User Manual

9140 Series
Triple Output Multi-Range DC Power Supplies



BK PRECISION

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Compliance Information

1.1 EMC

1.1.1 EC Declaration of Conformity - EMC

Compliance was demonstrated to the following specifications listed in the Official Journal of the European Communities: EMC Directive 2014/30/EU.

EN 61000-3-2: 2006 Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current <= 16 A per phase)

EN 61000-3-3: 1995+A1: 2001+A2: 2005 Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection

EN 61000-4-2 / -3 / -4 / -5 / -6 / -11 Electromagnetic compatibility (EMC) - Part 4-2: Testing and measurement techniques:

- Electrostatic discharge immunity test
- Radiated, radio-frequency, electromagnetic field immunity test
- Electrical fast transient/burst immunity test
- Surge immunity test
- Immunity to conducted disturbances, induced by radio-frequency fields
- Voltage dips, short interruptions and voltage variations immunity tests

EN 61326-1: 2006 Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

1.2 Safety

1.2.1 EC Declaration of Conformity - Low Voltage

Compliance was demonstrated to the following specification as listed in the Official Journal of the European Communities: Low Voltage Directive: 2006/95/EC.

EN61010-1: 2001 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements

1.3 IEC Measurement Category & Pollution Degree Definitions

Measurement Category (CAT) - classification of testing and measuring circuits according to the types of mains circuits to which they are intended to be connected.

Measurement Category other than II, III, or IV: circuits that are not directly connected to the mains supply.

Measurement Category II (CAT II): test and measuring circuits connected directly to utilization points (socket outlets and similar prints) of the low-voltage mains installation.

Measurement Category III (CAT III): test and measuring circuits connected to the distribution part of a building's low-voltage mains installation.

Measurement Category IV (CAT IV): test and measuring circuits connected at the source of the building's low-voltage mains installation.

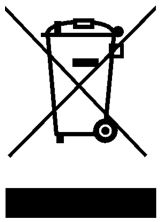
Mains Isolated: is for measurements performed on circuits not directly connected to a mains supply.

Pollution - addition of foreign matter, solid, liquid, or gaseous (ionized gases) that may produce a reduction of dielectric strength or surface resistivity.

Pollution Degree 2 (P2) - only non-conductive pollution occurs except that occasionally a temporary conductivity caused by condensation is expected.

1.4 Product End-of-Life Handling

The equipment may contain substances that could be harmful to the environment or human health if improperly handled at the product's end of life. To avoid release of such substances into the environment and to reduce the use of natural resources, we encourage you to recycle this product to an appropriate system that will ensure that most of the materials are reused or recycled appropriately.



This product is subject to Directive 2012/19/EU of the European Parliament and the Council of the European Union on waste electrical and electronic equipment (WEEE), and in jurisdictions adopting that Directive, is marked as being put on the market after August 13, 2005, and should not be disposed of as unsorted municipal waste. Please utilize your local WEEE collection facilities in the disposition of this product.

1.5 Terms and Symbols

1.5.1 Terms

CAUTION

A caution statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in damage to or destruction of parts or the entire product.

WARNING

A warning statement calls attention to an operating procedure, practice, or condition, which, if not followed correctly, could result in injury or death to personnel.

NOTICE

A note statement calls attention to an operating procedure, practice, or condition, which, should be noted before proceeding.

1.5.2 Symbols

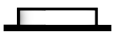


WARNING - HIGH VOLTAGE - possibility of electric shock.



CAUTION – Statements or instructions that must be consulted in order to find out the nature of the potential hazard and any actions which must be taken.

On (Supply). This is the AC mains connect/disconnect switch on the front of the instrument.



Off (Supply). This is the AC mains connect/disconnect switch on the front of the instrument.



Alternating current



Chassis (earth ground) symbol



Earth (ground) TERMINAL - Refer to the instructions accompanying this symbol in this manual.

Safety Notices

The following safety precautions apply to both operating and maintenance personnel and must be followed during all phases of operation, service, and repair of this instrument.

Before applying power to this instrument:

1. Read and understand the safety and operational information in this manual.
2. Apply all the listed safety precautions.
3. Verify that the voltage selector at the line power cord input is set to the correct line voltage. Operating the instrument at an incorrect line voltage will void the warranty.
4. Make all connections to the instrument before applying power.
5. Do not operate the instrument in ways not specified by this manual or by B&K Precision.

Failure to comply with these precautions or with warnings elsewhere in this manual violates the safety standards of design, manufacture, and intended use of the instrument. B&K Precision assumes no liability for a customer's failure to comply with these requirements.

2.1 Electrical Power

This instrument is intended to be powered from a CATEGORY II mains power environment. The mains power should be 115 V RMS or 230 V RMS. Use only the power cord supplied with the instrument and ensure it is appropriate for your country of use.



Do not use this instrument in an electrical environment with a higher category rating than what is specified in this manual for this instrument.



You must ensure that each accessory you use with this instrument has a category rating equal to or higher than the instrument's category rating to maintain the instrument's category rating. Failure to do so will lower the category rating of the measuring system.

2.2 Ground the Instrument

WARNING

To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical safety ground. This instrument is grounded through the ground conductor of the supplied, three-conductor AC line power cable. The power cable must be plugged into an approved three-conductor electrical outlet. The power jack and mating plug of the power cable meet IEC safety standards.

WARNING

Do not alter or defeat the ground connection. Without the safety ground connection, all accessible conductive parts (including control knobs) may provide an electric shock. Failure to use a properly-grounded approved outlet and the recommended three-conductor AC line power cable may result in injury or death.

WARNING

Unless otherwise stated, a ground connection on the instrument's front or rear panel is for a reference of potential only and is not to be used as a safety ground. Do not operate in an explosive or flammable atmosphere.

2.3 Environmental Conditions

This instrument is intended to be used in an indoor pollution degree 2 environment. The operating temperature range is 0°C to 40°C and 20% to 80% relative humidity, with no condensation allowed.

Measurements made by this instrument may be outside specifications if the instrument is used in non-office-type environments. Such environments may include rapid temperature or humidity changes, sunlight, vibration and/or mechanical shocks, acoustic noise, electrical noise, strong electric fields, or strong magnetic fields.

WARNING

Do not operate the instrument in the presence of flammable gases or vapors, fumes, or finely-divided particulates.

The instrument is designed to be used in office-type indoor environments. Do not operate the instrument:

- **In the presence of noxious, corrosive, or flammable fumes, gases, vapors, chemicals, or finely-divided particulates.**
- **In relative humidity conditions outside the instrument's specifications.**

WARNING

- **In environments where there is a danger of any liquid being spilled on the instrument or where any liquid can condense on the instrument.**
- **In air temperatures exceeding the specified operating temperatures.**
- **In atmospheric pressures outside the specified altitude limits or where the surrounding gas is not air.**
- **In environments with restricted cooling air flow, even if the air temperatures are within specifications.**
- **In direct sunlight.**

2.4 Do not operate instrument if damaged

WARNING

If the instrument is damaged, appears to be damaged, or if any liquid, chemical, or other material gets on or inside the instrument, remove the instrument's power cord, remove the instrument from service, label it as not to be operated, and return the instrument to B&K Precision for repair. Notify B&K Precision of the nature of any contamination of the instrument.

WARNING

Hazardous voltages may be present in unexpected locations in circuitry being tested when a fault condition in the circuit exists.

2.5 Clean the instrument only as instructed

WARNING

Do not clean the instrument, its switches, or its terminals with contact cleaners, abrasives, lubricants, solvents, acids/bases, or other such chemicals. Clean the instrument only with a clean dry lint-free cloth or as instructed in this manual. Not for critical applications.

2.6 Do not touch live circuits

WARNING

Instrument covers must not be removed by operating personnel. Component replacement and internal adjustments must be made by qualified service-trained maintenance personnel who are aware of the hazards involved when the instrument's covers and shields are removed. Under certain conditions, even with the power cord removed, dangerous voltages may exist when the covers are removed.

To avoid injuries, always disconnect the power cord from the instrument, disconnect all other connections (for example, test leads, computer interface cables, etc.), discharge all circuits, and verify there are no hazardous voltages present on any conductors by measurements with a properly-operating voltage-sensing device before touching any internal parts. Verify the voltage-sensing device is working properly

before and after making the measurements by testing with known-operating voltage sources and test for both DC and AC voltages.

Do not attempt any service or adjustment unless another person capable of rendering first aid and resuscitation is present.

2.7 General Safety

WARNING **Do not insert any object into an instrument's ventilation openings or other openings.**

WARNING **This instrument is not authorized for use in contact with the human body or for use as a component in a life-support device or system.**

2.8 Servicing

WARNING

Do not substitute parts that are not approved by B&K Precision or modify this instrument. Return the instrument to B&K Precision for service and repair to ensure that safety and performance features are maintained.

WARNING

Fuse replacement must be done by qualified service-trained maintenance personnel who are aware of the instrument's fuse requirements and safe replacement procedures. Disconnect the instrument from the power line before replacing fuses. Replace fuses only with new fuses of the fuse types, voltage ratings, and current ratings specified in this manual or on the back of the instrument. Failure to do so may damage the instrument, lead to a safety hazard, or cause a fire. Failure to use the specified fuses will void the warranty.

2.9 For continued safe use of the instrument

- Do not place heavy objects on the instrument.
- Do not obstruct cooling air flow to the instrument.
- Do not place a hot soldering iron on the instrument.
- Do not pull the instrument with the power cord, connected probe, or connected test lead.
- Do not move the instrument when a probe is connected to a circuit being tested.

Introduction

3.1 Product Overview

The 9140 Series are Switch Mode Power Supplies (SMPS) which combine industry-leading power density and performance with an extensive set of features in a compact 2U form factor. Three isolated output channels each produce 100 W of clean power with exceptionally low ripple and noise characteristics. Combine channels to output up to 300 W, distributing the power across all three channels.
Multiple outputs paired with advanced list mode programming, data logging, and protection features make these power supplies suitable for a wide range of benchtop or test system applications.



9140 9141

Figure 3.1 9140 and 9141 Front Views

Model	9140	9141
Voltage per Channel	0 to 32 V	0 to 60 V
Current per Channel	0 to 8 A	0 to 4 A
Maximum Power per Channel	100 W	
Maximum Combined Power	300 W	

Table 3.1 Models

3.2 Contents

Please inspect the instrument mechanically and electrically upon receiving it. Unpack all items from the shipping carton, and check for any obvious signs of physical damage that may have occurred during transportation. Report any damage to the shipping agent immediately. Save the original packing carton for possible future reshipment.
Every power supply is shipped with the following contents:

- 1 x 9140 or 9141 Power Supply
- 1 x AC Power Cord
- 1 x Certificate of Calibration
- 1 x Test Report

NOTICE **Ensure the presence of all the items above. Contact the distributor or B&K Precision if anything is missing.**

3.3 Features

- Three independent galvanically isolated, floating output channels providing up to 100 W per channel or 300 W total when combining all three channels
- High power density, compact 2U half-rack form factor
- Multi-ranging operation delivers rated power at various voltage/current combinations
- Combine outputs in parallel or series to increase current or voltage (up to 24 A or 180 V depending on the model)
- Advanced list mode programming with internal storage for up to 10 list mode programs and list sequencing capabilities
- Digital I/O block offers external triggering, voltage fault and remote inhibit capabilities
- Overvoltage (OVP), overcurrent (OCP), overtemperature (OTP), and includes a key-lock function
- NISPOM-compliant sanitization procedure to securely erase and return the instrument to factory settings
- USB (USBTMC-compliant) and LXI compliant LAN interfaces standard, GPIB optional
- LabVIEW™, IVI-C, and IVI.NET drivers provided

3.4 Dimensions

The 9140 power supply's dimensions are approximately: 213 mm (8.4 in) x 88.2 mm (3.47 in) x 330 mm (13 in) (W x H x D).



Figure 3.2 Dimensions

3.5 Rackmount Installation

The 9140 Series is compatible with the optional 19-inch rackmount kit model RK2US. The RK2US installation instructions can be downloaded from bkprecision.com.



Figure 3.3 RK2US Rackmount Kit

3.6 Front Panel



Figure 3.4 Front Panel

Item	Name	Description
1	**Power Button**	Power the instrument ON or OFF
2	**Function Keys**	See section for details.
3	**USB Host Port**	USB port used to connect flash drives.
4	**Display**	Visual presentation of the device function and measurements.
5	**Numeric Keypad**	Used to enter precise values.
6	**Rotary Knob**	Used to navigate menus or configure parameters.
7	**Output**	Isolated and floating output channel supporting sheathed banana plugs and spade lug type connectors
8	**Soft Keys**	Used to invoke any functions displayed above them.

Table 3.2 Front Panel

3.7 Display

Icon	Description
	The output is disabled.
	The output is enabled and in constant voltage mode
	The output is enabled and in constant current mode
	Data logging is enabled but not recording.
	Data logging is enabled and recording.
	The instrument is connected to a network.
	An issue occurred when attempting to connect to a network.
	The instrument is not connected to a network.
	All keys excluding softkey F6 are locked.
	Over voltage protection was triggered.
	Over current protection was triggered.
	Over temperature protection was triggered.
	The instrument is set to remote mode
	Remote sense is enabled.
	An issue occured when enabling remote.

Table 3.3 Display Icons

3.8 Rear Panel

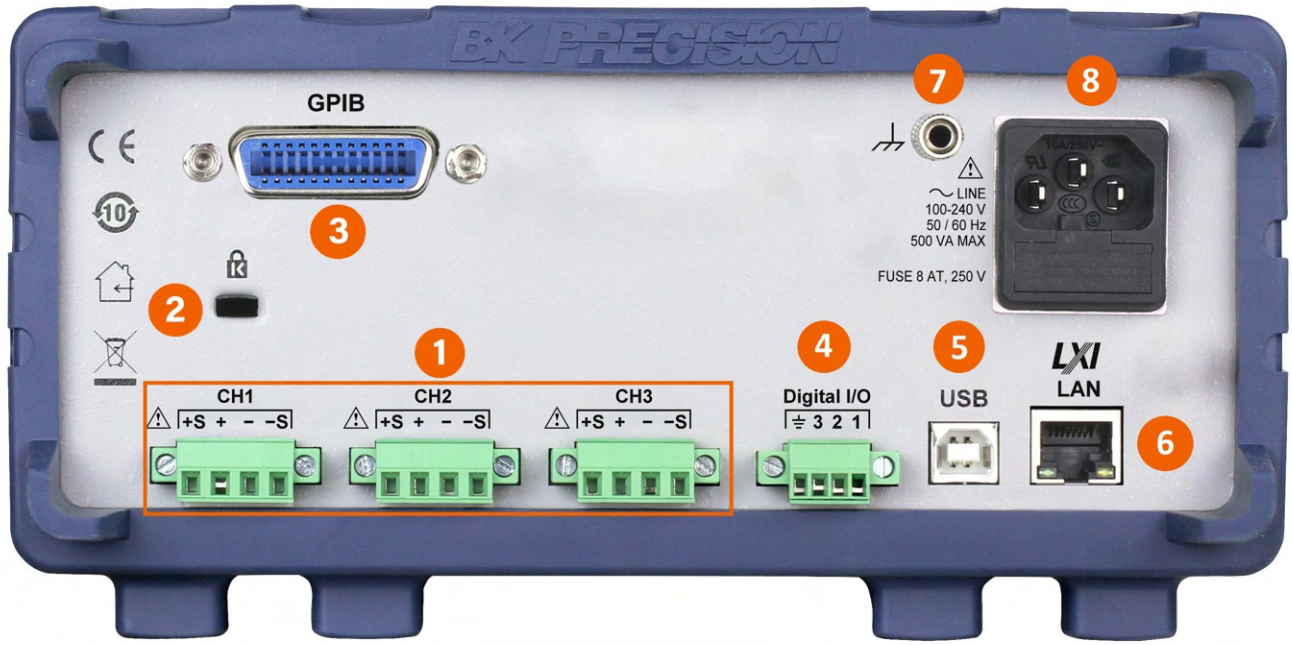


Figure 3.5 Rear Panel

Item	Name	Description
1	**Output/Sense**	Rear panel output with remote sense. Internal relays switch between local and remote sensing.
2	**Kensington security slot**	Lock the instrument to a fixed location using the security lock via the lock hole. Lock is not included.
3	**GPIB Interface (Optional)**	Connect a GPIB cable to remotely control the unit.
4	**Digital I/O**	Send or receive a signal to or from an external device.
5	**USB interface**	Connect a USB type B to type A to remotely control the unit.
6	**LAN interface**	Connect a Cat 5/6 Ethernet straight-through patch cable to remotely control the unit.
7	**Chassis ground**	Provides a zero potential voltage reference and a dissipation point for interference, transient voltages and static.
8	**AC power input & fuse box**	Houses the fuse as well as the AC input.

Table 3.4 Rear Panel

Getting Started

Before connecting and powering up the instrument, please review and go through the instructions in this chapter.

4.1 Input Power and Fuse Requirements

The supply has a universal AC input that accepts line voltage input within the following ranges:

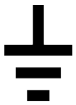
AC Line Input	100 - 240 VAC ±10%, 47 to 63 Hz
AC Line Phase	Single Phase
Maximum Rated Input Power	500 VA

Table 4.1 AC Input Specifications

Before connecting to an AC outlet or external power source, be sure that the power switch is in the OFF position and verify that the AC power cord, including the extension line, is compatible with the rated voltage/current and that there is sufficient circuit capacity for the power supply. Once verified, connect the cable firmly.



The included AC power cord is safety certified for this instrument operating in rated range. To change a cable or add an extension cable, be sure that it can meet the required power ratings for this instrument. Any misuse with wrong or unsafe cables will void the warranty.



SHOCK HAZARD: The power cord provides a chassis ground through a third conductor. Verify that your power outlet is of the three-conductor type with the correct pin connected to earth ground.

4.2 Fuse Requirements

An AC input fuse is necessary when powering the instrument. The table below shows the fuse required for all models.

Model	Fuse Specification
9140	5 A T, 250 V
9141	5 A T, 250 V

Table 4.2 Fuse Specifications

4.3 Check or Replace Fuse

For safety, no power should be applied to the instrument while changing line voltage operation. Disconnect all cables connected to the instrument before proceeding.

To check or replace the fuse:

- Locate the fuse box next to the AC input connector in the rear panel.
- Insert a small flathead screwdriver into the fuse box slit to pull and slide out the fuse box.
- Check and replace fuse if necessary.

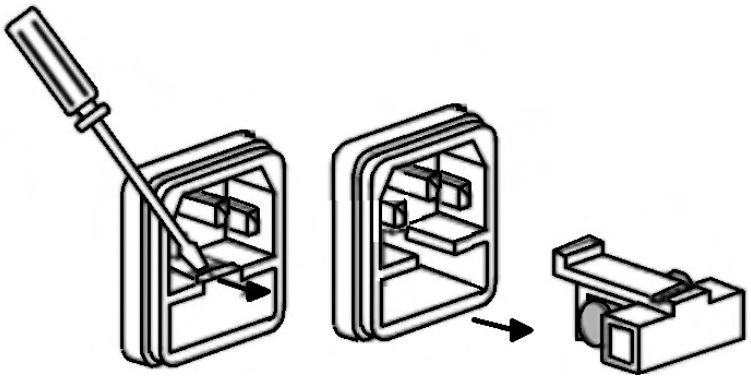


Figure 4.1 Fuse Removal

WARNING

Any disassembling of the case or changing the fuse not performed by an authorized service technician will void the warranty of the instrument.

Output Connections



SHOCK HAZARD: Hazardous voltages may exist at the outputs and the load connections when using a power supply with a rated output greater than 60 V. To protect personnel against accidental contact with hazardous voltages, ensure that the load and its connections have no accessible live parts. Ensure that the load wiring insulation rating is greater than to the maximum output voltage of the power supply.

The rear output terminals can accept wire sizes AWG 24 to AWG 12. However, we recommend using 12 AWG if current output is between 5 to 10 A. Refer to the table below to determine the proper wire size.

	Wire Gauge Rating							
AWG	14	16	18	20	22	24	26	28
Imax (A)	20	13	10	7	5	3.5	2.5	1.7
m Ω/meter	8.3	13.2	21	33.5	52.8	84.3	133.9	212.9

Table 4.3 Wire Gauge Rating

Output Isolation

The output terminals of the 9140 Series are isolated from earth ground. An earth ground terminal is provided on the front panel for convenience. Any output terminal may be grounded. However, output terminals must not exceed ±200 VDC.



SHOCK HAZARD: Floating voltage must not exceed 200 VDC.

4.4 Preliminary Check

Complete the following steps to verify the power supply is ready for use.

4.4.1 Verify AC Input Voltage

Verify and check to make sure proper AC voltages are available to power the instrument. The AC voltage range must meet the acceptable specification as explained in section **4.1**.

4.4.2 Connect Power & Self-Test

Connect AC power cord to the AC receptacle in the rear panel and press the power button. It will run through a self-test procedure initially before booting to the main screen.

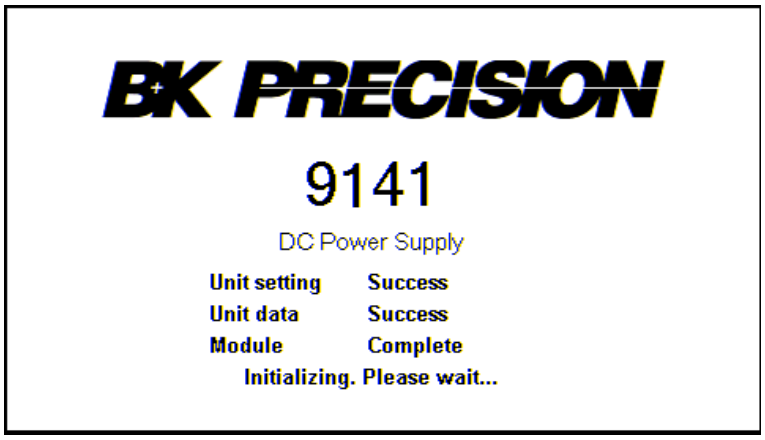


Figure 4.2 Initializing Screen

After the system scan is complete the LCD will display the home screen.

NOTICE **The initial power on state is based on the settings set on Power-ON.**



Figure 4.3 Home Display

4.5 Self Test Errors

The following errors will be displayed if the self-test did not complete successfully:

Error Message	Description
EEPROM Fail	The internal EEPROM is corrupted or damaged.
System Lost	Last system settings within the EEPROM are lost.
Module Fail	Channel response failure.
Cal Lost	Calibration data within the EEPROM is lost.
Fact Loss	Factory calibration data is lost.
Model Lost	Channel initialization failed.

Table 4.4 Self-Test Error Messages

If any of these errors occur, please contact B&K Precision.

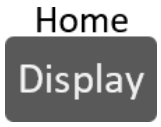
Basic Front Panel Operation

At power-on, the power supply will automatically enter the front-panel operation mode and the instrument can be controlled via the front panel keys and knob.

5.1 Keys

5.1.1 Main Keys

There are three main keys located on the front panel:



Home / Display

Navigates the 5 available screens. When navigating any menu, pressing this key will return to the "Home" main display.



Save / Recall

Opens up a menu giving access to various save and load options, regardless of the current display of the screen.



Utility

Opens the main menu bar. If a menu bar is already open, pressing Utility will navigate to the main menu bar.

Figure 5.1 Main Function Keys

Description: 5 Available Displays

- **Main page**: Overview of the 3 outputs.
- **Single Channel Display 1 to 3**: Detailed channel overview.
- **Live Output Monitoring**: Oscilloscope-like overview of the measured output parameters.

5.1.2 Soft Keys

The unit has six soft keys, which are located beneath the screen. Each key selects the corresponding function. Functions will vary depending on the current menu or display.



Figure 5.2 Soft Keys

5.1.3 Numeric Keys

The numeric keys allow the configuration of various parameters. Using the numeric keys provides a fast and precise input. The **Enter** key can be found with the numeric keys. Pressing enter will assign the selected value to the desired parameter.

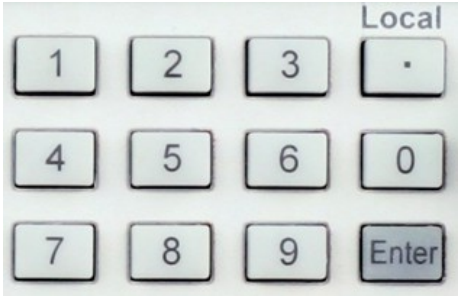


Figure 5.3 Numeric Keys

5.1.4 Output Control

- **ON**: The button toggles the output On/Off. When output is enabled, the ON button will turn green and the supply will display the state of the channel.
- **CC / CV**:
  - **CC** represents constant current mode.
  - **CV** represents constant voltage mode.
  - **OFF**: When output is disabled, the channel state will display OFF.
- **All CH**: The on/off key toggles all the channels On/Off simultaneously. Its function may vary depending on the coupling state of the channels. For more information, see the Coupling section.

Description: Automatic Mode Switching

The output will automatically switch between CV and CC mode when the current limit value is reached. Meaning, if a load connected to the power supply draws or needs to draw more current than the limit, the supply will automatically go into CC mode, giving the supply current control of the power output. This is indicated for each channel independently.

5.2 Display

These power supplies have three main display modes: three channel display, single channel display, and live output monitoring display. Press the **Home / Display** button to cycle between the different display modes or to return home when viewing any other menu.

5.2.1 Three Channel Display

- **Provides information of the outputs'**:
  - State
  - Voltage
  - Current
  - Power
- **Allows configuration of**:
  - Vset
  - Iset



Figure 5.4 Three Channel Display

5.2.2 Single Channel Display

- **Provides information of the outputs'**:
  - State
  - Run time
  - Voltage
  - Current
  - Power
- **Allows configuration of**:
  - Vset
  - Iset
  - Vmax/Vmin
  - OVP/OCP
  - OnDelay/OffDelay



Figure 5.5 Single Channel Display

5.2.3 Live Output Monitoring

The live output monitoring display shows metered output voltage and current over time. It is always active and will continuously plot and overwrite the oldest value when the display graph is full.

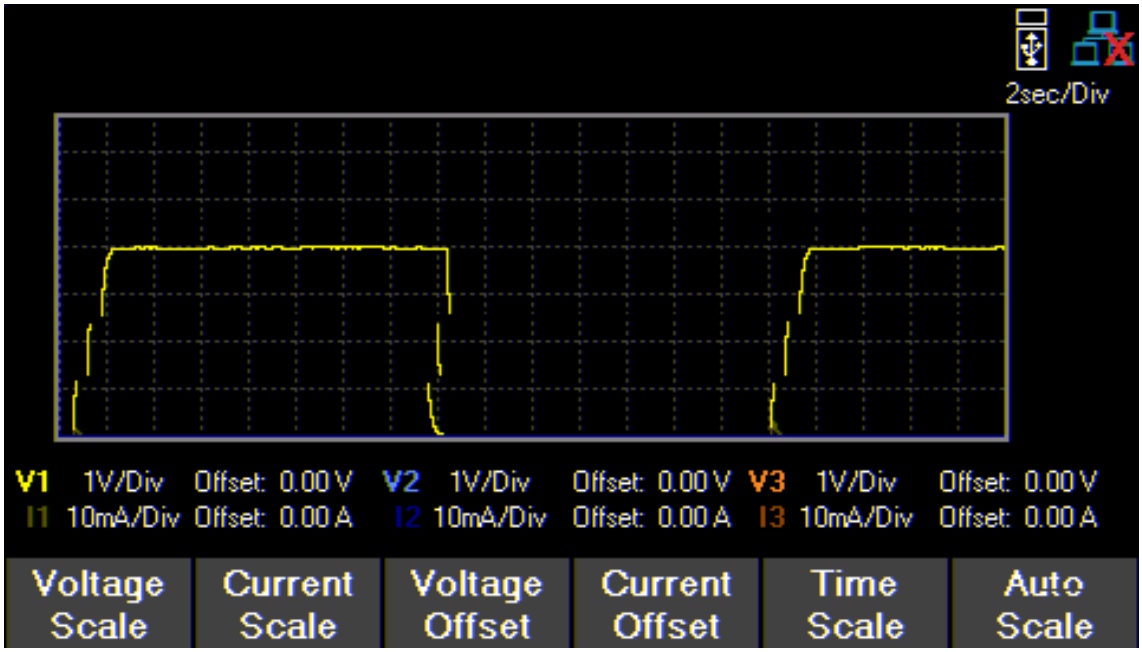


Figure 5.6 Live Output Monitoring Display

The Live output display can be configured by setting the: Voltage, Current, and Time Scale.

5.2.3.1 Voltage Scale

The voltage scale of each output can be set from 10 mV/Div up to 20 V/Div.

- While in Live Output Display use the softkeys to select **Voltage Scale**.
- Select a channel to configure.
- Use the rotary knob to navigate through the available scales.

5.2.3.2 Current Scale

The current scale of each output can be set from 10 mA/Div up to 3 A/Div.

- While in Live Output Display use the softkeys to select **Current Scale**.
- Select a channel to configure.
- Use the rotary knob to navigate through the available scales.

5.2.3.3 Time Scale

The time scale of each output can be set from 1 s/Div up to 10 min/Div.

- While in Live Output Display use the softkeys to select **Time Scale**.
- Use the rotary knob to navigate through the available scales.

5.2.3.4 Voltage Offset

A voltage offset can be added to each output. The offset can be set from 0 V up to 60.6 V on the 9141 and 0 V up to 32.2 V on the 9140.

- While in Live Output Display use the softkeys to select **Voltage Offset**.
- Select a channel to configure.
- Use the rotary knob to navigate through the available scales.

5.2.3.5 Current Offset

A current offset can be added to each output. The offset can be set from 0 A up to 4.4 A on the 9141 and 0 A up to 8.8 A on the 9140.

- While in Live Output Display use the softkeys to select **Current Offset**.
- Select a channel to configure.
- Use the rotary knob to navigate through the available scales.

5.3 Check Model and Firmware Version

The firmware version, model, and serial number can be verified by entering the security settings.

- Press **Utility** button.
- Use the soft keys to select **Utilities > Help > System Info** to view model and firmware information.

5.4 Setting Voltage and Current

Follow the steps below to set the output voltage or current. The values can be entered using the numeric keypad or the rotary knob.

Description: Using the Keypad

- Use the soft keys to select the channel **VSET** or **ISET** settings beneath channel view on the display.
- Use the numeric keypad to input the voltage or current value.
- Press **Enter** to confirm.

Description: Using the Rotary Knob

- Use the soft keys to select the channel **VSET** or **ISET** settings beneath the channel view on display.
- Turn the knob clockwise to increment or counter-clockwise to decrement the value.
- Use the < or > keys below the rotary knob to move the cursor.
- Press the knob in to confirm.

Output Configuration

6.1 Protection Settings

6.1.1 Over Voltage Protection (OVP)

Over voltage protection is always enabled; however, the user can set the OVP voltage limits. When OVP protection is tripped during operation, the output will be de-rated to 0 V and the icon **OV** will appear between the wattage and Vset.

- Press the **Utility** button then use the soft keys to select **Output config** > **Protection settings**.
- Use the soft keys to select a channel to adjust.
- Select **OVP Limit**.
- Use the numeric keypad or rotary knob to set the desired OVP limit.

6.1.2 Over Current Protection (OCP)

Over current protection state and limit can be set in the protection settings. When OCP protection is tripped during operation, the output will be de-rated to 0 V and the icon **OC** will appear between the wattage and Vset.

- Press the **Utility** button then use the soft keys to select **Output config** > **Protection settings**.
- Use the soft keys to select a channel to adjust.
- Press **OCP State** to toggle the over current protection on or off.
- Select **OCP Limit** and use the numeric keypad or rotary knob to set limit value.

6.1.3 Over Temperature Protection & Warning (OTP & OTW)

The state and limit of both OTP & OTW cannot be set or configured in the protection settings.

- **OTP**: Set to $85^{\circ}C$. If reached, the **OT** icon will show on the display and the output will turn off. The output will not be allowed to turn on until the temperature drops to $75^{\circ}C$.
- **OTW**: Set to $75^{\circ}C$. If reached, the **OT** icon will blink on the display with a low period beep sound.

Current Load	Fan Speed
< 2 A	0%
2 to 5 A	25%
> 5 A	100%

Table 6.1 Fan Speed Control

6.1.4 Vmax / Vmin

Configure the maximum or minimum voltage value the user can set from the protection settings.

- Press the **Utility** button then use the soft keys to select **Output config > Protection settings**.
- Use the soft keys to select a channel to adjust.
- Select **Vmax** or **Vmin** and set a maximum or minimum value using the numeric keypad or rotary knob.

6.1.5 Protection Clear

Protections are cleared from the output configuration settings as shown in the following steps.

- Press the **Utility** button then use the soft key to select **Output config > Protection Clear**.
- Press the soft key to clear the protection for the corresponding channel, or select **All CH Clear** to clear protections on all three channels.

6.2 Output Settings

6.2.1 Remote Sense

Remote sense can be used to compensate for voltage drops (up to 1 V) due to resistance from test leads connected to your device under test (DUT), thus providing more accurate output voltage.

- When remote sense is enabled, the positive (+S) and positive lead (+) of the DC output are connected to the positive (+) of the load.
- Similarly, the negative sense (-S) and negative lead (-) of the DC output are connected to the negative (-) end of the load shown in the figure.

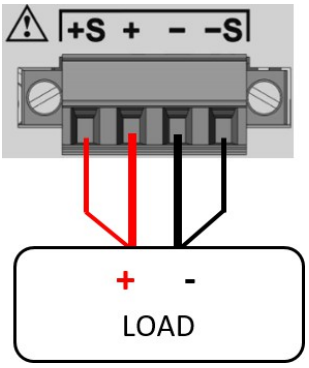


Figure 6.1 Remote Sense Connection



Never connect any power source into any of the terminals at any time during operation. When output is enabled, DO NOT use your hands to touch the terminals or the screws that are designed to tighten wires to the terminals. Doing so may create a shock hazard under high voltage output conditions.

CAUTION

DO NOT at any time disconnect the wires from the S+ and S- terminals to the DUT while output is enabled (ON). Doing so may damage the power supply and cause unstable output.

Remote sense is disabled by default. See the following steps to enable remote sense:

- Press the **Utility** button then use the soft key to select **Output config > Output Settings**.
- Select a desired channel to configure.
- Press **Remote Sense** using the soft key to enable remote sense.

6.2.2 Output Timer

Output timer can be set for each channel individually. When the output timer is enabled, an hourglass icon will be displayed next to the channel number. The timer countdown will begin when the channel output is enabled.
The output is disabled when the countdown reaches 0. The timer can be set from 1 second to 99 hours 59 minutes and 59 seconds.

- Press the **Utility** button then use the soft key to select **Output config > Output Settings**.
- Select a desired channel to configure. Push **Timer State** to enable the timer.
- Select **Timer Setting** and set a desired time for the output to be enabled using the numeric keypad or rotary knob. The timer format is: HH:MM:SS.

6.2.3 Voltage Slew

The rising voltage slew rate can be set in volts per second. The voltage slew range can be set from 0.001 V/s to 3200.0 V/s.

- Press the **Utility** button then use the soft key to select **Output config > Output Settings**.
- Select a desired channel to configure.
- Select **Voltage Slew** and use the numeric keypad or rotary knob to adjust the slew rate value.
- Press **Enter** to confirm input.

6.2.4 Current Slew

The rising current slew rate can be set in amps per second. The current slew range can be set from 1 A/s to 800 A/s.

- Press the **Utility** button then use the soft key to select **Output config > Output Settings**.
- Select a desired channel to configure.
- Select **Next Pg. > Current Slew** and use the numeric keypad or rotary knob to adjust the slew rate value.
- Press **Enter** to confirm input.

6.2.5 On/Off Delay

A channel on or off delay in seconds can be applied to any channel. These delays can be set from 0.001 s to 3600.0 s.

- Press the **Utility** button then use the soft key to select **Output config** > **Output Settings**.
- Select a desired channel to configure.
- Select **Next Pg.** > **On Delay** to set an on delay or **Off Delay** to set an off delay.
- Use the numeric keypad or rotary knob to adjust the delay value. Press **Enter** to confirm input.

Operating Mode and Coupling

The 9140 Series offers flexible operating modes to accommodate various voltage and current requirements. This chapter details how to configure the instrument for Normal, Series, Parallel, and Tracking modes, as well as how to use Channel Coupling and Output Sequencing.
To access the Operating Mode menu:

- Press the **Utility** button.
- Use the soft keys to select **Output config** > **Op. Mode/Coupling** > **Operation Mode**.

7.1 Normal Mode

Normal mode configures the instrument to operate as a true triple output power supply. Each channel operates independently with its own voltage and current settings.
To set the instrument to Normal Mode:

- Press the **Utility** button.
- Select **Output Config** > **Op. Mode/Coupling** > **Operation Mode** > **Normal**.

In Normal mode, the main page displays all three outputs. The **Display** button toggles between the three-channel view, single-channel view, and live output monitoring.



Configuration Menu Main Page

Figure 7.1 Normal Mode Configuration and Main Display

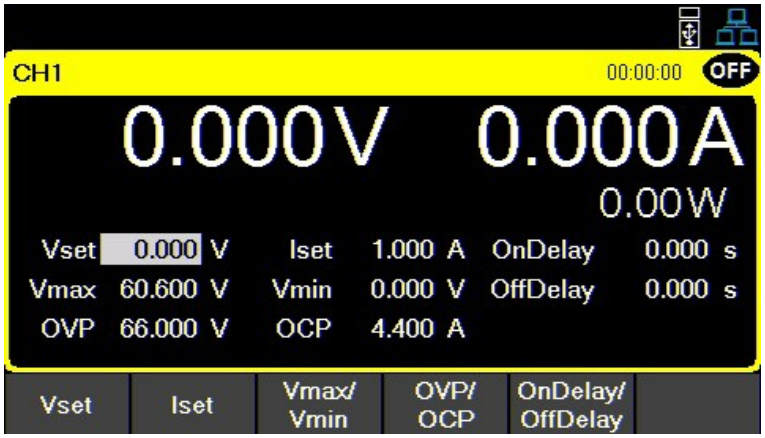


Figure 7.2 Single Channel Display

7.2 Series Mode

Series mode updates the user interface to accurately represent combined output configurations for higher voltage applications.

WARNING

Series mode does not internally wire the outputs. The outputs must be connected externally to increase the available voltage range. Failure to connect the outputs correctly may result in unexpected behavior.

To set the instrument to Series Mode:

- Press the **Utility** button.
- Select **Output Config** > **Op. Mode/Coupling** > **Operation Mode** > **Series**.

7.2.1 External Wiring

The following diagram illustrates the required external wiring to connect channels in series. Note that if **CH1+CH2** is selected, CH2's positive terminal does not connect to CH3's negative terminal.

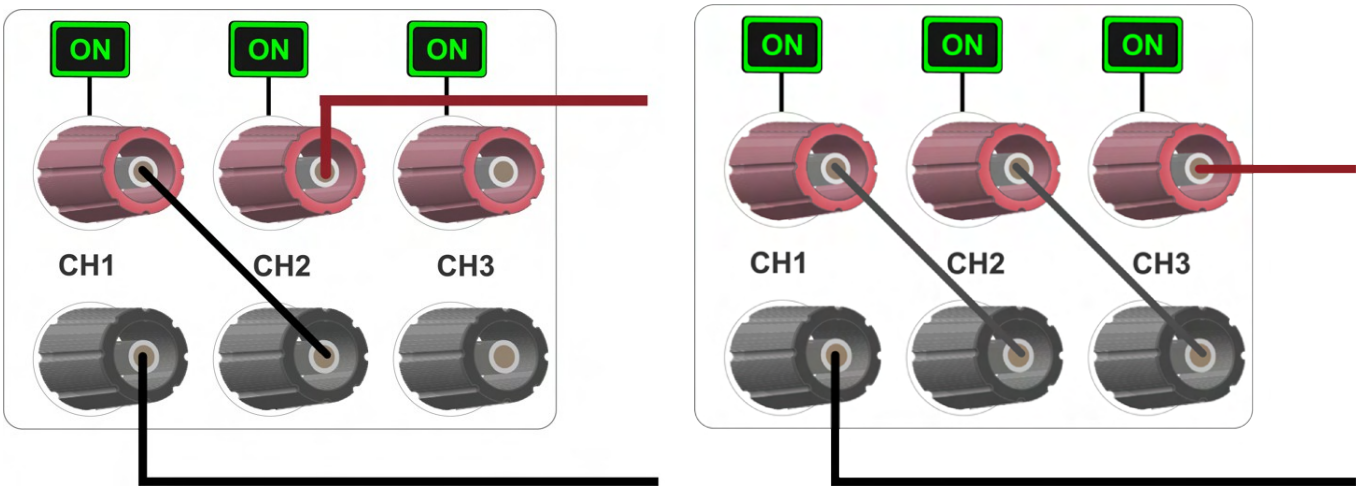


Figure 7.3 Series Wiring Diagram

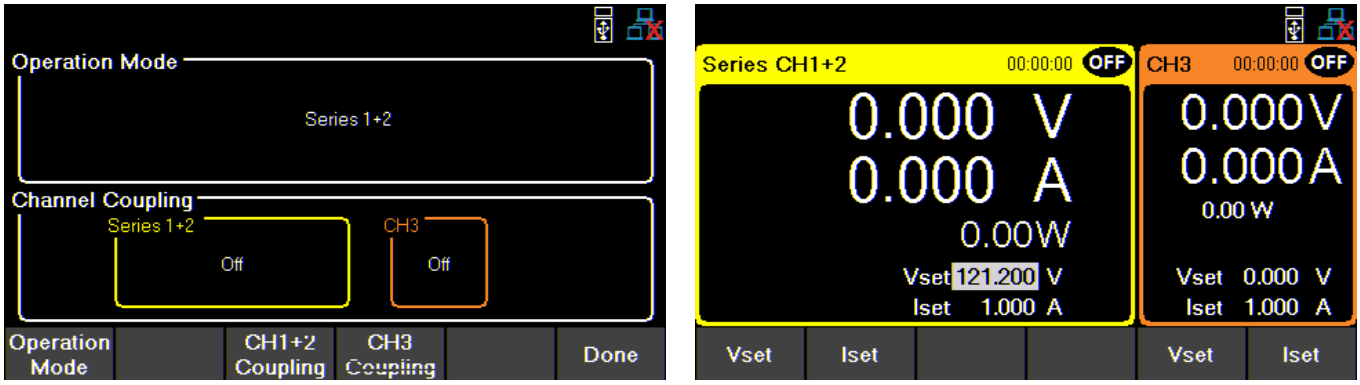
Configuration	9140	9141
CH1+CH2	64 V	120 V
All CHs	96 V	180 V

Table 7.1 Series Mode Voltage Ranges

7.2.2 CH1 + CH2

In this mode, Channel 1 and Channel 2 are coupled in series. Selecting this mode will undo any previous coupling configuration. The main page will display the combined output for CH1+2 and the individual output for CH3.

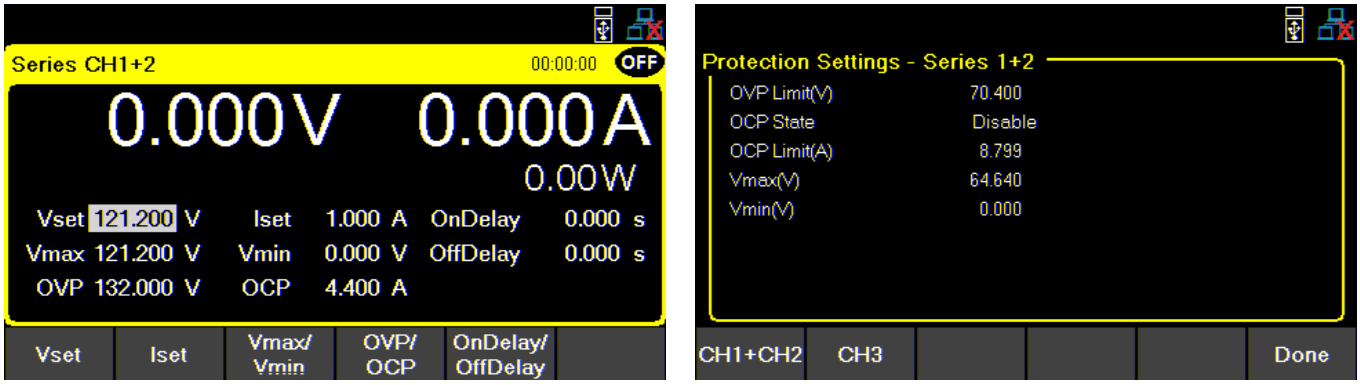
- Navigate to **Operation Mode** > **Series** > **CH1 + CH2**.



Configuration Main Page

Figure 7.4 Series CH1+2 Configuration and Main Display

The Single Channel display provides detailed information and configuration options for the combined output. Protection settings such as OVP and OCP can also be adjusted for the combined series output.



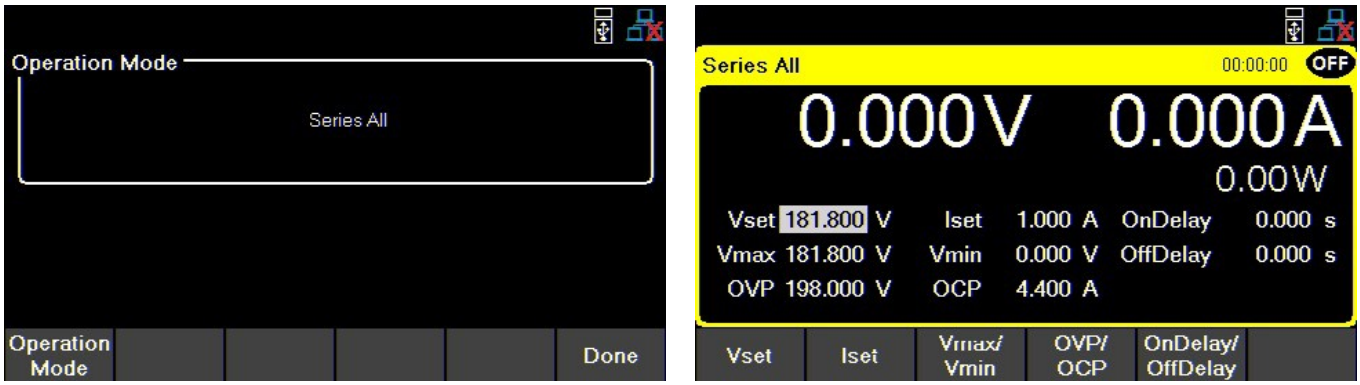
Single Channel Display Protection Settings

Figure 7.5 Series CH1+2 Single Channel and Protection

7.2.3 Series All

In this mode, all three channels are coupled in series. Coupling options are not available in **Series All** mode. The display toggles only between the Series All main page and live output monitoring.

- Navigate to **Operation Mode > Series > Series All**.



Configuration Main Page

Figure 7.6 Series All Configuration and Main Display

7.3 Parallel Mode

Parallel mode updates the user interface to represent combined output configurations for higher current applications.

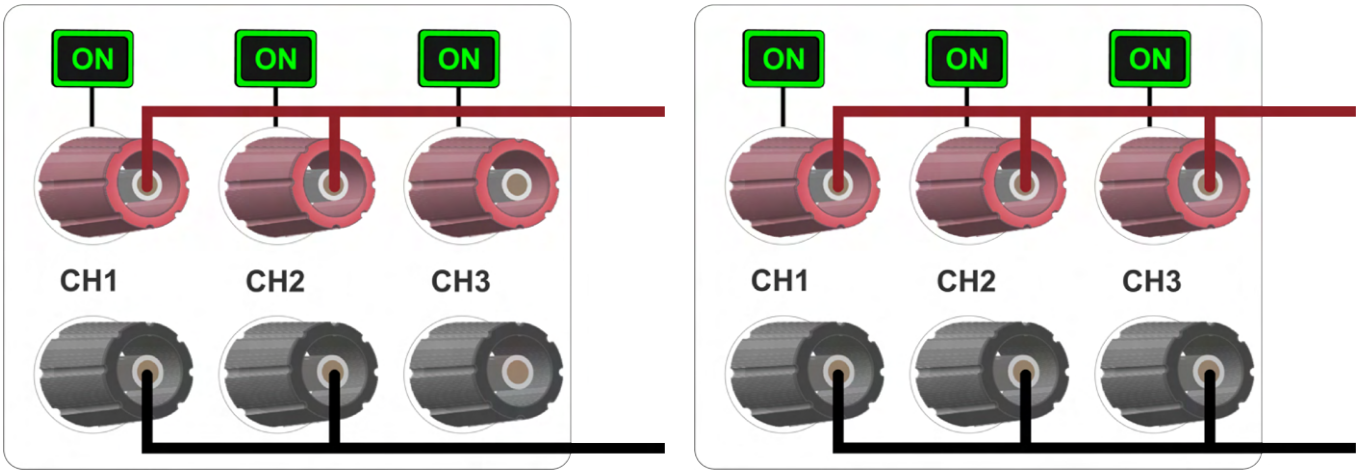
WARNING **Parallel Mode does not internally wire the outputs. The outputs must be connected externally to increase the available current range.**

To set the instrument to Parallel Mode:

- Press the **Utility** button.
- Select **Output Config** > **Op. Mode/Coupling** > **Operation Mode** > **Parallel**.

7.3.1 External Wiring

The following diagram illustrates the required external wiring to connect channels in parallel. If **CH1+CH2** is selected, CH2's terminals do not connect to CH3's terminals.



Parallel CH1 + CH2 **Parallel All**

Figure 7.7 Parallel Wiring Diagram

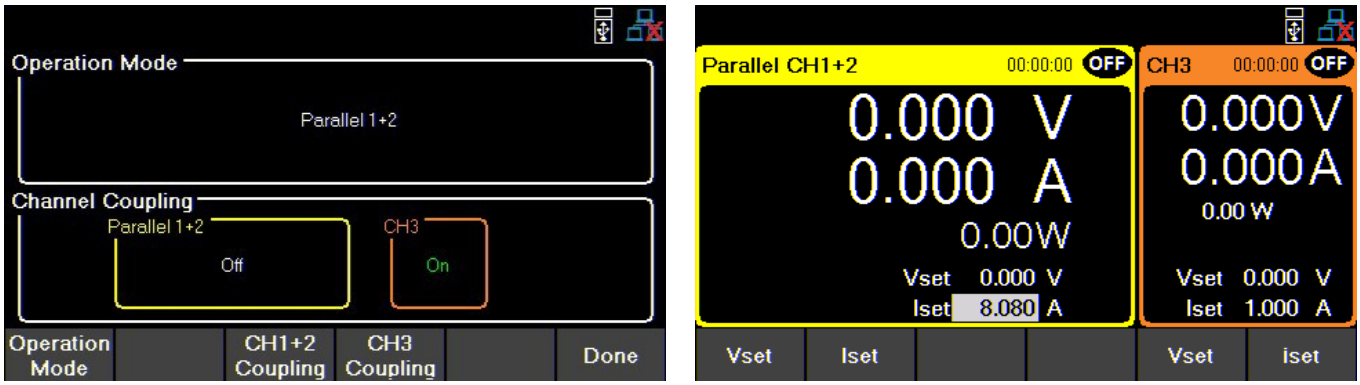
Configuration	9140	9141
CH1+CH2	16 A	8 A
All CHs	24 A	12 A

Table 7.2 Parallel Mode Current Ranges

7.3.2 CH1 + CH2

In this mode, Channel 1 and Channel 2 are coupled in parallel. The main page displays the combined output for CH1+2 and the individual output for CH3.

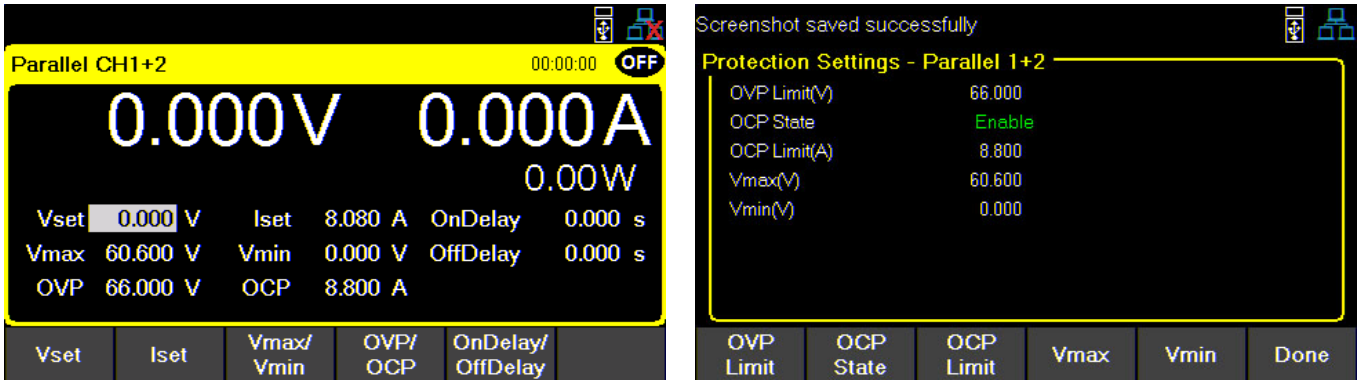
- Navigate to **Operation Mode** > **Parallel** > **CH1 + CH2**.



Configuration Main Page

Figure 7.8 Parallel CH1+2 Configuration and Main Display

The Single Channel display adjusts to allow current configuration up to 16 A (9140) or 8 A (9141). Protection settings are also adjusted for the combined parallel output.



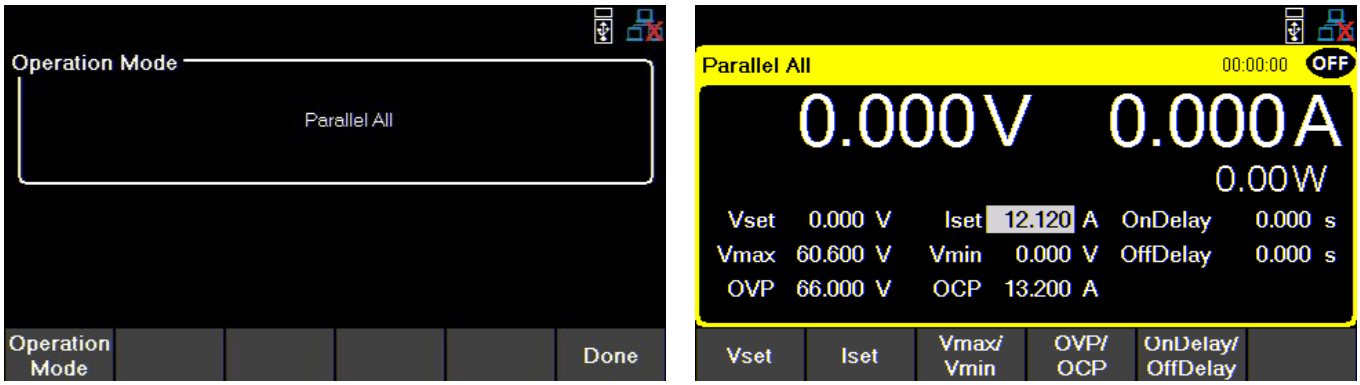
Single Channel Display Protection Settings

Figure 7.9 Parallel CH1+2 Single Channel and Protection

7.3.3 Parallel All

In this mode, all three channels are coupled in parallel. In Parallel All mode, the display toggles only between the Parallel All main page and live output monitoring.

- Navigate to **Operation Mode** > **Parallel** > **Parallel All**.



Configuration Main Page

Figure 7.10 Parallel All Configuration and Main Display

Protection settings can be configured for the combined output.

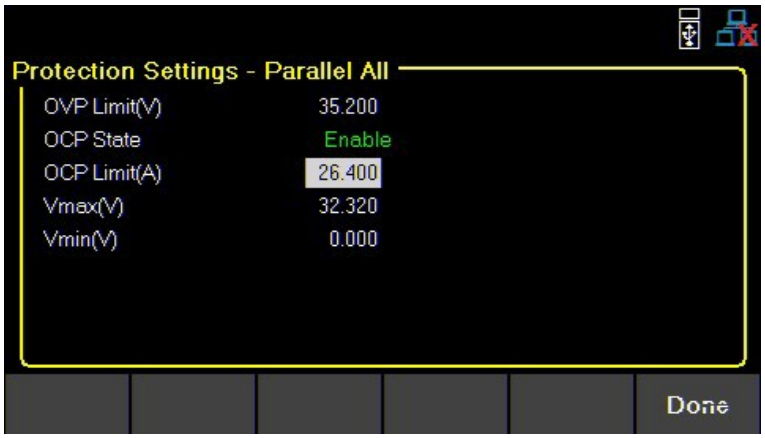


Figure 7.11 Parallel All Protection Settings

7.4 Tracking Mode

Tracking mode allows real-time voltage tracking across all channels or between CH1 and CH2.

- Press the **Utility** button.
- Select **Output Config** > **Op. Mode/Coupling** > **Operation Mode** > **Tracking**.

NOTICE

When tracking mode is enabled, List Mode will still operate independently on the channel that has a list enabled. Tracking channels will not track list changes.

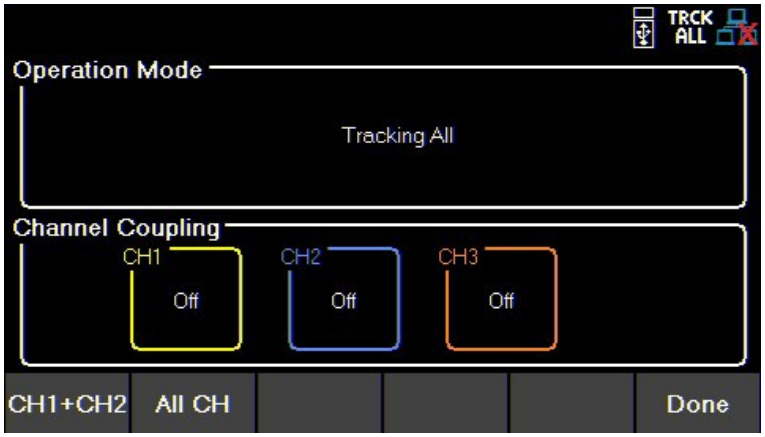


Figure 7.12 Tracking Mode Configuration

7.5 Coupling

Channel coupling allows the user to link the On/Off state of multiple channels.

- Press the **Utility** button.
- Select **Output Config > Op. Mode/Coupling**.
- Use the soft keys to toggle individual channel coupling **On** or **Off**.

Description: Behavior

If coupling is enabled:

- The **All CH** On/Off button will follow the coupling settings.
- Individual channel On/Off buttons will control coupled channels.

- **Example**: If CH1 and CH2 are coupled and CH3 is not:
  - Turning CH1 On/Off will also turn CH2 On/Off, but CH3 will remain unaffected.
  - However, if all channels are OFF, the **All CH** button will turn all channels ON.
  - If all channels are ON, the **All CH** button will turn all channels OFF.

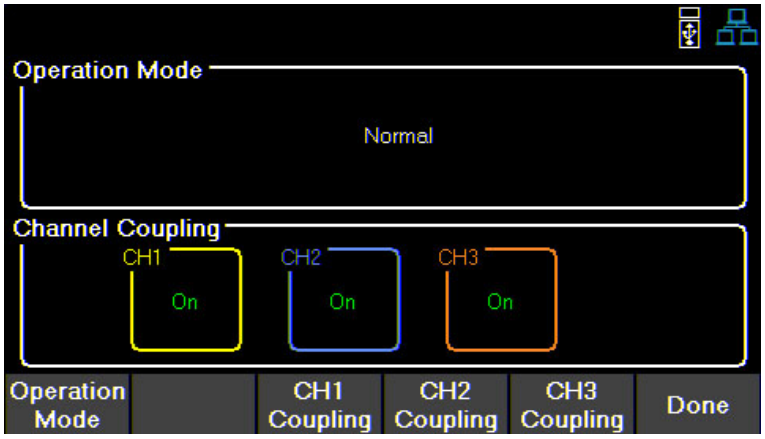


Figure 7.13 Coupling Configuration

7.6 Output Sequencing

By combining Channel Coupling with Output On/Off Delays, users can configure a set sequence for turning outputs on and off.

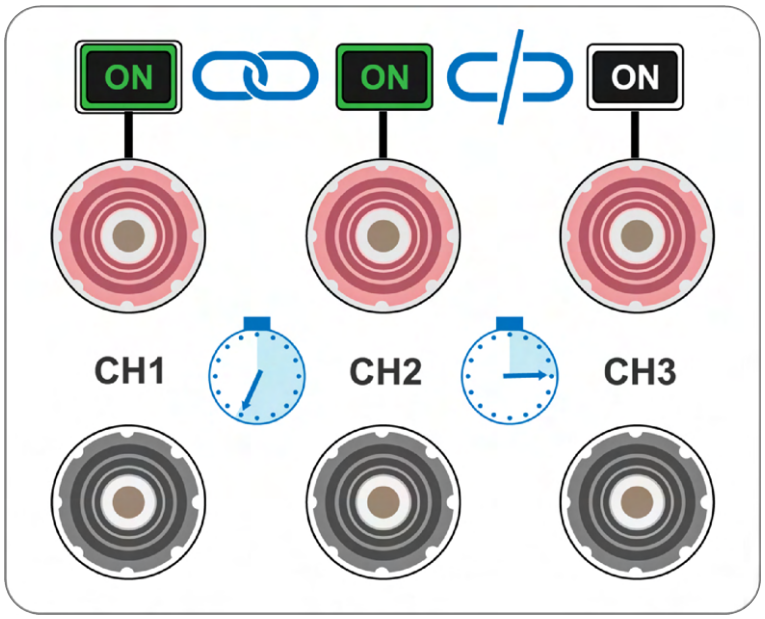


Figure 7.14 Output Sequencing Diagram

Description: To configure a sequence:

1. Set the voltage and current output for the participating channels (Reference section **5.4**).
2. Synchronize the output state by enabling coupling for all participating channels (Reference section **7.5**).
3. Configure the turn-on order using the On and Off Delay settings for each channel (Reference section **6.2.5**).
4. Begin the sequence by turning on any of the participating outputs.

List Mode

The 9140 and 9141 are capable of storing up to 10 programmable lists in the internal memory. Each list can have up to 100 configurable steps. List memory is shareable across all 3 channels, allowing the channels to run the same list or different lists simultaneously.

If all ten internal memory slots are filled, lists can also be saved to a USB flash drive. Lists can be loaded from a USB, allowing for a larger collection of programmed sequences.

8.1 List Setup

To configure the list settings:

- Press the **Utility** button.
- Use the soft keys to select **List Setup**.
- Select the desired channel (CH1, CH2, or CH3).

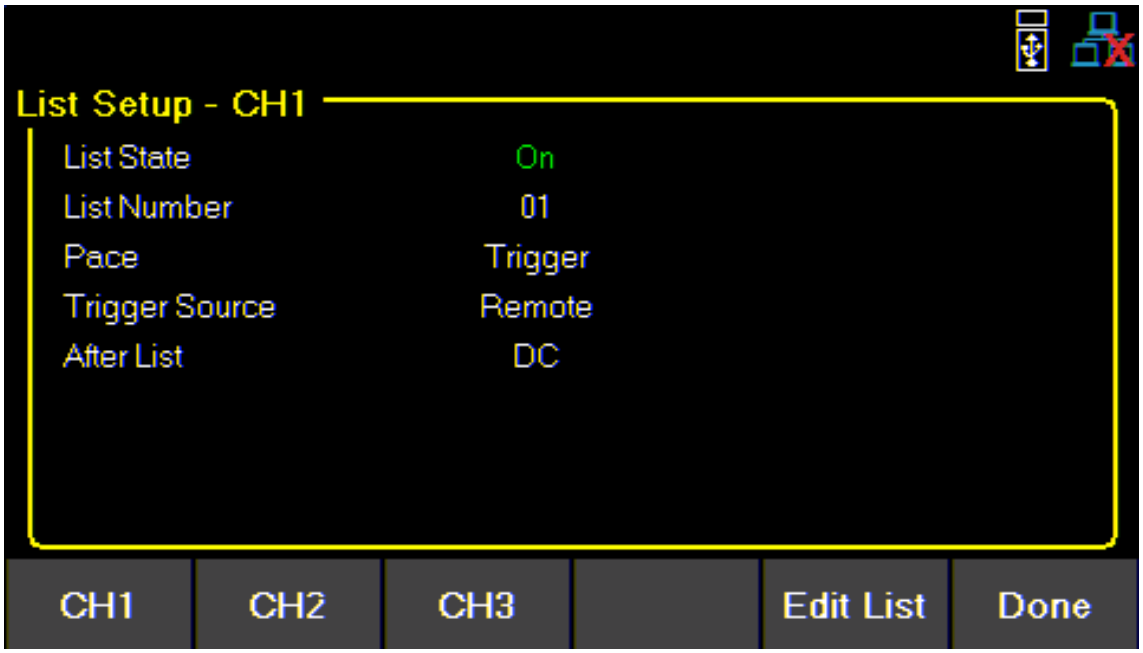


Figure 8.1 List Setup Menu

The following parameters can be configured in the List Setup menu:

Soft Key	Function
List State	Toggle the list function **On** or **Off** for the selected channel.
List Number	Select a list program (01–10) from the internal memory to run. Use the numeric keypad or rotary knob to select, then press **Enter**.
Pace	Determines how steps are executed: • **Dwell**: The next step outputs automatically once the dwell time elapses. • **Trigger**: After the dwell time elapses, the unit waits for a trigger before outputting the next step.
Trigger Source	Sets the source of the trigger event: • **Manual**: Use the **Trigger** softkey on the main display. • **Digital IO**: Receives a trigger via the digital I/O pins. • **Remote**: Receives a trigger command via the remote interface.
After List	Defines the output state after the list ends: • **DC**: Returns to the DC output values set prior to enabling List Mode. • **Last**: Retains the voltage and current values of the final step in the list.

Table 8.1 List Setup Parameters



Figure 8.2 Waiting for Trigger (Manual Mode)

NOTICE **If a list is aborted, the output will return to the last set voltage and current values before the list began, even if After List is set to Last.**

8.2 Edit List

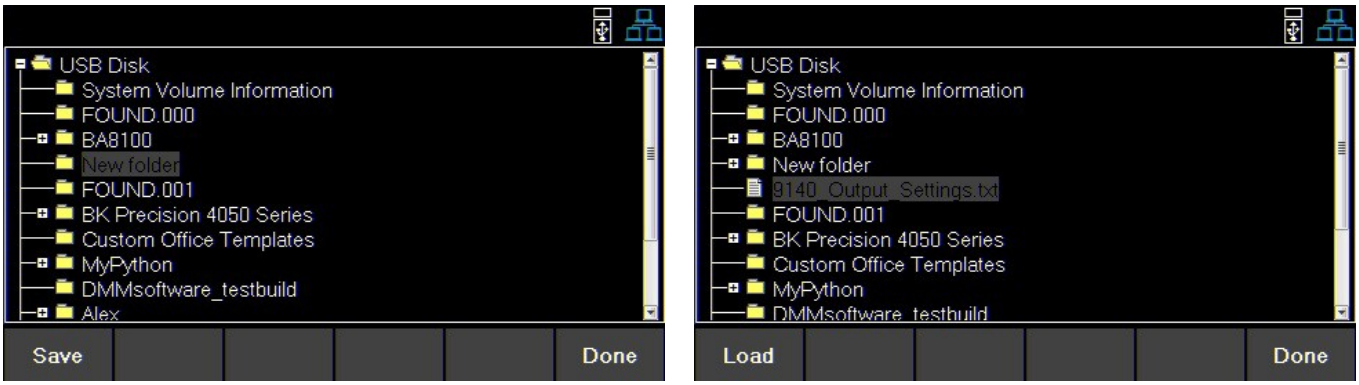
To edit a list program:

- Press the **Utility** button.
- Select **List Setup** > **Edit List**.

The Edit List menu allows you to manage list files and configure step parameters.

8.2.1 Load/Save List

You can save the current list to a USB drive or load a previously saved list.



Save to USB Load from USB

Figure 8.3 USB Load and Save Operations

Description: Save to USB

- Select **Load/Save List** > **Save to USB**.
- Use the rotary knob to navigate the file path. Press **Enter** to expand folders.
- Press the **Save** softkey to save the file to the selected location.

Description: Load from USB

- Select **Load/Save List** > **Load from USB**.
- Navigate to the desired file using the rotary knob.
- Press the **Load** softkey.

NOTICE **A list must be saved or overwritten to the selected internal List Number location before it can be assigned to a channel.**

8.2.2 List Number

Select the internal memory location (0–9) to edit.

- Use the numeric keypad or rotary knob to select the list number.
- Press **Enter** to confirm.

8.2.3 Next

Set the next list program to run automatically after the current list completes.

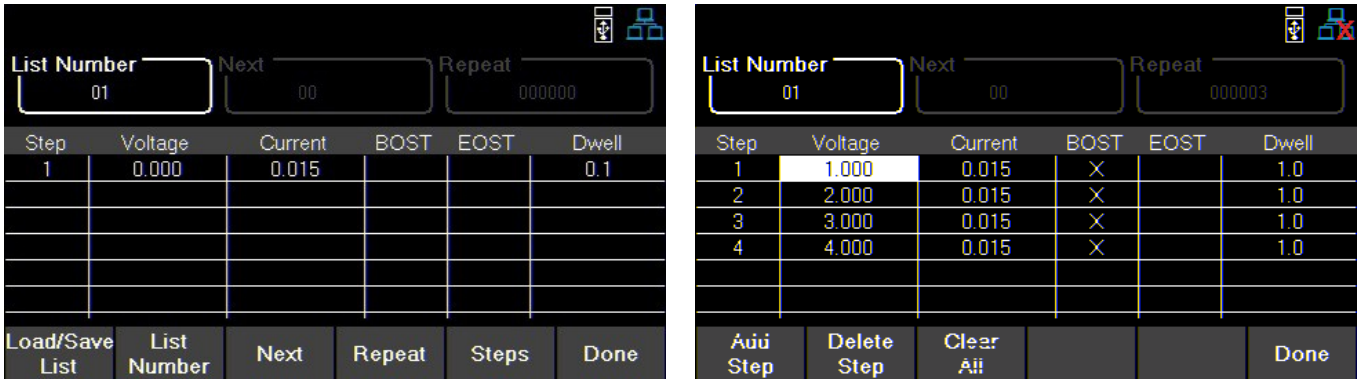
- **Continuous Loop**: Set **Next** to the same number as the current List Number.
- **Chaining Lists**: Set **Next** to a different list number (e.g., Set List 1 to transition to List 2).

8.2.4 Repeat

Set the number of times the current list will repeat before finishing or moving to the **Next** list. Use the keypad to enter the value.

8.2.5 Steps

This menu allows adding, deleting, and editing individual steps.



Default Step Step Editor

Figure 8.4 List Step Configuration

- **Add Step**: Adds a new step. The new step duplicates the currently selected step.
- **Delete Step**: Deletes the currently selected step.
- **Clear All**: Clears all steps in the list.
- **Edit Step**: Use the rotary knob to navigate rows (steps) and the arrow keys to navigate columns (parameters).

Parameter	Description
Voltage	Sets the Vset value. **Note:** The list does not limit voltage based on Operating Mode. Verify values are within the range of the configured mode (Normal/Series/Parallel) to prevent protection trips.
Current	Sets the Iset value. **Note:** The list does not limit current based on Operating Mode. Verify values are within the range of the configured mode.
BOST	Beginning of Step Trigger. Enable to send a trigger-out signal at the start of the step.
EOST	End of Step Trigger. Enable to send a trigger-out signal at the end of the step.
Dwell	Sets the duration of the step in seconds.

Table 8.2 Step Parameters

8.3 List Run

List mode allows sequences to be compatible with Normal, Parallel, or Series modes. Lists can run simultaneously on different channels due to shareable memory.

Description: Procedure to Run a List

1. Configure the steps in the **Edit List** menu.
2. Configure the channel settings in the **List Setup** menu (Enable List State, select List Number, Pace, Trigger, etc.).
3. Press **Home** to return to the main display.
4. If List State is enabled, the **Vset** softkey will be replaced with **List Start**.
5. Press **List Start** to begin execution.



List Ready (Start) List Running (Abort)

Figure 8.5 List State Indicators

Once the list begins, the softkey changes to **List Abort**. Pressing this will stop the list immediately.

Description: Live Adjustment

While a list is running, you can temporarily adjust the output of the current step:

- Use the rotary knob or keypad to adjust Voltage or Current.
- This change applies only to the active step and is not saved to the list memory.
- Once the step dwells time elapses, the next step will load with its programmed values.

NOTICE

If Trigger Source is set to Manual, live adjustment via softkeys is disabled. Use the Single Channel Display to access Vset/Iset controls during a manual trigger wait state.

Data Logger

The 9140 series has a built-in data logger that can sample and record voltage, current, and status codes across all three channels simultaneously.

9.1 Using the Data Logger Function

To access and configure the data logger:

- Press the **Utility** button.
- Use the soft keys to select **Data Logger**.

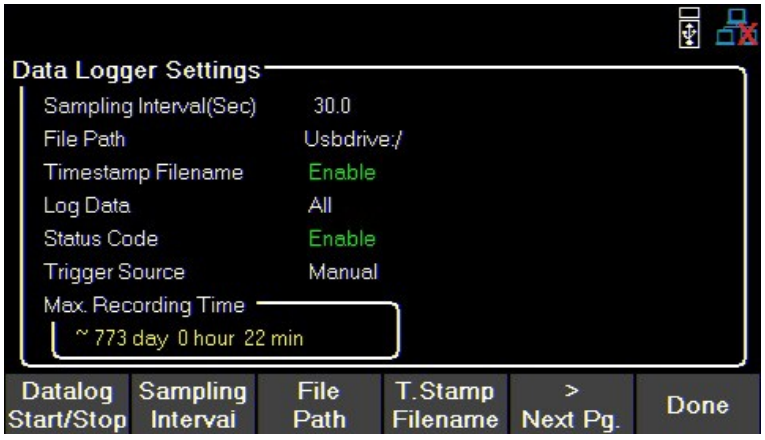


Figure 9.1 Data Logger Settings

Before starting the Data Logger, configure the settings in the following order:

1. Set the desired **Sampling Interval**.
2. Select a **File Path** to determine where to store the collected data.
3. Enable or disable **T. Stamp Filename**.
4. Choose what data to record in **Log Data**.
5. Enable or disable **Status Code**.
6. Select a **Trigger Source**.
7. Press **Datalog Start/Stop** to begin recording.

9.2 Parameters

The following parameters can be configured in the Data Logger menu:

Parameter	Description
Sampling Interval	Sets the time between data points. Range: 0.2 s to 300 s.
File Path	Select the destination for the log file (Internal memory or USB). Press **Enter** to browse and select a folder.
T. Stamp Filename	Toggle to enable/disable time and date on the file name. Example Enabled: `9140_log_20201017002307` Example Disabled: `9140_log`
Log Data	Select data to be logged: • **All**: Record voltage and current of all channels. • **Voltage**: Record voltage of all channels. • **Current**: Record current of all channels.
Status Code	Toggle to enable/disable recording of error codes.
Trigger Source	Sets the trigger method: • **Manual**: Use the softkey to start/stop. • **Digital IO**: Trigger via digital I/O pins. • **Remote**: Trigger via remote interface.

Table 9.1 Data Logger Parameters

9.2.1 File Path

Navigate the USB file system using the rotary knob. Press **Enter** to expand folders. Once the desired location is found, press the **Save** softkey (furthest to the left) to set the path.

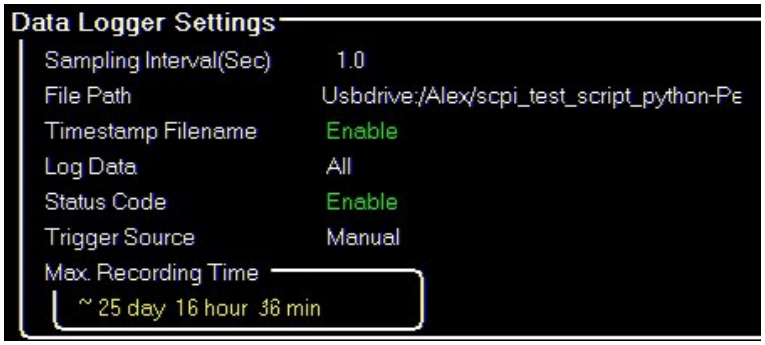


Figure 9.2 File Path Selection

9.2.2 Log Data Order

The data is recorded in a CSV format. The order of the data columns depends on the selection.

9241 XXXXXXXX Datalog			
Sample interval: 0.2			
Log data:All			
Date: 2021-04-01 13:54:18			
00:00:00.00	0	0	0x0000
00:00:00.20	0	0	0x0000
00:00:00.40	0	0	0x0000
00:00:00.60	0	0	0x0000
00:00:00.80	0	0	0x0000
00:00:01.00	0	0	0x0000
00:00:01.20	0	0	0x0000
00:00:01.40	0	0	0x0000
00:00:01.60	0	0	0x0000
00:00:01.80	0	0	0x0000
00:00:02.00	0	0	0x0000
00:00:02.20	0	0	0x0000
00:00:02.40	0	0	0x0000
00:00:02.60	0	0	0x0000
00:00:02.80	0	0	0x0000
00:00:03.00	0	0	0x0000
00:00:03.20	0	0	0x0000
00:00:03.40	0	0	0x0000
00:00:03.60	0	0	0x0000

Figure 9.3 Log Data Example (All)

Data Order (when "All" is selected)						
CH1 Voltage	CH1 Current	CH2 Voltage	CH2 Current	CH3 Voltage	CH3 Current	Status Code

Table 9.2 Data Recording Order

9.2.3 Status Code

If enabled, the status code records protection faults or state information.

Code	Description
0x0001	Over Voltage Protection Triggered
0x0002	Over Current Protection Triggered
0x0004	Over Temperature Protection Triggered
0x0008	Sense not connected

Table 9.3 Status Codes

9.2.4 Datalog Start/Stop

- Press the **Datalog Start/Stop** softkey to toggle the logger On/Off.
- **LOG** (Black): Displayed when the logger is On but not recording (waiting for trigger).
- **LOG** (Red): Displayed when the logger is actively recording.

Utilities Menu

Configure the system settings in the following menus:

- User Settings
- Remote Interface
- I/O Configuration
- Test/Admin
- Error Log
- Help

10.1 User Settings

Press the **Utility** button then use the soft key to select **Utilities > User Settings**.

10.1.1 Key Lock Output

Toggle to enable/disable the key lock output function.

- Enabling Key Lock Output changes the function of the front panel **Key Lock**.
- Default: **OFF**

10.1.2 Beep Sound

Toggle to enable/disable the beeper sound.

- Default: **ON**

10.1.3 Date and Time

- **Date**: Set the date using the numeric keypad (Format: YY/MM/DD).
- **Time**: Set the time using the numeric keypad (Format: HH:MM:SS).

10.1.4 Screen Intensity

Adjust the screen brightness level from 1 (Lowest) to 10 (Highest).

- Use the rotary knob or number pad to set the intensity.

10.1.5 Language

Set the language for the On Screen Help guide.

- **Note**: This does not change the language of the menu interface.

10.2 Remote Interface

The 9140 series supports remote communication via USB, LAN, and optional GPIB.

- When in remote mode, the screen displays **RMT** in the upper right corner.
- Front panel operation is disabled in remote mode. Press the **Local** key to revert to manual control.

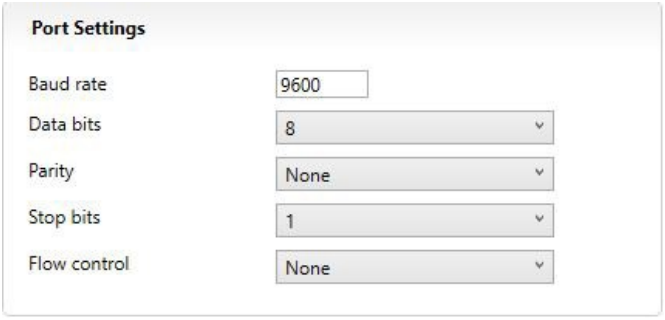
10.2.1 USB Settings

The USB device port is located on the rear panel. The instrument supports both USBTMC and USB VCP.

- Navigate to **Utilities > I/O Config > USB Settings**.
- Select **USBVCP** or **USBTMC** (Default: USBVCP).



USB Mode Selection



VCP Port Settings

Figure 10.1 USB Settings and VCP Port Configuration

10.2.2 LAN Settings

To configure LAN settings, navigate to **Utilities** > **I/O Config** > **LAN Settings**.

Parameter	Description
IP Mode	Select **DHCP** (Dynamic Host Configuration Protocol) or **Manual**.
IP Address	Unique string of numbers separated by periods. Use the numeric keypad to enter.
Subnet Mask	Divides the IP address into network and host addresses.
Gateway IP	IP address of the network device connecting the instrument.
Primary DNS	IP address of the Domain Name Service system.
Hostname	Unique hostname (Default: `BK-<model>-<serial>`).

Table 10.1 LAN Configuration Parameters

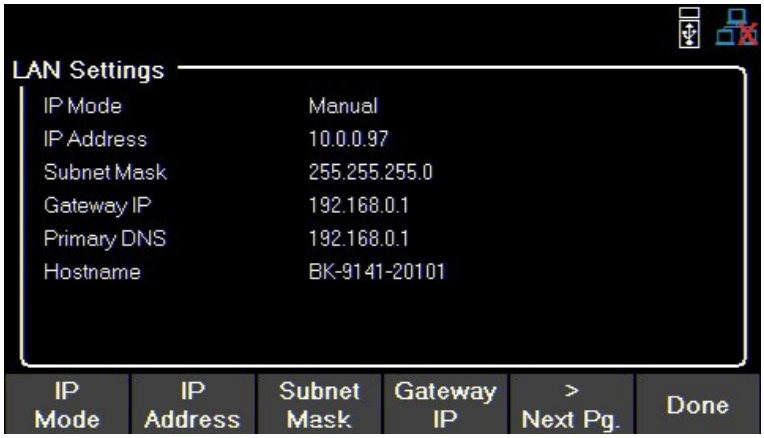


Figure 10.2 LAN Settings Menu

10.2.2.1 LAN Reset

Resets all LAN settings and webpage passwords.

- Select **LAN Reset** and confirm with **Yes**.
- **Note**: The default webpage password is **bk**.

10.2.2.2 Restore Default

Restores all LAN settings to factory defaults.

- Select **Restore Default** and confirm with **Yes**.

10.2.2.3 LAN Status

View the current LAN configuration, including MAC address and connection status.

- Navigate to **Utilities** > **I/O Config** > **LAN Status**.

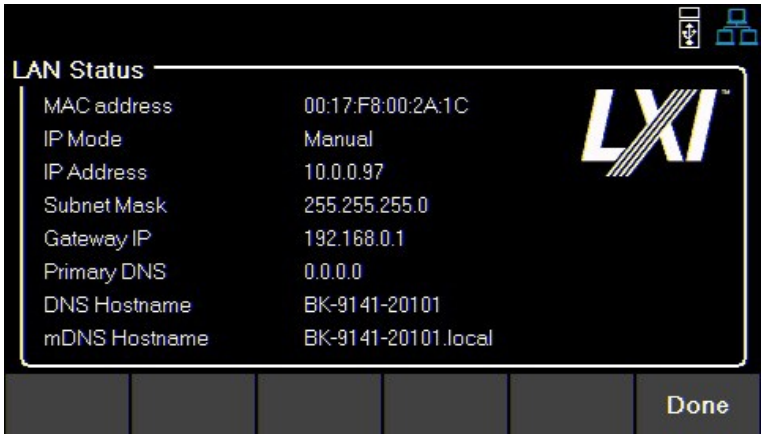


Figure 10.3 LAN Status Display

10.2.2.4 Web Server

The 9140 features a built-in web server that provides a convenient graphical interface for monitoring and controlling the instrument remotely over a LAN connection. By entering the instrument's IP address into a standard web browser, users can access real-time status updates, adjust output parameters, and manage settings without needing to use custom SCPI commands.

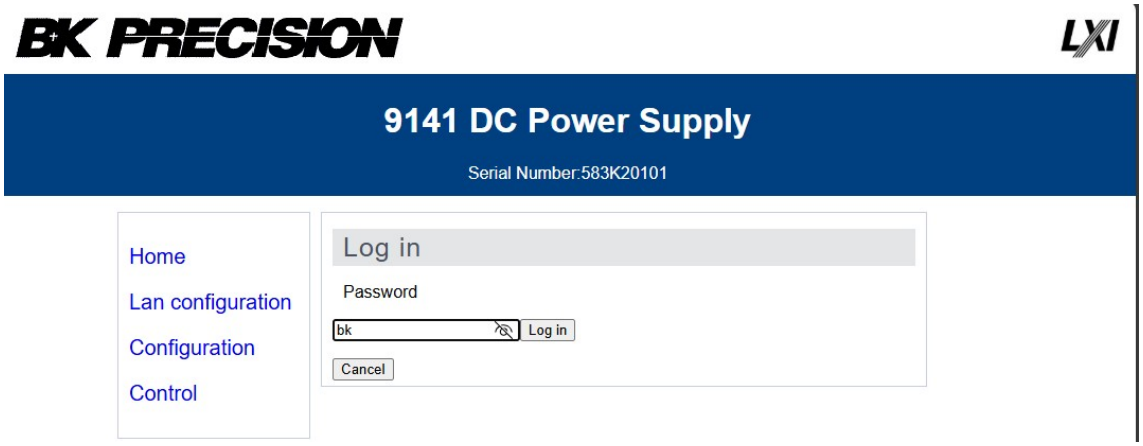


Figure 10.4 Web Server

NOTICE **To access and use the web server's control features, a password is required. The default password is bk.**

10.2.3 GPIB (Optional)

To change the GPIB address:

- Navigate to **Utilities > I/O Config > GPIB**.
- Use the numeric keypad or rotary knob to set the address (01 to 30).
- Press **Enter** to confirm.

10.3 Digital I/O

The Digital I/O terminal on the rear panel offers configurable pins for various control functions.

- Navigate to **Utilities > I/O Config > Digital I/O**.
- Select a pin (Pin 1, Pin 2, or Pin 3) to configure its function and polarity.

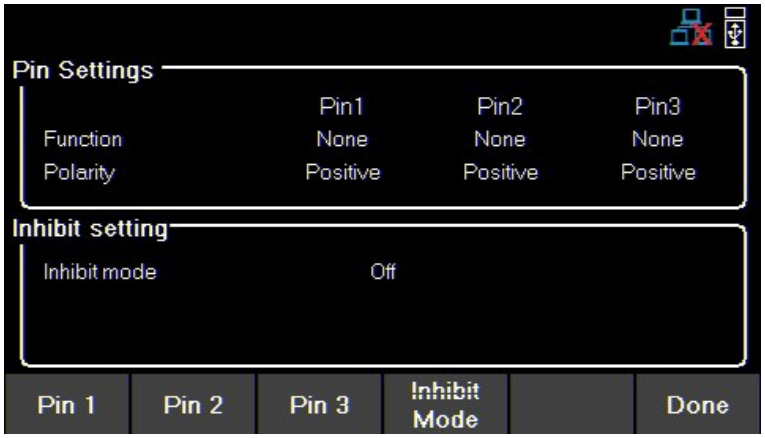


Figure 10.5 Digital I/O Menu

10.3.1 Functions

Assign one of the following functions to the selected pin:

Function	Description
None	No function assigned.
Digital In	Receive a signal from an external device.
Digital Out	Send a signal to an external device.
Trigger In	Receive a signal to trigger an event (List step or Data Logger start/stop).
Trigger Out	Send a trigger signal when specified (BOST or EOST in List Mode).
Fault Out	Enable a fault condition. Generates a signal when OVP, OCP, or OTP occurs, disabling all outputs.
Inhibit In	Receive an external signal to control the output state (Pin 3 only).

Table 10.2 Digital I/O Functions

WARNING **The input voltage range for digital I/O pins is 0 V to 5 V. To prevent damage, do not exceed 5 V or supply a negative voltage.**

10.3.2 Polarity

Set the logic polarity for the selected pin.

- **Positive**: Logic true = High voltage.
- **Negative**: Logic true = Low voltage.

10.3.3 Inhibit Mode (Pin 3 Only)

Controls how the instrument responds to an Inhibit In signal on Pin 3.

- **Off**: The inhibit input is ignored.
- **Latched**: A logic-true transition disables the power supply. The output remains disabled until manually reset.
- **Live**: Output follows the state of the inhibit signal (True = Disabled, False = Enabled).

10.4 Test/Admin

10.4.1 Self Test

Run a comprehensive module test.

- Navigate to **Utilities** > **Test/Admin** > **Self-Test**.
- Press **Start**.

10.4.2 Security

Access restricted settings including Calibration, Firmware Update, and NISPOM.

- Navigate to **Utilities** > **Test/Admin** > **Security**.
- Enter the default code: **77416699**.



Figure 10.6 Security Menu

- **Change Code**: Change the security password.
- **Calibrate**: Enter calibration mode (See Calibration Chapter).
- **Firmware Update**: Update instrument firmware.
- **NISPOM**: Perform a complete memory wipe for security.
- **Lock**: Lock the security settings again.

10.5 Error Log

View up to 50 error codes, cleared from memory starting with the oldest.

- Navigate to **Utilities** > **Error Log**.
- **Save**: Save the log to a connected USB drive.
- **Clear All**: Clear the error log from internal memory.

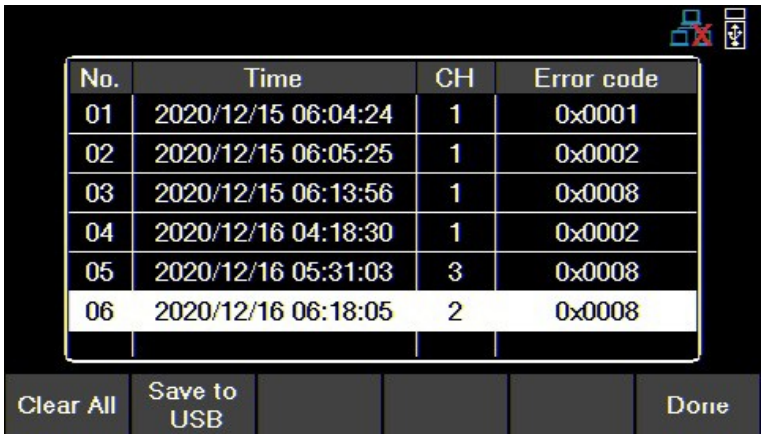


Figure 10.7 Error Log Display

Code	Description
0x0001	Over Voltage Protection Triggered
0x0002	Over Current Protection Triggered
0x0004	Over Temperature Protection Triggered
0x0008	Sense not connected

Table 10.3 Common Error Codes

10.6 Help

10.6.1 Quick Help

Select a topic from the list to view on-screen instructions.

- Toggle display modes
- Save screenshots
- Protection clear
- Contact support

10.6.2 System Info

View the instrument's model number, serial number, and firmware version.

- Navigate to **Utilities** > **Help** > **System Info**.

10.7 On Screen Help

Press and hold any soft key that selects a menu branch for 3 seconds to receive a context-sensitive explanation of that function.

Key Lock

The Key Lock function prevents accidental changes to the instrument settings by disabling the front panel keys.

11.1 Locking the Instrument

To lock the front panel:

- Press the **Utility** button.
- Press and hold the **Key Lock** soft key for 3 seconds.
- A message "Hold 'Key Lock' for 3 seconds to lock the front panel keys" may appear during the process.
- Once locked, a lock icon will appear on the display.

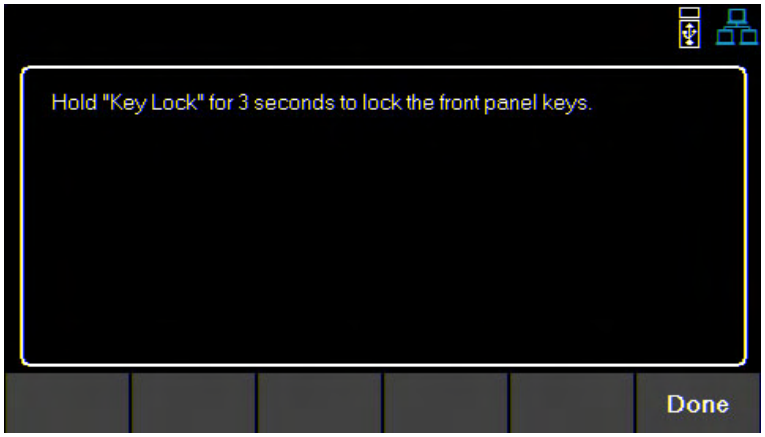


Figure 11.1 Key Lock Indicator

11.2 Key Lock Behavior

The behavior of the Key Lock function depends on the **Key Lock Output** setting configured in the User Settings (Reference section **10.1.1**).

Key Lock Output State	Behavior
Disabled (Default)	Locks all front panel keys, including the **On/Off** and **All CH** buttons.
Enabled	Locks all front panel keys **except** the **On/Off** and **All CH** buttons, allowing the output to be toggled while settings remain locked.

Table 11.1 Key Lock Modes

11.3 Unlocking the Instrument

To unlock the front panel:

- Press and hold the **Unlock** soft key for 3 seconds.
- The lock icon will disappear, and front panel control will be restored.

Save/Recall

The Save/Recall function allows users to save and recall the instrument's output settings and configure power-on states. This feature is useful for quickly switching between different test setups.

12.1 Save the Output Settings

12.1.1 Save to Internal Memory

Save the instrument's output settings to the internal memory. A total of 10 (0 to 9) output settings can be saved.
To save the output settings:

- Press the **Save/Recall** button.
- Use the soft keys to select **Save** > **Save to INT**.
- Using the numeric keypad, enter a number from 0 to 9 to save the output settings to that address.
- The settings will be saved after a short delay.

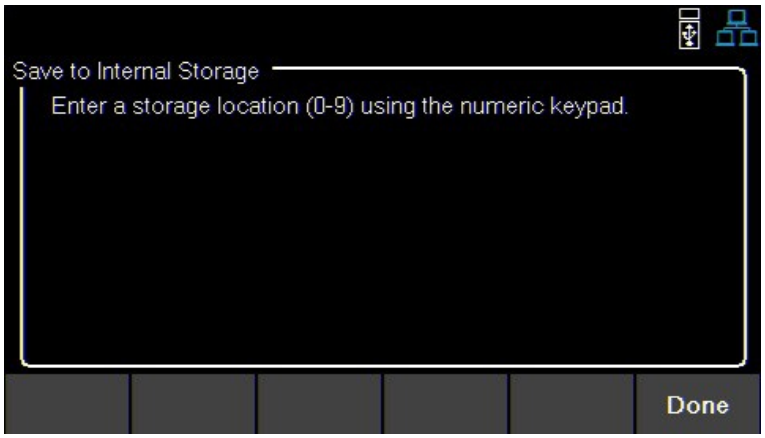


Figure 12.1 Save to Internal Storage

12.1.2 Save to USB

Save the instrument's output settings to a USB flash drive connected to the front panel USB host port. To save to USB:

- Press the **Save/Recall** button.
- Use the soft keys to select **Save** > **Save to USB**.
- Using the rotary knob, navigate through the file paths of the USB.
- Use the **Enter** button to expand folders.
- Once the desired location has been found, press the **Save** softkey.
- The output settings will be saved after a short delay.

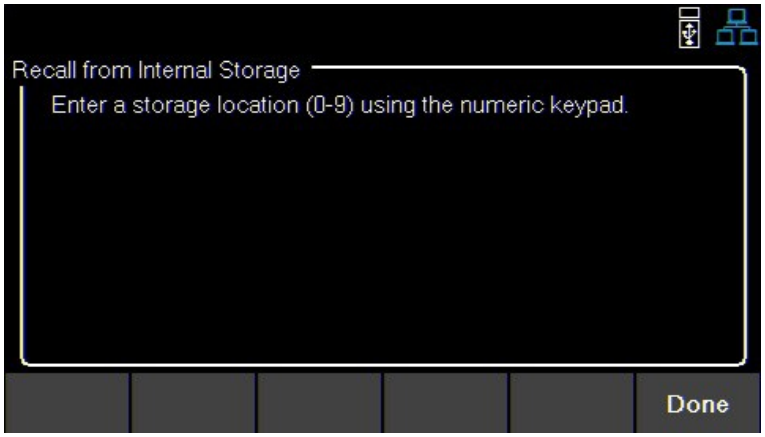


Figure 12.2 Save to USB

12.2 Recall the Instrument's Settings

12.2.1 Recall from Internal Memory

Recall previously saved output settings from the internal memory. A total of 10 (0 to 9) user settings can be saved and recalled.
To recall settings:

- Press the **Save/Recall** button.
- Use the soft keys to select **Recall > Recall from INT**.
- Use the numeric keypad to enter a number from 0 to 9 to recall the output settings stored in that address.
- The settings will be recalled after a short delay.

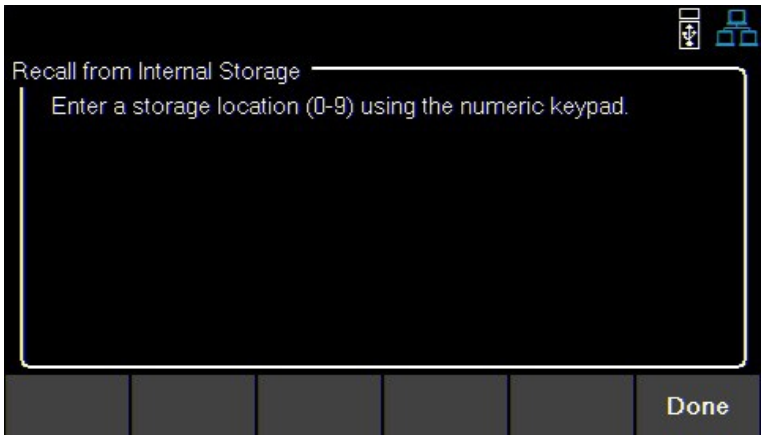


Figure 12.3 Recall from Internal Storage

12.2.2 Recall from USB

Recall the instrument's output settings from a USB drive.
To recall from USB:

- Press the **Save/Recall** button.
- Use the soft keys to select **Recall** > **Recall from USB**.
- Use the rotary knob to navigate through the file paths of the USB.
- Use the **Enter** button to expand folders.
- Once the desired location has been found, press the **Load** softkey.
- The settings will be recalled after a short delay.

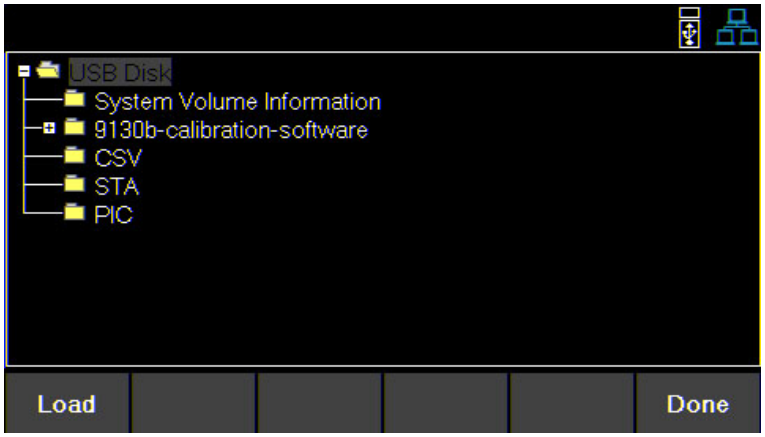


Figure 12.4 Recall from USB

12.3 Power-On Settings

Configure the load parameters of the instrument at power-on.

12.3.1 Power-On Modes

- **Off**: To turn off Power-On Mode (Default).
  - Navigate to **Power-On Settings > Power-On Mode > Off**.
- **Last**: To set the output parameters to the state they were in before the instrument was powered off.
  - Navigate to **Power-On Settings > Power-On Mode > Last**.
- **User**: To set the output parameters to a previously saved user setting.
  - Navigate to **Power-On Settings > Power-On Mode > User**.
  - Select **Power-On Settings > User Settings**.
  - Use the numeric keypad or rotary knob to assign an address (0 to 9).

12.3.2 Default Values

To reset the instrument's output settings to factory defaults:

- Press the **Save/Recall** button.
- Use the soft keys to select **Set to Default**.

The table below lists the default values and ranges for the instrument parameters.

Parameter	9140			9141			Unit
	Default	Max	Min	Max	Min	Default	
VSET	0	32.32	0	0	60.6	0	V
ISET	1	8.08	.015	1	4.04	.015	A
Vmax	32.32	32.32	0	60.6	60.6	0	V
Vmin	0	32.32	0	0	60.6	0	V
Vslew	1600	3200	0.001	600	3000	0.001	V/s
Islew	500	800	1	100	200	1	A/s
OVP Limit	35.2	35.2	0	66	66	0	V
OCP Limit	8.8	8.8	0.015	4.4	4.4	0.015	A
Timer	0	99:59:59	0	0	99:59:59	0	H:M:S
On Delay	0	3600	0	0	3600	0	s
Off Delay	0	3600	0	0	3600	0	s
Log Interval	0.2	300	0.2	0.2	300	0.2	s
List Dwell	0.1	9999	0.1	0.1	9999	0.1	s
List Volt	1	96.96	0	1	181.8	0	V
List Curr	.015	24.24	.015	.015	12.12	.015	A
List Repeat	0	100000	0	0	100000	0	-

Table 12.1 Default Values & Ranges

12.4 Screenshot

The instrument allows users to capture a screenshot of the current display and save it to a USB flash drive.
To take a screenshot:

- Insert a USB flash drive into the front panel USB port.
- Press and hold the **Save/Recall** and **Enter** keys simultaneously for 3+ seconds until you hear a beep.

NOTICE

A USB flash drive must be plugged in for this function to work.
Screenshots are saved in .BMP format.

Calibration Adjustment Procedure

The recommended calibration interval for the 9140 series is one year.
To enter the Calibration Menu:

- Press the **Utility** button.
- Select **Test/Admin > Security**.
- Enter the security code (Default: 77416699) and press **Enter**.
- Select **Calibrate**.

In the Calibration Menu, use the softkeys to select a parameter to calibrate: Voltage, Current, OVP, OCP, or RTC.

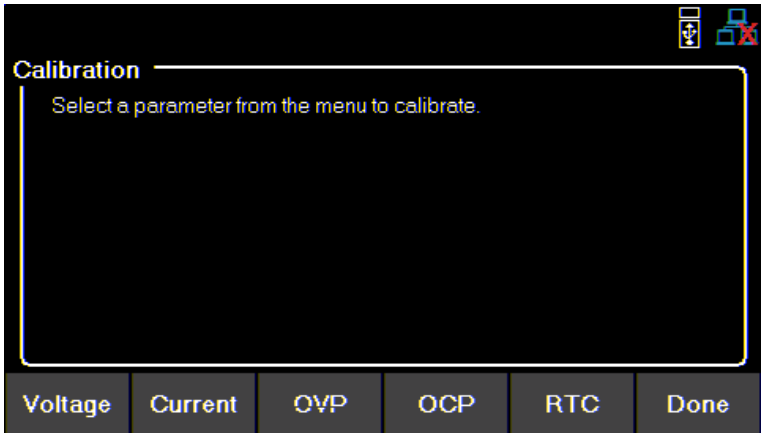


Figure 13.1 Calibration Parameters

13.1 Voltage Calibration Adjustment

A precise DMM is required for the voltage calibration procedure.

1. Enter the Calibration Menu (Reference section **13**).
2. Use the softkeys to select **Voltage**.
3. Select the channel to calibrate: **CH 1**, **CH 2**, or **CH 3**.
4. Verify the correct channel is chosen by checking the frame color on the display:
   - **Yellow**: CH 1
   - **Blue**: CH 2
   - **Orange**: CH 3
5. Connect the DMM's voltage input to the power supply's binding posts for the selected channel.
6. Press the **Start** softkey.
7. The power supply will output a voltage. Measure this voltage with the DMM.
8. Use the numeric keypad to enter the measured voltage value on the power supply.
9. Press **Enter** to configure the point.
10. Repeat steps 6 through 9 for the remaining calibration points.
11. Upon entering the last calibration point, the display will return to the channel selection screen.
12. Repeat the procedure for the remaining channels.

13.2 Current Calibration Adjustment

A precise DMM is required for the current calibration procedure.

1. Enter the Calibration Menu.
2. Use the softkeys to select **Current**.
3. Select the channel to calibrate: **CH 1**, **CH 2**, or **CH 3**.
4. Verify the correct channel is chosen (Yellow=CH1, Blue=CH2, Orange=CH3).
5. Connect the DMM's current input to the power supply's binding posts for the selected channel.

NOTICE

Upon entering a calibration point, the unit will immediately output the next current point. To avoid blowing the DMM's fuse, ensure the DMM is set to the correct range (usually the 10 A input).

Point	Output Current (Approximate)
1st Point	0.4 A (9140) / 0.2 A (9141)
2nd Point	2.8 A (9140) / 1.4 A (9141)
3rd Point	5.5 A (9140) / 2.7 A (9141)
4th Point	8.0 A (9140) / 4.0 A (9141)

Table 13.1 Current Calibration Output Points

6. Press the **Start** softkey.
7. Measure the output current with the DMM.
8. Use the numeric keypad to enter the measured current value.
9. Press **Enter** to configure the point.
10. Repeat for the remaining calibration points.
11. Repeat the procedure for the remaining channels.

13.3 OVP Calibration Adjustment

For Over Voltage Protection (OVP) calibration, the instrument's voltage must be calibrated first.

1. Enter the Calibration Menu.
2. Use the softkeys to select **OVP**.
3. Select the channel to calibrate.
4. Connect the DMM's voltage input to the power supply's binding posts.
5. Press the **Start** softkey.
6. The **Calibration State** will show as **Busy**.
7. After a few seconds, the calibration will complete automatically.
8. Repeat for the remaining channels.

13.4 OCP Calibration Adjustment

For Over Current Protection (OCP) calibration, the instrument's current must be calibrated first.

1. Enter the Calibration Menu.
2. Use the softkeys to select **OCP**.
3. Select the channel to calibrate.
4. Connect the DMM's 10 A current input to the power supply's binding posts.
5. Press the **Start** softkey.
6. The **Calibration State** will show as **Busy**.
7. After a few seconds, the calibration will complete automatically.
8. Repeat for the remaining channels.

13.5 RTC Calibration Adjustment

To adjust the Real-Time Clock (RTC) calibration:

1. Enter the Calibration Menu.
2. Use the softkeys to select **RTC**.
3. Press the **Start** softkey.
4. The **Calibration State** will show as **Busy**.
5. The calibration will adjust automatically in approximately 4 to 5 minutes.
6. The state will change to **Success** once finished.

Performance Verification

Performance verification ensures the instrument will meet specifications listed in the datasheet. Load regulation can be tested for both the front and rear outputs.

NOTICE

All specifications apply to the unit after a temperature stabilization time of 15 minutes over an ambient temperature range of $23^{\circ}C \pm 5^{\circ}C$. Specifications are valid for single unit operation only.

14.1 CV Load Regulation Front Panel Output

1. Turn off the power supply before making any connections.
2. Connect the DMM, electronic load, and the rear panel remote sense to the power supply's terminal being tested. (Remote sense must correspond with the channel being tested.)

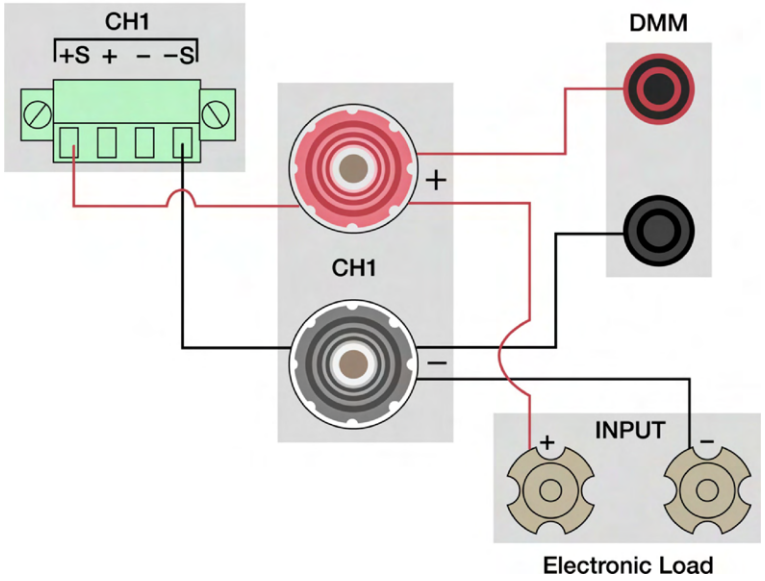


Figure 14.1 Front Panel Wiring Diagram

3. Turn on the power supply.
4. Set the power supply settings of the channel being tested to the values given in **14.1**.
5. Set the electronic load settings to the stated values in **14.1**.
6. Enable remote sense (Reference section **6.2.1**).
7. Enable the channel output.
8. Enable the electronic load. Monitor the power supply to ensure it remains in CV mode. If the power supply switches to CC, slightly lower the current on the electronic load until the power supply returns to CV mode.

9. Give the power supply some time to settle and record the DMM reading as V_{load}.
10. Disable the electronic load and record the DMM reading as V_{noload}.
11. Calculate the difference ($V_{load} - V_{noload}$) and record the value as the voltage regulation. The difference should be within the specification limit.

NOTICE **Keep all cables as short as possible.**

14.2 CV Load Regulation Rear Panel Output

1. Turn off the power supply before making any connections.
2. Connect the DMM, electronic load, and the rear panel remote sense to the power supply's rear +/- terminal being tested. Use jumpers to connect the +S to + and -S to -.
3. Turn on the power supply.
4. Set the power supply settings of the channel being tested to the values given in **14.1**.
5. Set the electronic load settings to the stated values in **14.1**.
6. Enable remote sense.
7. Enable the channel output.
8. Enable the electronic load. Monitor the power supply to ensure it remains in CV mode.
9. Give the power supply some time to settle and record the DMM reading as V_{load}.
10. Disable the electronic load and record the DMM reading as V_{noload}.
11. Calculate the difference ($V_{load} - V_{noload}$) and record the value as the voltage regulation. The difference should be within the specification limit.

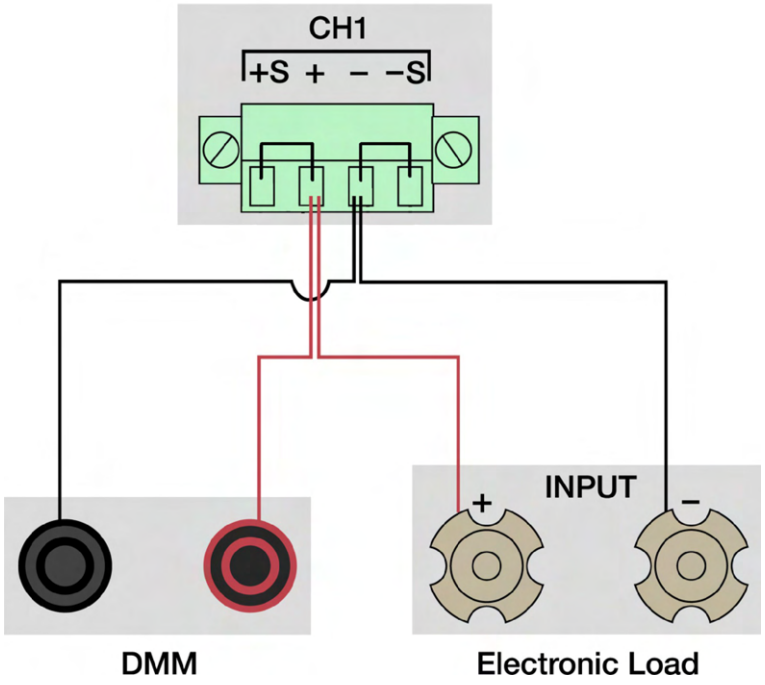


Figure 14.2 Rear Panel Wiring Diagram

14.3 Verification Parameters

The following table lists the settings and limits for performance verification.

Model	Voltage	Current	Power Supply Settings		E-Load	Load Regulation Limit	
			Remote	Mode	Current	Lower	Upper
9140	32.000 V	3.069 A	Enabled	CC	3.065 A	-6.2 mV	+6.2 mV
9141	60.000 V	1.666 A	Enabled	CC	1.650 A	-9 mV	+9 mV

Table 14.1 Load Regulation Verification Table

Specifications

Note: All specifications apply to the unit after a temperature stabilization time of 15 minutes over an ambient temperature range of 23 °C ± 5 °C. Specifications are valid for single unit operation only.

Model		9140	9141
Output Rating			
Voltage		32 V	60 V
Current		8 A	4 A
Maximum Output Power per Channel		100 W	
Total Output Power		300 W	
Load Regulation [1] ± (% output + offset)			
Voltage		≤ 0.01% + 3 mV	
Current		≤ 0.1% + 3 mA	
Line Regulation ± (% output + offset)			
Voltage		≤ 0.01% + 3 mV	
Current		≤ 0.1% + 3 mA	
Ripple and Noise (20 Hz to 20 MHz)			
Normal Mode Voltage p-p		≤ 5 mV	≤ 10 mV
Normal Mode Voltage rms		≤ 1 mV	≤ 2 mV
Normal Mode Current rms		≤ 3 mA	
Programming / Readback Resolution			
Voltage		1 mV	
Current		1 mA	
Programming / Readback Accuracy ± (% output + offset)			
Voltage		0.03% + 4 mV	0.03% + 8 mV
Current		0.1% + 5 mA	0.1% + 3 mA
Series Accuracy (combined mode)			
Voltage		0.03% + 12 mV	0.03% + 24 mV
Current		0.1% + 5 mA	0.1% + 3 mA
Parallel Accuracy (combined mode)			
Voltage		0.03% + 4 mV	0.03% + 8 mV
Current		0.1% + 15 mA	0.1% + 9 mA
Temperature Coefficient per °C			
Voltage		6.4 mV / °C	12 mV / °C
Current		1.6 mA / °C	0.8 mA / °C
Output Response Time [2]			
Rise Time	Full load	10 ms	20 ms
	No load	10 ms	20 ms
Fall Time	Full load	10 ms	20 ms
	No load	250 ms	250 ms
Transient Response [3]			
Time		0.5 ms	
Protection			
OVP	Range	35.2 V	66 V
	Accuracy	320 mV	600 mV
OCP	Range	8.8 A	4.4 A
	Accuracy	80 mA	40 mA

General		
Remote Sense Compensation		1 V
Command Response Time [4]		10 ms
Power Factor		0.98 / 115 VAC 0.94 / 230 VAC
I/O Interfaces		USB (USBTMC-compliant and virtual COM), LAN (1.5 LXI device specification 2016), GPIB (optional)
AC Line Input		100 VAC to 240 VAC ± 10%, 47 Hz to 63 Hz
Maximum Rated Input Power		500 VA
Temperature Ratings	Operation	32 °F to 104 °F (0 °C to 40 °C)
	Storage	14 °F to 158 °F (-10 °C to 70 °C)
Dimensions (W x H x D)		8.4" x 3.5" x 13" (213 x 88 x 330 mm)
Weight		11 lbs (5 kg)
Warranty		3 Years
Standard Accessories		Power cord & certificate of calibration
Optional Accessories		Rack mount kit (RK2US)

Regulatory Compliance	
Safety	Low Voltage Directive (LVD) 2014/35/EU, EN61010-1:2010, cTUVus certification mark[5] fulfills US (UL 61010-1:2012) and Canadian (CAN/CSA-C22.2 NO. 61010-1-12) safety standards
Electromagnetic Compatibility	EMC Directive 2014/30/EU, EN61326-1:2013

(1) With remote sense terminal connected.
(2) From 10% to 90% or from 90% to 10% of total voltage excursion.
(3) Time for output voltage to recover within 0.5% of its rated output for a load change 50-100% of full load.
(4) Typical time required for output to begin to change following receipt of command data.
(5) Tested and certified by a Nationally Recognized Testing Laboratory (NRTL), accredited by OSHA.

Ordering Information

9140 Series Power Supplies

Model	Description
9140	32 V / 8 A, 300 W
9140-GPIB	32 V / 8 A, 300 W with GPIB
9141	60 V / 4 A, 300 W
9141-GPIB	60 V / 4 A, 300 W with GPIB

Service Information

Warranty Service: Please go to the support and service section on our website at bkprecision.com to obtain an RMA #. Return the product in the original packaging with proof of purchase to the address below. Clearly state on the RMA the performance problem and return any leads, probes, connectors and accessories that you are using with the device.

Non-Warranty Service: Please go to the support and service section on our website at bkprecision.com to obtain an RMA #. Return the product in the original packaging to the address below. Clearly state on the RMA the performance problem and return any leads, probes, connectors and accessories that you are using with the device. Customers not on an open account must include payment in the form of a money order or credit card. For the most current repair charges please refer to the service and support section on our website.
Return all merchandise to B&K Precision Corp. with prepaid shipping. The flat-rate repair charge for Non-Warranty Service does not include return shipping. Return shipping to locations in North America is included for Warranty Service. For overnight shipments and non-North American shipping fees please contact B&K Precision Corp.

Include with the returned instrument your complete return shipping address, contact name, phone number and description of problem.

B&K Precision Corp.
22820 Savi Ranch Parkway
Yorba Linda, CA 92887
bkprecision.com
714-921-9095

LIMITED THREE-YEAR WARRANTY

B&K Precision Corp. warrants to the original purchaser that its products and the component parts thereof, will be free from defects in workmanship and materials for a period of **13years** from date of purchase.

B&K Precision Corp. will, without charge, repair or replace, at its option, defective product or component parts. Returned product must be accompanied by proof of the purchase date in the form of a sales receipt.

To help us better serve you, please complete the warranty registration for your new instrument via our website www.bkprecision.com

Exclusions: This warranty does not apply in the event of misuse or abuse of the product or as a result of unauthorized alterations or repairs. The warranty is void if the serial number is altered, defaced or removed.
B&K Precision Corp. shall not be liable for any consequential damages, including without limitation damages resulting from loss of use. Some states do not allow limitations of incidental or consequential damages. So the above limitation or exclusion may not apply to you.
This warranty gives you specific rights and you may have other rights, which vary from state-to-state.

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