



SMARTER CHIP™

DATASHEET

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Document History

Revision	Note	Date
v0.1	Initial Draft	15/02/2024
v0.2	Updated Screenshots	20/20/2024
v1.0	First Release	08/05/2024
v1.1	Updated History Screenshot and number of Logs	13/05/2024
V2.0	Added plots section, updated screenshots	30/09/2024
V3.0	Updated screenshots, new data structure	20/10/2025
V3.1	Updated parameters, added PLC and Auto-Depass	16/03/2026
V3.2	Updated screenshots	12/05/2026

Terms of Use

The purpose of this manual is to guide authorized users of the Downhole Battery Inc. Smarter Chip™.

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Introduction

The Smarter Chip™ module is integrated into the Downhole Battery system, functioning seamlessly without disrupting normal operations. Its primary function is to monitor the battery usage and record vital data including battery usage, tool current, shock and vibration, temperature, and inclination (Beta).

Users can utilize the Smarter Chip™ to adjust the sampling rate according to their preferences, enabling sampling speeds as rapid as 5 samples/second. Also, the memory capacity allows for storage of up to 250 individual logs and can record continuous data for over 7 days at a sampling rate of 5 samples/second.

The shock and vibration measured using calibrated three axis accelerometer for reliable readings. The Smarter Chip™ App uses the raw data from the accelerometer to calculate Max X,Y and Z shock, along with Axial and Lateral shock using vectors (magnitude and direction) for error compensation.

The stored logs include the following, battery voltage, peak current, inclination (Beta), temperature, Max X, Y, Z shock, lateral and axial shock, X,Y,Z vibration RMS. The final logs are generated and stored as *.LAS files along with shock reports (*.CSV) for a quick overview.

The Smarter Chip™ App features advanced charting capabilities that allow for data visualization with no loss of resolution, even when processing millions of data points. Additionally, it can plot historical data without requiring a connected battery.

The Smarter Chip™ is the first of its kind to utilize interrupts for wake-up and sampling, ensuring efficient power management. Its ultra-low sleep current consumption extends battery shelf life for several years. Furthermore, the Smarter Chip™ monitors its own power consumption to provide precise battery usage estimates, adjusting for temperature variations in accordance with the cell manufacturer's recommendations.

The amp-hour (Ah) usage displayed in the software represents the actual measured power consumption, including the Smarter Chip™ usage, with temperature compensation applied. This provides users with a reliable, accurate reading that can be relied upon without the need for additional calculations.

Also, the Smarter Chip App is the first in the industry to introduce AI battery assistant! It answers questions, estimates remaining runtime, and gives real-time warnings for shocks, high temperatures, or high memory usage. You'll also get helpful reminders and troubleshooting tips, all dynamically updated as your battery status changes.

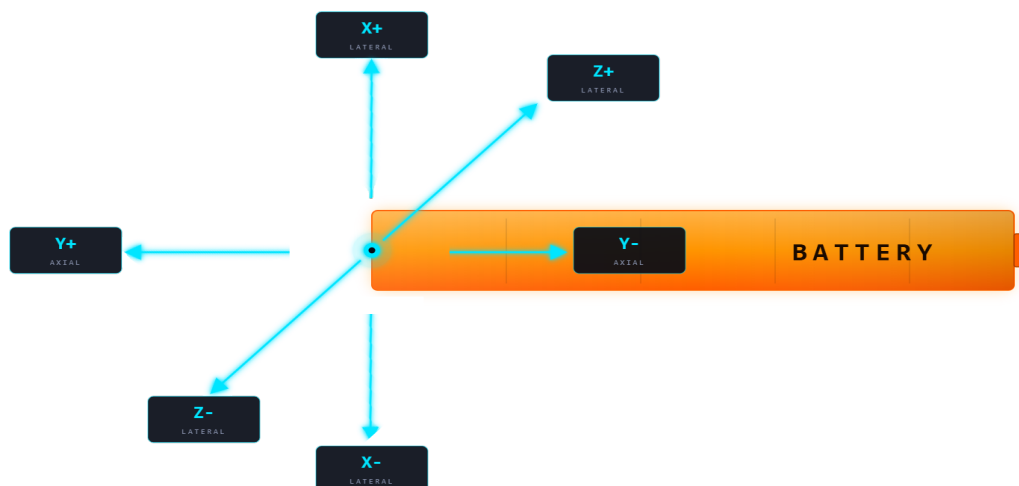


FIGURE 1: OVERVIEW

Communication

The Smarter Chip™ leverages high-speed Power Line Communication (PLC) through the interface box, which is then converted to a USB connection for the fastest and most efficient data transfer in the industry. Communication is only initiated when the Smarter Chip™ detects a valid USB connection and the application is active. When the battery is connected to other tools, PLC communication is automatically disabled, ensuring it remains fully transparent to the system. This approach provides reliable, high-speed communication without interfering with normal tool operations, as it does not use CANBus or any other lines for communication.

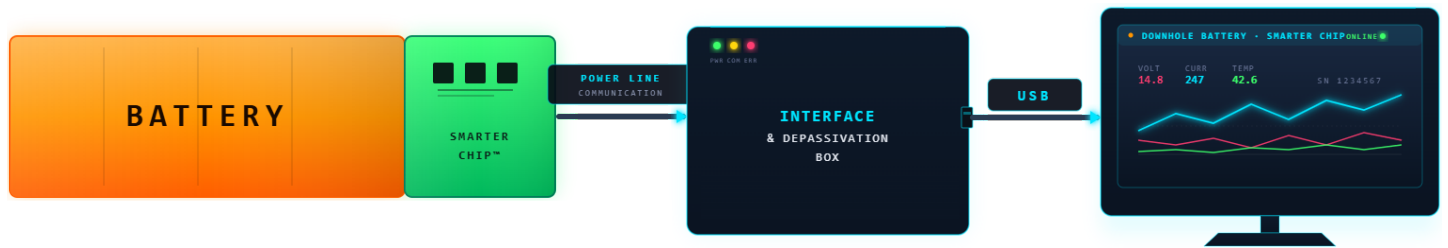


FIGURE 2: COMMUNICATION

AI Assistant

The Smarter Chip™ AI Assistant is an interactive tool integrated into the software to help users monitor, troubleshoot, and manage battery systems efficiently. It can answer general questions, calculate estimated battery runtime based on average current draw and remaining capacity, and provide dynamic reminders about memory usage, current thresholds, and time synchronization. The assistant also issues real-time warnings for shocks, high temperatures, or excessive memory usage, helping users take preventive actions. Users can interact with it directly via the text input box, request troubleshooting guidance, or simply receive automatic notifications when critical variables change.

Sampling Frequency

The accelerometer sampling frequency is optimized to 400 samples per second for each axis (X, Y, and Z). The raw data is processed through a filter to extract calibrated values, with the final results stored in the chip’s memory at user-specified intervals.

Current measurements are taken at 400 samples per second, enabling the detection of current spikes. To ensure accuracy, an automatic scale selection mechanism adjusts for low or high readings. The maximum current value is recorded in memory based on the user-defined sampling interval.

Due to the slower rate of change in voltage and temperature, these measurements are averaged once per second, and then stored at the end of the sampling interval.

Operating Parameters

Testing conditions: 24VDC input, 25 Degrees C unless otherwise specified

Parameter	Min	Typical	Max	Note
Operating temperature	- 40 °C	-	+150 °C	
Operating Voltage	+8 VDC	-	+36 VDC	
Tools Current	-	-	5 A	
Power consumption (Sleep)	-	-	6 mW	
Power consumption (Sampling @ 1 sec)	-	-	60 mW	
SmarterChip current (sampling):				
Sampling rate: 1 sec	-	-	2.5 mA	Average current @ 24VDC input
Sampling rate: 5 sec	-	-	0.75 mA	Average current @ 24VDC input
Sampling rate: 10 sec	-	-	0.5 mA	Average current @ 24VDC input
Voltage Measurement:				
Range	8	-	36 VDC	
Accuracy	-	± 0.3%	± 0.5%	Typical, -40 to +150
Offset	-	± 0.5 mV	-	
Current Measurement:				
Range	0	-	5A	2 auto switching scales, low and high
Accuracy	-	± 0.3%	± 0.5%	Typical, -40 to +150
Offset	-	± 0.25 mA	± 1mA	low scale (0-1 A)
	-	± 1.25 mA	± 5 mA	high scale (1-5 A)
Vibration Measurement:				
X, Y, Z axis scale	-200 g	-	+200 g	
Lateral shock scale	0 g	-	+282 g	
Axial shock scale	-200 g	-	+200 g	
Nonlinearity	-	± 0.5%	-	
Cross-Axis Sensitivity	-	± 2.5%	-	
Offset	-	± 3 g	-	
0 g offset due to temperature	-	± 100 mg/C	-	
Temperature measurement scale	-40 C	-	+150 C	On board measurement
Inclination measurement scale	0	-	180°	(Beta)
Sampling Rate:				
Tier 1	0.2 sec	-	1 sec	Raw X,Y,Z
Tier 2	1 sec	-	10 sec	Vibration RMS, Lateral/Axial Shock, Peak Current, Temp, battery voltage & inclination
Memory capacity	-	-	16 MB	
Memory Capacity (Records)	-	-	3,337,420	Raw X,Y,Z
Memory Capacity (Records)	-	-	667,484	Vibration RMS, Lateral/Axial Shock, Peak Current, Temp, battery voltage & inclination
Memory Capacity (Logs)	-	-	250	

TABLE 1: OPERATING PARAMETERS

Memory Records

The memory exclusively holds the finalized results, omitting the storage of raw values to conserve memory. Additionally, the sampling rate is divided into two tiers, each of which can be configured independently as follows:

- **Tier 1:** The sampling rate for Raw X,Y,Z measurements, can be adjusted in tier 1 to sample at intervals ranging from 0.2 to 1 seconds.
- **Tier 2:** The sampling rate for Vibration RMS, Lateral/Axial shock, Peak Current, Temperature, Battery Voltage and Inclination given their infrequent fluctuations, can be set to sample at intervals of 1 to 10 seconds.

Below is the description of the memory records:

1. **Max X,Y,Z shock (g):** The maximum value (positive or negative) measured over the sampling interval.
2. **Axial Shock (g):** The maximum value (positive or negative) of the Y-Axis measured over the sampling interval.
3. **Lateral Shock (g):** The absolute maximum value of the vector magnitude in the direction of X-Axis and Z-Axis measured over the sampling interval, this measurement has no polarity.
4. **RMS X,Y,Z vibration (g):** The averaged value (RMS) measured over the sampling interval.
5. **Peak Current (mA):** The maximum current draw from the battery (including the Smarter Chip™), the range will automatically switch between low and high scale based on the measured current.
6. **Temperature (C):** The temperature in degrees C.
7. **Bat Voltage (mV):** The measured battery voltage.
8. **Inclination (°):** The deviation from the vertical plane where 0° is vertical and 90° is horizontal.

Configurations

The Smarter Chip™ App is user friendly and has minimal configurations required, below is a list of the configurations that can be programmed by the user:

1. **Tool Current Threshold:** (5 -> 250 mA) the current draw expected (including the Smarter Chip™) when connecting the tool. Provided the threshold is surpassed for more than 5 seconds, the smarter chip will transition from the "Sleep Mode" into the "Sampling Mode". When the smarter chip in sampling mode, a new log is created and sampling will commence at the programmed rates for tier1 and tier2.
2. **Tier 1 Sampling Interval:** (0.2 -> 1 second) the sampling interval for Raw X,Y,Z.
3. **Tier 2 Sampling Interval:** (1 -> 10 seconds) the sampling interval for Vibration, Peak Current, Lateral/Axial Shock, Temperature, Battery Voltage and Inclination.

Data Processing

Using the Smarter Chip™ App, the data are downloaded and parsed as a standard LAS V2.0 files. The app will also produce shock report as CSV files for easy overview. Each log will have its own LAS/CSV files to help the user identify the job data. The downloaded files are stored locally under the user selected path.

In addition to the sampling data, users can download "Events Data", which includes information about the performance and critical events associated with the Smarter Chip™. Furthermore, the Smarter Chip™ App generates and stores debug files locally under user temporary folder.

Below is a summary of the available and generated files:

1. ***.LOG(x).LAS:** Where "x" is the log number, this is the main log and contains all sampled data.
2. ***. LOG (x).csv:** Where "x" is the log number, can be stored and contains all data in addition to maximum readings and shock counters.
3. ***.events.csv:** This file contains all critical events related to the Smarter Chip™ itself.

Smarter Chip™ APP

The App was crafted with the end-user in focus, ensuring great user experience and requiring minimal configurations. Below is a brief overview of the App:

1. **DASHBOARD:** Click on the red button “Offline” to search for connected battery and bring it online, this tab contains real time readings and all associated information about the smarter chip. The user can synchronize the module’s Real-Time clock (RTCC) with the PC time by pressing the “SYNC” button.

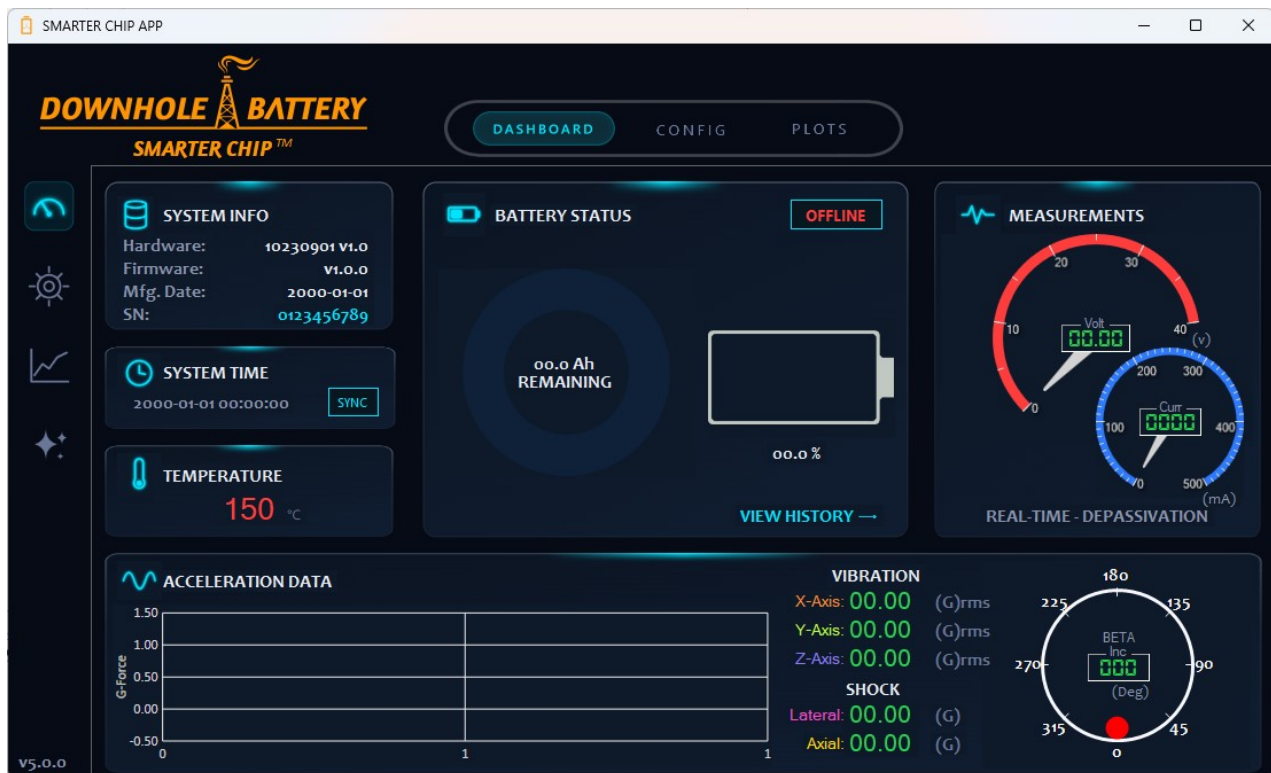


FIGURE 3: BATTERY OFFLINE



FIGURE 4: BATTERY ONLINE

At any time, the user can click on “View History” to download the battery usage history including AmpHrs, voltage and system flags as shown below.

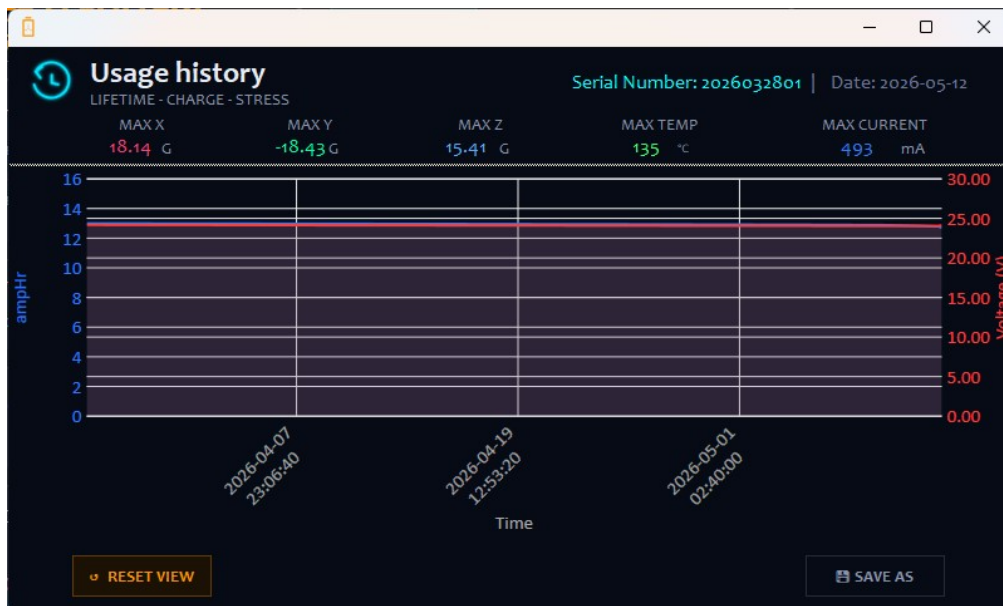


FIGURE 5: USAGE HISTORY

The user can also click on “View Real-Time Graph” to plot the voltage and current readings in real-time, this is practical when performing de-passivation on the battery or connecting tools and monitoring the change.



FIGURE 6: REAL-TIME GRAPH

Besides monitoring real-time data, the user can click on “STAR DEPASS”, this will automatically de-passivate the battery until the voltage come up to a reliable level, or after 5 minutes timeout whichever comes first. After the depass, the user can see the depass log stored in the memory.



FIGURE 7: AUTOMATIC DEPASSIVATION

- 2. CONFIGURE:** This tab includes the previously discussed configuration options and allows the users to verify the memory status as well as clear/download data partitions.

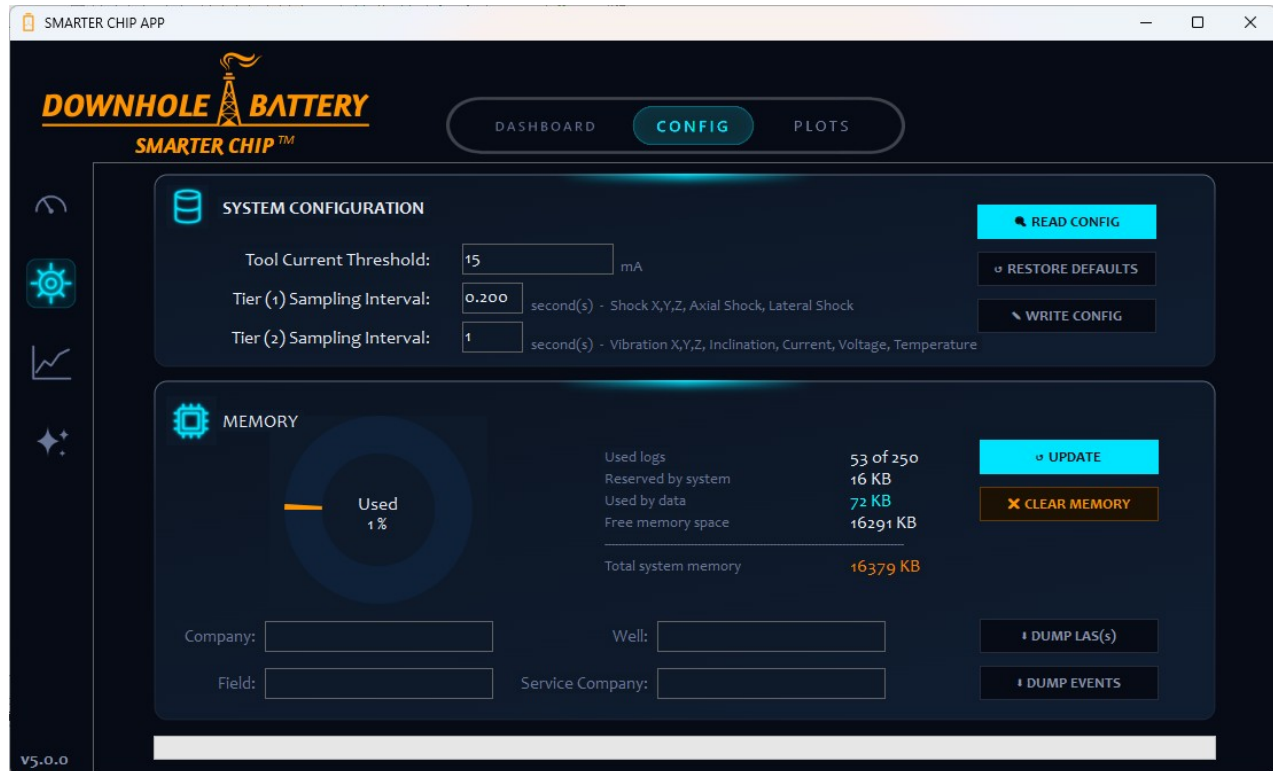


FIGURE 8: CONFIGURATION AND MEMORY

The user can select to dump memory files into a specific location, the Events partition contains critical events related to the performance of the Smarter Chip™.

While the LAS partition, contains all memory logs and shock reports, all logs can be downloaded and stored at once when clicking on “Dump LAS(s)”.

The available fields (i.e. Company, Well, Field, Service Company) are optional and if filled they will be added to the headers of each LAS file.

- PLOTS:** This tab features state-of-the-art charts capable of plotting tens of millions of data points, utilizing the LTTB down-sampling algorithm only when necessary to ensure high performance. These charts preserve all critical details without compromising data integrity or resolution.



FIGURE 9: PLOTS AND LOGS DOWNLOAD

NOTE:

- The downloaded LAS and CSV files include all data points in their entirety, without any down-sampling applied.
- The user can load a previously downloaded CSV file for a specific log and review the chart without the need for the battery to be connected.

4. **AI ASSISTANT:** The Smarter Chip™ AI Assistant is an integrated, offline intelligence feature designed to enhance user experience by providing real-time insights, guidance, and system awareness. Built directly into the application, it leverages embedded knowledge of the Smarter Chip™ system to deliver accurate, relevant, and context-aware responses without requiring an internet connection.

Key Features:

- Provides real-time system information and explanations.
- Displays warnings for abnormal or critical conditions.
- Delivers helpful reminders to improve operation and reliability.
- Estimates runtime based on system usage and configuration.
- Offers expert knowledge specific to the Smarter Chip™ system.

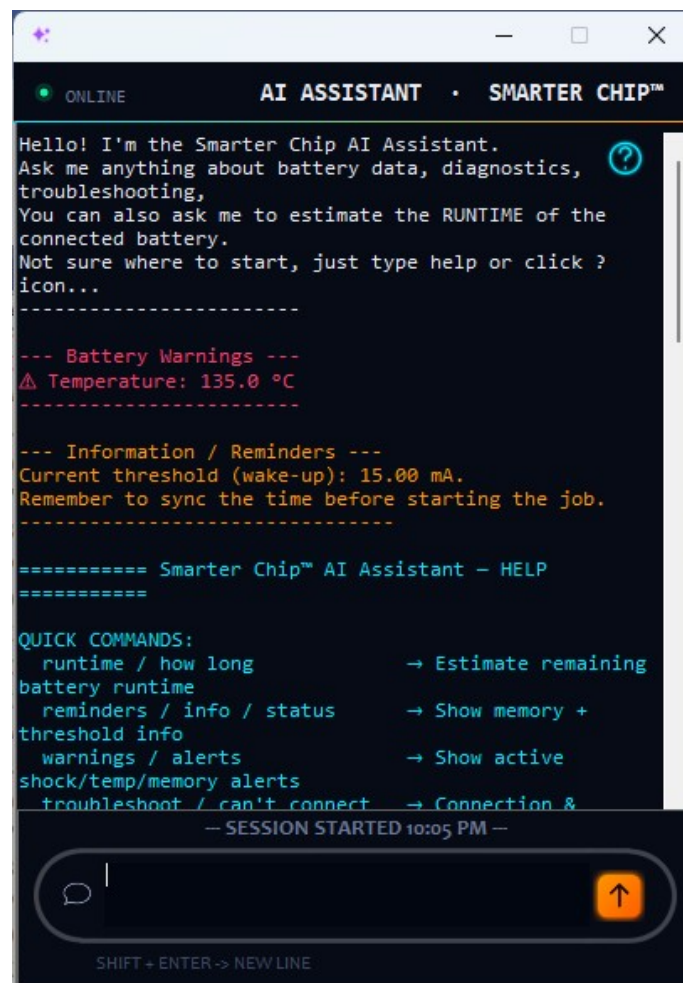


FIGURE 10: AI INFORMATION AND WARNINGS

The main feature is estimating the connected battery RUNTIME based on the remaining AH gauge and the expected average current draw from the connected tools.

The user can simply ask “what is the estimated runtime?”

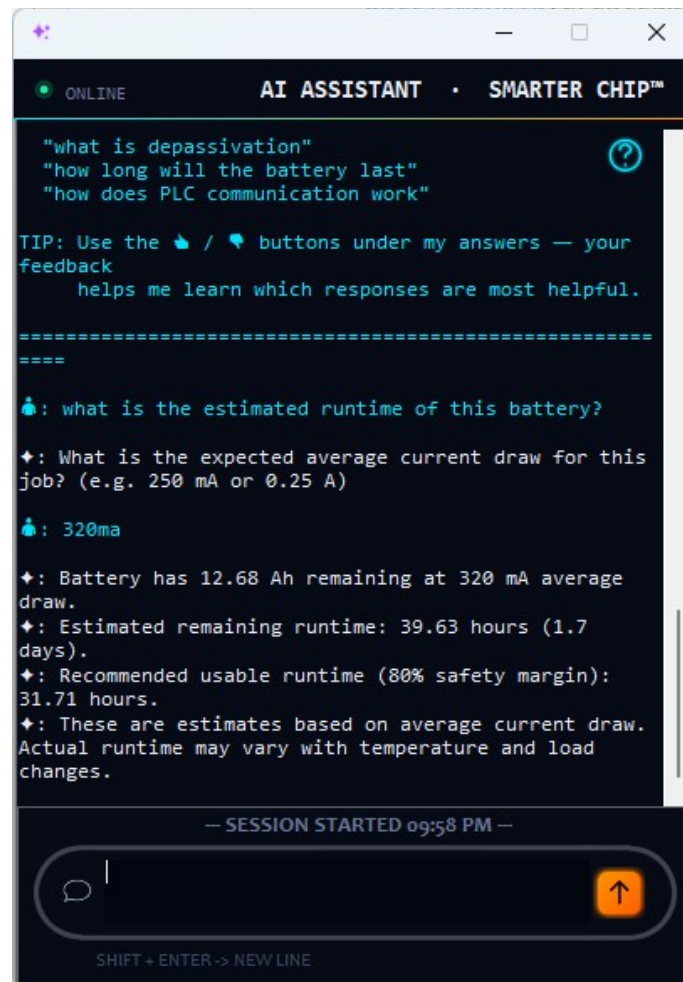


FIGURE 11: AI RUNTIME ESTIMATION