



GPS-3004

Four-Channel Programmable DC Power Supply

4 × 0 to 32 V at 0 to 10 A · 384 W shared

Operating Manual

Part number 523004 · Issue 1

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1 Safety

Read this section before connecting the instrument. Every item in it is here because ignoring it can injure you or destroy what you are working on.

- Only a person competent in electrical work should connect, set up and use this instrument.
- Use the supplied three-core mains lead and make sure the instrument is earthed. Do not defeat the earth connection.
- Check the instrument before use. Do not use it if the case is damaged or a cover is loose, and do not use it where explosive gas, vapour or dust is present.
- Use leads whose cross-section suits the current. Every pair of load leads must carry the full short-circuit current of the channel without overheating. At 10 A a thin lead is a hazard as well as a voltage drop.
- Check polarity before connecting a battery. Reversed polarity will damage the instrument.
- Place the instrument on a level surface in free air and keep at least 100 mm clear behind it for the fan.
- There are no user-serviceable parts inside. Disconnect the mains lead and return the instrument to GPS or to a qualified engineer if it behaves abnormally.
- Do not use this instrument in life-support equipment or anywhere else a failure would be dangerous.

Voltages above 30 V rms, 42 V peak or 60 V DC are hazardous to touch. All four channels in series reach 128 V, well above that. Switch the output off before changing any connection, and treat the terminals as live whenever the instrument is on.

This instrument is installation category II and pollution degree 2, for indoor use up to 2000 m.

2 Introduction

The GPS-3004 is a four-channel programmable linear DC power supply. Each channel delivers 0 to 32 V at up to 10 A, and all four are galvanically isolated and float free of the chassis, so they can be stacked in series to 128 V, bundled in parallel to 40 A, or paired about a common point for a matched positive and negative supply.

An electronic pre-regulator ahead of a linear output stage keeps the ripple low without the size a purely linear supply of this power would need. Each channel crosses over between constant voltage and constant current automatically according to the load.

Beyond holding a rail, the instrument will run one. A list sequence steps through programmed voltage and current values, tracking moves channels together, and electronic fuses, soft limits and warning bands protect what is connected.

This manual covers operating the instrument. The command reference for SCPI and MODBUS is a separate communication manual, available from GPS on request; section 11 covers the port settings needed to establish a connection.

3 Power: two figures that apply together

This is the part of the instrument most likely to catch you out, so it comes before the specification rather than after it.

Each channel is bounded by 160 W

A channel is not a rectangle. The full 10 A is available anywhere up to 16 V, and above that the 160 W rating governs, so 32 V comes with 5 A rather than 10. Above 16 V the current available is 160 W divided by the voltage: at 24 V that is 6.67 A.

The four channels share 384 W

Four channels at 160 W would be 640 W. The instrument provides 384 W, and it is yours to divide as the job needs: all of it to one demanding rail and three light ones, or spread evenly across four.

Add your rails up against the 384 W before you rely on the instrument. If the total is exceeded it switches the output off and displays a warning, which is better than a brown-out but is worth avoiding altogether.

4 Specification

Setting and readback accuracies apply at 25 °C ± 5 °C.

Outputs

Item	Specification
Channels	Four, identical, galvanically isolated and floating
Voltage, per channel	0 to 32 V
Current, per channel	0 to 10 A
Power, per channel	Up to 160 W in any voltage and current pairing • the full 10 A to 16 V, and 5 A at 32 V
Power, whole instrument	384 W shared across the four channels
Series	Up to 128 V with all four in series
Parallel	Up to 40 A with all four in parallel

The instrument

Item	Specification
Setting accuracy, voltage	Not more than 0.05% of reading + 5 mV
Setting accuracy, current	Not more than 0.1% of reading + 5 mA
Readback accuracy, voltage	Not more than 0.05% of reading + 5 mV
Readback accuracy, current	Not more than 0.1% of reading + 2 mA
Resolution	1 mV and 0.2 mA
Line and load regulation	Voltage not more than 0.01% + 2 mV • current not more than 0.01% + 250 μ A
Ripple and noise	Voltage not more than 1.5 mV rms • current not more than 1 mA rms, 20 Hz to 20 MHz
Remote sensing	Compensates up to 1 V of drop along the load leads
Electronic fuse	Response under 10 ms • delay 0 to 250 ms
Over voltage protection	Per channel, preset 32.5 V
Memory	Ten instrument setups, and three arbitrary waveforms per channel
Interfaces	RS-232 and USB fitted, LAN fitted during manufacture only • SCPI or MODBUS • 4800 to 115200 baud
Mains input	110 V or 220 V ± 10%
Operating conditions	5 °C to 40 °C, relative humidity below 80%
Storage conditions	-20 °C to 70 °C, relative humidity below 80%

Item	Specification
Dimensions and mass	285 × 136 × 405 mm (w × h × d), 14.0 kg
Part number	523004

5 The front panel

The panel carries the display, the channel and function keys, the numeric keypad and knob, and the output and sense terminals for all four channels. The same outputs are repeated at the rear.

Display

The home screen shows all four channels at once: for each, the voltage and current set, the power that follows from them, and the state of any function running on that channel.

Key colours

The channel keys show what a channel is doing. Green is constant voltage, red is constant current, blue means a setting is being made on that channel. A key alternating between blue and green or blue and red is being set while the output is live. Function keys are lit white when active and unlit when not.

Power

Mains switch. The instrument starts in the state it was left in. Whether the outputs come up live is set by Power On Status, section 6.8.

Ch1 to Ch4

Select which channel a setting applies to. Several may be selected at once.

Output

Switches on the output of every channel currently selected.

Voltage and Current

Press Voltage or Current, then a channel key, then set the value with the knob or type it on the keypad and press Enter. Press the function key again to finish, or wait for the key fallback time and the instrument applies the value itself.

Track

Links channels so a change to one moves the others by the same amount. See section 7.5.

Fuse

Press Fuse, then a channel key, to enable the electronic fuse on that channel. The delay and any linking are set in the menu.

Store and Recall

Ten complete instrument setups in locations 0 to 9. Press Store, choose a location with the knob, press the knob to confirm, then press Store to return. Recall works the same way, and a saved setup overwrites whatever was in that location.

Menu and Remote

Menu opens the list in section 6. Remote switches between front panel and computer control; the key is lit while the instrument is under remote control, and pressing it returns control to the panel.

Knob, arrow keys and keypad

Turning the knob moves the selection or changes a value; pressing it enters a setting or confirms one. The left arrow returns to the previous menu level and the right arrow enters a setting. Values can also be typed on the keypad and confirmed with Enter.

Terminals

Each channel has a positive and a negative output terminal and a pair of sense terminals. The same four channels appear again on the rear panel, where the connection resistance is lower; use the rear terminals when a channel is working hard.

Do not connect the front and rear terminals of the same channel at the same time.

6 The menu

Press Menu to open the list. Turn the knob to move through it, press the knob or the right arrow to enter an item, and press the left arrow to go back a level or Menu to return to the home screen. The fourteen items are described below in the order the instrument lists them.

Menu item	What it does
Fuse Linking	Links the electronic fuses of chosen channels, so that a fuse tripping on one switches off all of them
Fuse Delay	Delays the fuse from 0 to 250 ms, so an inrush is tolerated and a fault is not
Over Voltage Protection	Sets the trip voltage per channel, preset to 32.5 V, referenced either to the measured voltage or to the value set
Arbitrary	Edits, saves, transfers and runs a programmed voltage and current sequence · the dwell time per step is 10 ms or more, and a cycle count of 000 repeats indefinitely
Interface	Chooses USB, LAN or RS-232, and sets baud rate, device address, command set and line ending
Display & Key	Brightness, contrast, and how long before the display dims
Beeper	Off, on every key, or on errors only
Power On Status	Whether the outputs come up live at switch-on
Voltage Limit	Caps the voltage adjustment range on a channel, so it cannot be turned past what the load will take
Current Limit	Caps the current adjustment range in the same way
Voltage Warning Range	An upper and lower voltage for a channel · the display shows VL or VH when the output leaves the band
Current Warning Range	The same for current, shown as AL or AH
Information	Model, firmware version and the internal temperature
Reset Device	Restores the factory settings

6.1 Fuse Linking

Links the electronic fuses of two or more channels, so that a fuse tripping on one switches off all of them. Useful where several rails feed one board and losing one rail alone would damage it.

Press Menu, select Fuse Linking, turn the knob to choose the channel to set, then press the knob or the right arrow and choose the channel to link it to. The Output key stays active; the affected channels switch off individually.

6.2 Fuse Delay

Delays the electronic fuse from 0 to 250 ms, so that a current peak at switch-on, from a capacitive load for instance, does not trip it while a genuine fault still does.

Press Menu, select Fuse Delay, choose the channel with the up and down arrows, and set the time with the knob.

6.3 Over Voltage Protection

Switches the output off if the voltage on a channel exceeds a value you set, preset to 32.5 V. Two modes are available: measured, which compares the voltage actually at the terminals, and protected, which compares the value set on the instrument.

Press Menu, select Over Voltage Protection, set the value with the knob or the keypad, and use the knob or the up and down arrows to choose the mode and move between channels. When the protection operates, OVP flashes on that channel and its output closes.

6.4 Arbitrary

Defines and runs a programmed sequence of voltage and current values. See section 8.

6.5 Interface

Chooses USB, LAN or RS-232 and sets the parameters for it. See section 11.

6.6 Display and Key

Sets the brightness of the display and the keys, the display contrast, and how long the instrument waits before dimming both. If nothing is changed during that time the display and keys dim on their own.

6.7 Beeper

Off, a beep on every key, or a beep only when something is wrong.

6.8 Power On Status

Decides whether the outputs come up live when the instrument is switched on. Set it off where a rack must start quiet, and on where a test expects power immediately.

6.9 Voltage Limit and 6.10 Current Limit

Cap the adjustment range of a channel, so the knob cannot be turned past a voltage or a current you have chosen. On a four-channel supply feeding four different rails this is the simplest protection there is: set the limit to what the board tolerates and the wrong value cannot be entered.

Press Menu, select Voltage Limit or Current Limit, move to the channel and the upper or lower figure with the knob or the arrows, and set it with the knob or the keypad.

6.11 Voltage Warning Range and 6.12 Current Warning Range

Set an upper and a lower figure per channel. If the output leaves that band the display shows VL or VH beneath the voltage, and AL or AH beneath the current. Nothing switches off: this is a warning, not a protection, and it is useful for spotting a rail that is drifting rather than failing.

6.13 Information

Shows the model, the firmware version and the current internal temperature.

6.14 Reset Device

Restores the factory settings listed in section 12. Stored arbitrary waveforms are not affected.

7 Operation

7.1 Constant voltage and constant current

The instrument chooses its mode from the load, not from you. In constant voltage it holds the voltage you set and lets the current rise to the limit you set. If the load draws more than that limit, it crosses over to constant current: the current stays at the limit and the voltage falls below the value you set. The channel key turns from green to red as it crosses over.

7.2 Setting a rail

Switch the output off, set the voltage, set the current limit, connect the load, then switch the output on. Setting before connecting protects the load from whatever the controls were left at by the last job.

7.3 Setting a current limit deliberately

Where the limit matters, set it against a short rather than by eye. Set the voltage first with the output off. Short the channel's output terminals with a lead rated for the current you intend to draw, switch the output on, and set the current until the ammeter reads the limit you want. The channel key will be red. Switch the output off, remove the short, and connect the load.

7.4 Electronic fuses

The current limit holds the current at its set value; the electronic fuse switches the output off instead. Use the limit to protect a load that can survive being held at a current, and the fuse for one that cannot. Set a delay, section 6.2, if the load draws a large current briefly at switch-on.

7.5 Tracking

Press Track, then Voltage, then the channel keys of the channels to move together. Use the left and right arrows to choose the digit and the knob or the up and down arrows to change it: every linked channel moves by the same amount, keeping whatever difference you had set between them. Press Current and repeat for the current limits.

Tracking holds that difference until a channel reaches its own maximum or minimum. Track stays on until you press it again and is not released by the key fallback time.

7.6 Remote sensing

At 10 A, a metre of ordinary lead costs real volts, and the instrument regulates at its own terminals rather than at your board. Remote sensing measures at the load instead and compensates up to 1 V of drop.

Run two light insulated wires of the same length and cross-section from the channel's sense terminals to the same points on the load as the current-carrying leads. No current flows in them. Connect them the same way round as the supply leads, and route them the same way when channels are in series or parallel.

8 Arbitrary waveforms

The arbitrary function runs a programmed sequence of voltage and current values on a channel: a step, a ramp, a staircase, or a simple approximation of a battery discharging. Each step holds for a dwell time of 10 ms or more, and a cycle count of 000 repeats the sequence indefinitely.

8.1 Creating a waveform

Press Menu, select Arbitrary, then Edit Waveform. For each step set the index, the voltage, the current and the dwell time, moving between fields with the knob or the up and down arrows and setting values with the knob or the keypad. Set the cycle count last; it applies to every channel rather than to one.

8.2 Saving and recalling

Save Waveform stores what you have edited, in one of three locations per channel. Recall Waveform loads one back into the editor. Clear Waveform discards the edit in progress.

8.3 Running a waveform

Select Transfer Waveform and choose the channel to send it to, repeating for any other channels that need it. Then select Start Waveform and choose the channel to run. Return to the home screen and switch that channel's output on. Stop Waveform ends it.

Waveforms are transferred to each channel separately and start with a short delay, so sequences on different channels are close together but not synchronised. Where exact simultaneity matters, drive the instrument over the interface instead.

9 Series operation

Channels in series add their voltages, and the same current flows through all of them. All four in series reach 128 V.

Set every channel to the same voltage and the same current limit, so the total divides evenly. Enable over voltage protection on each. Then, with the output off, connect the positive terminal of one channel to the negative of the next, and take your supply from the outer pair. Connect the sense lines the same way round, from the negative sense of the first channel and the positive sense of the last.

Select all the connected channels and switch them on together with the Output key.

Four channels in series reach 128 V. Earth at most one point of the chain, and switch the output off before changing any connection. Connecting an earthed instrument to the wrong point will short a channel through the earth path.

If one channel reaches its current limit the whole chain collapses, which is why the limits are set equal and the protection enabled.

10 Parallel operation

Channels in parallel add their currents. All four in parallel reach 40 A.

Set every channel to the same voltage and divide the current you need between them. With the output off, connect all the positive terminals together and all the negative terminals together, using leads of the same type and the same length so that the current shares evenly. Connect the sense lines in parallel in the same way.

Select all the connected channels and switch them on together. If a load draws its full current the moment it is connected, bringing channels up one at a time puts the whole of it through the first channel.

Small differences between channels are normal. If one channel takes noticeably more than its share, raising its voltage setting by a few millivolts will even the distribution.

11 Remote control

The instrument can be driven from a computer over USB, LAN or RS-232. USB and RS-232 are fitted as standard; LAN is fitted during manufacture and cannot be added later.

11.1 Choosing and setting the interface

Press Menu and select Interface, then choose USB, LAN or RS-232. For USB and RS-232 the parameters are the baud rate, from 4800 to 115200 with 9600 as the default; the device address; the command set, SCPI or MODBUS; and the

line ending, CR, LF, CR+LF or LF+CR. For LAN the address parameters are set in the same dialog. The Information entry shows the settings currently in use.

11.2 Serial port settings

The serial connection uses no parity, eight data bits and one stop bit. These are fixed; only the baud rate is selectable.

11.3 The command set

The SCPI and MODBUS command reference is a separate communication manual, available from GPS on request. Ask for it with your order if the instrument is going into an automated system.

Press Remote to return the instrument to front panel control at any time.

12 Factory settings

Reset Device, section 6.14, restores the following. Stored arbitrary waveforms are not affected.

Setting	After a reset
Fuse linking	Off, no channels linked
Fuse delay	0 ms
Over voltage protection	Enabled on every channel, 32.5 V
Interface	USB • 9600 baud • device address 1 • SCPI • line ending LF
Display and keys	Brightness 5, contrast 0 • display dims after 30 minutes, keys after 5 seconds
Beeper	Off
Power on status	Outputs on
Voltage and current limits	Full range
Warning ranges	Full range
Arbitrary waveforms	Not cleared by a reset

13 Care and maintenance

- Clean the case with a dry or barely damp cloth. Do not use solvents, and do not clean inside the instrument.
- Keep 100 mm clear behind the instrument so the fan can work, and do not stand anything on top of it.
- The mains fuse rating is marked on the rear panel. Replace it only with the same type and rating, and disconnect the mains lead first.
- If the instrument is to be stored for a long period, disconnect the mains lead and keep it dry.
- Recalibration and repair are available from GPS. Contact us with the model and part number.

14 Supplied with the instrument

- GPS-3004 power supply
- Mains lead, USB cable and RS-232 cable
- Sense leads and four test leads
- This manual

The LAN interface is fitted during manufacture and cannot be added later, so it has to be specified with the order. Rack mounting and calibration are available from GPS.

15 Warranty

One year from the date of purchase, subject to product registration with GPS. The warranty covers defects in materials and workmanship and does not cover damage caused by operation outside the rated conditions, by unauthorised repair, or by connection to a supply outside the stated input range.

For service, calibration or technical support contact GPS at sales@gpslimited.com or +44 (0) 203 093 0914. Please quote the model, the part number and the serial number.