

Five-Point Electrical Verification of Ion Modules

Preface

MAXMAC checks ion-module current consumption and functional status at five defined temperature-voltage conditions. Four points combine the cold and hot temperatures with the supply-voltage endpoints. A fifth point provides a room-temperature reference.

This note describes the five-point arrangement, operating procedure and measured results. Six modules were checked at all five conditions, producing 30 current readings. Every reading met the 100 mA limit, and LIN communication was normal at all five points for all six samples.

Test Configuration

The modules use LIN communication and are checked at **9 V and 16 V** under **-40 °C and +85 °C**. The room-temperature reference is **+23 °C / 13.5 V**. Each result is linked to its sample identification and test point.

Five Temperature-Voltage Conditions

Points A-D cover four temperature-voltage combinations. Point E records function at the room-temperature reference. Both **supply current** and **LIN status** are checked at each point.

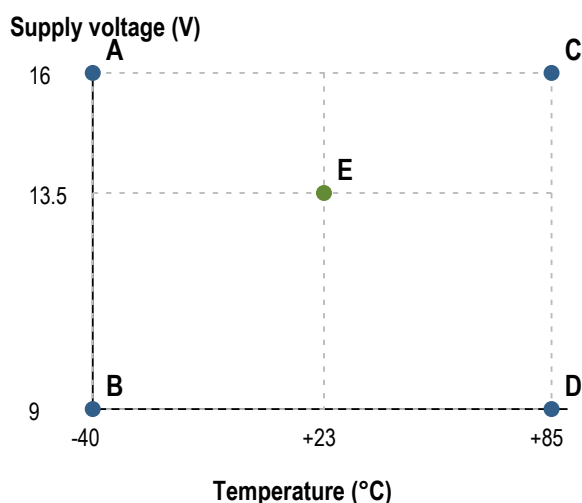
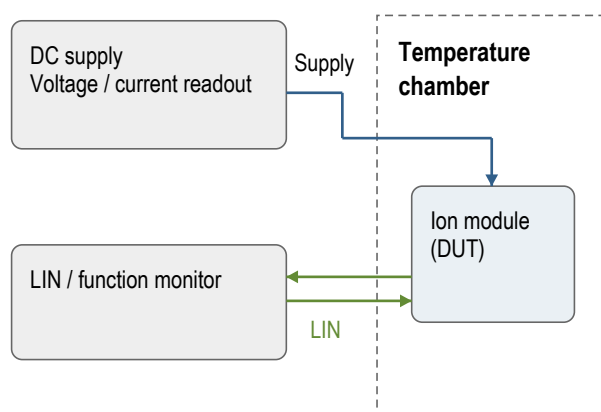


Figure 1 A: -40 °C / 16 V; B: -40 °C / 9 V; C: +85 °C / 16 V; D: +85 °C / 9 V; E: +23 °C / 13.5 V.

The room-temperature point is part of the five-point matrix. Samples are checked in the sequence A, B, C, D and E.

Equipment and Connections

An **RDB-1200E** temperature / humidity chamber (E-007) establishes the temperature conditions. The DC supply and functional monitoring equipment connect to the modules in the chamber.



Supply-current and LIN monitoring

Figure 2 Functional test connections: the supply provides the test voltage and current readout; the LIN monitor checks communication with the module.

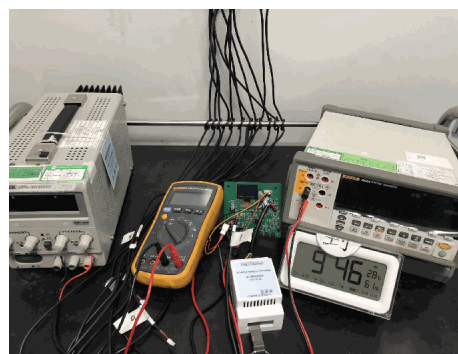


Figure 3 Recorded power-supply and functional monitoring arrangement. The foreground clock records time and ambient conditions.

Five-Point Test Procedure

At Each Test Condition

1. Arrange and identify the samples

Place the modules in the chamber. Maintain at least **100 mm** between samples and at least **100 mm** between samples and chamber walls.

2. Stabilize the temperature

Set the required chamber temperature. Once stable, maintain the condition for **30 minutes** before the functional check.

3. Apply the test voltage

Apply the voltage corresponding to the selected point: 16 V or 9 V for the cold / hot points, and 13.5 V for the room-temperature point.

4. Check current and function

Record the supply-current reading and check LIN communication for message errors and faults. Record the result against the sample ID and test point.

5. Complete all five points

Repeat the temperature-voltage checks until A-E are complete for all six modules. Retain the 30 current readings and their corresponding LIN judgments.

Acceptance Criteria

Supply current: $I \leq 0.1 \text{ A} = 100 \text{ mA}$.

Function: normal.

LIN: normal communication, with no reported message errors or faults.

The report assigns **Class A** functional acceptance to the five-point check. All six samples are recorded as meeting this requirement.

Five-Point Workflow

Arrange samples

Identify the module and check spacing



Set chamber temperature

Stabilize, then hold for 30 minutes



Apply the point voltage

Use the A-E temperature-voltage settings



Measure and check

Record current and LIN communication



Complete A-E

Retain one result for each sample / point

Figure 4 Measurement workflow for the five-point check.

Results by Test Condition

Point	Current range (mA)	LIN / result
A	30.178 - 35.622	OK / Pass
B	20.564 - 21.532	OK / Pass
C	13.9492 - 15.5462	OK / Pass
D	10.5788 - 11.5872	OK / Pass
E	12.8213 - 13.9794	OK / Pass

Table 1 Minimum-to-maximum current across the six samples at each point. LIN communication is normal for all six samples at A-E.

The highest recorded current is **35.622 mA**, at **-40 °C / 16 V**. All 30 readings meet the $\leq 100 \text{ mA}$ requirement.

Measured Results Across the Five Conditions

Six modules were measured at each temperature-voltage point. The chart shows the current range at each point on a common scale with the 100 mA acceptance limit.

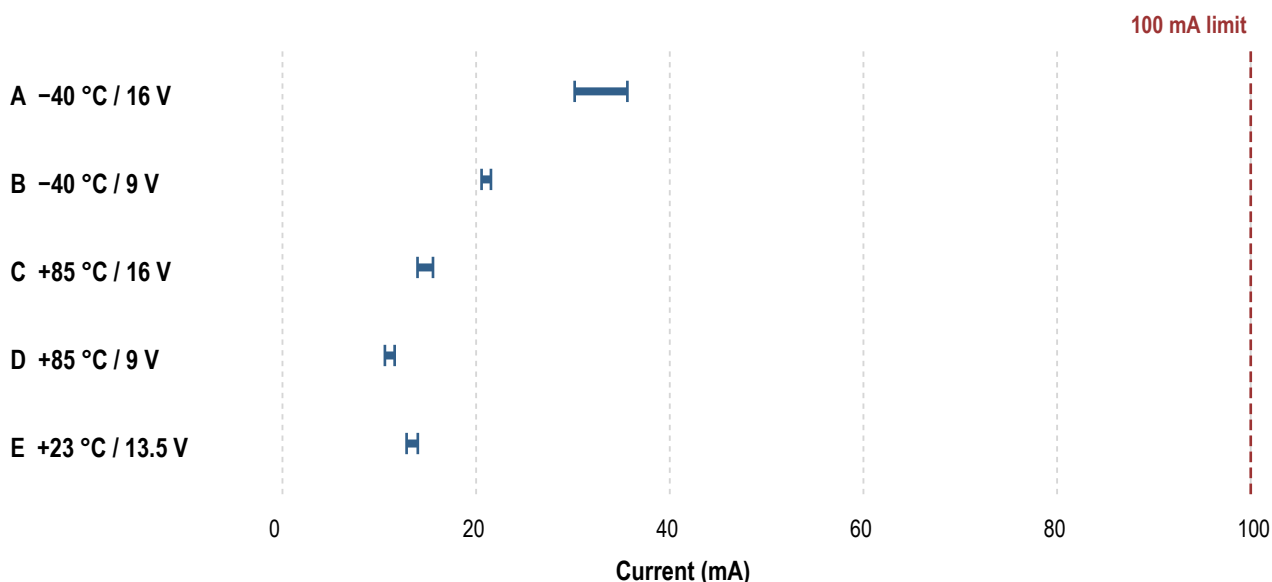


Figure 5 Observed current range across six samples at each condition. The range endpoints are the lowest and highest recorded sample readings.

Measured Current at the Five Test Conditions

Sample	A: -40 °C 16 V (mA)	B: -40 °C 9 V (mA)	C: +85 °C 16 V (mA)	D: +85 °C 9 V (mA)	E: +23 °C 13.5 V (mA)
01	30.178	20.989	15.1235	10.5788	13.5923
02	35.622	21.532	14.6700	10.6861	13.5931
03	34.882	21.422	15.2036	11.5872	13.9046
04	33.322	20.564	13.9492	10.6834	12.8213
05	31.947	20.980	14.9334	10.7732	13.2905
06	33.875	21.035	15.5462	11.5047	13.9794

Table 2 Sample-level current readings. All six samples: LIN OK at A-E; overall result: Pass.

Recorded Observations

Current readings range from **10.5788 to 35.622 mA** across the five conditions. Each reading meets the **≤100 mA** limit. LIN communication is normal at every point, and all six modules receive a passing judgment.

Test Basis and Records

Q/MAT 5502-2023, 6.1.

Source: MAXMAC Leg1 report, method p. 18, results p. 19 and setup photographs p. 21. Sample labels 01-06 correspond to 1#-6#.

Revision 1.2: 20 October 2026. Five-point method, workflow and one complete six-sample result set.