ID	Requirement Description	Test	Passed
Req-01	Design and testing carried out must comply with AS61010.1 (Safety Requirements for Electrical Equipment).	Performing safety tests (such as overcurrent protection, leakage current, grounding, etc.) to ensure compliance with the relevant AS61010.1 safety requirements.	Yes
Req-02	The device must incorporate output protection that switches off output voltage if the output current exceeds the set current limit (as per Req-17). Protection must be resettable to allow for repeat testing and give visual indication when cut-off is engaged.	Using an oscilloscope to measure the output current under various load conditions and ensure that the output voltage is switched off when the current limit is exceeded.	Yes
Req-03	The device must incorporate output protection capable of response times in the tens (10's) of milliseconds after current limit detection.	Under standard test conditions, an oscilloscope can measure and verify the 1%, 5% and average response times of output protection for various loads are compliant.	Yes
Req-04	The device must incorporate a hardware interlock that limits the DC voltage to 100 Volts.	Under standard testing conditions the output terminal voltage should be measured with interlock open to validate 100V limit. Closing the interlock allows voltage up to 200V, testing the output protection by opening the interlock when above 105V.	Yes

ID	Requirement Description	Test	Passed
Req-05	The device must incorporate a hardware interlock that limits the AC voltage to 50V RMS.	Under standard testing conditions, the output terminal voltage should be measured using an oscilloscope with interlock open to validate 50V RMS limit. Closing the interlock allows voltage up to 200V RMS; testing the output protection by opening the interlock when above 50V RMS.	Not built yet
Req-06	Enclosure must be constructed to have sufficient rigidity, protection from electric shock and fire/elevated temperature.	Performing thermal, electrical insulation, and mechanical testing to ensure the case can withstand typical lab treatment and accidental mishandling. Further verification using the AS3820 and AS61010.1 Clause 8 guidelines can be performed upon client request.	Yes
Req-07	The device will be designed such that, in the event of any internal failure, the output is disabled (no voltage) and a clear visual indication is given.	Prior to circuit integration into case, an internal failure can be simulated by grounding a high voltage component during operation to ensure detection, output cut-off and isolation occurs.	Yes
Req-08	The device must be capable of providing a DC output voltage over the range of 0-200V, adjustable as per Req-09.	Under standard testing conditions, output voltage can be measured and verified throughout the desired range, checking for consistency, accuracy and settling time.	Yes

ID	Requirement Description	Test	Passed
Req-09	The device must be capable of output voltage adjustments of as little as 0.05 Volts.	Under standard testing conditions, measuring the AC and DC outputs as desired voltage is changed to confirm minimum adjustment.	No
Req-10	The device must be capable of supplying up to 10 mA of current over the full range of AC and DC outputs.	Under standard testing conditions, an oscilloscope can be used to measure the output currents and validate the maximum current.	Yes
Req-11	The device must incorporate a switchable output signal amplitude modulator (100% level) using a square wave signal over the range of 10–100Hz for all DC outputs, tuneable as per Req-15.	Under standard testing conditions, an oscilloscope can be used to verify the frequency of the modulating wave (square wave), ensuring the switching speed is sufficient for negligible rise/fall times.	Yes
Req-12	The device must be capable of supplying a full range of 0 to 200 Volts RMS AC, tuneable between 50-300 kHz.	What is the final voltage and frequency ranges the devices is capable of. How fine is the tuning accuracy	Not built yet
Req-13	The device must incorporate a switchable output signal amplitude modulator (100% level) using a square wave signal over the range of 10–100 Hz for all AC outputs, tuneable as per Req-15.	Under the standard testing conditions, waveform analysis (using an oscilloscope) will ensure output waveform accuracy and smoothness over the full voltage range for all frequency steps. 'Smoothness' meaning minimal skew and consistent rise, fall and peak-peak times.	Yes

ID	Requirement Description	Test	Passed
Req-14	The device must be designed to operate using an external power supply adapter that provides a specified DC voltage in the range of 5 to 30 V DC. If possible, the design will utilise a 12 V input.	Final design capability can be verified demonstrably to the client under standard test conditions, showing the device is capable of the required range of output functionality using the specified external power adapter. A recommendation of a preferred, market available, adapters alongside alternatives tested will be provided with the final design.	Yes
Req-15	The device must be capable of adjusting the output square wave modulation frequency in steps of 10Hz.	Under standard testing conditions, the step frequency change can be verified using an oscilloscope.	Yes
Req-16	The device must be capable of AC frequency adjustments steps of ~10 kHz.	Under standard testing conditions, the step frequency change can be verified using an oscilloscope.	Yes
Req-17	The current limit is tuneable between 1 and 10 mA, using steps of ~2 mA.	Under standard testing conditions, the step current protection cut-off changes can be verified using an oscilloscope.	No

ID	Requirement Description	Test	Passed
Req-18	The device output voltage must not deviate more than 0.05V from the expected voltage. This includes noise and the impact of voltage ripples.	Under standard testing conditions, the level of noise present in the system should be evaluated and verified using an oscilloscope for the full range of AC and DC voltages and current outputs. Testing under non-ideal conditions (increased heat, electromagnetically noisy lab settings etc) should be considered at this stage to increase device versatility.	No
Req-19	The project must be prepared using hardware under the CERN-OHL-P License.	Provide documentation for relevant hardware.	Yes
Req-20	Project handover must occur on Friday Week 12 (20/10/2023).	Submission complete and on-time.	No
Req-21	The device will shut down if internal temperature exceeds 80˚C	Ideally this should not occur given proper heatsink and (if necessary) active cooling solutions. The total output power is only 2W, hence the system is unlikely to trigger the overtemperature under normal conditions (triggering when component fault or excessive external heat). Thus, to test the system, using a heat gun on the sensor directly may be required, verifying its activation.	Yes

ID	Requirement Description	Test	Passed
Req-22	The device will use high-voltage BNC ports for the output signals. This is a project constraint, as the requirement to accommodate this port type will affect the design of the circuity and the selection of components used in the design.	Testing the output signal is as desired from the ports, using an oscilloscope.	Yes
Req-23	Project outcomes will be shared with the project partner using GitHub. This is inclusive of: reports; designs; prototype documents; CAD Models; PCB Files; component registers; testing results; a design modification registry and may develop as the project progresses.	GitHub is well structured, complete and on-schedule.	Yes
Req-24	The process of selecting components shall be conducted with careful consideration of component availability, lead times, and the current manufacturing state. This approach aims to ensure timely procurement and seamless integration of components into the final product.	As part of the final design, identifying and providing recommendations for component replacements/alternatives should stock be unavailable or be discontinued.	Yes
Req-25	The human-machine interface must allow user's to set device parameters including the output signal type, frequency and voltage, as well as the output protection current limit	Connect the output to a multimeter and check outputs correctly correspond to the user input	Yes

ID	Requirement Description	Test	Passed
Req-26	The lab voltage supply design shall prioritise repairability, maintainability, and an operational lifespan of a minimum of 10 years. Some measures shall be considered to address potential component unavailability in the future by providing recommendations for suitable replacements.	As part of final design, provide recommendations to the client on replacement/alternative components should specific parts get discontinued. Should a necessary part look likely to be unavailable within the lifespan, advocate for a last-time buy strategy to stockpile that part.	Yes
Req-27	Design shall use Restriction of Hazardous Substances Directive (RoHS) compliant components wherever feasible.	Inspecting the documentation of components to verify their RoHS certification.	Yes
Req-28	The project budget will be less than $350 inclusive of all prototyping, testing and final design.	Inspecting the project budget to ensure adherence to the allocated amount.	No
Req-29	The device may incorporate a programmable output feature that allows users to define precise voltage and frequency parameters for designated durations. Once defined, output can be run using one button press. This feature will work for either AC or DC output for a given run.	Testing the programmable output feature under various voltage and frequency settings to ensure that the user can define these parameters and run the output with a single button press.	No

Learnings
The first prototype of the DC current sensing circuit was able to detect the current and send a high signal to the transistor pin if the current exceeded the output current limit.
The maximum operation time of the protection relay is 10ms.
The device interlock is 80V after consultation with client as this was deemed sufficient. The functionality was proved during testing.

Learnings
The AC supply system is capable of adjusting the input using software, but a hardware interlock is not yet built
Metal enclosure was built and earthed to eliminate electrtic shock hazard.
Safety relay implemented on the output, actuated through microcontroller
Capability is achieved and test passed.

Learnings
Circuitry is capable of an adjustment fidelity of <0.1V, but the measurement and readout design cannot display values down to required step-size.
Each circuit has been tested and passed.
Circuit is tested and passed.
The Selected Circuitry should be capable of reaching the requirment, however was not protoyped fully as required additional -145 supply
Output of AC waveform generator may be modulated using switching device, encorporated into design

Learnings
Incorporated in design architecture, utilises 12VDC input.
Through the HMI, users may adjust the parameter. This is then translated into the necessary PWM signal to adjust modulation frequency
The waveform generator uses an SPI signal to set the AC frequency and is capable of the required steps.
The first prototype of the DC sensing circuit did not include this functionality.

Learnings
The switching noise amplitude exceeds the 0.05V requirement. Filtering circuitry was deployed to attempt achieving this requirement but the team was not able to achieve sufficient filering to meet the requirement.
This deadline was extended to Wednesday (25/10/2023).
Test conducted and design passed.

Learnings
HV BNC port installed on output.
All deliverables presented in the requested format.
Components were sourced on time and recommendations for potential improvements if time allowed.
Test conducted and design passed.

Learnings
N/A was implemented through component selection, ensuring no components were scheduled for obsolescence.
All utilised components adhere to the RoHS certification.
Budget was exceeded. Please refer to final design BOM.
This feature was not included in the design due to budget and time constraints.