### TSx00 converters and TSConfig application software

Each member of the TSx00 group has its own firmware version number and version history.

## TS400 firmware versions

***ts04v1.8***
Date: 03/09/2018. Replaces *ts04v1.7*

Added functionality:
Battery indicator, Indicator flash
An extra option, 'Indicator flash', is given for the battery indicator that is represented by the left LED on the converter. To reduce power consumption, the indicator is flashed (50 millisec, every 2 seconds) instead of always on. With this option checked, the TS400 consumes 8 mA only (standby mode).

Fix/change:
Temperature control optimized
In version **ts04v1.6** this option was introduced, but did not work correctly with low maximum output current settings (setting #22).

***ts04v1.7***
Date: 16/08/2018. Replaces *ts04v1.6*

Added functionality:
Temperature control optimized
Current limitation at temperatures close to setting 23 'Maximum temperature (pcb)' has been improved for 28V output voltage settings (for all $V_{out}$ > 20V).
In addition, when the internal temperature reaches setting 23, the converter is switched off.
The converter is then blocked (blue led blinks) for switching on again during 5 minutes of cooling down.

***ts04v1.6***
Date: 20/06/2018. Replaces *ts04v1.5*

Added functionality:

Battery voltage charge protection
To enable this feature, check setting 31 ‘Battery voltage charge protection’ in TSConfig.
Before the converter switches on, the output voltage (of the battery to be charged) is checked against the programmed setting 31.
When the battery voltage is lower than this setting, the output current is limited to the value that is programmed in the setting labelled ‘Current limitation at voltage under:’.
This limitation remains active until the converter is switched off.

Temperature control optimized
Setting 22 has an extra option: ‘Temperature control optimized’.
Normally, when the converter switches on, the output current can rise to the maximum setting immediately. The internal temperature will then rise, until the automatic temperature control limits the output current when the maximum temperature value comes closer.
With the option ‘Temperature control optimized’ enabled (automatically enabled when using ‘send settings’), the converter switches on and starts with 75% of its maximum output current. From this point the current is slowly increased to the maximum programmed setting. This enables the internal temperature sensor to pick up the rising of the temperature earlier and prevent overheating of the hot spots on the circuit board (near the mosfets), by limiting the output current accordingly.
In situations where the voltage difference between input and output is big, the input current can rise to very high levels which causes a fast increase of the temperature leading to possible failure of certain electronic components.

LED indication of active current limitation
The output LED on the converter goes purple when the converter is switched on and outputs current. In addition, the purple LED now *blinks* purple (2 Hz) in the situation of an active current limitation caused by low output battery voltage (setting 31).

Converter on/off by input voltage
To enable this feature, check ‘Converter on/off by input voltage’ in TSConfig.
In some situations the vehicle’s engine does not cause enough vibrations to be picked up by the sensor to switch on the converter.
Now you can use the voltage value of the input of the converter, to switch the converter on.
To do so, set the threshold (setting 57) and hysteresis (setting 58) to the desired values.
The converter switches on when the input voltage is higher than setting 57, after the switch on delay.
The converter switches off when the input voltage is lower than (setting 57 – setting 58) after the switch off delay, unless the sensor has picked up vibrations. Valid vibrations will restart the switch off delay.

Fix/change:
The input current is not being used anymore as a parameter for limiting the output current.

***ts04v1.5***
Date: 08/12/2016. Replaces *ts04v1.4*.
Added functionality:
Inductor noise reduction algorithm.
To enable this feature, check ‘Inductor noise reduction algorithm’ in TSConfig.
In special situations an internal inductor can produce audible noise when the converter supplies significant current. This can happen when Vout is slightly lower than Vin: the converter mode constantly changes from buck-boost to buck and back.
With 'inductor noise reduction algorithm' on and Vout less than 500 mV under Vin (during a minimum of 5 seconds), the controller reduces the output current for 10 minutes.
After 10 minutes, operations switches back to normal (and repeats if necessary).
(the current reduction is approx. 50%).
Fix:
None.

***ts04v1.4***
Date: 14/10/2016. Replaces *ts04v1.3*.
Added functionality:
Powerdown mode.
Powerdown is only available when using pin 1 (purple wire input 1 on pin 1) for switching the converter on and off.
To enable powerdown, check ‘Powerdown’ in TSConfig.
The converter enters sleep mode when the converter is switched off ***and*** output 2 is switched off after the delay (# 54) ***and*** TSConfig is closed for more than 5 seconds.
In sleep mode the current consumption is reduced to 1.3 mA (USB connector not plugged in).
In sleep mode, TSConfig cannot communicate with the converter.
To exit sleep mode, the converter has to be switched on by pin 1 (purple wire).
Fix:
None.

***ts04v1.3***
Date: 14/07/2016. Replaces *ts04v1.2*.
Added functionality:
None.
Fix:
The combination of Victron BMS input (setting 29) and ‘Converter on/off with pin 1’ (setting 50).
In previous versions this combination of settings would result in continuously switching the converter on and off when the Victron BMS output goes low.

***ts04v1.2***
Date: 11/04/2016. Replaces *ts04v1.1*.
Added functionality:
None.
Fix:
When programming high output voltages (higher than 14.4), the converter could shortly (100 msec) generate even higher voltages during switch on. This could cause the breakdown of internal protection components, resulting into general failure of the converter.
Fix:
Victron BMS input (setting 29). The 2 minutes exception has been removed (see version 1.0).

***ts04v1.1***
Date: 08/03/2016. Replaces *ts04v1.0*.
Added functionality:
Invert output pin 2 (setting 75).
The output pin 2 (green wire) can now be set to act inverted. Instead of going 'high' according to settings 71/72, the pin goes 'low'. For details, see TSConfig help.
Fix:
None.

***ts04v1.0***
Date: 14/01/2016. Replaces version *dc400wv1.0*.
Added functionality:
Victron BMS input (setting 29). Blocks the converter to start when the BMS output is low. Connect the BMS output to input 2 (green wire). This input is ignored for 2 minutes if the output voltage is lower than the 2nd setting 27 (battery low voltage).
Fix:
In previous versions the converter could switch off momentary (once every minute) in a situation with irregular vibrations sensed, in combination with a 1 minute switch off delay (setting 54).

## TS4002 firmware versions

***ts42v1.1***
Date: 25/06/2019. Replaces *ts42v1.0*.
Added functionality:
The existing (slow working) undervoltage protection (TSConfig setting 24/25) is extended with an fast double undervoltage lockout to prevent the converter from operating under extreme low input voltages.
The undervoltage lockout will trip in two situations:

- At Vinput < 9 Volts during 8 milliseconds (voltage is averaged out of 8 samples)
- At Vinput < 8 Volts during 1 millisecond (1 voltage sample)

When the undervoltage lockout trips, the converter is stopped and a block-time of 1 minute starts (blue led is blinking). The voltages and timing are fixed and cannot be changed.

Fix:
None.

***ts42v1.0***
Date: 13/03/2019. Initial version.

Functionality:
Same as TS400 as in ***ts04v1.8.***

## TS800 firmware versions

***ts08v1.8***
Date: 03/09/2018. Replaces *ts08v1.7*

Added functionality:
Battery indicator, Indicator flash
An extra option, 'Indicator flash', is given for the battery indicator that is represented by the left LED on the converter. To reduce power consumption, the indicator is flashed (50 millisec, every 2 seconds) instead of always on. With this option checked, the TS800 consumes 5 mA only (standby mode).

Fix/change:
Temperature control optimized
In version **ts08v1.6** this option was introduced, but did not work correctly with low maximum output current settings (setting #22).

***ts08v1.7***
Date: 16/08/2018. Replaces *ts08v1.6*.
Added functionality:
Temperature control optimized
Current limitation at temperatures close to setting 23 'Maximum temperature (pcb)' has been improved for 28V output voltage settings (for all $V_{out}$ > 20V).
In addition, when the internal temperature reaches setting 23, the converter is switched off.
The converter is then blocked (blue led blinks) for switching on again during 5 minutes of cooling down.

***ts08v1.6***
Date: 06/03/2018. Replaces *ts08v1.5*.
Added functionality:

Battery voltage charge protection

To enable this feature, check setting 31 'Battery voltage charge protection' in TSConfig.
Before the converter switches on, the output voltage (of the battery to be charged) is checked against the programmed setting 31.
When the battery voltage is lower than this setting, the output current is limited to the value that is programmed in the setting labelled 'Current limitation at voltage under:'.
This limitation remains active until the converter is switched off.

Temperature control optimized

Setting 22 has an extra option: 'Temperature control optimized'.
Normally, when the converter switches on, the output current can rise to the maximum setting immediately. The internal temperature will then rise, until the automatic temperature control limits the output current when the maximum temperature value comes closer.
With the option 'Temperature control optimized' enabled (automatically enabled when using 'send settings'), the converter switches on and starts with 60% of its maximum output current. From this point the current is slowly increased to the maximum programmed setting. This enables the internal temperature sensor to pick up the rising of the temperature earlier and prevent overheating of the hot spots on the circuit board (near the mosfets), by limiting the output current accordingly.
In situations where the voltage difference between input and output is big, the input current can rise to very high levels which causes a fast increase of the temperature leading to possible failure of certain electronic components.

LED indication of active current limitation

The output LED on the converter goes purple when the converter is switched on and outputs current. In addition, the purple LED now *blinks* purple (2 Hz) in the situation of an active current limitation caused by low output battery voltage (setting 31).

Converter on/off by input voltage

To enable this feature, check 'Converter on/off by input voltage' in TSConfig.
In some situations the vehicle's engine does not cause enough vibrations to be picked up by the sensor to switch on the converter.
Now you can use the voltage value of the input of the converter, to switch the converter on.
To do so, set the threshold (setting 57) and hysteresis (setting 58) to the desired values.
The converter switches on when the input voltage is higher than setting 57, after the switch on delay.
The converter switches off when the input voltage is lower than (setting 57 – setting 58) after the switch off delay, unless the sensor has picked up vibrations. Valid vibrations will restart the switch off delay.

Fix/change:
The input current is not being used anymore as a parameter for limiting the output current.
Alternating internal converter switchover when Vout (monitor 3) reaches Vout|(setting 20) is removed.

***ts08v1.5***
Date: 08/12/2016. Replaces *ts08v1.4*.
Added functionality:
Inductor noise reduction algorithm.
To enable this feature, check ‘Inductor noise reduction algorithm’ in TSConfig.
In special situations an internal inductor can produce audible noise when the converter supplies significant current. This can happen when Vout is slightly lower than Vin: the converter mode constantly changes from buck-boost to buck and back.
With 'inductor noise reduction algorithm' on and Vout less than 500 mV under Vin (during a minimum of 5 seconds), the controller reduces the output current for 10 minutes.
After 10 minutes, operations switches back to normal (and repeats if necessary).
(the current reduction is approx. 50%).
Fix:
None.

***ts08v1.4***
Date: 14/10/2016. Replaces *ts08v1.3*.
Added functionality:
Powerdown mode.
Powerdown is only available when using pin 1 (purple wire input 1 on pin 1) for switching the converter on and off.
To enable powerdown, check ‘Powerdown’ in TSConfig.
The converter enters sleep mode when the converter is switched off ***and*** output 2 is switched off after the delay (# 54) ***and*** TSConfig is closed for more than 5 seconds.
In sleep mode the current consumption is reduced to 1.3 to 1.7 mA (USB not plugged in).
In sleep mode, TSConfig cannot communicate with the converter.
To exit sleep mode, the converter has to be switched on by pin 1 (purple wire).
Fix:
None.

***ts08v1.3***
Date: 14/07/2016. Replaces *ts08v1.2*.
Added functionality:
None.
Fix:
The combination of Victron BMS input (setting 29) and ‘Converter on/off with pin 1’ (setting 50).
In previous versions this combination of settings would result in continuously switching the converter on and off when the Victron BMS output goes low.

***ts08v1.2***
Date: 22/06/2016. Replaces *ts08v1.1*.
Added functionality:
None.
Fix:
Communication with TSConfig. During the handling of several continuous analog to digital conversions, communication with the TSConfig application was sometimes missed, resulting into communication errors. From this version onwards, the issue has been solved.

***ts08v1.1***
Date: 11/04/2016. Replaces *ts08v1.0*.
Added functionality:
Invert output pin 2 (setting 75).
The output pin 2 (green wire) can now be set to act inverted. Instead of going 'high' according to settings 71/72, the pin goes 'low'. For details, see TSConfig help.
Fix:
When programming high output voltages (higher than 14.4), the converter could shortly (100 msec) generate even higher voltages during switch on. This could cause the breakdown of internal protection components, resulting into general failure of the converter.
Fix:
Victron BMS input (setting 29). The 2 minutes exception has been removed (see version 1.0).

***ts08v1.0***
Date: 24/12/2015. Replaces all previous versions *dc800wv1.0* to *dc800wv2.7*.
Added functionality:
Victron BMS input (setting 29). Blocks the converter to start when the BMS output is low. Connect the BMS output to input 2 (green wire). This input is ignored for 2 minutes if the output voltage is lower than the 2nd setting 27 (battery low voltage).
Fix:
In previous versions the converter could switch off momentary (once every minute) in a situation with irregular vibrations sensed, in combination with a 1 minute switch off delay (setting 54).

## TS800C firmware versions

***tsc08v1.5***
Date: 03/09/2018. Replaces *tsc08v1.4*

Added functionality:
Battery indicator, Indicator flash
An extra option, 'Indicator flash', is given for the battery indicator that is represented by the left LED on the converter. To reduce power consumption, the indicator is flashed (50 millisec, every 2 seconds) instead of always on. With this option checked, the TS800C consumes 5 mA only (standby mode).

Fix/change:
Temperature control optimized
In version **tsc08v1.3** this option was introduced, but did not work correctly with low maximum output current settings (setting #22).

***tsc08v1.4***
Date: 16/08/2018. Replaces *tsc08v1.3*.
Added functionality:
Temperature control optimized
Current limitation at temperatures close to setting 23 'Maximum temperature (pcb)' has been improved for 28V output voltage settings (for all $V_{out}$ > 20V).
In addition, when the internal temperature reaches setting 23, the converter is switched off.
The converter is then blocked (blue led blinks) for switching on again during 5 minutes of cooling down.

***tsc08v1.3***
Date: 29/01/2018. Replaces *tsc08v1.2*.
Added functionality:

CAN bus software for external temperature sensor

To enable this feature, check setting 80 ‘CAN bus external temperature sensor’ in TSConfig.
The external temperature sensor module is to be fitted on the battery being charged.
Depending on the type of battery, low temperatures normally require low charge currents.
The output current of the converter will be limited to the programmed setting, when the temperature of the sensor <= upper temperature setting.
The converter will be switched off, when the temperature of the sensor <= lower temperature setting. In this case the converter will be blocked to switch on again, until the temperature is higher than the lower temperature setting during more than 5 minutes.

Battery voltage charge protection

To enable this feature, check setting 31 ‘Battery voltage charge protection’ in TSConfig.
Before the converter switches on, the output voltage (of the battery to be charged) is checked against the programmed setting 31.
When the battery voltage is lower than this setting, the output current is limited to the value that is programmed in the setting labelled ‘Current limitation at voltage under:’.
This limitation remains active until the converter is switched off.

Temperature control optimized

Setting 22 has an extra option: ‘Temperature control optimized’.
Normally, when the converter switches on, the output current can rise to the maximum setting immediately. The internal temperature will then rise, until the automatic temperature control limits the output current when the maximum temperature value comes closer.
With the option ‘Temperature control optimized’ enabled (automatically enabled when using ‘send settings’), the converter switches on and starts with 60% of its maximum output current. From this point the current is slowly increased to the maximum programmed setting. This enables the internal temperature sensor to pick up the rising of the temperature earlier and prevent overheating of the hot spots on the circuit board (near the mosfets), by limiting the output current accordingly.
In situations where the voltage difference between input and output is big, the input current can rise to very high levels which causes a fast increase of the temperature leading to possible failure of certain electronic components.

LED indication of active current limitation

The output LED on the converter goes purple when the converter is switched on and outputs current. In addition, the purple LED now *blinks* purple (2 Hz) in the situation of an active current limitation caused by low output battery voltage (setting 31) or low battery temperature (setting 80).

Fix/change:
The input current is not being used anymore as a parameter for limiting the output current.
Alternating internal converter switchover when Vout (monitor 3) reaches Vout|(setting 20) is removed.

***tsc08v1.2***
Date: 27/02/2017. Replaces *tsc08v1.1*.
Added functionality:
Converter on/off by input voltage.
To enable this feature, check ‘Converter on/off by input voltage’ in TSConfig.
In some situations the vehicle’s engine does not cause enough vibrations to be picked up by the sensor to switch on the converter.
Now you can use the voltage value of the input of the converter, to switch the converter on.
To do so, set the threshold (setting 57) and hysteresis (setting 58) to the desired values.
The converter switches on when the input voltage is higher than setting 57, after the switch on delay.
The converter switches off when the input voltage is lower than (setting 57 – setting 58) after the switch off delay, unless the sensor has picked up vibrations. Valid vibrations will restart the switch off delay.
Fix:
None.

***tsc08v1.1***
Date: 08/12/2016. Replaces *tsc08v1.0*.
Added functionality:
Inductor noise reduction algorithm.
To enable this feature, check ‘Inductor noise reduction algorithm’ in TSConfig.
In special situations an internal inductor can produce audible noise when the converter supplies significant current. This can happen when Vout is slightly lower than Vin: the converter mode constantly changes from buck-boost to buck and back.
With 'inductor noise reduction algorithm' on and Vout less than 500 mV under Vin (during a minimum of 5 seconds), the controller reduces the output current for 10 minutes.
After 10 minutes, operations switches back to normal (and repeats if necessary).
(the current reduction is approx. 50%).
Fix:
None.

***tsc08v1.0***
Date: 14/10/2016. First firmware version.
Basic converter functionality copied from TS800 firmware version ts08v1.4.
Added functionality:
Simple CAN routines to demonstrate the possibilities of sharing information over the CAN bus.
Fix:
None.

## TS800C-2 firmware versions

***ts82v1.3***
Date: 18/08/2020. Replaces *ts82v1.2*.

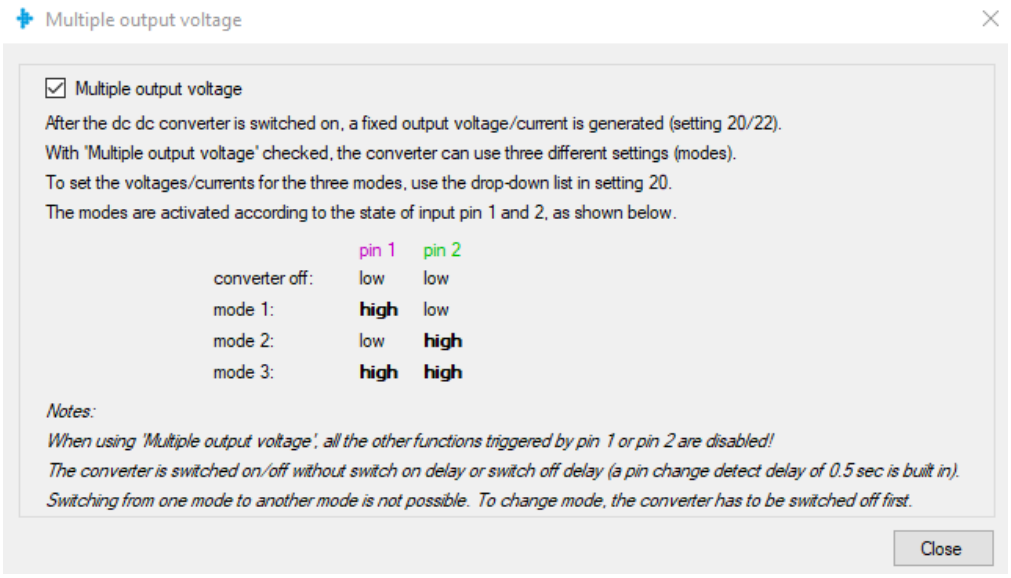
Changes:
The firmware source files are compiled to the .hex file using a new compiler (xc8 version 2.20).

The undervoltage lockout has been changed on two details:
The undervoltage lockout will trip in two situations:

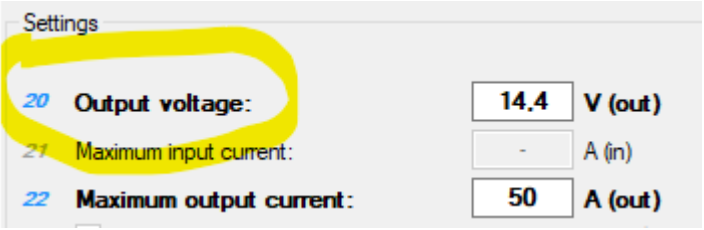
- At Vinput < 9 Volts during 8 milliseconds (voltage is averaged out of 8 samples). NOT CHANGED.
- At Vinput < 8 Volts during 1 millisecond (1 voltage sample). The threshold of 8 Volts changes to 6.5 V when the converter is in Multiple ouput voltage mode 2 or 3.

When the undervoltage lockout trips, the converter is stopped and a block-time of 10 seconds (was 1 minute) starts (blue led is blinking). The voltages and timing are fixed and cannot be changed.

Added functionality:
Multiple output voltage.
This new functionality is only available for TS800C-2, using TSConfig version 2.10 or higher.




Click on setting 20 to make the Multiple output voltage window visible.




Fix:
None.

***ts82v1.2***
Date: 25/06/2019. Replaces *ts82v1.1*.
Added functionality:
The existing (slow working) undervoltage protection (TSConfig setting 24/25) is extended with an fast double undervoltage lockout to prevent the converter from operating under extreme low input voltages.
The undervoltage lockout will trip in two situations:

- At Vinput < 9 Volts during 8 milliseconds (voltage is averaged out of 8 samples)
- At Vinput < 8 Volts during 1 millisecond (1 voltage sample)

When the undervoltage lockout trips, the converter is stopped and a block-time of 1 minute starts (blue led is blinking). The voltages and timing are fixed and cannot be changed.

Fix:
None.

***tsc82v1.1***
Date: 14/02/2019. Initial version.

Functionality:
Same as TS800C as in ***tsc08v1.5.***

## TS800C3/C4/C5 firmware versions

***ts83v1.1***
Date: 13/10/2022. Replaces *ts83v1.0*.

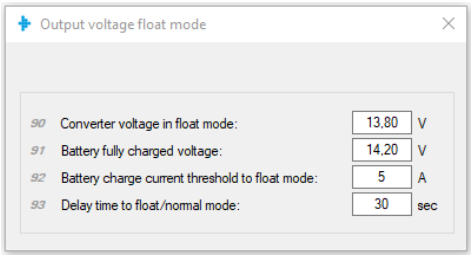
The TS800C5 is a hardware variant to the TS800C3/4 versions, not an upgrade.
Different DAC's are used for setting the output voltage/current.
TS800C5 runs on firmware ts83v1.1 or higher.
TS800C5 is recognized by TSConfig from version 2.2.4.

***ts83v1.0***
Date: 15/12/2021.

The ts83vx.x firmware is introduced for TS800C3 and C4 devices that have been upgraded from TS800C-2.
The differences between C3 and C4:

- Output mosfets (pin 1 and 2) changed footprints
- From C4 the CAN bus power supply pin is fuse-protected

Added functionality:
The output current and output voltage is now measured with an accuray of 0.5%.
New settings have been introduced to create a float mode after charging.



## TS1600 firmware versions

***ts16v1.2***
Date: 25/06/2019. Replaces *ts16v1.1*.
Added functionality:
The existing (slow working) undervoltage protection (TSConfig setting 24/25) is extended with an fast double undervoltage lockout to prevent the converter from operating under extreme low input voltages.
The undervoltage lockout will trip in two situations:

- At Vinput < 9 Volts during 8 milliseconds (voltage is averaged out of 8 samples)
- At Vinput < 8 Volts during 1 millisecond (1 voltage sample)

When the undervoltage lockout trips, the converter is stopped and a block-time of 1 minute starts (blue led is blinking). The voltages and timing are fixed and cannot be changed.

Fix:
None.

***ts16v1.1***
Date: 14/09/2018. Replaces version *ts16v1.0*.

Fix:
Incorrect behavior of current limitation circuit nr. 5.

***ts16v1.0***
Date: 26/08/2018. Initial version.

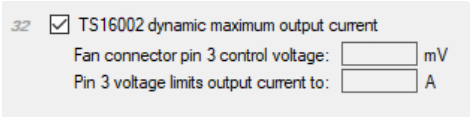
Functionality:
Same as TS800C as in ***tsc08v1.5.***

Added functionality:
Battery indicator, Indicator flash
An extra option, 'Indicator flash', is given for the battery indicator that is represented by the left LED on the converter.
To reduce power consumption, the indicator is flashed (50 millisec, every 2 seconds) instead of always on.
With this option checked, the TS1600 consumes 12 mA only (standby mode).

## TS16002 firmware versions

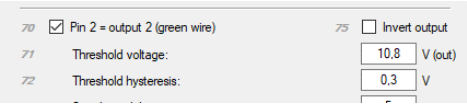
***ts162v1.2***
Date: 18/10/2023.

Functionality:
Pin 3 on the fan connector can be used as an analog control pin to vary the maximum output current.
The control voltage range is 0..2V (use a low impedance source!).
This voltage 0..2V controls 0..100% of setting 22, the maximum output current.
Note that this maximum never calculates lower than 8A.
Note that the current limit caused by high temperature has priority over this voltage control.
Note that when leaving pin 3 unconnected, the result is 2.048V control voltage that sets 100% output current.




***ts162v1.1***
Date: 28/09/2022.

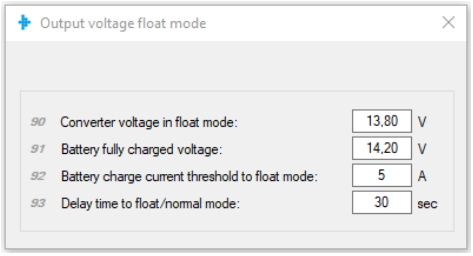
Fix:
Setting 72 is now handled in the correct way (it was not accurate).




***ts162v1.0***
Date: 21/01/2022.

The ts162vx.x firmware is for TS16002 devices only.
The TS16002 is a hardware upgrade from the TS1600.

Added functionality:
The output current and output voltage is now measured with an accuray of 0.5%.
New settings have been introduced to create a float mode after charging.

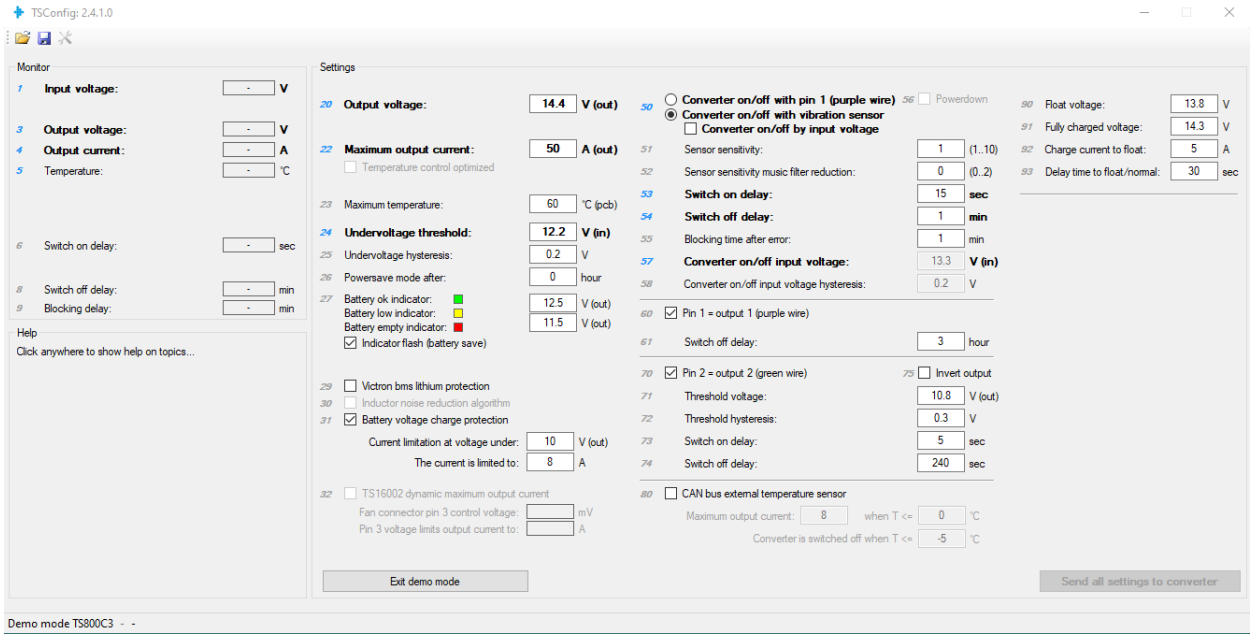



Fix:
None.

## TSConfig

**Version 2.4.1.**
Date: 21/02/2024. Replaces version 2.4.0.

Change in the main window:
The width of the main window has been resized to 1350 pxs, so it will also fit on laptops with a 1366 pxs screen.

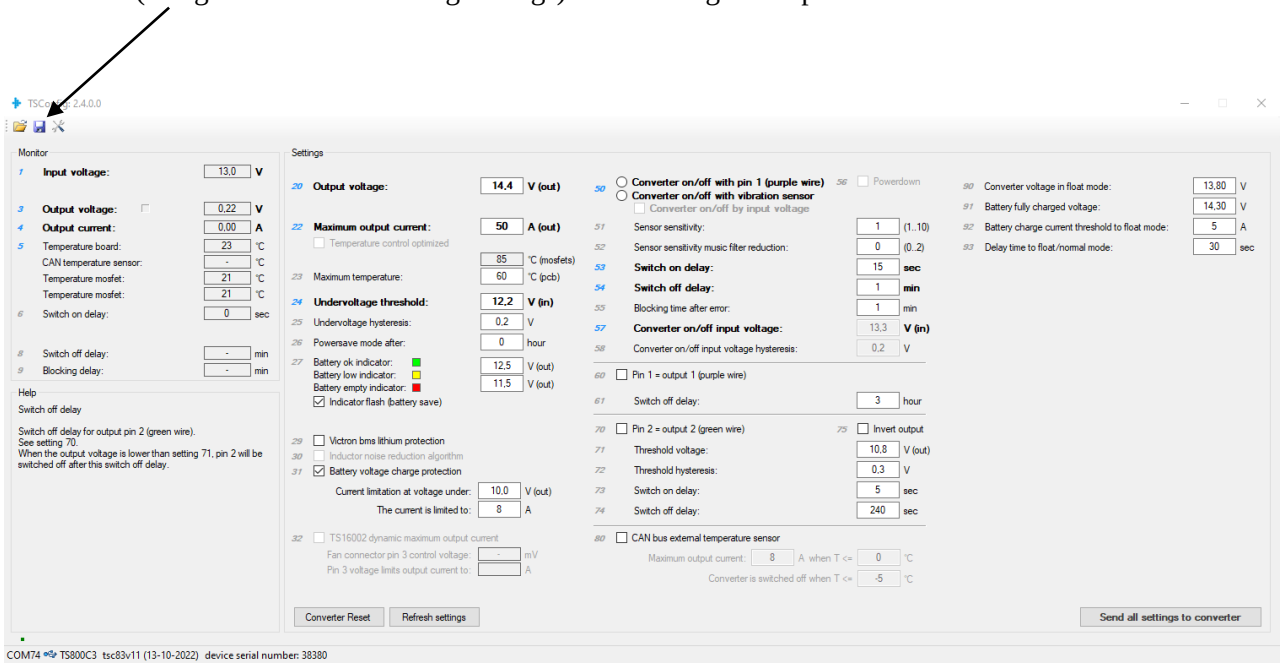



Included converter firmware:

- ts04v18.hex
- ts42v11.hex (firmware for the TS4002 devices with black enclosure)
- ts08v19.hex
- tsc08v15.hex
- tsc82v12.hex (firmware for the TS800C-2 devices with black enclosure)
- tsc82v13.hex
- tsc82v14.hex
- tsc83v10.hex (firmware for the TS800C3/C4 devices)
- tsc83v11.hex (firmware for the TS800C3/C4/C5 devices)
- ts16v12.hex (firmware for TS1600)
- ts162v11.hex (firmware for TS16002)
- ts162v12.hex (firmware for TS16002)

**Version 2.4.0.**
Date: 14/02/2024. Replaces version 2.3.0.

Change in the main window:
The float mode settings (settings 90..93) have been moved from the separate window to the main window. In older versions (with a separate window for float mode settings), these four settings were not properly saved to file (using the button for saving settings) after closing this separate 'float' window.

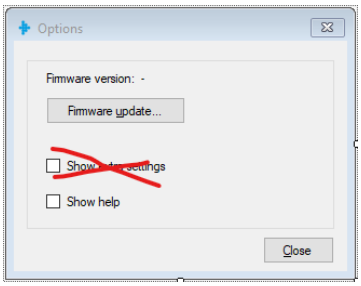



Included converter firmware:

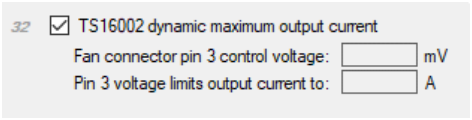
- ts04v18.hex
- ts42v11.hex (firmware for the TS4002 devices with black enclosure)
- ts08v19.hex
- tsc08v15.hex
- tsc82v12.hex (firmware for the TS800C-2 devices with black enclosure)
- tsc82v13.hex
- tsc82v14.hex
- tsc83v10.hex (firmware for the TS800C3/C4 devices)
- tsc83v11.hex (firmware for the TS800C3/C4/C5 devices)
- ts16v12.hex (firmware for TS1600)
- ts162v11.hex (firmware for TS16002)
- ts162v12.hex (firmware for TS16002)

**Version 2.3.0.**
Date: 18/10/2023. Replaces version 2.2.5.

Change in menu options :
In the options menu, the ‘Show extra settings' checkbox is not available anymore.




Functionality for the TS16002 for protection of alternator overload:
Pin 3 on the TS16002 fan connector can be used as an analog control pin to vary the maximum output current. The control voltage range is 0..2V (use a low impedance source!).
This voltage 0..2V controls 0..100% of setting 22, the maximum output current.
Note that this maximum never calculates lower than 8A.
Note that the current limit caused by high temperature has priority over this voltage control.
Note that when leaving pin 3 unconnected, the result is 2.048V control voltage that sets 100% output current.

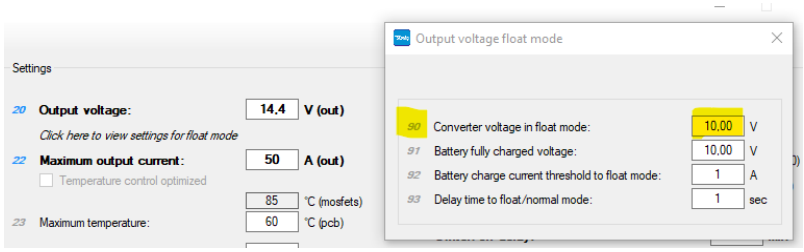



Included converter firmware:

- ts04v18.hex
- ts42v11.hex (firmware for the TS4002 devices with black enclosure)
- ts08v19.hex
- tsc08v15.hex
- tsc82v12.hex (firmware for the TS800C-2 devices with black enclosure)
- tsc82v13.hex
- tsc82v14.hex
- tsc83v10.hex (firmware for the TS800C3/C4 devices)
- tsc83v11.hex (firmware for the TS800C3/C4/C5 devices)
- ts16v12.hex (firmware for TS1600)
- ts162v11.hex (firmware for TS16002)
- ts162v12.hex (firmware for TS16002)

**Version 2.2.5.**
Date: 02/03/2023. Replaces version 2.2.4.

Change in setting limits :
The lower limit of Setting 90 (Converter voltage in float mode) has been lifted from 5V to 10V.
A value lower than 10V will be changed to 10V during programming (in 'Send Settings').
In previous versions of TSConfig it was possible to enter a value as low as 5V, but this would give unpredictable output voltages during float mode.



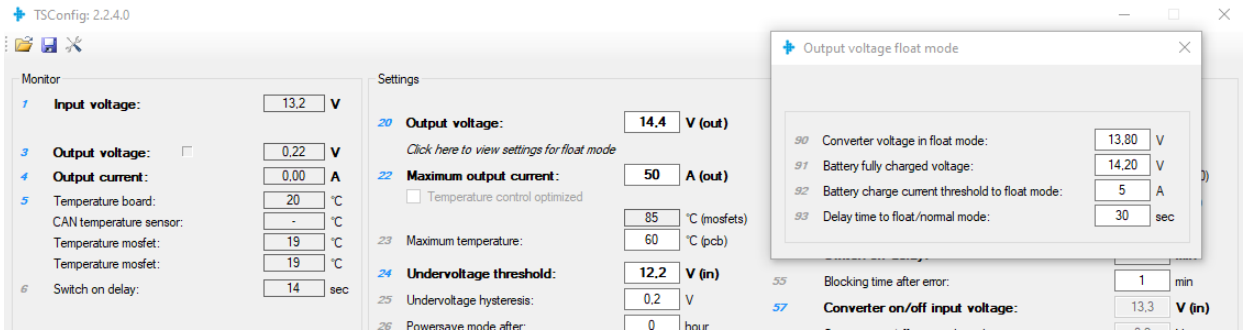

Included converter firmware:

- ts04v18.hex
- ts42v11.hex (firmware for the TS4002 devices with black enclosure)
- ts08v19.hex
- tsc08v15.hex
- tsc82v12.hex (firmware for the TS800C-2 devices with black enclosure)
- tsc82v13.hex
- tsc82v14.hex
- tsc83v10.hex (firmware for the TS800C3/C4 devices)
- tsc83v11.hex (firmware for the TS800C3/C4/C5 devices)
- ts16v12.hex (firmware for TS1600)
- ts162v11.hex (firmware for TS16002)

**Version 2.2.4.**
Date: 14/10/2022. Replaces version 2.2.2.

Added functionality:
Support for TS800C3/C4/C5 devices and the TS16002.
Due to several hardware changes, a firmware version for C3, C4 and C5 devices is introduced: tsc83vxx.
Each of these Cx devices is recognized by this version of TSConfig.
The TS1600 has been upgraded to TS16002.

For TS800C3/C4/C5 and TS16002 devices, the float mode is supported.
Click on 'float mode' in the setting 20 field to open the float mode settings window.

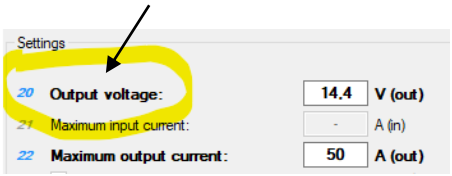



Included converter firmware:

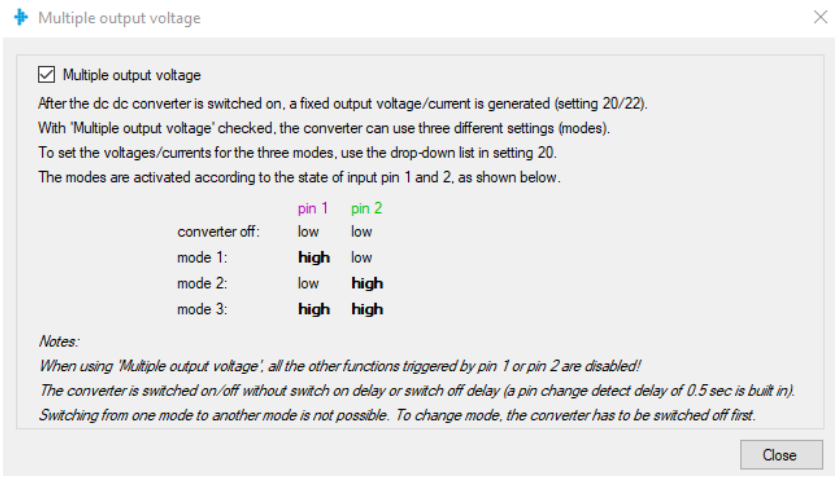
- ts04v18.hex
- ts42v11.hex (firmware for the TS4002 devices with black enclosure)
- ts08v19.hex
- tsc08v15.hex
- tsc82v12.hex (firmware for the TS800C-2 devices with black enclosure)
- tsc82v13.hex
- tsc82v14.hex
- tsc83v10.hex (firmware for the TS800C3/C4 devices)
- tsc83v11.hex (firmware for the TS800C3/C4/C5 devices)
- ts16v12.hex (firmware for TS1600)
- ts162v10.hex (firmware for TS16002)

**Version 2.1.1.**
Date: 18/08/2020. Replaces version 2.0.0.

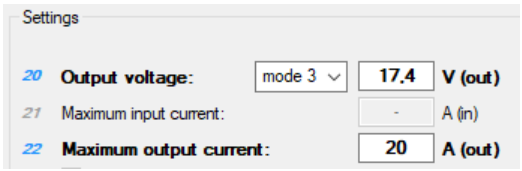
Added functionality:
Multiple output voltage.
Click on setting 20 to make the Multiple output voltage window visible.




This new functionality is only available for the TS800C-2 (with firmware version *tsc82v13* or higher).




After Multiple output voltage is enabled, the mode selector becomes available to set three different modes of conversion (voltage/current).




Changes:
Certain settings in TSConfig use formulas to calculate value's for the converter to work with.
Formulas having the constant 2.048 V (internal voltage reference) used by the converter types TS1600/TS800C-2/TS4002, have been changed to 2.0 V.

Included converter firmware:

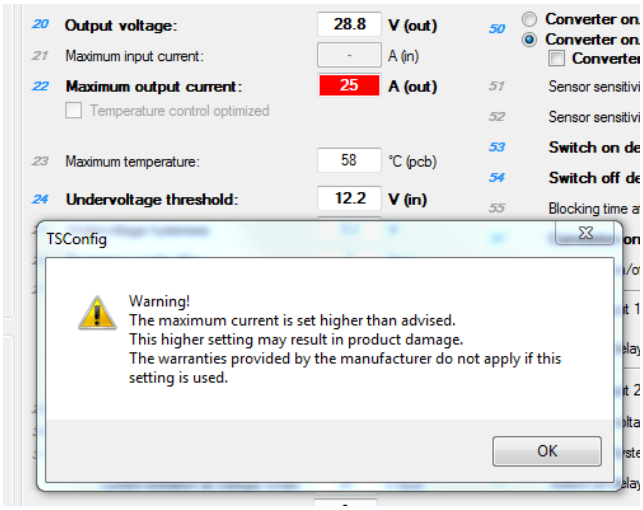
- ts04v18.hex
- ts42v11.hex (firmware for the new TS4002 devices with black enclosure)
- ts08v18.hex
- tsc08v15.hex
- tsc82v12.hex (firmware for the new TS800C-2 devices with black enclosure)
- **tsc82v13.hex**
- ts16v12.hex

**Version 2.0.0.**
Date: 24/06/2020. Replaces version 1.7.2.

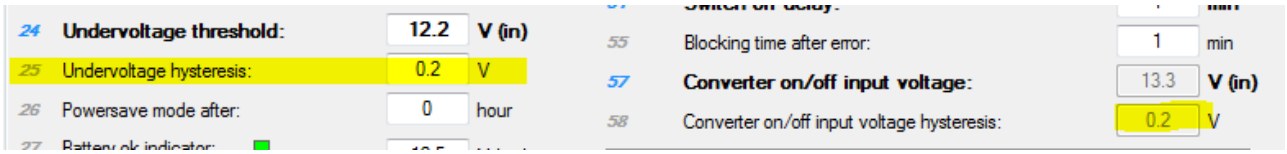
New company logo in the connect dialog:

TS ENOVATIONS
innovative energy components

Added functionality:
For TS800C and TS800C2, when high output voltages (typ. 28V) are set, the maximum output current may be set 5A higher than normally recommended.
When the current is set higher than recommended, the value will be shown in flashing red. This means that a setting is chosen where the warranties provided by the manufacturer do not apply anymore.
This warning is shown only once (until a restart of the application).




Fix :
At programming of all settings, the value for setting #25 was taken from the value present at setting #58.

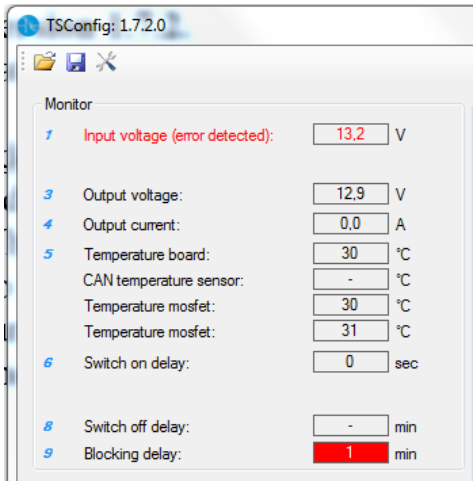



Included converter firmware:

- **ts04v18.hex**
- **ts42v11.hex** (firmware for the new TS4002 devices with black enclosure)
- **ts08v18.hex**
- **tsc08v15.hex**
- **tsc82v12.hex** (firmware for the new TS800C-2 devices with black enclosure)
- **ts16v12.hex**

**Version 1.7.2.**
Date: 25/06/2019. Replaces version 1.7.1.

Added functionality:
Indication of the undervoltage lockout trip event (added functionality in ts42v11/tsc82v12/ts16v12).
When the undervoltage lockout has tripped, the blocking delay has started.
To indicate that the blocking is caused by the undervoltage lockout, monitor 1 *input voltage*, is colored red during the blocking time. The input voltage value shown is the current value, not the trip voltage.
(the trip voltage levels are fixed in the device's firmware).




Included converter firmware:

- ts04v15.hex
- ts04v16.hex
- ts04v17.hex
- **ts04v18.hex**
- ts42v10.hex (firmware for the new TS4002 devices with black enclosure)
- **ts42v11.hex**
- ts08v15.hex
- ts08v16.hex
- ts08v17.hex
- **ts08v18.hex**
- tsc08v12.hex
- tsc08v13.hex
- tsc08v14.hex
- **tsc08v15.hex**
- tsc82v11.hex (firmware for the new TS800C-2 devices with black enclosure)
- **tsc82v12.hex**
- ts16v11.hex
- **ts16v12.hex**

**Version 1.7.1.**
Date: 10/04/2019. Replaces version 1.7.0.

Added functionality:
Support for TS4002 (TS400 converter with black enclosure).

Fix :
None

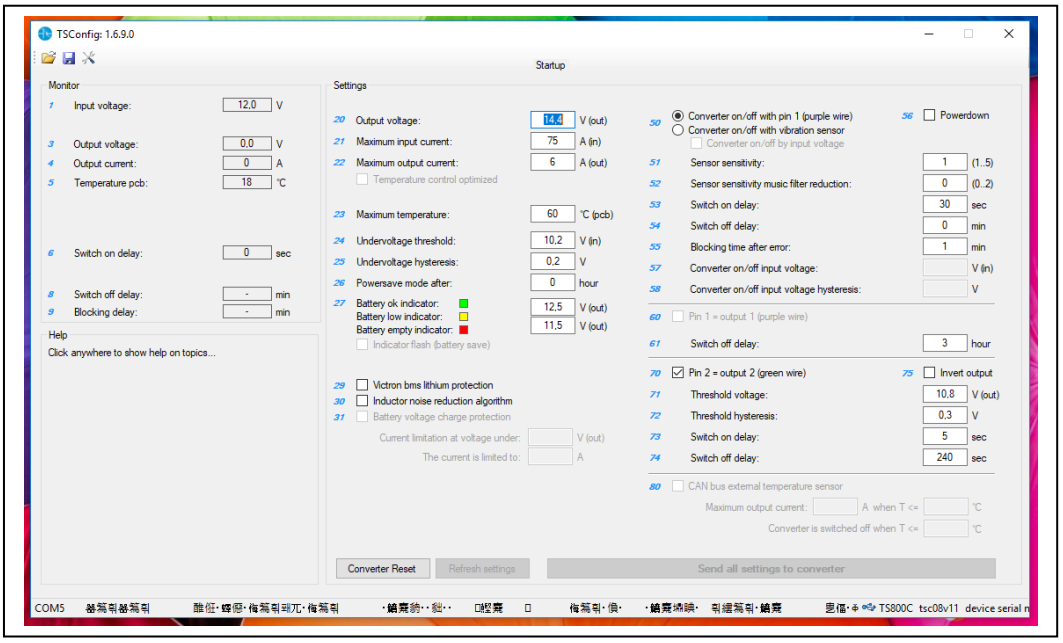
Included converter firmware:

- ts04v15.hex
- ts04v16.hex
- ts04v17.hex
- **ts04v18.hex**
- **ts42v10.hex** (firmware for the new TS4002 devices with black enclosure)
- ts08v15.hex
- ts08v16.hex
- ts08v17.hex
- **ts08v18.hex**
- tsc08v12.hex
- tsc08v13.hex
- tsc08v14.hex
- **tsc08v15.hex**
- **tsc82v11.hex** (firmware for the new TS800C-2 devices with black enclosure)
- **ts16v11.hex**

**Version 1.7.0.**
Date: 13/03/2019. Replaces version 1.6.9.

Added functionality:
Support for TS4002 (TS400 converter with black enclosure).

Fix :
On some (new) Windows 10 computers, the TSConfig statusstrip can show erroneous characters. (Windows adds these characters to the COMx string)
Also, connecting through a manually selected COM port, the application can exit.




Included converter firmware:

- ts04v15.hex
- ts04v16.hex
- ts04v17.hex
- **ts04v18.hex**
- **ts42v10.hex** (firmware for the new TS4002 devices with black enclosure)
- ts08v15.hex
- ts08v16.hex
- ts08v17.hex
- **ts08v18.hex**
- tsc08v12.hex
- tsc08v13.hex
- tsc08v14.hex
- **tsc08v15.hex**
- **tsc82v11.hex** (firmware for the new TS800C-2 devices with black enclosure)
- **ts16v11.hex**

**Version 1.6.9.**
Date: 17/02/2019. Replaces version 1.6.5-1.6.8.

Added functionality:
This version supports the new TS800C-2 devices (with black enclosure).

Included converter firmware:

- ts04v15.hex
- ts04v16.hex
- ts04v17.hex
- **ts04v18.hex**
- ts08v15.hex
- ts08v16.hex
- ts08v17.hex
- **ts08v18.hex**
- tsc08v12.hex
- tsc08v13.hex
- tsc08v14.hex
- **tsc08v15.hex**
- **tsc82v11.hex** (firmware for the new TS800C-2 devices with black enclosure)
- **ts16v11.hex**

**Version 1.6.5.**
Date: 14/09/2018. Replaces version 1.6.3.

Added functionality:
Demonstration mode selectable for TS400, TS800C and TS1600 devices.

Included converter firmware:

- ts04v15.hex
- ts04v16.hex
- ts04v17.hex
- **ts04v18.hex**
- ts08v15.hex
- ts08v16.hex
- ts08v17.hex
- **ts08v18.hex**
- tsc08v12.hex
- tsc08v13.hex
- tsc08v14.hex
- **tsc08v15.hex**
- **ts16v11.hex**

**Version 1.6.3.**
Date: 27/08/2018. Replaces version 1.6.2.

Added functionality:
Support for TS1600 dc/dc converter.

Setting #23 : Maximum temperature.
The TS1600 converter has 2 extra internal temperature sensors, placed near the mosfets.
In this way, temperature monitoring is improved to prevent overheating.
The maximum temperature allowed for the mosfets is fixed in firmware by adding 25°C to the value of setting #23.
So, when the maximum temperature (pcb) is set to 60°C, the TS1600 firmware sets the maximum mosfet temperature to 85°C
When connected to a TS1600, setting #23 also shows the maximum temperature for the mosfets, based on the value that is given for the pcb temperature.

Setting #27 : Battery indicator, Indicator flash.
An extra option, 'Indicator flash', is given for the battery indicator that is represented by the left LED on the converter.
To reduce power consumption, the indicator is flashed (50 millisec, every 2 seconds) instead of always on.

Included converter firmware:
- ts04v15.hex
- ts04v16.hex
- ts04v17.hex
- **ts04v18.hex**
- ts08v15.hex
- ts08v16.hex
- ts08v17.hex
- **ts08v18.hex**
- tsc08v12.hex
- tsc08v13.hex
- tsc08v14.hex
- **tsc08v15.hex**
- **ts16v10.hex**

**Version 1.6.2.**
Date: 16/08/2018. Replaces version 1.6.0.

Changes:
Setting #20 : Output voltage.
Setting #22 : Maximum output current.
Setting #24 : Undervoltage threshold.
These three settings are related. The maximum output current changes to a specific maximum, when the output voltage is increased or when the undervoltage threshold is decreased.

Setting #23 : Maximum temperature (pcb).
The default maximum value is 60°C for 12V settings. Now, with 28V output voltages (at all $V_{out}$ > 20V), the maximum value becomes 58°C.

Included converter firmware:
- ts04v15.hex
- ts04v16.hex
- **ts04v17.hex**
- ts08v15.hex
- ts08v16.hex
- **ts08v17.hex**
- tsc08v12.hex
- tsc08v13.hex
- **tsc08v14.hex**

**Version 1.6.0.**
Date: 20/06/2018. Replaces version 1.5.1.

Fix :
Setting #58 : Converter on/off input voltage hysteresis. The value of this setting was written by TSConfig to the wrong internal register in the converter, leaving the converter's value for this setting unchanged.

Changes:
Setting #41: Dual mode: converter is master
To enable more configuration settings in Master mode, setting 29 and setting 70 are not fixed anymore.
Also, choosing default settings (menu option) now has two different Master choices.

Added functionality:

1. Converter on/off by input voltage (setting 50) now available for TS400.

Note: only for TS400 with firmware version ts04v1.6 or higher

2. Battery voltage charge protection (setting 31) now available for TS400.

Note: only for TS400 with firmware version ts04v1.6 or higher

3. Temperature control optimized (setting 22) now available for TS400.

Note: only for TS400 with firmware version ts04v1.6 or higher

Included converter firmware:

- ts04v15.hex
- ts04v16.hex
- ts08v15.hex
- ts08v16.hex
- tsc08v12.hex
- tsc08v13.hex

**Version 1.5.1.**
Date: 06/03/2018. Replaces version 1.4.7.
Changes:
Setting 21 ‘Maximum input current’ is disabled when the connected device runs a firmware version that no longer uses this parameter.

Added functionality:

4. CAN bus software for external temperature sensor

To enable this feature, check setting 80 ‘CAN bus external temperature sensor’.
The external temperature sensor module is to be fitted on the battery being charged.
Depending on the type of battery, low temperatures normally require low charge currents.
The output current of the converter will be limited to the programmed setting, when the temperature of the sensor <= upper temperature setting.
The converter will be switched off, when the temperature of the sensor <= lower temperature setting. In this case the converter will be blocked to switch on again, until the temperature is higher than the lower temperature setting during more than 5 minutes.

5. Battery voltage charge protection

To enable this feature, check setting 31 ‘Battery voltage charge protection’.
Before the converter switches on, the output voltage (of the battery to be charged) is checked against the programmed setting 31.
When the battery voltage is lower than this setting, the output current is limited to the value that is programmed in the setting labelled ‘Current limitation at voltage under:’.
This limitation remains active until the converter is switched off.

6. Temperature control optimized

Setting 22 has an extra option: ‘Temperature control optimized’.
Normally, when the converter switches on, the output current can rise to the maximum setting immediately. The internal temperature will then rise, until the automatic temperature control limits the output current when the maximum temperature value comes closer.
With the option ‘Temperature control optimized’ enabled, the converter switches on and starts with 60% of its maximum output current. From this point the current is slowly increased to the maximum programmed setting. This enables the internal temperature sensor to pick up the rising of the temperature earlier and prevent overheating of the hot spots on the circuit board (near the mosfets), by limiting the output current accordingly.
In situations where the voltage difference between input and output is big, the input current can rise to very high levels which causes a fast increase of the temperature leading to possible failure of certain electronic components.

7. Device serial number

The status strip shows the serial number of the connected TSx00 device.

Included converter firmware:

- ts04v15.hex
- ts08v15.hex
- ts08v16.hex
- tsc08v12.hex
- tsc08v13.hex

**Version 1.4.7.**
Date: 15/05/2017. Replaces version 1.4.6.
Changes:
None.
Added functionality:
Warning on setting 20.
When the Vout voltage is set > 16V, a warning to check the generated voltage is displayed.
Checking this voltage is important, because the converter is calibrated around 14.4 V.
High settings like 28.8V can lead to lower/higher generated voltages.
To be sure that the converter generates the desired voltage, the Vout setting should be adjusted until the measured voltage on the +OUT connection is correct.

Included converter firmware:
- ts04v14.hex
- ts04v15.hex
- ts08v13.hex
- ts08v14.hex
- ts08v15.hex
- tsc08v10.hex
- tsc08v11.hex
- tsc08v12.hex

**Version 1.4.6.**
Date: 27/02/2017. Replaces version 1.4.5.
Changes:
None.
Added functionality:
Setting 50: Converter on/off by input voltage.
Setting 57: Converter on/off input voltage.
Setting 58: Converter on/off input voltage hysteresis.
Included converter firmware:
- ts04v14.hex
- ts04v15.hex
- ts08v13.hex
- ts08v14.hex
- ts08v15.hex
- tsc08v10.hex
- tsc08v11.hex
- tsc08v12.hex

**Version 1.4.5.**
Date: 30/01/2017. Replaces version 1.4.4.
Changes:
Setting 24, Undervoltage threshold, is pre-loaded with a value of 12.2 V when loading default settings using the option 12-12 or 12-24 from the Load settings window.
Setting 53, Switch on delay, is pre-loaded with a value of 15 seconds (was 30 seconds) when loading default settings using the option 12-12 or 12-24 from the Load settings window.
Added functionality:
None.
Included converter firmware:
- ts04v14.hex
- ts04v15.hex
- ts08v13.hex
- ts08v14.hex
- ts08v15.hex
- tsc08v10.hex
- tsc08v11.hex

**Version 1.4.4.**
Date: 08/12/2016. Replaces version 1.4.1 to 1.4.3.
Added functionality:
Setting 30: Inductor noise reduction algorithm.
To enable this feature, check ‘Inductor noise reduction algorithm’ in TSConfig.
In special situations an internal inductor (TS800/TS800C/TS400) can produce audible noise when the converter supplies significant current. This can happen when Vout is slightly lower than Vin: the converter mode constantly changes from buck-boost to buck and back.
With 'inductor noise reduction algorithm' on and Vout less than 500 mV under Vin (during a minimum of 5 seconds), the controller reduces the output current for 10 minutes.
After 10 minutes, operations switches back to normal (and repeats if necessary).
(the current reduction is approx. 50%).

Included converter firmware:
- ts04v14.hex
- ts04v15.hex
- ts08v13.hex
- ts08v14.hex
- ts08v15.hex
- tsc08v10.hex
- tsc08v11.hex

**Version 1.4.1.**
Date: 14/10/2016. Replaces version 1.3.3 to 1.4.0.
Added functionality:
TS800C (TS800 with CAN connector next to the USB connector).
TSConfig can now detect a TS800C converter.
The TS800C is a TS800 converter with CAN (controller area network) functionality added.

Powerdown (setting 56) (current consumption reduction).
This function can only be used when the converter is configured to be switched on by input 1 on pin 1 (purple wire). It cannot be used when the vibration sensor is activated.
TS400: powerdown function build in version *ts04v1.4* or higher.
TS800: powerdown function build in version *ts08v1.4* or higher.
TS800C: powerdown function build in version *tsc08v1.0* or higher.

Changes:
Setting 24, Undervoltage threshold, is pre-loaded with a value of 11.8 V (was: 11.3 V) when loading default settings using the option 12-12 or 12-24 from the Load settings window.
Fix:
None.
Included converter firmware:
- ts04v13.hex
- ts04v14.hex
- ts08v13.hex
- ts08v14.hex
- tsc08v10.hex

**Version 1.3.3**
Date: 14/07/2016. Replaces version 1.3.2.
Added functionality:
None.
Fix:
The combination of Victron BMS input (setting 29) and 'Converter on/off with pin 1' (setting 50).
In previous versions setting 50 (converter on/off with pin 1) was disabled after checking setting 29.
Included converter firmware:
- ts08v13.hex
- ts04v13.hex

**Version 1.3.2**
Date: 30/06/2016. Replaces version 1.3.1.
Added functionality:
Demonstration mode. Settings can be viewed and saved to file without connecting to a converter.
Fix:
None.
Included converter firmware:
- ts08v12.hex
- ts04v12.hex

**Version 1.3.1**
Date: 29/06/2016. Replaces all versions 1.2.x.
Added functionality:
None.
Fix:
In previous versions, TSConfig did not work correctly on Chinese versions of Windows.
In the transmission routines SBCS values and/or DBCS values were used.
Those values are now changed into Unicode.
The Unicode value is independent of the culture and code page settings for the current thread in Windows.

**Version 1.2.0**
Date: 12/04/2016. Replaces all previous versions.
Added functionality:
Extra default setting 12V-24V in the 'open' menu.
Menu options has an extra button to start firmware update.
In firmware update selection, TSConfig checks with warning for choosing the correct combination of converter type and firmware version.
Fix:
Setting 52 now has limited value's (0..2).
Powersave is set to 0 when using the default settings.
Added help information: 'use 1k-10k resistor in series for the inputs of the converter'.