AKKU POWER

Error Coding System

Strongarm & eDraulic

Introduction

Background

This presentations is designed for service center employees and Hurst sales team helping them to **understand** and **act** on customer complaints or trouble with Hurst StrongArm and eDraulic batteries and chargers. With this additional knowledge Hurst employees will be able to improve customer service and problem solving capabilities with their customers and improve communication and product warranty process with Akku Power.

Content

The content of this material includes a complete guide and explanation of all common error codes and problems that may occur. The material covers:

- StrongArm + Charger
- eDraulic + Charger
- Battery and Charger test procedure

Goal

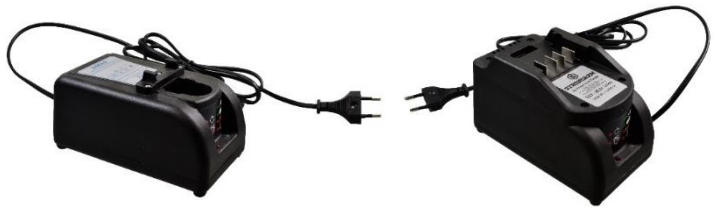
Hurst staff will gain a full understanding and guide on

- Error Codes – description and meaning
- Troubleshooting and recomendations on how to proceed

Error coding system

Batteries

Charger



7 STEP test procedure

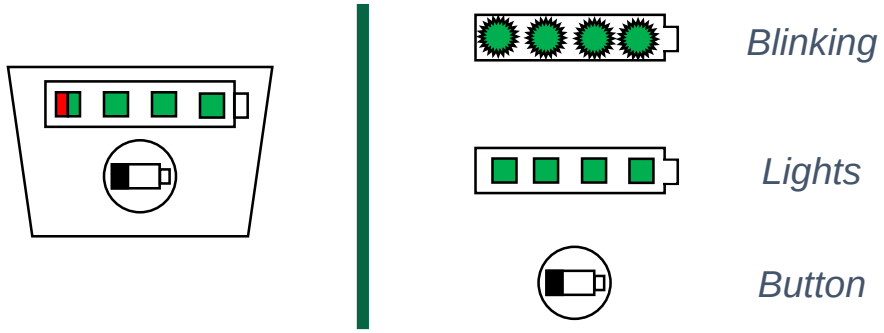
AKKU POWER

E-Draulic
BY HURST JAWS OF LIFE

Battery LED Definition with two main functions

eDraulic battery

Display



Main Functions

Display

1 *SOC*

State of Charge

The state of charge (SOC) is displayed for 5s after the push of the button.

2 *Error Codes*

The error states are displayed for 10s after the error occurrence.

Every battery contains only red and green LEDs, orange LED is a combination of both, red and green, colors. The LED indicator contains 4 green LEDs and 1 red LED

State of charge display

State of Charge

LED Code	Description
#1	SOC < 5%
#2	5% ≤ SOC < 12%
#3	12% ≤ SOC < 25%
#4	25% ≤ SOC < 37%
#5	37% ≤ SOC < 50%
#6	50% ≤ SOC < 62%
#7	62% ≤ SOC < 75%
#8	SOC > 75%

Error code display

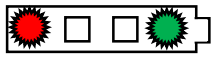
Error Codes

LED Code	Description
#9	Undervoltage
#10	Load overcurrent
#11	Charge overcurrent
#12	Short-circuit
#13	Overvoltage
#14	FETs overtemperature
#15	Cells overtemperature
#16	Cells undertemperature
#17	Undervoltage when undertemperature

Error codes

Understand

Act

LED Code	Description of protection	Meaning
#9 	Undervoltage	Battery voltage ist too low / completely empty

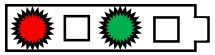
Troubleshooting & Recommendations

Troubleshooting:
Charge battery until 100% of charge is reached

Recommendation:
If battery is not charging after 5 minutes and charger is indicating defective battery please contact your Hurst technical service

Understand

Act

Error Code	Description of protection	Meaning
#10 	Load overcurrent	Current consumption between battery and tool is temporarely too high

Troubleshooting & Recommendations

Troubleshooting:
Wait until the error code is gone (max. 15s). Check the battery function using another tool.

Recommendation:
If the error persists with second tool contact your dealer otherwise check the first tool to exclude it is defect.

Error codes

Understand

Act

Error Code	Description of protection	Meaning
#11 	Charge overcurrent	Charging current too high

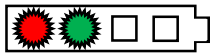
Troubleshooting & Recommendations

Troubleshooting:
Check battery on another charger and after minimum 30 sec the error should be gone

Recommendation:
If the error persists with the second charger contact your dealer otherwise send in the first charger for a technical revision.

Understand

Act

Error Code	Description of protection	Meaning
#12 	Short-circuit	Power consumption too high – higher than the overload current

Troubleshooting & Recommendations

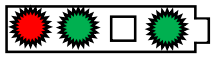
Troubleshooting:
Be sure that „+ / -“ contacts are not directly in connact via conducting materials. Wait for at least 30 sec until the error should be gone, than check the battery in another tool.

Recommendation:
If the battery error code occures in second tool please contact your dealer´s technical service for assistance

Error codes

Understand

Act

Error Code	Description of protection	Meaning
#13 	Overvoltage	The charging voltage is too high or defective battery cells

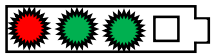
Troubleshooting & Recommendations

Troubleshooting:
Check battery in another charger. After min 30 sec error should be gone

Recommendation:
If the error persists with the second charger contact your dealer and send back the battery, otherwise send in the first charger for a technical revision

Understand

Act

Error Code	Description of protection	Meaning
#14 	FETs overtemperature	Battery in contact with too high current for too long time

Troubleshooting & Recommendations

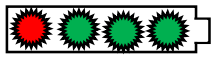
Troubleshooting:
Test the battery in another tool to test if the the error persists

Recommendation:
If the battery error code occures in second tool please contact your dealer´s technical service for assistance

Error codes

Understand

Act

Error Code	Description of protection	Meaning
#15 	Cells overtemperature	Cells temperature above the recommend operating temperature caused by high current flow to the tool and very high ambient temperatures

Troubleshooting & Recommendations

Troubleshooting:
Disconnect or stop operating the battery in order to let the battery cool down until it reaches the maximum allowed temperature

Recommendation:
Check the cooled battery again and if the error persists contact your dealer.

Understand

Act

Error Code	Description of protection	Meaning
#16 	Cells undertemperature	Cells temperature below the recommend operating temperature

Troubleshooting & Recommendations

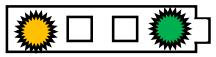
Troubleshooting:
Disconnect the battery from the tool and bring it to the recommended temperature conditions and start using the battery again.

Recommendation:
Check the warmed up battery again in the same tool and if the error persists contact your dealer.

Error codes

Understand

Act

Error Code	Description of protection	Meaning
#17 	Undervoltage protection when undertemperature	Battery voltage ist too low by very low temperartures

Troubleshooting & Recommendations

Troubleshooting:

Charge battery until 100% of charge is reached. Be aware that the battery is in charging temperature conditions (> 32°F / 0°C)

Test the battery in the same conditions as the error codes ocurred.

Recommendation:

If battery is not charging after 5 minutes in the recommended temperature conditions, or the charger is indicating defective battery please contact your Hurst technical service.

If the battery remains with the error code under the same cold conditions please contact your Hurst technical service.

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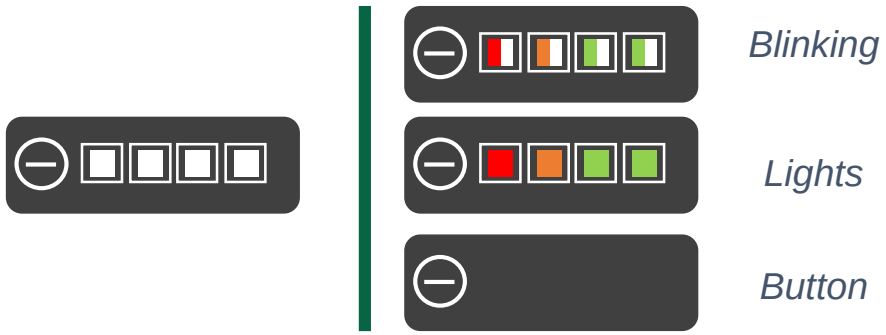
STRONGARM™

Battery LED Definition with two main functions

Strongarm battery

Display



Main Functions

Display

1

SOC

State of Charge

The state of charge (SOC) is displayed for 5s after the push of the button.

2

Error Codes

The error states are displayed for 10s after the error occurrence.

Every battery contains only red and green LEDs, orange LED is a combination of both, red and green, colors. The LED indicator contains 4 green LEDs and 1 red LED as follows

State of charge display

	LED Code	Description
SOC on the Tool		SOC 75% of capacity
		SOC 50% of capacity
		SOC >25% of capacity
		SOC <25% of capacity
SOC on the Charger		SOC 100% of capacity
		SOC 75% of capacity
		SOC 50% of capacity
		SOC >25% of capacity
		SOC <25% of capacity

If the capacity is less than 50%, the automatic blinking of second [first] LED starts

Error codes

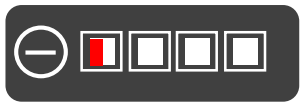
Error Codes

LED Code	Description
#1	Undervoltage
#2	Load overcurrent 1
#3	Load overcurrent 2
#4	Charge overcurrent
#5	Short circuit
#6	Temperature not OK

Error codes

Understand

Act

Error Code	Description of protection	Meaning
	Undervoltage	Battery voltage ist too low / completely empty

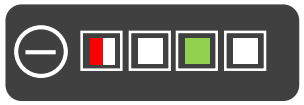
Troubleshooting & Recommendations

Troubleshooting:
Charge battery until 100% of charge is reached

Recommendation:
If battery is not charging after 5 minutes and charger is indicating defective battery please contact your Hurst technical service

Understand

Act

Error Code	Description of protection	Meaning
	Load overcurrent 1 (75A)	Current consumption between battery and tool is temporarely too high

Troubleshooting & Recommendations

Troubleshooting:
Wait until the error code is gone (max. 15s). Check the battery function using an another tool.

Recommendation:
If the error persists with second tool contact your dealer otherwise check the first tool to exclude its defect.

Error codes

Understand

Act

Error Code	Description of protection	Meaning
	Load overcurrent 2 (80A)	Current consumption between battery and tool is temporarely too high

Troubleshooting & Recommendations

Troubleshooting:
Wait until the error code is gone (max. 15s). Check the battery function using an another tool.

Recommendation:
If the error persists with second tool contact your dealer otherwise check the first tool to exclude its defect.

Understand

Act

Error Code	Description of protection	Meaning
	Charge overcurrent	Charging current too high

Troubleshooting & Recommendations

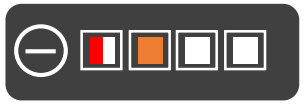
Troubleshooting:
Check battery on another charger and after minimum 30 sec error should be gone as battery resets functions after the error code

Recommendation:
If the error persists with the second charger contact your dealer otherwise send in the first charger for a technical revision.

Error codes

Understand

Act

Error Code	Description of protection	Meaning
	Short circuit	Charging current too high – higher than charge overcurrent

Troubleshooting & Recommendations

Troubleshooting:
Check battery on another charger and after minimum 15 sec error should be gone as battery resets functions after error code

Recommendation:
Check battery in a second charger in the case that the error is not remaining it is more likely that the charger is defective. If the battery error code remains in second charger please contact your dealer´s technical service for assistance

Understand

Act

Error Code	Description of protection	Meaning
	Temperature not OK	Cell and FETs temperature is outisde the recommend temperature range

Troubleshooting & Recommendations

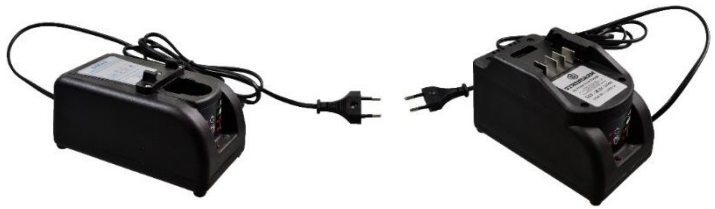
Troubleshooting:
First adjust the Cells temperature by disconnecting or stop operating the battery in order to let the battery cool down or warm up until it reaches the maximum or minimum allowed temperature
Later if the battery is still blocked test the battery in another tool to test if the the error persists

Recommendation:
If the battery error code occures in second tool please contact your dealer´s technical service for assistance

Error coding system

Batteries

Charger



7 STEP test procedure

Charger LED display definition

State of Charge	LED Code	Meaning
	#1	Charger connected to the main ready to charge
	#2	Battery full
	#3	Battery charging

Error Codes

Understand

Act

Error Code	Description of protection	Meaning
#4 	Temperature not OK	Battery is out of recommended charging temperature

Troubleshooting & Recommendations

Troubleshooting:
Bring the charger and battery into the recommended temperature conditions. Under the recommended conditiones the charger will restart the charging process again

Recommendation:
If the error persits try charger with another battery to reconfirm the error. If error remains unplug the charger and contact your dealer´s technical service for assistance.

Understand

Act

Error Code	Description of protection	Meaning
#5 	Defective battery	Battery is not working correctly

Troubleshooting & Recommendations

Troubleshooting:
Unplug the battery for at least 30 sec, reconnect the battery for 5 minutes to reconfirm the error.

Recommendation:
Read error coding on the battery, follow the recommendations acording the battery error code

Error codes

Understand

Act

Error Code	Description of protection	Meaning
#6 -10 	Charger error – the left LED is blinking regardless to the right one	Broken charger

Troubleshooting & Recommendations

Troubleshooting:
N/A

Recommendation:
Disconnect the charger from plug and contact your dealer´s technical service for assistance.

Understand

Act

Error Code	Description of protection	Meaning
#11 	Charger not ready	No main supply or broken charger

Troubleshooting & Recommendations

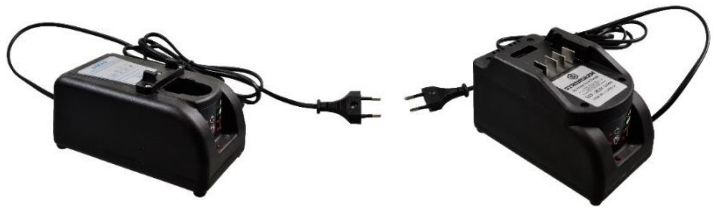
Troubleshooting:
Connect charger to main supply.

Recommendation:
If the charger does not display „ready to charge“ disconnect the charger from plug and contact your dealer´s technical service for assistance.

Error coding system

Batteries

Charger



7 STEP test procedure

Service guide and service return form

Date: 19.01.2018 Author: Dr. L. Valda Rev.: B. Kubitschek	**Lukas & Hurst 7S2P Battery Service Guide**	AKKU POWER
Page: 1 from 8	Service Guide Version: 2	

1. Objective

This paper is intended for service centers helping them to identify issues with Lukas and Hurst 7S2P batteries.

2. Definitions

2.1. Battery LED indicator

● ● ●	RED, GREEN, ORANGE LED is blinking
● ● ●	RED, GREEN, ORANGE LED is lighting
○	No LED is lighting or blinking

Table 1: LED colors and modes

Battery contains only red and green LEDs, orange LED is a combination of both, red and green, colors. The LED indicator contains 4 green LEDs and 1 red LED as follows:

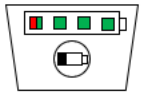


Figure 1: LED indicator with button

All possible LED combinations are listed in table 2 - table 4.

LED combination	LED combination number	Description
○ ○ ○ ○	0	Battery no reaction

Table 2: No LED is lighting and blinking

LED combination	LED combination number	Description
● ○ ○ ○	1	SOC < 5%
● ○ ○ ○	2	5% ≤ SOC < 12%
● ● ○ ○	3	12% ≤ SOC < 25%
● ● ○ ○	4	25% ≤ SOC < 37%
● ● ● ○	5	37% ≤ SOC < 50%
● ● ● ○	6	50% ≤ SOC < 62%
● ● ● ●	7	62% ≤ SOC < 75%
● ● ● ●	8	SOC > 75%

Table 3: State of charge (SOC) indicator

The state of charge (SOC) is displayed for 5s after the push of the button.

Template name: Guide	Checked by: Michael Hutmacher
Document name: Lukas&Hurst_7S2PBattery_Service Guide	Approved by: Wolfgang Lehner

Service return form

Required fields - please fill in all fields ton ensure quick processing

AKKU POWER

Customer Feedback (for Customer use only)

Complaint number: | Article / item number:

Lot number:

Detailed error description:

Hurst Analysis (for Hurst use only)

Hurst contact:
Telephone:
E-Mail:
Date:

Visual Analysis Battery

Broken casing
Water damage
Damaged or bad conditioned contacts
Burning signs and/or odor
Other physical damages
Product open

Electrical Analysis Battery

Step	Description	Battery LED Sequence	Charger LED Sequence	Measured values	Comment
1	SOC Check				
2	Measure resistance of			NTC res.: Code res.:	
3	Check Charging				
4	Measure battery			Voltage:	
5	Discharge battery				
6	Charge battery			Voltage:	
7	Measure battery capacity			Capacity:	

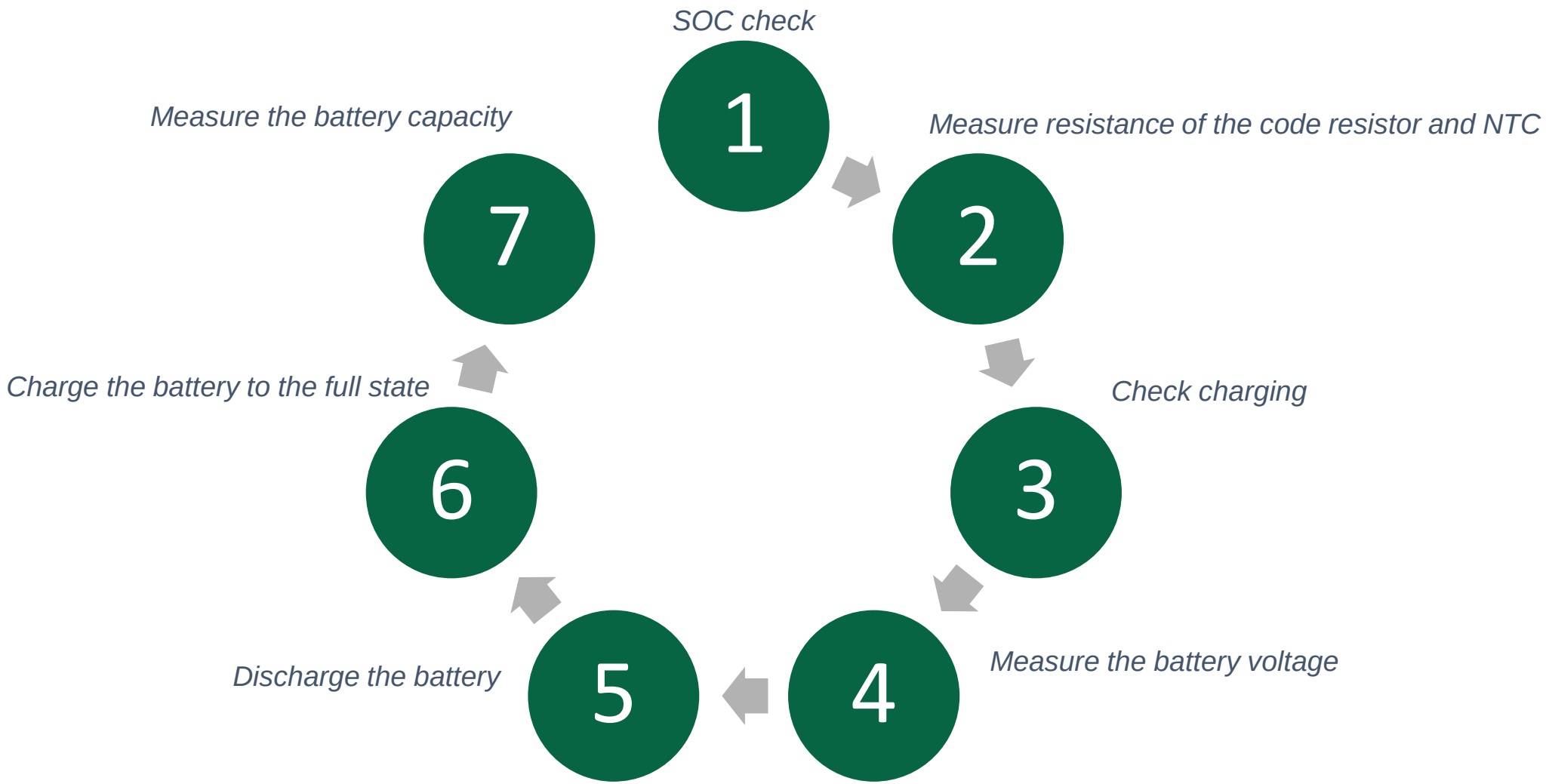
Visual Analysis Charger & Power Supply

Broken casing
Water damage
charging cable / charging plug defective
short circuit with smoke development
Other physical damages
Product open

Visual observation

For photo documentation please turn page and use the predefined blank spaces

Akku Power 7 step test procedure



Akku Power 7 step test procedure

1 SOC check

To do: Press the button for 1s to activate LED indicator and write the time sequence you see.

Example: You see the SOC state number 4 followed by the error state number 9. The resulting sequence is 4 - 9. These sequences must be watched and written for every following step for the battery. In the steps where the charger is used write the sequence of the charger

2 Measure resistance of the code resistor and NTC

To do: Measure resistance of the code resistor and NTC using an ohmmeter as shown below.
The resistance of the code resistor should be about 22.5kΩ (+/- 5%) and resistance of the NTC about 7kΩ when the battery has about 77°F / 25°C (+/-5%). Write these values with an accuracy of one-tenth if possible.

3 Check charging

To do: Charge the battery for at least 1 minute with the charger and note the LED sequence of the charger into the table on the service return form

4 Measure the battery voltage

To do: Measure the battery voltage using a voltmeter immediately after unplug of the battery from the charger. Value of the voltage write with an accuracy of one-tenth of volt. Write the measured capacity into the table provided on the service return form.

Akku Power 7 step test procedure

5 *Discharge the battery*

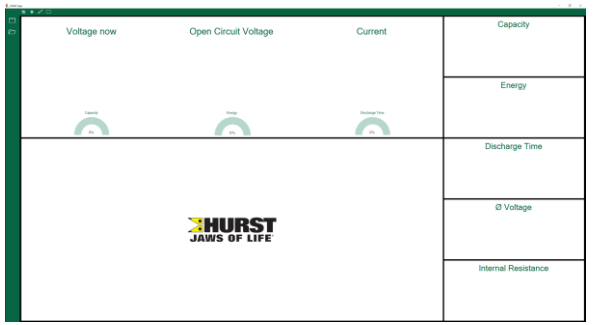
To do: Discharge the battery under 26V using the electronic load AD60 (12A discharge current) or a tool until 75% of SOC is reached

6 *Charge the battery to the full state*

To do: Plug the battery to the charger and wait until the charger shows battery full (charger LED state 2). Unplug Battery from the charger and immediately measure the voltage and write it into table of the provided service form.

7 *Measure the battery capacity*

To do: Completely discharge the battery using the electronic load AD60 to find out the real battery capacity. The proper initial setup of the software application for AD60 control and capacity measurement environment is shown below. The running capacity measurement environment is shown in. Write the measured capacity into the line 7 in the service return form.



Thank you!