32 bit and 64-bit versions are supported.
- One free USB port is required to connect the UPort.
- The utilities has been made with a compact main window to make it fit on small laptops. Minimum screen resolution is 800x700. Higher is recommended.
- No special requirements for CPU, memory or hard disk.

15.1.5 User requirements

- It is assumed that the installer/user of these utilities is a somewhat advanced Windows user

15.1.6 Support

You can request the latest revisions of this document, the CCU/CLU, PSBC firmware, and other documentation from RIPEnergy

There is also a remote control software available. If you need help using the utilities, it will be much easier for RIPEnergy to help if you let us remote control your computer.

NOTE: Using this remote control software will give RIPEnergy full control over your computer. Please check with your IT-department first. Your company may not allow this.

15.2 Installing

15.2.1 Installing Moxa UPort 1150I device driver

Install device driver according to the UPort manual. The driver is on the included CD.

NOTE: The UPort installation manual states that you should run Setup.exe. This is incorrect. The filename is driv_win_uport1p_v?.?_build_????????_whql.exe. Contradictory to the folder structure on the CD, the same file is used for all Windows versions.

NOTE: The driver included may not be the newest version. The newest version can be found at http://www.moxa.com/

The first time the UPort is connected, it may take some time to install the drivers. Wait unit you get the message “Your new hardware is installed and ready to use”. This may also apply if the UPort is moved to another USB port.

When the driver is installed, no further setup of the UPort is necessary. The utilities will automatically set up the UPort correctly.

It is possible to use RS-485 adapters other than UPort. Requirements:

- Must be available to Windows as a COM port
- Must support 2-wire interface
- Speed and format must be set to 19200bps N-8-1
- Transmitter enable must be automatic

4-wire interface can be used, but in this case transmit and receive wires must be connected together, and transmitter must go high-Z when not transmitting.

The utilities will only set up Moxa UPort 1150I automatically. All other adapters must be set up correctly by the user.

RIPEnergy highly recommends using isolated adapters.

15.2.2 Installing the utilities

The utilities each consists of only one file each:

- Config_XX_YY.exe
- Log_XX_YY.exe

XX is the major revision of the utilities, and also the highest PSBC firmware supported. YY is the minor revision of the utilities.

The utilities does not require any installation, and can be run directly from any folder or the Windows desktop. If the utilities are run from removable media, the media can't be removed while the utilities are running.

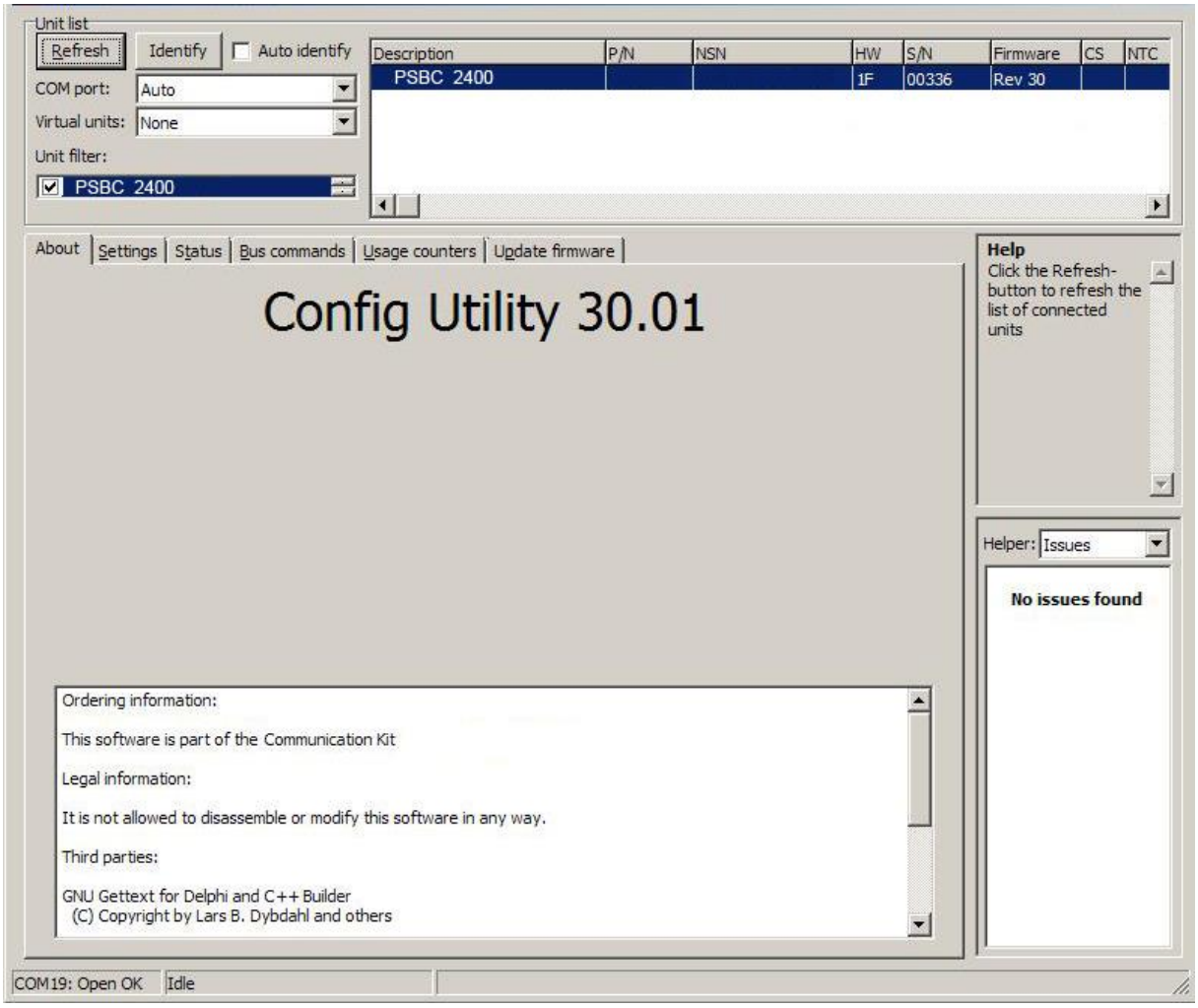
15.3 Connecting PSBCs to the computer

Connect the communication cable from the UPort to a PSBC (NTC/COM1 or 2). If more than one PSBC is to be connected, use parallel cables to daisy-chain all the units. See section 3.8.2 for details about parallel cables. Turn on all the PSBCs.

15.4 PSBC Config Utility (CCU)

15.4.1 Starting the CCU

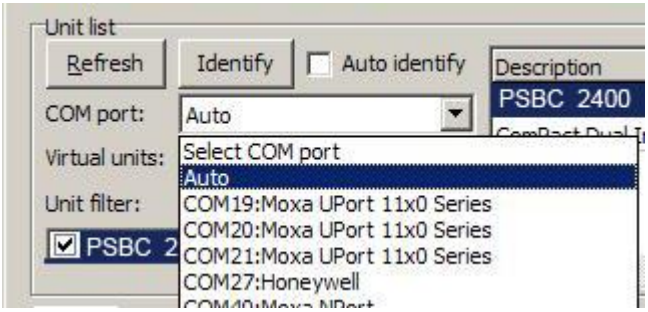
When the CCU is started, it will look like this:



Select a control to get help about that control. The help is at the right part of the window. If the window is enlarged the help is easier to read. A control is any item where you can select an option with the mouse, or enter a value.

15.4.2 Unit list

Select the correct COM port by clicking this drop down list:



All COM-ports on the computer will show up in this list. If you are using the RIPEnergy supplied Moxa UPort, this COM port will be marked with “Moxa UPort 11x0 Series”.

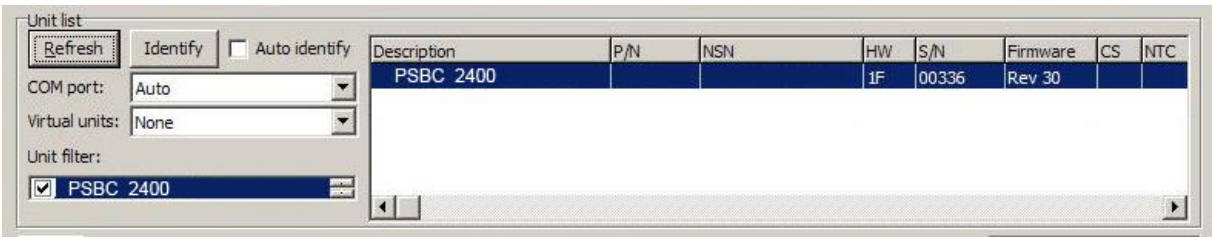
If the selected COM port is available, the leftmost status field at the bottom will indicate “Open OK”. If the COM port is not available, the status will indicate “Open FAIL”.

NOTE: “Open OK” does not mean that you have selected the correct COM port, only that it was opened successfully.

Selecting Auto means that the CCU will automatically choose the first Moxa port that is not in use by another software. When using the Moxa Uport 1150I, it is normally recommended to select Auto.

When you believe you have selected the correct COM port, click Refresh to refresh the unit list. If the green TxD LED on the UPort flashes a few times, you have selected the correct COM port.

When communication is up and running, all connected units should be listed in the Unit list:



NOTE: If several units are connected (by daisy chaining with parallel cables), you may have to enlarge the window to see all the units.

NOTE: If units with firmware revision “L” or older is connected, it may be difficult to get all connected units added to the list. If this happens, click Refresh several times. If this also fails, turn off or disconnect units that you do not need to talk to, then click refresh again.

Identify

The button Identify will identify the selected unit. When the button is clicked, the selected unit will flash one or both of the upper two dots in the display. The unselected units will not flash.

If "Auto identify" is checked, the selected unit will be identified automatically when it is selected.

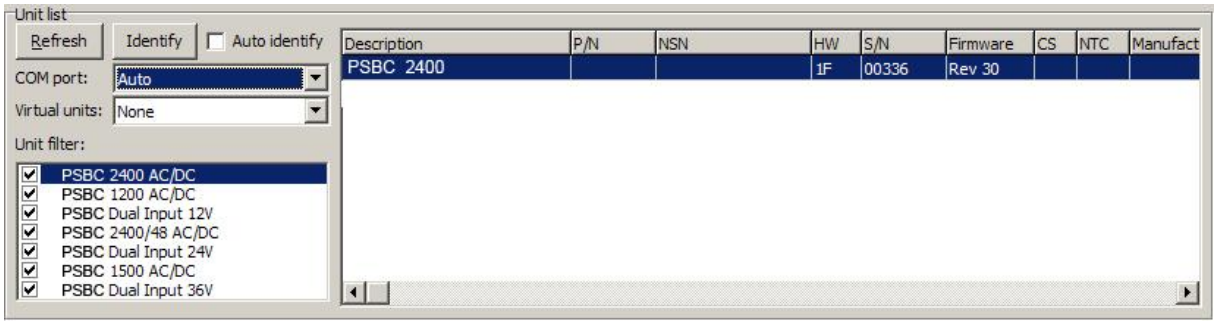
Virtual units

If you select a firmware revision from the "Virtual units" drop-down, several virtual units is added; one for each PSBC type available. These will be added even if the COM port is incorrect or missing. These can be used to play around with the CCU, or to create settings files without a unit connected. To remove the virtual units, select "None".

If a unit is connected/disconnected while the CCU is running, the unit list will not be updated automatically. You have to click Refresh to update the list.

Unit filter

If you enlarge the window, the Unit filter selection list will be complete:



15.4.3 About tab

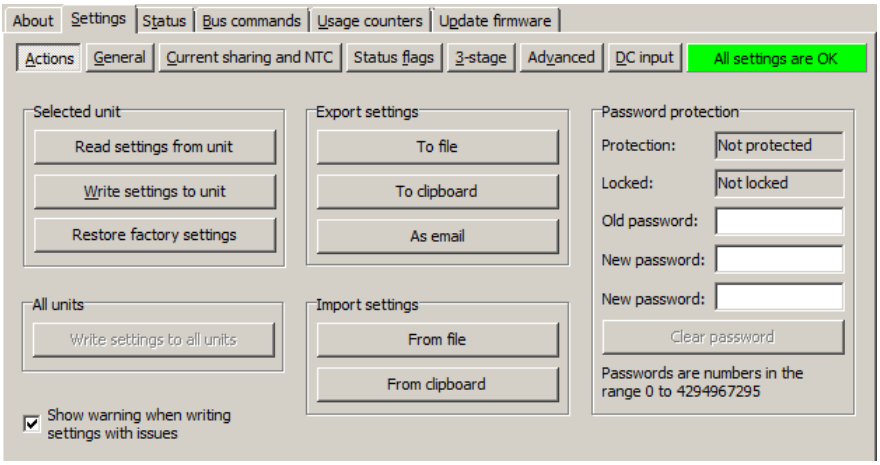
Click the About tab.

The "30.01" part of "PSBC Config CCU 30.01" is the revision of the CCU. "30" means that the CCU is designed for PSBC firmware revision up to and including "30". "01" is the first revision of the CCU that supports PSBC firmware revision "30".

NOTE: "30.01" is an example only. Your CCU may be different.

Websites and Email can be clicked to open the RIPEnergy website, and to send an email to RIPEnergy.

15.4.4 Settings tab



Here you can save settings to the selected unit, import/export settings and so on. Settings are never saved to the unit without your knowledge. You either have to press the “Write settings to unit”, or answer Yes to a “Do you want to save”-question.

Whenever a unit is selected in the unit list, the settings for that unit is read into the CCU. It is not necessary to click “Read all settings from unit”. This button is only used if you have changed some settings, and wish to go back to the settings stored in the unit.

The button “Restore factory settings” will restore all settings to default factory settings. Note that if a unit has been delivered with custom settings, this button will set all values to default factory settings, not the custom settings the unit was delivered with.

The rest of the buttons should be self-explanatory. Use the built-in help for more information.

Click the buttons “General”, “Current sharing and NTC”, “Status flags”, “3-stage settings” and “DC input” to view or edit the settings. Fields that are marked in red have an invalid value.

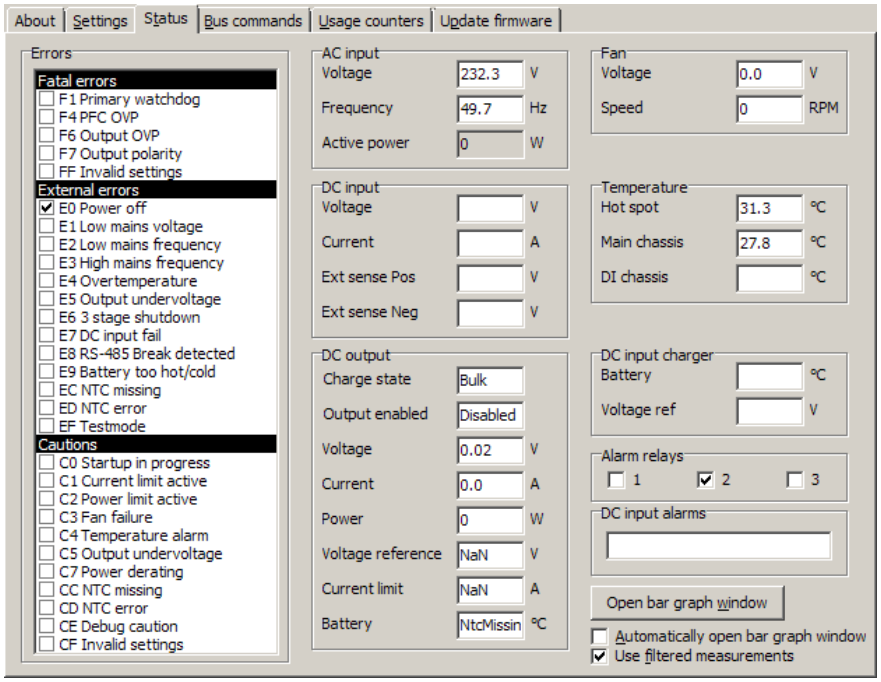
You are not allowed to write invalid settings to PSBC, nor are you allowed to export, copy to clipboard or send as email any invalid settings.

You are allowed to select values that make little sense. It’s important to understand the consequences of the values that are selected.

When all the settings are to your satisfaction, press “Actions” button, and then press “Write settings to unit”.

NOTE: Feel free to experiment. There are no settings that can't be undone by pressing the “Restore factory settings”. There are no settings that will cause the PSBC to be destroyed. However, it may be possible to destroy a load connected to the DC output. Make sure that the load can accept the output voltage and current you select.

15.4.5 Status tab

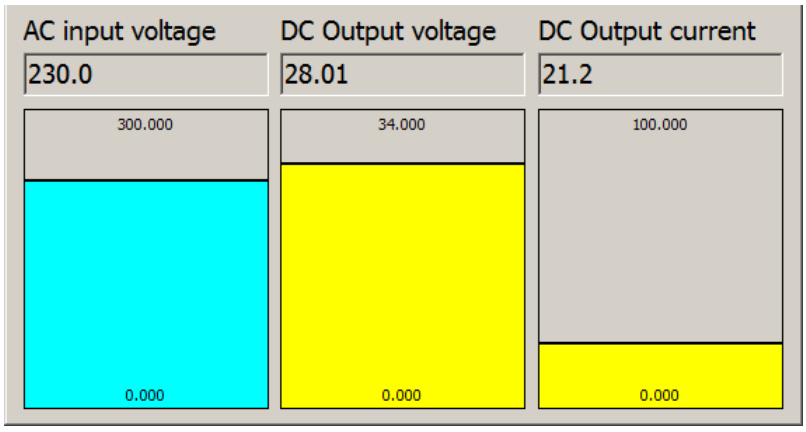


This tab gives detailed status of the selected unit. The status is updated approx. 2 times a second.

See section 9 for details about the various error codes.

Most values are actual measurements. Some are calculated from other measurements. Use the built-in help for details.

If you click the “Open bar graph window” button, a new windows opens:



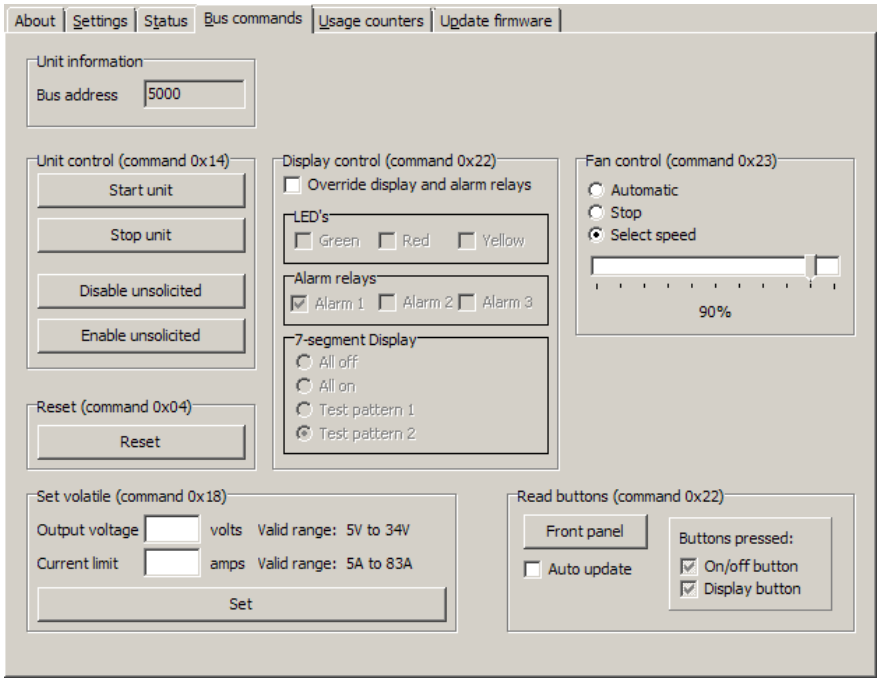
This is a subset of the information in the Status tab.

- To remove a bar: Right-click on a bar and select Delete
- To change a bar: Right-click on a bar and select measurement and color

- To add a new bar: Right-click in the space between the bars, or in the space to the far left/right of the bars

If "Automatically open bar graph window" is checked, the bar graph window will open automatically every time the CCU is started.

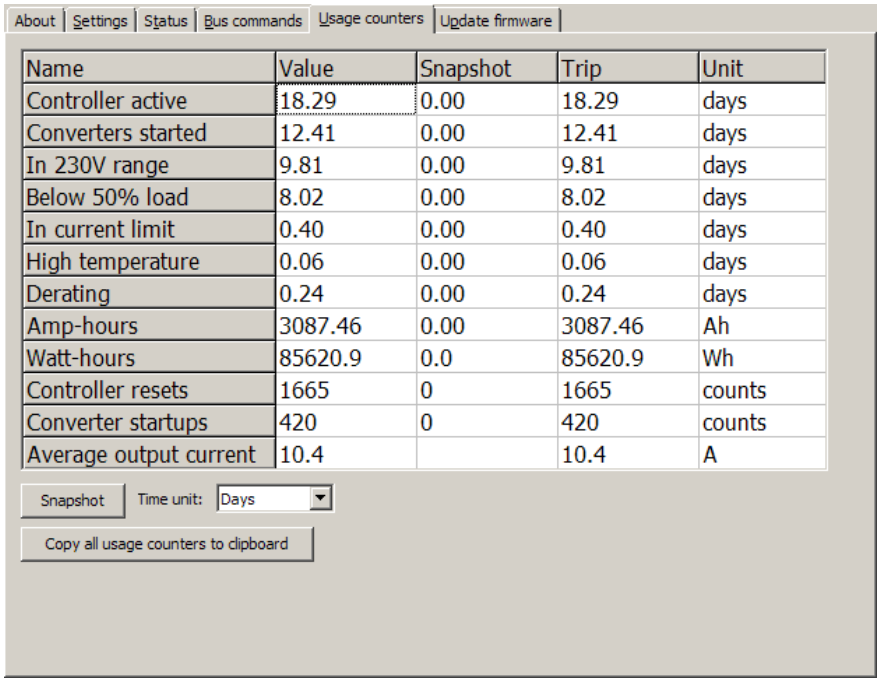
15.4.6 Bus commands tab



Here are most of the commands that are available to customers. See document "P01A06_ RIPEnergy RS-485 communication protocol" for details. This document is available from the PSBC support website.

NOTE: Feel free to experiment. Nothing you do on the Bus commands tab is saved permanently. Everything is forgotten when the unit is turned off, and the display goes dark. Nothing is destructive for the PSBC. However, it may be possible to destroy a load connected to the DC output. Make sure that the load can accept the output voltage and current you select.

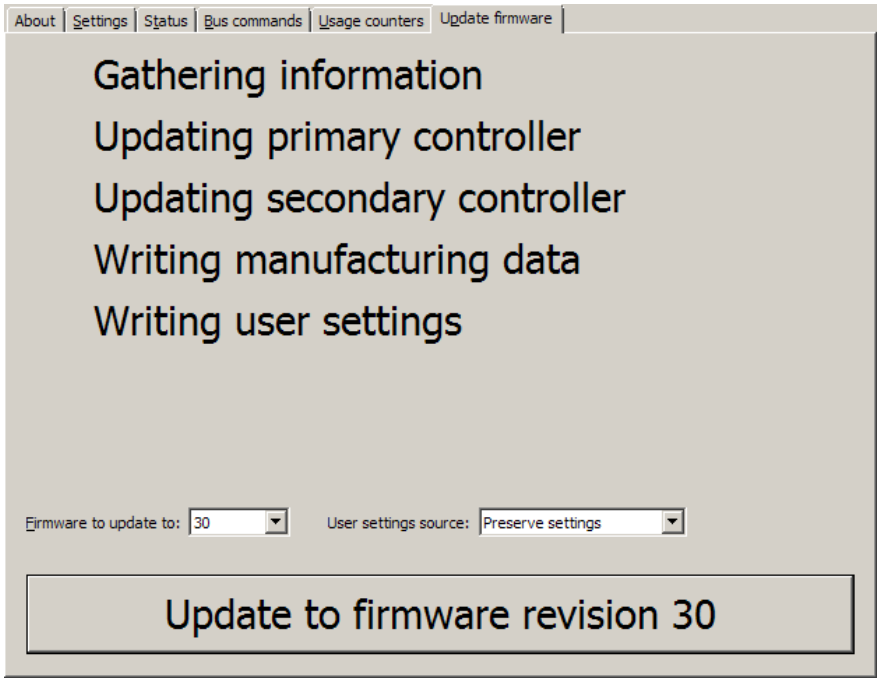
15.4.7 Usage counters tab



This shows some statistics for the selected PSBC.

NOTE: Only PSBC firmware revision ‘m’ and up has this functionality. If a PSBC with firmware revision lower than ‘m’ is upgraded to newer firmware, all the counters will start at zero. The counters will not be reset in any other situation.

15.4.8 Update firmware tab



The firmware in the unit can be upgraded. In some cases it is also possible to downgrade the firmware. However, PSBCs with different firmware revision can be used together in the same system, so there is normally no reason to downgrade.

The CCU will tell you if it for some reason can't update the unit.

See the section 16 for details about the different firmware revisions.

When updating the firmware, the settings may also be automatically updated. See the built-in help in the CCU.

When upgrading, new functionality in the firmware is generally disabled, and must be activated by going to Settings and editing the settings.

When downgrading, settings not available on the older firmware are lost.

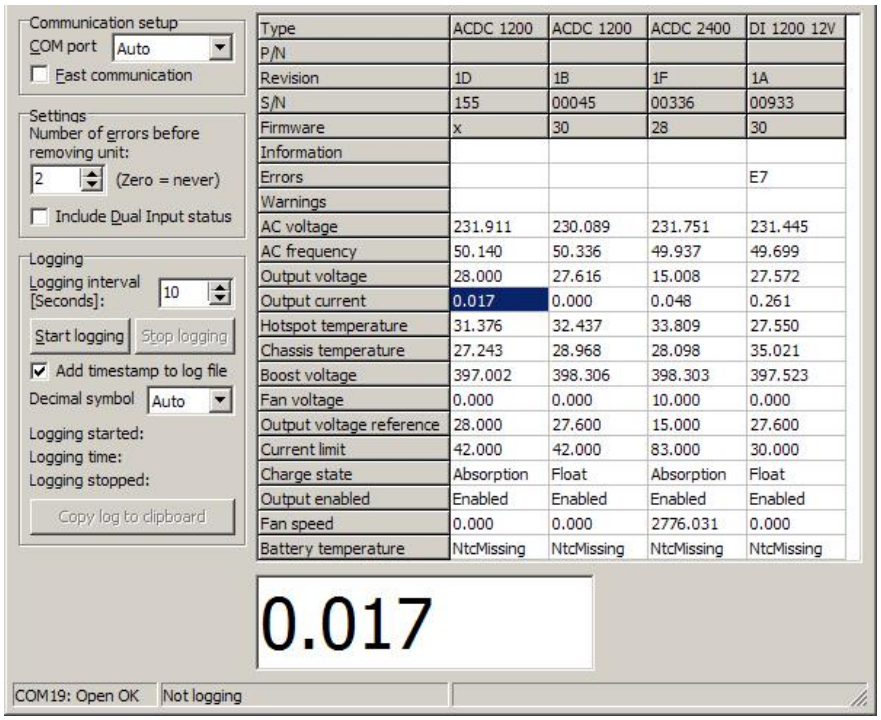
Whenever a unit is chosen in the unit list, the highest firmware revision available is chosen. If several units are to be updated to another firmware revision than the newest, remember to select the correct firmware for each unit. If you update to an incorrect revision, simply update again to the correct revision.

WARNING: RIPEnergy have tried to make the update process as fail-safe as possible. However, if the computer or the PSBC being updated loses power during the update, the PSBC may end up inoperable. Make sure that you do not lose power during update. If this happens, contact RIPEnergy.

NOTE: If there are communication problems during update, the update will in most cases recover. Read any error messages thoroughly, and make sure that you answer them correctly.

NOTE: If there are any problems during the update, read all error messages carefully. If you are contacting RIPEnergy for support, please give all RIPEnergy all error messages.

15.5 PSBC Logging Utility (CLU)



Type	ACDC 1200	ACDC 1200	ACDC 2400	DI 1200 12V
P/N				
Revision	1D	1B	1F	1A
S/N	155	00045	00336	00933
Firmware	x	30	28	30
Information				
Errors				E7
Warnings				
AC voltage	231.911	230.089	231.751	231.445
AC frequency	50.140	50.336	49.937	49.699
Output voltage	28.000	27.616	15.008	27.572
Output current	0.017	0.000	0.048	0.261
Hotspot temperature	31.376	32.437	33.809	27.550
Chassis temperature	27.243	28.968	28.098	35.021
Boost voltage	397.002	398.306	398.303	397.523
Fan voltage	0.000	0.000	10.000	0.000
Output voltage reference	28.000	27.600	15.000	27.600
Current limit	42.000	42.000	83.000	30.000
Charge state	Absorption	Float	Absorption	Float
Output enabled	Enabled	Enabled	Enabled	Enabled
Fan speed	0.000	0.000	2776.031	0.000
Battery temperature	NtcMissing	NtcMissing	NtcMissing	NtcMissing

15.5.1 Communication setup

COM port setup is the same as for CCU (see section 15.4.2).

If “Fast communication” is checked, the CLU will update the status very often. This may disturb other communication on the bus. This means that for example active current sharing may not work properly. It is generally not recommended to use fast communication unless you know that no PSBCs or other equipment are sending commands on the bus.

New units connected to the bus will automatically be discovered. There is no need to manually refresh the list of connected units like in the CCU.

15.5.2 Settings

Number of errors before removing unit

If the communication is lost for this many attempts, the unit will be automatically removed.

Include Dual Input status

If this is checked, extra status for the DC input section of a Dual Input is also shown. For a non-Dual Input PSBC, these values will be blank.

15.5.3 Logging to file

Logging interval

While the screen will be updated continuously, the CLU will add an entry in the log file only as often as you specify here. You can right-click on the control to select some common values, without having to calculate how many seconds this is.

Start logging

Starts logging to file. A separate file for each PSBC connected will be created (or appended to).

Stop logging

Stops logging for all connected units.

Add timestamp to log file

If not checked, the filename will be based on part number, hardware revision, and serial number. The same log file will be appended to the next time you log the same unit.

If checked, the filename will be based on part number, hardware revision, serial number, and date/time. A new log file will be created every time you log the same unit.

Decimal symbol

Auto: Decimal point or decimal comma will be used, based on the regional settings in Windows.

Point: Decimal point will be used, independent of the regional settings in Windows. This is useful in countries that normally uses decimal comma (Windows regional settings set to use decimal comma), but are reading the log files in software that are using decimal point.

Copy log to clipboard

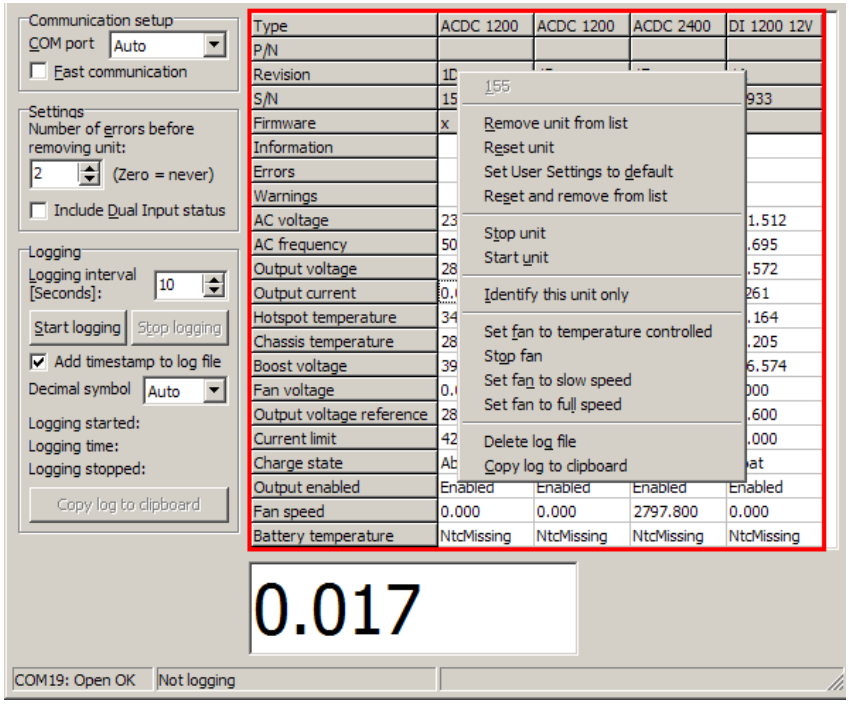
Grayed out if none or two or more units are connected.

If exactly one unit is connected, copies the log file to clipboard. The log file can then be pasted into Excel or other software.

This is a shortcut to right-clicking on a single unit, and selecting “Copy log to clipboard” from the menu.

15.5.4 Right clicking on a unit

If you right-click in the area inside the red rectangle, you get a menu with various commands you can send to the unit:



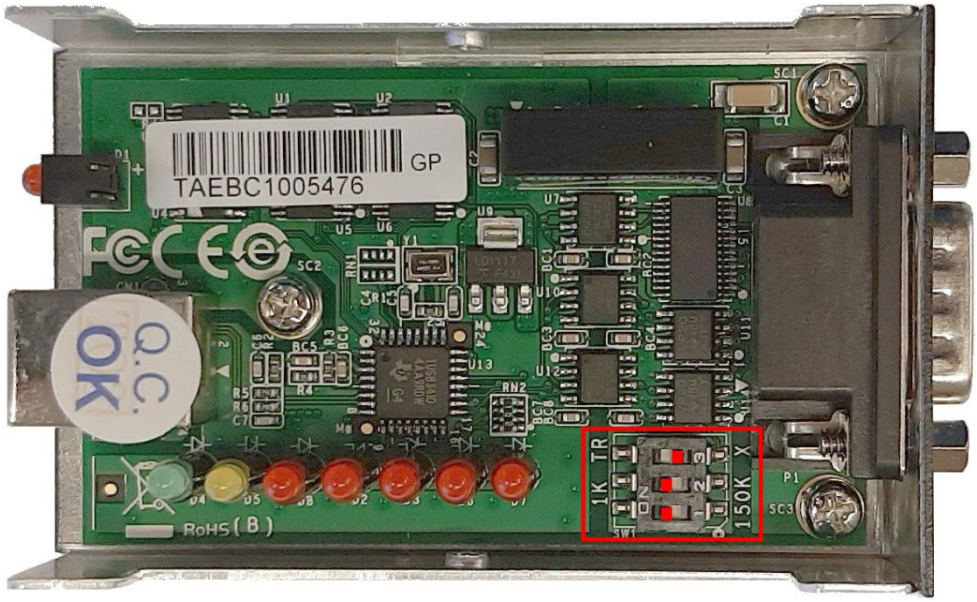
If you right-click on the left-most (gray) column, the commands will be sent to all the units.

If you right-click on one specific unit, the commands will be sent to this unit only.

15.6 Communication problems

If there are high noise levels or a DC voltage present on the communication bus, communication may be unstable or missing.

If this is the case, there are switches inside the Moxa UPort adapter that may improve the situation. Remove the cover on the Moxa UPort. Move DIP-switch 1 and 2 to the 1K position, as in this picture:



This adds 1KΩ pull-up/down resistors to the signal lines.

NOTE: In most cases, DIP switch 1 and 2 can be in either position, without any issues. Moving the switches to the 1K position will normally not cause any problems. However, if pull-up/down resistors are already present on the bus, adding more can make the total resistance too low.

DIP-switch 3 is a termination resistor. If you are using the cable supplied with the communication kit, there is a termination resistor in the DSUB connector. If you are using different cabling, you can move DIP switch 3 to the TR position to add a terminator.

15.7 Technical information

This information is not needed for most users. It is provided for system administrators and advanced users.

15.7.1 General

The file name of the utilities can be changed, as long as the extension is .exe. This does not affect operation in any way.

It is permissible to run several instances of the utilities, as long as each instance is using its own COM port.

If the UPort is used, the settings for the UPort are updated in the registry. Apart from this, nothing is stored in the registry.

15.7.2 Settings files

All settings for the utilities are stored in folder:

- %APPDATA%\File

Since %APPDATA% is user specific, settings are stored per user.

15.7.2.1 CCU

All settings for the CCU are stored in file ConfigUtility.INI

This file has the same name even if the CCU is renamed. This information is stored:

- Selected COM port
- Window positions and sizes
- Auto identify checkmark
- Unit filter selection
- Bar graph setup
- Other similar information

No PSBC settings are stored in this file. No essential information is stored in this file. It may be deleted without any serious consequences. It will be recreated the next time the CCU is closed.

During firmware update, a file with support information is saved. This file is automatically deleted when the update succeeds. If the update for some reason fails, this file can be used by RIPEnergy support personnel to recover the update.

CCU 29.08 and older saves this file in folder %APPDATA%\File

CCU 29.09 and higher saves this file in the folder the CCU is located.

15.7.2.2 CLU

All settings for the CLU are stored in file Log.INI

This file has the same name even if the CLU is renamed. This information is stored:

- Selected COM port
- Window position and size
- Other similar information

15.7.3 Uninstalling the utilities

No special uninstall procedure is required, just delete any copies of the utilities.

If you wish to remove all files generated by the utilities, delete this folder:

- %APPDATA%\File

16. Firmware revisions and known issues

Some general information about firmware revisions:

- All units must have firmware new enough to support the needed functionality
- Units with different firmware revisions can be mixed in a system
- Functionality and settings are backwards and forward compatible.
- You should look through section 16.2 to see if any of the issues affects your system, and upgrade/downgrade as needed

16.1 List of all firmware revisions

This is a short summary of the PSBC firmware revisions.

NOTE: The first 26 revisions was called ‘a’ to ‘z’, with ‘a’ equalling 1. After that numerical revisions are used.

Revision		Changes
Letter	**Number**	
G	7	Initial commercial release
H	8	Added support for firmware upgrades
I	9	Added support for new hardware revision
J	10	Added support for PSBC PS: • It is now possible to disable the front panel setup • Non-critical errors can be disabled • Errors can be set to latch • Added output undervoltage shutdown
K	11	Fan speed optimized for lower acoustical noise
L	12	Fan speed optimized for even lower acoustical noise
M	13	Added functionality: • 3-stage charging of lead-acid batteries (Section 10) • Fan speed measurement. Fan failure will now result in a caution • Configurable alarm relays (Section 7.8) • NTC modes can be selected (Section 8.3) • Added usage data • Fan always runs 5 seconds at full speed on startup Improvements: • Improved handling of short undervoltages/underfrequencies on AC input • Improved front panel LED indicator control (Section 3.6.2) • Improved handling of NTC (battery temperature) errors • Numerous optimizations
N	14	Added support for alternate current limit (Section 11.1)
O	15	Bug fixes only
P	16	Bug fixes only

Revision		Changes
Letter	Number	
Q	17	Added functionality: • Support for PSBC 48V • Fatal Error F7: Incorrect output polarity (See section 9) • Front panel display can be dimmed (Section 7.7.2) • A power limit can be set (Section 7.1.3) • PSBC 28V models: Maximum output voltage is increased from 30.7V to 34V Improvements: • All analog measurements are sampled at a much higher rate and filtered digitally, and are much more stable
R	18	Added functionality: • Support for PSBC Dual Input
S	19	Added functionality: • Fan speed can now be fixed, instead of automatic depending on temperature (Section 7.6)
T	20	Rewrite of high temperature derating/shutdown logic (Section 7.4)
U	21	3-stage charging now also works if the unit is set up to not participate in current sharing
V	22	Added user selectable min/max output voltage limits (Section 7.1.1) Added option for second degree battery voltage compensation (Section 8.3.2) Added user setting to shut down at low battery temperatures (Section 8.3.5)
W	23	Added possibility to automatically compensate for DC cable voltage drop: The output voltage can rise/fall proportionally to the load current. (Section 13)
X	24	Added functionality: • Added possibility to use the RS-485 bus as an input (Section 11.3) • Added an alarm relay mode (Section 7.8)
Y	25	Bug fixes only
Z	26	Added functionality: • Added dynamic power limit (Section 7.1.3) • Added high current mode (Section 7.1.2)
	27	Improvements: • Function DC cable voltage drop compensation can now be used for up to 6 units in parallel (Section 13.1.3) • RS-485 bus handles high bus utilization better (added collision prevention) Added functionality: • Added password protection (Section 6)

Revision		Changes
Letter	**Number**	
	28	Bug fixes Added functionality: • Derating of current limit according to NTC temperature. See section 8.3.9.
	29	Bug fixes Added functionality (All PSBCs): • Possibility to disable the DC OUT ON/OFF and Toggle V/A buttons Added functionality (Dual Input types only): • User selectable temperature shutdown/startup limits • Two new Power On Modes • Possibility to enable/disable the maintenance charger • Possibility to disable the DC input on/off-button
	30	Added functionality (All PSBCs): • One more alarm relay mode. See section 7.8.1. • Alarm relay outputs can be inverted. See section 7.8.2. • RS-485 Break detection can be inverted. See section 11.3. • Caution C5 undervoltage now has option for hysteresis. See section 7.3.2.

Because of the numerous improvements and optimizations in firmware revision 'M', it is recommended to upgrade older units when convenient.

To upgrade the firmware, use the PSBC Config Utility. See section 15.4.

16.2 Known firmware issues

The table below lists all significant firmware issues.

Firmware revisions having the issue are listed in the rightmost column named “Rev”.

For example, “G-N” means that:

- Revisions A to F do not have the issue
- Revisions G to N does have the issue
- Revisions O and later do not have the issue

ID	Function	Issue	Rev
ID01	3-stage charging	3-stage charging is disabled if the unit is set up to not participate in current sharing	M-T
ID02	3-stage charging	If custom 3-stage mode is activated, and one of the “Next stage” settings is set to shutdown, the unit will reset instead of going into shutdown. Do not use “Next stage” = shutdown on these revisions.	R-27
ID03	3-stage charging	In 3-stage mode 3 to 23, the absorption safety timer is 22 minutes (should be 4 hours)	M-N
ID04	3-stage charging	The following combination does not work: • Two or more units in parallel • Custom 3-stage is selected • Absorption termination current is set • Termination current Next stage is set to Shutdown If this combination is used, the units will not shut down correctly when the charge current goes below the termination current. Only one unit will shut down, and after a few seconds this unit will restart again. The units will now start and stop in an unpredictable manner. Notes: • If any of the conditions are not present, this issue does not apply • There are no plans to fix this issue as this time, as we do not predict that customers need this combination. Contact RIPEnergy if you need this feature combination	M-??
ID05	Active current sharing	In some cases, the automaster feature will not work properly. The units will operate at full performance, the only consequence is that active current sharing may not always work. If current sharing is vital, it is highly recommended to either use manual setting of current share master/slave, or to upgrade the firmware.	G-J
ID06	Active current sharing	Maximum and minimum voltage compensation was swapped.	G-Z

ID	Function	Issue	Rev
ID07	Active current sharing/Voltage drop compensation	The units does not always update the list of active units correctly.	27
ID08	Alarm relays	When an alarm relay should close on caution flags, the alarm relay does not close these cautions: • CF: InvalidSettings • CE: Debug • Cd: NTC_Error • CC: NTC_Missing The other cautions work as intended.	S-X
ID09	Derating	Derating does not always behave correctly	G-S
ID10	Error flags	Dual Input only: It was possible to disable error flag E7 when sending a ReadWriteUserSettings command on the RS-485 bus. Note that the PSBC Config Utility does not allow this, so this issue is only present if you use some other tools to send commands on the bus.	R-27
ID11	Front panel	The yellow front panel LED does not turn on when the unit is in current limit.	U-V
ID12	Inrush on DC output	In some situations (including regular startup) the inrush circuitry on the DC output was not functioning properly, and the output voltage is pulled down momentarily.	G-N
ID13	NTC	NTC-modes 3 to 16 does not respond correctly to a missing or faulty NTC	G-O
ID14	Overtemperature shutdown	When the unit enters high temperature shutdown, or is close to the shutdown temperature, the unit may reset. When the temperature drops, the unit will function normally again.	Q
ID15	Password protection	Dual Input only: It is not possible to read user settings from the DC input section on a password protected unit. The unit must be unlocked with the correct password before reading the settings.	27
ID16	RS-485	Dual Input only: When sending a Reset command, the DC input section is not reset, only the AC input section.	27
ID17	NTC	An NTC will adjust the output voltage on all the PSBCs connected to the same bus, regardless of power groups (see section 8.1). If only some PSBCs in a system are to use temperature compensated charging, disable the NTC on the PSBCs that do not require temperature compensated charging.	G-P
ID18	Dual Input 3-stage charging	The charger that charges batteries on the DC input does not activate float charging. The charger stays in boost charging forever. Note that this issue does not affect 3-stage charging on the DC output.	R-28

17. CE declaration of conformity

RIPEENERGY
The Power Conversion Company

Declaration of CE Conformity

RIPEnergy AG
Wägitalstrasse 24
CH-8854 Siebnen
Schweiz

Model Number:	PSBC-Mil 2400 AC/DC
Type of Equipment:	Power Supply and Charger
Applicable Directives:	2004/108/EC Electromagnetic Compatibility Directive Low Voltage Directive (LVD) 2006/95/EC 2006/95/EY
Standards of Conformity:	EN 55022 Incorporating corrigendum 1 EN 55024 Incorporating corrigendum 1 EN 61000-3-2 + A2 and EN 61000-3-3 EN 60950-1:2006/A11:2009
Other Test:	47CFR15.107 and 47CFR15.109 Mil-STD-461E; Ground Army; CE101, CE102, RE101, RE102, RS103, CS101, CS114, C5115 and CS116

RIPEnergy hereby declares that the products specified above conform to the Directives and Standards, when installed and operated in accordance with the specifications set in the Manual.

Date 29.09.2013
Signatory Marco Buholzer

18. Revision history

Typos and minor changes are not mentioned here, only corrected factual errors and new information.

Revision A

This is the initial revision of this document. However, this document loosely is based on P01A04, revision O. The biggest addition compared to P01A04O is that PSBC Dual Input models are described.

Revision B

Section 9.3:

- Corrected text “There is latching functionality” to “There **no** is latching functionality”

Revision C

Section 1.6:

- Added block schematics and description of functionality

Section 3.3:

- Replaced figure with picture. Some minor rewrites

Section 3.12/3.13:

- Added information about idle current consumption

Section 3.4.7:

- Added note about placing switches or circuit breakers on the negative wire

Section 3.8.2, item (7):

- Removed termination resistor recommendation

Section 3.9.2:

- Added leakage resistance of 48V PSBCs

Section 15:

- Added all information in document P12A01F PSBC Communication Kit User Manual
- Information from P12A01F updated according to newer software utilities

Revision D

Section 3.9.1 AC input filter:

- Corrected schematic drawing (rectifier bridge was connected incorrectly)

Section 7.8 Alarm relay mode:

- Added information about new alarm relay modes in firmware revision 30

Section 10 3-stage charging:

- Added information about stage Softstart

Section 11.3 RS-485 break handling:

- Added information about option to invert RS-485 break handling in firmware revision 30

Section 11.4 Debug modes:

- Added additional debug mode

Added section 14 DC output current limit selection.

Section 15.7.2.1 CCU:

- Updated information for newer CCU