DC Electronic Loads

RMX-400x Series

USER MANUAL

ISO-9001 CERTIFIED MANUFACTURER

The information in this manual was correct at the time of printing. However, National Instruments Corporation continues to improve products and reserves the right to change specification, equipment, and maintenance procedures at any time without notice.

378075B-01 May 2024

Table of Contents

SAFETY INSTRUCTIONS

This chapter contains important safety instructions you must follow when operating the RMX-4000/4002, and when keeping it in storage. Read the following before operating the RMX-4000/4002 to ensure your safety and to keep the RMX-400x Series in the best possible condition.

Safety Symbols

These safety symbols may appear in this manual or on the RMX-4000/4002.

 WARNING	Warning: Identifies conditions or practices that could result in injury or loss of life.
 CAUTION	Caution: Identifies conditions or practices that could result in damage to the RMX-4000/4002 or to other properties.
	DANGER High Voltage
	Attention Refer to the Manual
	Protective Conductor Terminal
	Earth (ground) Terminal

Waste Electrical and Electronics Equipment (WEEE)

EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

Safety Guidelines

General Guideline

CAUTION

- Do not place any heavy object on the RMX-4000/4002.
- Avoid severe impact or rough handling that leads to damaging the RMX-4000/4002.
- Do not discharge static electricity to the RMX-4000/4002.
- Do not block or obstruct the cooling fan vent openings.
- Do not perform measurement at circuits directly connected to Mains (Note below).
- Do not disassemble the RMX-4000/4002 unless you are qualified as service personnel.
- The equipment is not for measurements performed for CAT II, III and IV.

(Measurement categories) EN 61010-1:2010 specifies the measurement categories and their requirements as follows. The RMX-4000/4002 falls under category I.

- Measurement category IV is for measurement performed at the source of low-voltage installation.
- Measurement category III is for measurement performed in the building installation.
- Measurement category II is for measurement performed on the circuits directly connected to the low-voltage installat ion.
- Measurement category I is for measurements performed on circuits not directly connected to Mains.

Power Supply

⚠ WARNING

- 100-120 Vac/ 200-240 Vac (90-132 Vac/ 180-250 Vac)
  Frequency: 47-63 Hz
  Power rating: RMX-4002: 250 VA Max
  RMX-4000: 150 VA Max
- The power supply voltage should not fluctuate more than 15%.
- Connect the protective grounding conductor of the AC power cord to an earth ground, to avoid electrical shock.

Fuse

⚠ WARNING

- Fuse type: T3.15 A/250 V
- Make sure the correct type of fuse is installed before power up.
- To avoid fire, replace the fuse with only the specified type and rating.
- Disconnect the power cord before fuse replacement.
- Make sure the cause of a fuse blowout is fixed before replacing the fuse.

Cleaning the RMX-400x	• Disconnect the power cord before cleaning. • Use a soft cloth dampened in a solution of mild detergent and water. Do not spray any liquid. • Do not use chemicals or cleaners containing harsh material such as benzene, toluene, xylene, and acetone.
Operation Environment	• Location: Indoor, no direct sunlight, dust free, almost non-conductive pollution (refer to the pollution degree descriptions below) • Temperature: 0 °C to 40 °C • Altitude: Up to 2000 m • Transient Overvoltage on the main supply is 2500 V. (Pollution Degree) EN 61010-1:2010 specifies the pollution degrees and their requirements as follows. THE RMX-4000/4002 falls under degree 2. Pollution refers to "addition of foreign matter, solid, liquid, or gaseous (ionized gases), that may produce a reduction of dielectric strength or surface resistivity". • Pollution degree 1: No pollution or only dry, non-conductive pollution occurs. The pollution has no influence. • Pollution degree 2: Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected. • Pollution degree 3: Conductive pollution occurs, or dry, non-conductive pollution occurs which becomes conductive due to condensation which is expected. In such conditions, equipment is normally protected against exposure to direct sunlight, precipitation, and full wind pressure, but neither temperature nor humidity is controlled.
Storage environment	• Location: Indoor • Relative Humidity: < 80% • Temperature: −10 °C to 70 °C

Disposal

Waste Electrical and Electronics Equipment (WEEE)

EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit ni.com/environment/weee.

Power Cord for the United Kingdom

When using the RMX-4000/4002 in the United Kingdom, make sure the power cord meets the following safety instructions.

NOTE: This lead/appliance must only be wired by competent persons.

⚠WARNING: THIS APPLIANCE MUST BE EARTHED

IMPORTANT: The wires in this lead are colored in accordance with the following code:

Green/ Yellow:	Earth
Blue:	Neutral
Brown:	Live (Phase)

As the colors of the wires in main leads may not correspond with the colored marking identified in your plug/appliance, proceed as follows: The wire which is colored Green and Yellow must be connected to the Earth terminal marked with either the letter E, the earth symbol ⏚ or colored Green/Green and Yellow.

The wire which is colored Blue must be connected to the terminal which is marked with the letter N or colored Blue or Black.

The wire which is colored Brown must be connected to the terminal marked with the letter L or P or colored Brown or Red.

If in doubt, consult the instructions provided with the equipment or contact the supplier.

This cable/appliance should be protected by a suitably rated and approved HBC mains fuse: refer to the rating information about the equipment and/or user instructions for details. As a guide, a cable of 0.75 mm2 should be protected by a 3 A or 5 A fuse. Larger conductors would normally require 13 A types, depending on the connection method used.

Any exposed wiring from a cable, plug or connection that is engaged in a live socket is extremely hazardous. If a cable or plug is deemed hazardous, turn off the mains power and remove the cable, any fuses and fuse assemblies. All hazardous wiring must be immediately destroyed and replaced in accordance to the above standard.

GETTING STARTED

This chapter describes the features and functions of the RMX-4000/4002, including the front and rear panel appearance, panel installation and connection types. Use the Tutorial section for quick access to step-by-step instructions on the main functions.

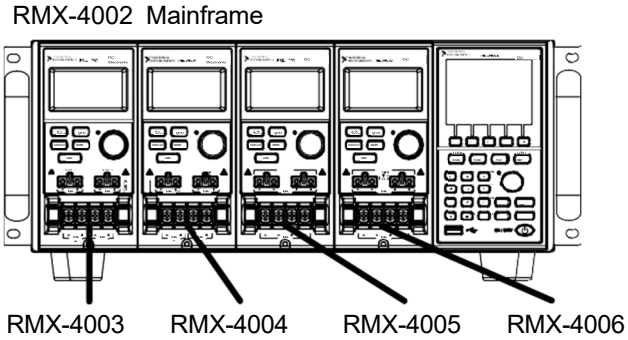
Main Features

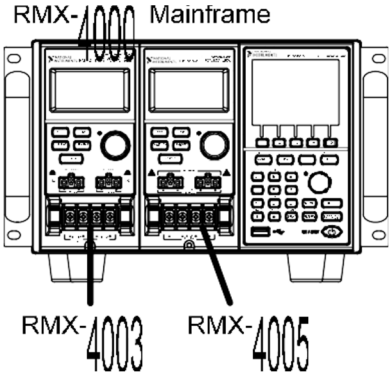
Description	The RMX-4000 and 4002 are multichannel programmable DC electronic load mainframes. The RMX-4000 mainframe can hold two load modules, while the RMX-4002 can hold four. The flexible module configuration allows the mainframes to either sink multiple loads independently or large loads when used in parallel. The RMX-400x Series supports four operation modes: constant current (CC), constant voltage (CV and CV+CC), constant resistance (CR) and constant power (CP). Constant current and constant resistance mode can operate in either static or dynamic mode.

Feature Overview	• Flexible operation with removable load modules • Multiple independent isolated channels • High performance, up to 5-digit resolution • High slew rate enabling a high response speed • High capacity when frame linked • You can use different load module types in the same mainframe • Dedicated parallel mode • Supports rack mount installation (RMX-4002) • Supports frame link connections, with up to four slave units • Color LCD display • 120 different sets of programmable sequences • Accurate load simulation using sequences • Four panel setups • USB flash drive support
Interface	• USB • RS-232C • LAN

Series Overview

The RMX-400x Series comprises of two different mainframes: the RMX-4000 and the RMX-4002. The mainframes differ by the number of load modules that can be accommodated. The RMX-4000 has two load module slots, while the RMX-4002 has four. There are four different load module models, the RMX-4003, RMX-4004, RMX-4005, and RMX-4006.





The four different load module models each differ in the amount of current, voltage and power and the number of channels that the load module can accommodate. The procedures in this manual will be load module model independent unless specifically stated. Below is a table

showing the basic differences between each load module model. For detailed specificat ions, refer to page 334.

Load Module	Channels	Power (W) CH L/R (Low/High Range)	Current (A) Range Low/High	Voltage (V)
RMX-4003 (100 W x 2)	2	100/100	2/20	0-80
RMX-4004 (30/(25/250 W))	2	30/(25/250)	5/4/40	0-80
RMX-4005	1	(35/350)	7/70	0-80
RMX-4006	1	(35/350)	1/10	0-500

Package Contents and Accessories

The RMX-400x electronic load has a number of standard and optional accessories. For more information, visit the National Instruments website at ni.com or consult your authorized distributor for details.

Standard Accessories	Description
Power Cable	Mains power cable (region dependent) (18 AWGx3C, 125 V/10 A,1.8 m)
CD ROM	Contains RMX-400x Series User Manual, Programming Manual, and USB Driver
Load Cables	2X red, 2X black (per load module)
Sense Cables	1X red, 1X black (per load channel)

Options	Description
RMX-4003	Load Module
RMX-4004	
RMX-4005	
RMX-4006	

Optional Accessories	Description
786533-01	RMX-400x Rack Mount kit (handle only)
182238-01	RS-232C Cable (9F-9F serial cable, 1m)
182238-02	RS-232C Cable (9F-9F serial cable, 2m)
182238-04	RS-232C Cable (9F-9F serial cable, 4m)
184125-01	USB 2.0 Cable (Type A to Type B, 1m)
184125-02	USB 2.0 Cable (Type A to Type B, 2m)

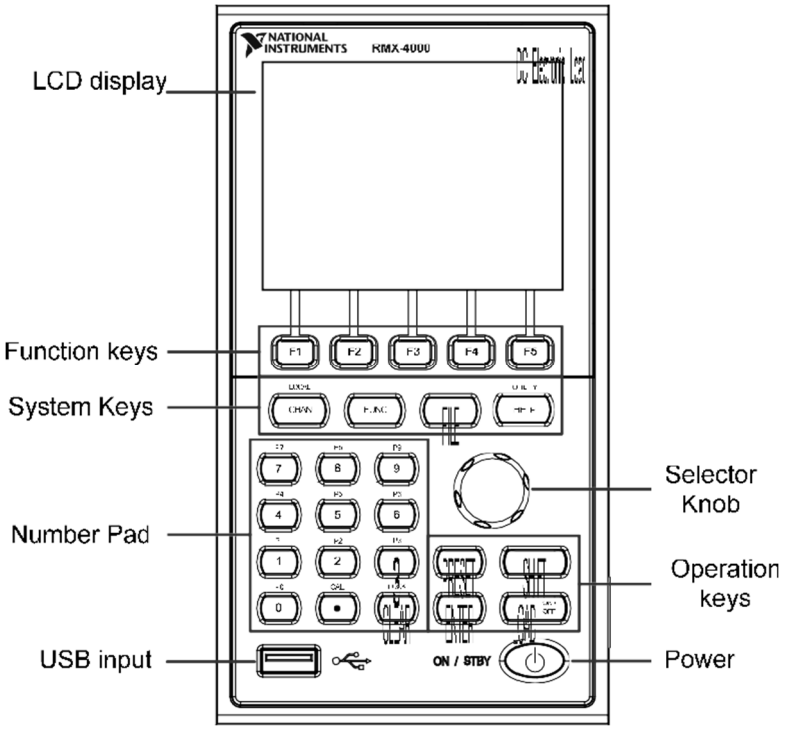
GTL-249	Frame link cable

Measurement Overview

The RMX-400x Series has several operating modes that are completely configurable. All the modes have customizable Go/NoGo limits, range limits, timers, slew rates, alarms, and protection limits. For parallel loads, there is a dedicated parallel configuration mode. You can create programs and sequences to create tests.

Function	Description
Constant Current Mode (CC)	In constant current mode, the load module sinks a constant amount of current, regardless of the voltage.
Constant Voltage Mode (CV)	Under constant voltage mode, the voltage remains unchanged, regardless of the current.
Constant Resistance Mode (CR)	In constant resistance mode, the resistance load will remain unchanged as the voltage and current remain proportional.
Constant Power Mode (CP)	In constant power mode, the load module ensures the power consumed is constant.
Programmable Sequences (Prog.)	The load module supports programming sequences with up to 120 memory settings in 12 programs with 10 sequences.
Sequences (Seq.)	Use sequences to create load profiles to accurately simulate a load. You can create sequences for each channel.
Group Unit Mode	Group Unit Mode enables the RMX-400x mainframes to use load modules (of the same type/rating) easily in parallel. Use parallel mode in conjunction with CC or CR modes. You cannot use CP and CV mode with this mode.

Front Panel Overview

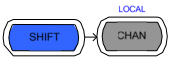


LCD display	320 by 240, TFT LCD display.
Function keys	F1 ~ F5 Access the menu functions on the bottom of the display.

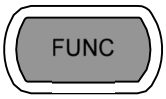
System keys

Use CHAN/LOCAL to select the load channel. Use LOCAL combined with the shift key to activate/deactivate local control (during remote control via the interface or frame link connections).

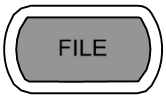
Brings up the Channel Menu.



Activates local control mode during remote control via the interface.



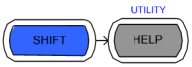
Accesses the Program, Sequence, or OCP automation menu.



Accesses the File menu.

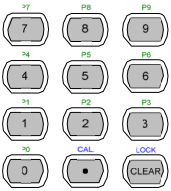
Brings up the Help menu and utility menu.

Accesses help for the last function /key pressed.

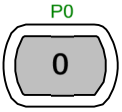


Activates the Utility Menu.

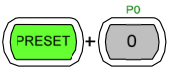
Number pad



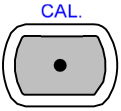
Enters numerical values or save/recall presets (P0-P9).



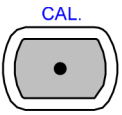
Number values.



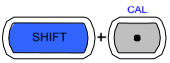
Presets numbers P0-P9.



Decimal point and Calibration key.



Decimal point.



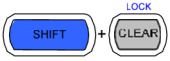
Activates calibration mode.

Note

Calibration mode is not supported. Refer to the *Calibration* section below for more information.

Clears current values. Alternate function locks the keys and selector knob.

Clears the current value.

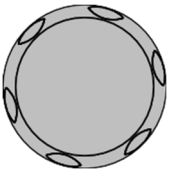


Locks all keys and selector knob.

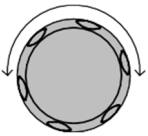
USB Input

USB flash memory slot.

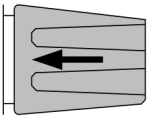
Selector Knob



Selects operations and increase/decrease values.



When turned left or right, moves the cursor in menus or changes the selected item or value.



When pressed, acts as the Enter key.

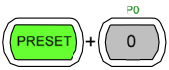
Operation Keys

Saves and recalls preset settings and values.

Press in combination with the number pad to recall or save presets P0-P9.

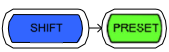
Inactive.

Active. Use in combination with the number pad and/or shift key.



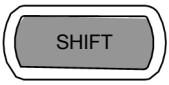
Press to recall a channel preset.

Hold to save a channel preset.

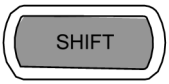


Press to recall all channel presets.

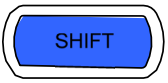
Hold to save all channel presets.



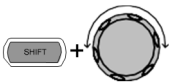
Use the shift key to access alternate functions assigned to select keys. You also can use the shift key to toggle between coarse and fine control mode when used in conjunction with the selector knob to adjust parameters.



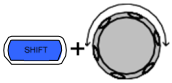
Inactive mode.



Active. When active, use the shift key to access the Local and Utility menus.

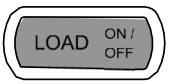


Coarse control mode.



Fine control mode

Confirms selections.



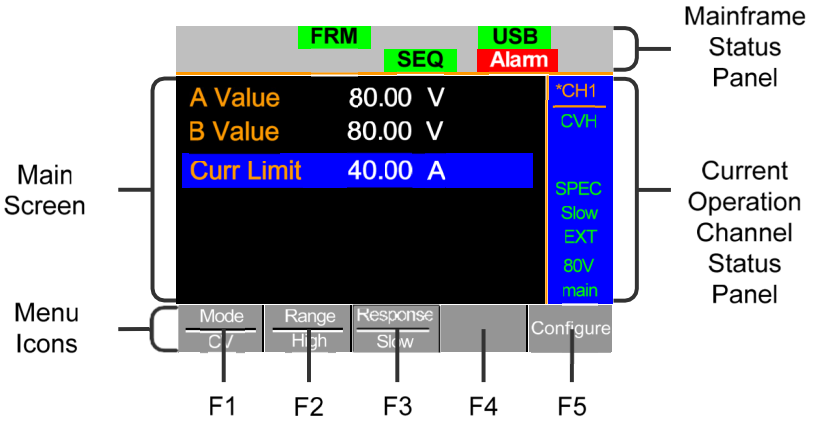
Turns the current load/channel on or off.

Load is off. (unlit)

Load is on. (orange light)

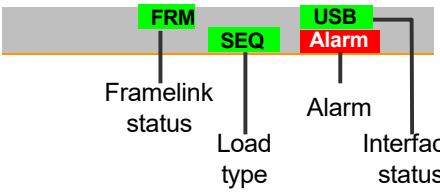
Power		Turns the unit on or to standby mode.
		Standby mode.
		On.

Display Overview – Mainframe



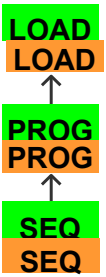
Mainframe Status Panel

The Mainframe Status Panel displays the Mainframe interface, programs, and alarm status.



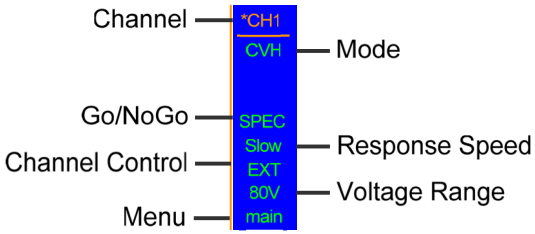
Frame Link Status

Indicates Frame Link is turned on and that the mainframe is set as either a master (FRM) or slave (FRS) unit.

Load Type		Indicates whether a Sequence (SEQ) or Program (PROG) is turned on. If not, LOAD is displayed as default. When any Load type is running, its icon turns orange.
Interface Status		Displays which interface type is set.

Current Operation Channel Status Panel

Generally displays the current channel's status.



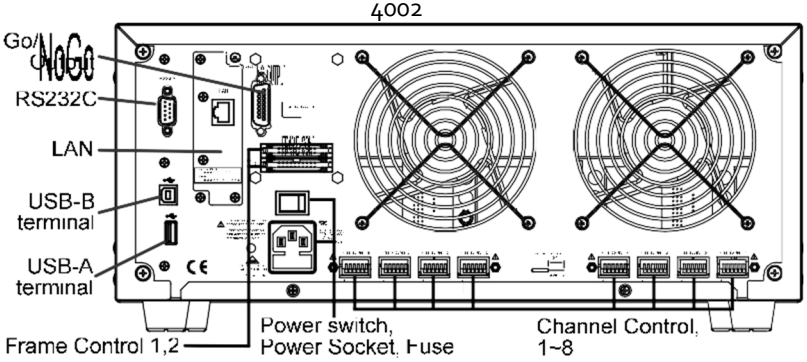
Channel	CH1-CH8	Displays the current channel.
	*CHx	* = independent mode
	CHxS	S = Group Channels Sync mode
	CHxP	P = Group Channels Parallel mode

	Mode	Displays the current mode.	
		CCL	CC Static Low Range
		CCH	CC Static High Range
		CCDL	CC Dynamic Low Range
		CCDH	CC Dynamic High Range
		CRL	CR Static Low Range
		CRH	CR Static High Range
		CRDL	CR Dynamic Low Range
		CRDH	CR Dynamic High Range
		CVL	CV Static Low Range
		CVH	CV Static High Range
		CPL	CP Low Range
		CPH	CP High Range
	Go/NoGo	SPEC	If Go/NoGo is on, SPEC is displayed.
	Response Speed	Slow Fast	In CV mode, the Slow or Fast response speed is shown.
	Channel Control	EXT	When Channel Control is set to External, EXT is displayed.
	Voltage Range	Displays the current setting's voltage range.	
	Menu	Shows the current menu.	
		main	= Chan menu
		conf	= Chan→Configure menu
		s_edit	= Chan→Seq.Edit menu
		file	= File menu
		s_loop	= Chan→Seq.Edit→Loop menu
Main Screen	Main display screen.		

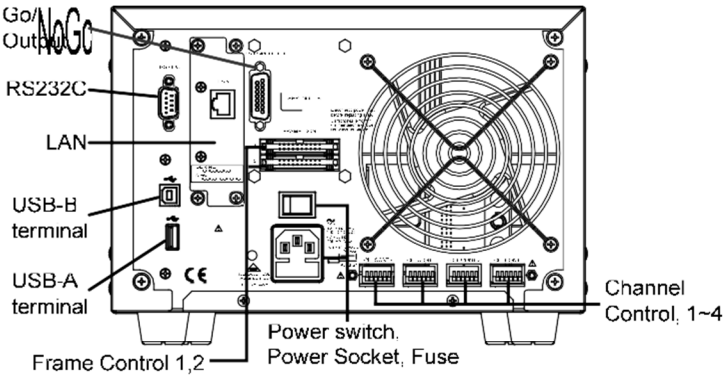
Menu Icons	F1-F5	The F1-F5 function keys control each menu icon.

Rear Panel Overview

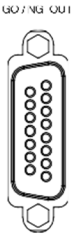
RMX-4002



RMX-4000

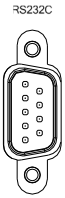
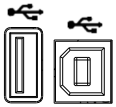


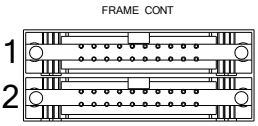
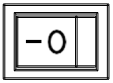
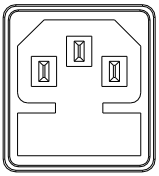
Go/NoGo Output



The Go/NoGo Output terminal outputs a pass (high)/fail (low) voltage for each channel.

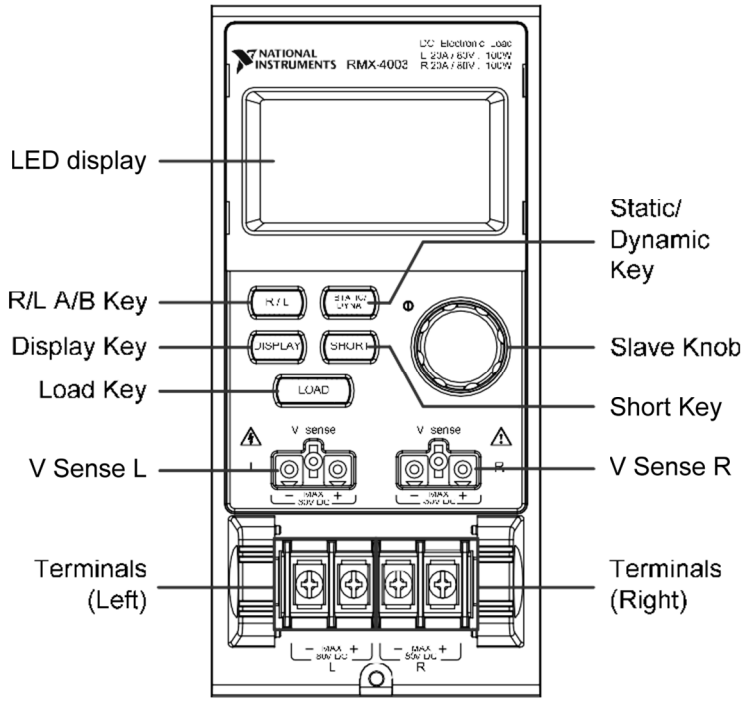
Refer to pages 67 and 318 for details.

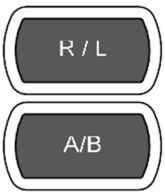
RS232 port		The RS232 port is used for remote control connections. RS-232C: DB-9 pin male Refer to page 312 for remote control details.
LAN port		Ethernet port for controlling the RMX-4000 remotely.
USB-A (host)/ USB-B (device) port		Like the RS232 port, the USB-B (device) port is for remote control. The USB-A (host) port is reserved for power delivery 5 V only. If you use the USB-A (host) as a USB flash memory slot, do not set the interface to USB. Refer to page 104 for interface details.

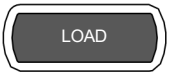
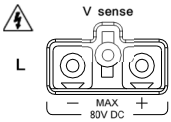
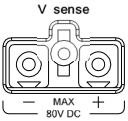
Frame Control Port		The Frame Control port is for Frame Link connections. Mainframes are daisy-chained together. There are two Frame control ports: 1: Slave 2: Master Connection type: MIL 20-pin connector. For frame link connection details, refer to pages 61 and 315.
Power Switch		External Power Switch
Power Socket/ Fuse		The power supply socket accepts the AC mains Voltage. The fuse holder is below the power socket. Power: 47-63 Hz Fuse: T3.15 A/250 V For fuse replacement details, refer to page 321.

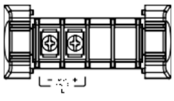
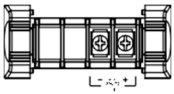
Channel Control port (1-8)		Each channel has a dedicated channel control port to enable external monitoring and control. The channel control port has six wire sockets that are screw-less and self clamping. Required wire gauge: 24 AWG For connection or specification details, refer to pages 63 and 313.

Front Panel Overview – Load Module

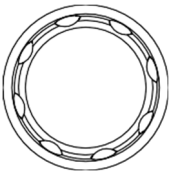


LED display	2 x 5-digit custom LED display.
Right/Left Key or A/B Key	 Use the L/R key to switch between the right and left load channel on a dual-channel load module. Use the A/B key to switch between A and B Values for single-channel load modules.

Display Key		Alternates the display output on the load module.  Current  Voltage  Power  Load time
Load Key		Activates the load for the active channel. (right or left/A or B)
Left Voltage Sense		Use the voltage sense terminals when you need precise measurements, to compensate for voltage drops across the main terminals caused by the load wires' resistance.
Right Voltage Sense		It is automatically activated when connected to a DUT. The voltage difference between the DUT and load voltage should not exceed 2 V. Otherwise, you will get an incorrect measurement for the voltage. (Applicable to all models.)

Positive and Negative Terminals Left		The terminals for both the left and right side of a load can draw differing amounts depending on the load module specifications.
Positive and Negative Terminals Right		For two-channel load modules, the left terminals are for the first channel, and the right terminals are used for the second channel. On single-channel load modules, the left terminals are the lower (-) potential terminals, while the right terminals are the positive (+) potential terminals.
Static/Dynamic Selector Key		The STATIC/DYNA. key manually switches the load from static (manual) to dynamic. Dynamic loads are supported in only CC and CR mode. For more information, refer to pages 69 and 72.

Slave Knob (Load)



Use the Slave Knob to edit and vary parameters for the active channel on the local load. Depending on the mainframe setup, the Slave Knob updates either the load only (locally) or both the local module and mainframe*. You also can configure the Slave Knob to display measured or set values on the local load module**.

*For more information about knob types, refer to page 233.

**For more information about the Slave Knob, refer to page 237.

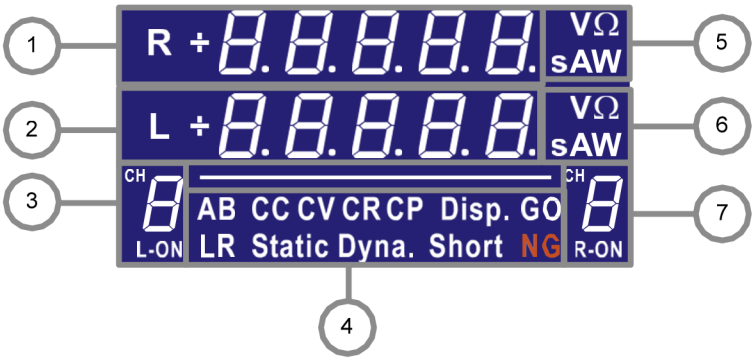
Short Key

Use the SHORT key to short circuit the active channel manually on the local active load. When a load is off, the SHORT key toggles the short key type.

You can set the Short key to enable or disable in the configuration setting.

Load on: Pressing or holding the SHORT key shorts the load, depending on the short type selected.

LED Display Overview – Load Module



---

1 and 2 Channel Display

R or **L** Left and right channel indicator.

5-digit display.

---

3 and 7 Channel Number Indicator

Indicates the channel number (1-8).

L-ON Indicates whether the load is active on the load module for dual-channel load modules.

ON Indicates whether the load is on for single-channel load modules.

---

4 Mode Indicator

The Mode Indicator LEDs indicates the current mode or settings on the active channel(s).

A or **B** Value A or B for a single-channel load module. Applies to CR, CV, CP, and CC static mode only.

CC Constant Current Mode (CC) mode activated.

CV Constant Voltage Mode (CV) mode activated.

CR Constant Resistance Mode (CR).

CP Constant Power Mode (CP).

Disp. Display is shown on dual-channel load modules when both left (L) and right (R) channel information is displayed.

Press the Display button repeatedly to show information for both channels.

GO Lights up when Go/NoGo is activated and the load passes the Go/NoGo limits.

L or **R** L or R lights up when you select the left or right channel.

Static Lights up when in Static mode.

Dyna. Lights up when in Dynamic mode.

	Short	Lights up when a load is shorted.
	NG	Lights up when Go/NoGo is activated and the load fails the Go/NoGo limits.
5 and 6 Channel Unit Indicators		The Unit Indicators display the current unit.
	V	Voltage
	Ω	Resistance
	A	Current
	W	Power
	S	Second

Installation

This chapter describes how to load the load modules, install the optional rack mount kit, and determine each channel number.

If you need to move all installed devices to another location, disassemble the modules first, then reassemble the modules after moving to the desired location.

Load Module Installation

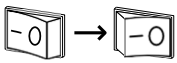
WARNING To avoid static electricity, use appropriate anti-static work practices.

Module installation

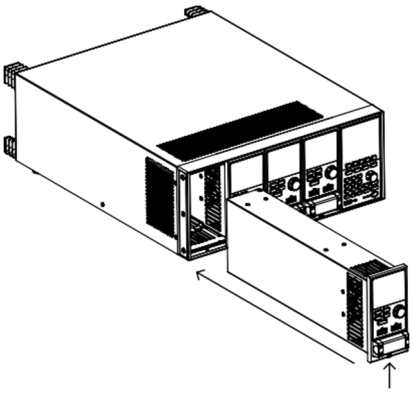
The RMX-4000 and 4002 can accommodate two and four load modules, respectively. Module loads can have one or two channels. Load module installation is the same for both models.

Steps

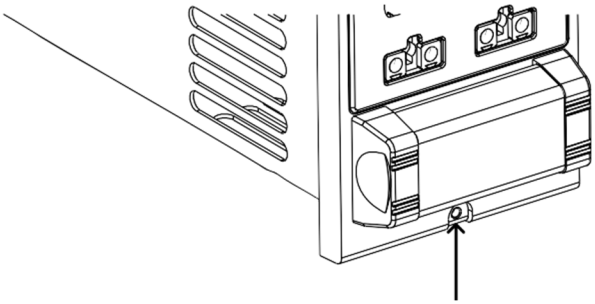
1. Ensure that the mainframe is turned off from the rear panel. Disconnect the power cord.



2. Slide the module onto the rails of an empty load slot.

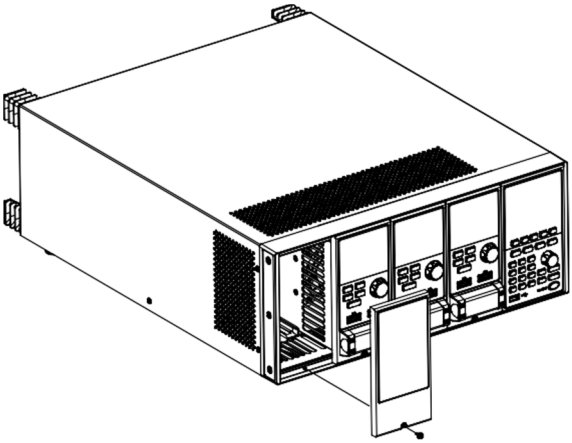


3. Use the supplied screw to attach the module to the load slot under the load terminals.

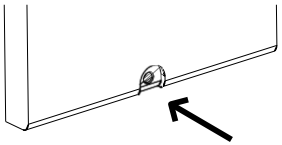


4. Install any additional modules as described above.

5. If there are any empty slots, install the supplied panel cover (National Instruments part number 63FP-AG106501). The panel cover improves safety and increases air flow.



6. Use the supplied screws to attach the panel cover(s) over the load slot.



Rack Mount Installation

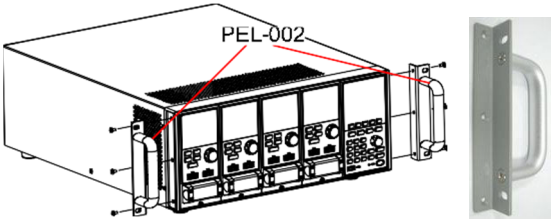
Background

You can use the RMX-4002 in a standard 19 in. rack mount enclosure with the optional rack mount kit (National Instruments part number 11EL-20040201). Each unit requires a rack height of 4U with a 1U space for ventilation top and bottom. The rear of the rack mount enclosure must be free of obstruction to allow heat to dissipate from the mainframe(s).

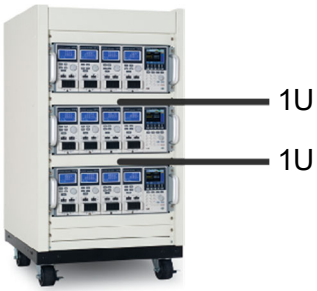
Steps

1. Attach the rack mount brackets as shown below using the supplied bolts.

RMX-4002



2. Insert the RMX-4002 into a standard 19 in. rack enclosure with at least 1U of space top and bottom for ventilation.



Channel Number

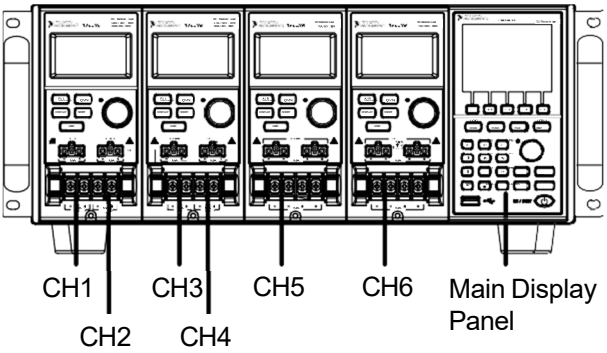
Description

The slot a module load occupies on the mainframe chassis determines the module load channel number. There can be one or two channels per slot, depending on the load module type.

The RMX-4000 has two slots; the RMX-4002 has four slots. Channel 1 is the farthest away from the main display panel, and channel 8 (RMX-4002) or channel 4 (RMX-4000) is the closest to the main display panel.

As shown in the following figure, the RMX-4002 has all four slots occupied with the RMX-4003, RMX-4004, RMX-4005, and RMX-4006 load modules (LM), respectively. The RMX-4003 and 4004 have two channels per load module; the RMX-4005 and RMX-4006 have only one. The channel determination is:

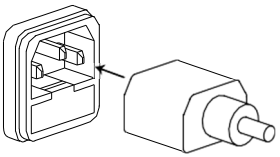
LM1: CH1, CH2; LM2: CH3, CH4; LM3: CH5; LM4: CH6.



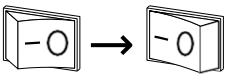
Power Up and Self Test

Panel Operation

1. Connect the power cord to the power socket.

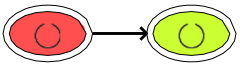


2. Turn on the external power switch.



3. Hold the power button on the front panel to turn on the power.

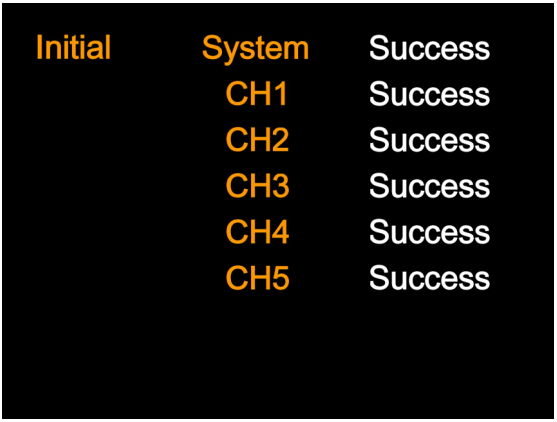
The power button turns from red (standby) to green.



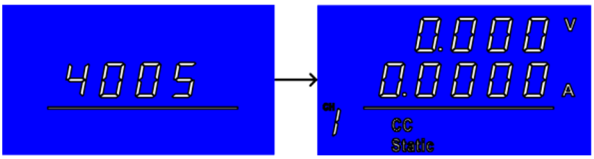
WARNING Ensure that the power outlet has a ground socket. The power outlet has a ground connection if it is a three-socket type.

When turned on, the Mainframe performs a self-test. The self-test checks the system, followed by any attached channels.

NOTE When the mainframe and slave firmware versions are not identical, the following message appears on the mainframe: "The firmware will be updated, please access to website www.ni.com to confirm the firmware version."



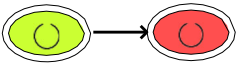
When the system check happens, the load modules display each channel as it is checked, then display the current mode.



4. If any System checks fail, power down the load and reinstall the appropriate load module(s).

5. To turn off the load, hold the power button for a few seconds.

The RMX-400x mainframe returns to standby mode.



Load Connections

Precautions and Procedures

Introduction

The RMX-400x series supports several load configurations for flexible operation:

- Single DUT, single load
- Single DUT, parallel load
- Multiple DUTs, multiple loads
- Multiple DUTs, multiple mainframe loads
- Single DUT, parallel mainframes

The RMX-400x series also supports a number of different control methods and interfaces. The connections used are described here:

- Frame link
- Channel control
- Go/NoGo

Wire Gauge Considerations

Before connecting the RMX-400x series, you must consider the wire gauge. Load wires must be large enough to resist overheating when a short-circuit condition occurs, as well as maintain good regulation. The size, polarity, and length of a wire are all factors in determining if it can withstand short circuiting.

Wire Selection

Wires must be large enough to withstand a short circuit and limit voltage drops to no more than 2 V per wire. Use the table below to help make a suitable selection.

AWG	Max Current (Amp)
24	7.64
22	10.0
20	13.1
18	17.2
16	22.6
14	30.4
12	40.6
10	55.3

Load Line Inductance Considerations

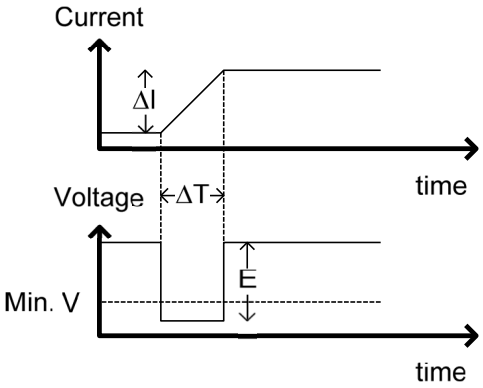
When using the RMX-series, you must consider the voltage drop and voltage generated due to load line inductance and current change. Extreme changes in voltage may exceed the minimum or maximum voltage limits. Exceeding the maximum voltage limit may damage the RMX-400x series.

To determine the voltage generated, use the following equation:

$E = L \times (\Delta I / \Delta T)$

E = voltage generated
L = load line inductance
Δ I = change of current (A)
Δ T = time (us)

You can approximate load line inductance (L) as 1 uH per meter of wire. (Δ I / Δ T) is the slew rate in A/us.

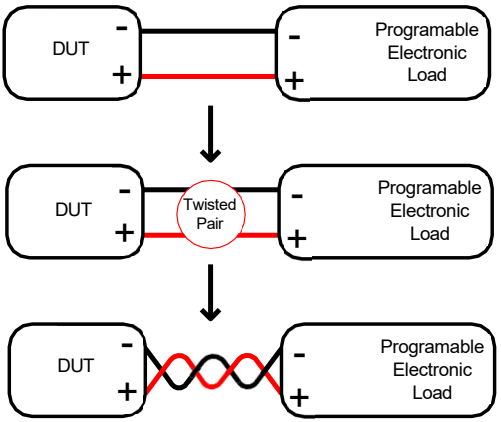


The diagram above shows how changes in current can affect voltage.

Limiting Load Line Inductance

You can reduce load line inductance by ensuring load wires are as short as possible and twisting positive and negative load wires together. You can limit current change by limiting the slew rate when switching.

A twisted pair is shown on any connection diagram where you should twist the load wires together.



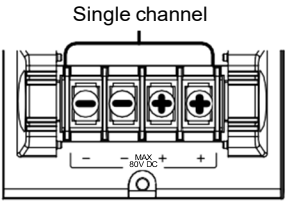
Load Module Considerations

The RMX-400x series supports single and dual-channel load modules.

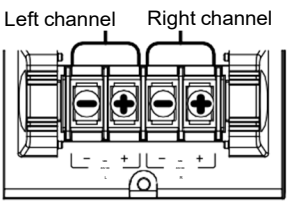
Single-channel load modules have one bank of negative terminals and one bank of positive terminals. Each terminal pair has a 40 A capacity. For higher loads, you can wire each terminal in parallel to increase capacity.

Dual-channel load modules have one bank of positive and negative terminals for each channel.

Single-Channel Load Module



Dual-Channel Load Module



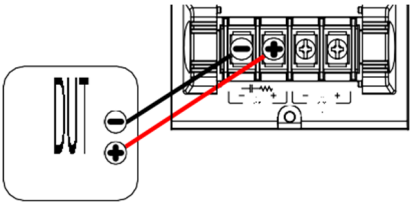
Connection

Follow the procedure below for all load connections.

CAUTION Ensure that power is off from the load and the DUT before making any connections.

Steps

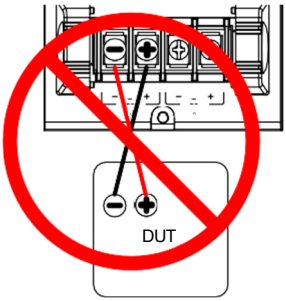
1. Carefully lift the terminal covers.
2. Connect the positive (+) terminal on the load module to the DUT high potential output.
3. Connect the negative (-) load terminal to the DUT low potential output.



4. Close the terminal cover securely. Ensure that the wires are secured properly and the wires are not exposed when the cover is in place.

WARNING Ensure that the wires are tied or twisted together to prevent noise and inductance.

CAUTION Ensure the polarity is correct before proceeding with any connections. Using the wrong polarity could result in reverse voltage damage.



Ensure that the input voltage does not exceed specifications. Exceeding the voltage specifications could result in damage to the instrument.

Remote (Sense) Connection

Background

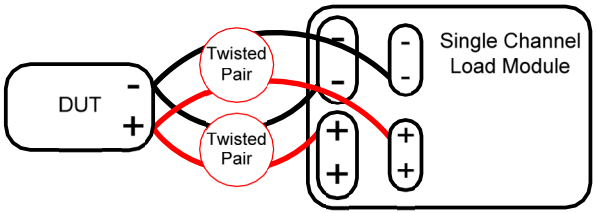
The electronic load modules have two voltage sense contacts: Vsense + and Vsense -. You can use voltage sense to help compensate for long cable length. The longer the cable, the higher the potential resistance and inductance; therefore, a short cable is best. Twisting the cable can help reduce induced inductance, and using the Vsense terminals compensates the voltage drop seen across the load leads, especially leads with higher resistance. This is useful when used in CV, CR, or CP mode.

⚠ WARNING

Vsense + must have a higher potential than Vsense -.

Connection

The diagram below shows how you can connect a DUT using voltage sense. Note that the sense wires are also twisted pairs.



⚠ Note

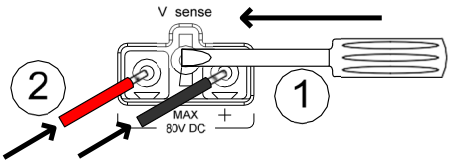
The wire gauge for the sense wires should be no smaller than 16 gauge.

Input

The voltage sense terminals must use a wire gauge of 16 to 14 (diameter 1.29 mm - 1.63 mm).

Remote Sense Terminal connection

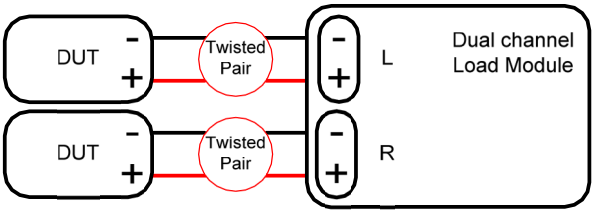
The voltage sense terminals use a screwless clamp connector. You must open the clamp prior to inserting a wire. Use a small screwdriver to push the clamp release mechanism, as shown below. Insert both wires, then release the clamp mechanism.



Single-Load Connections

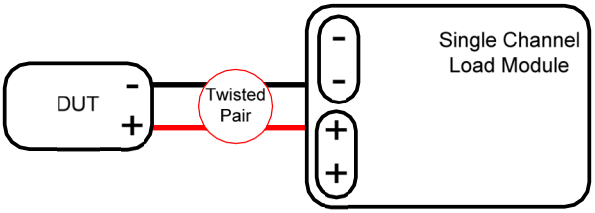
Dual Channel Load Module Connection

You can use a dual-channel load module to sink two loads concurrently.



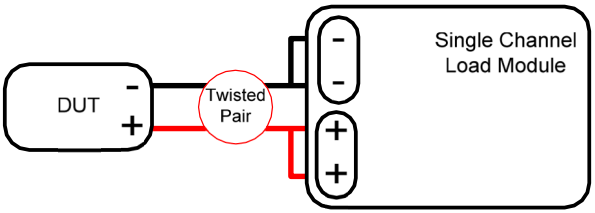
Single Channel Load Module Connection

On a single-channel load module, the left terminals are both negative (-), while the right terminals are both positive (+). Note that this also applies to the voltage sense terminals.



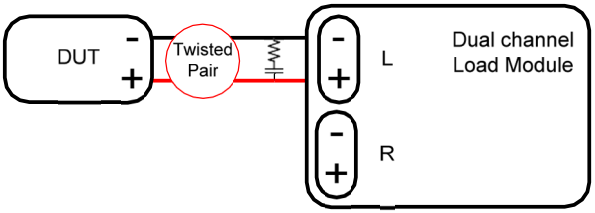
CAUTION

For loads exceeding 40 A, you must use both positive and both negative terminals in parallel.



DC Connection

For purely DC operation, you can connect a resistor and capacitor in parallel to the electronic load to reduce oscillation. The capacitor and resistor values depend on the load settings. Ensure that the capacitor ripple current is within allowable limits.



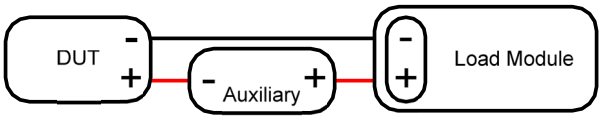
Low Voltage Connection

Using the load with low voltage loads is generally limited to over 1 V (load module dependent). To support low voltage loads, you need an auxiliary power supply to boost the voltage to a range suitable for the load.

Precautions:

- Take into account the combined power of the load and auxiliary power supply.
- Make sure the auxiliary power supply can provide enough current.
- Take into account any noise or irregularities from the auxiliary supply.

The diagram below shows a typical connection.



WARNING

Using an auxiliary power supply may induce reverse current. The RMX-400x Series has reverse voltage protection. For details, refer to the protection section on page 92.

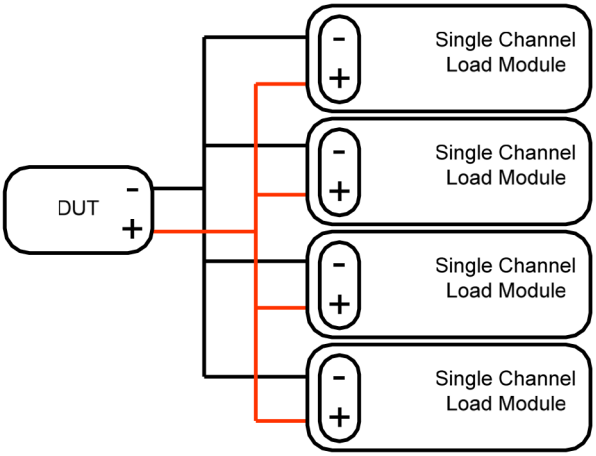
Parallel Load Connections

Parallel Load Modules

When the power output of a DUT exceeds the power rating of a channel or load module, you can use the channel terminals, load modules, or mainframes in parallel to dissipate more power when used in CC or CR mode. Each channel sinks the amount of current specified. The total power sunk is the sum of all channels/modules. The amount of power can vary from each channel. For example, if CH1 is 25 A and CH2 is 20 A, the total current sunk is 45 A. Parallel loads are supported for both static and dynamic loads (refer to page 90 for a description on parallel dynamic loading). Note that you must use the same modules when operating the parallel.

The RMX-400x series also features a dedicated parallel configuration setting known as Group Unit. When Group Unit is turned on, you must use load modules of the same type and rating in parallel for CC and CR mode. Refer to pages 80 and 221 for more information.

Parallel Load

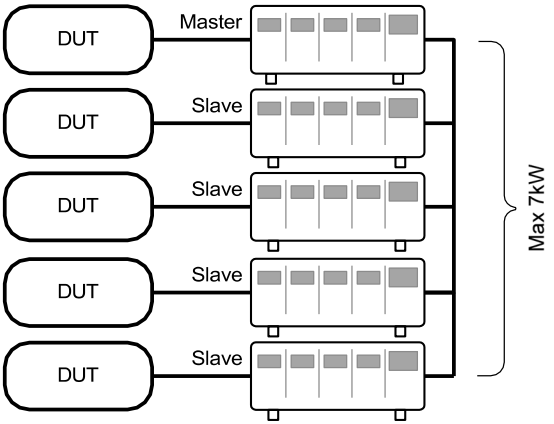


Note

You must use the same load modules in parallel.

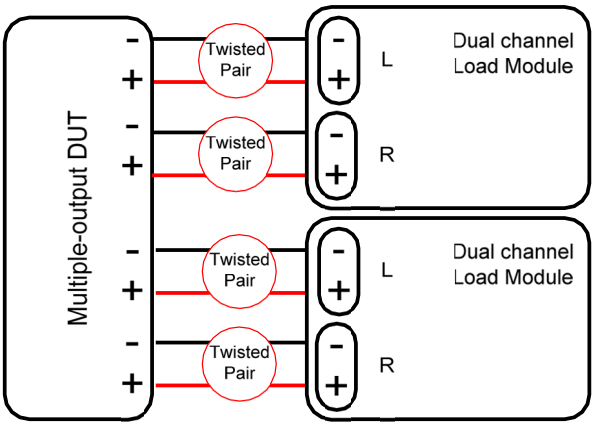
Parallel Loads Using Frame Link Connections

You also can connect RMX-400x series mainframes in parallel. When using a frame link connection, there is a delay between the master and slave. Refer to page 61 for details.



Mult i-Output Power Supply Load

The RMX-400x series also can sink a number of loads concurrently from multiple DUTs or sink a number of loads from the same DUT (that is, a multiple output power supply).

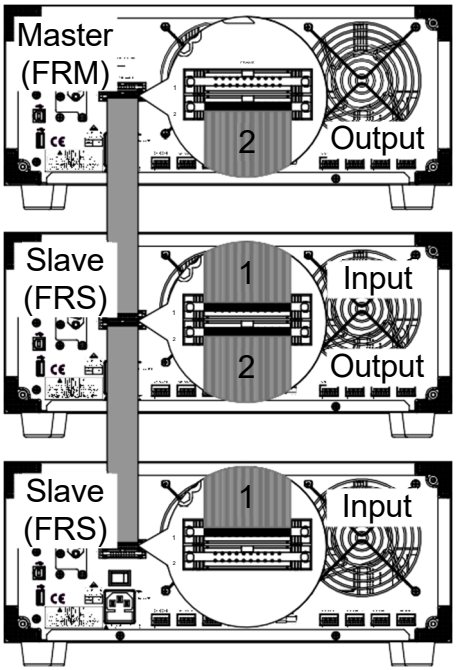


Frame Link Connection

Background

Frame link control involves connecting multiple mainframes using the frame link connections. You can connect up to four slave mainframes to the master mainframe. You can use the first mainframe (master) to control the other slave frames. There is a delay time of 2 µs between the master and first slave mainframe, and 4 µs, 6 µs, and 8 µs to the second, third, and fourth slave mainframes, respectively. The connectors used are standard MIL 20-pin connectors. For pin arrangement, refer to page 315. The frame link cable (part no. GTL-249) is an optional accessory; refer to page 18 for details.

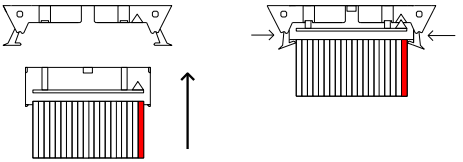
Frame Link Connection



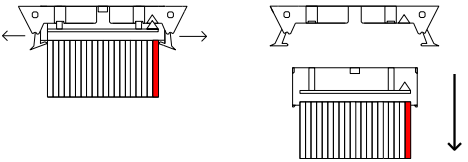
The first mainframe connected is the master frame; any additional frames are slave units. The ribbon cable connects to the master from connector 2, and the slave from connector 1. Each successive slave unit is connected in a cascading manner the same way.

Ensure that the mainframes are turned off before connecting the ribbon cables. Push the cable into the frame link connector. Ensure that the arrows line up. The latches close when the connection is complete. To remove, pull the latches out, and the connector comes out.

Insertion



Removal



WARNING

Ensure that all the mainframes are off and disconnected from mains power before connecting.

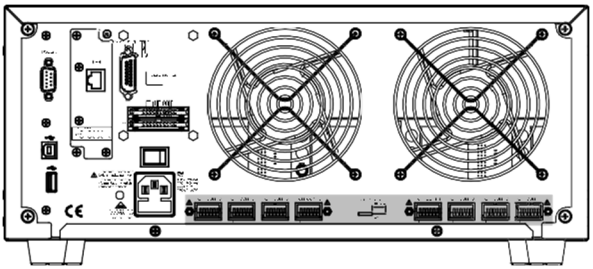
Channel Control Connection

Background

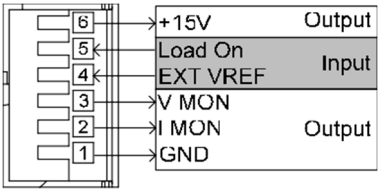
The Channel Control connecters are on the rear panel of each mainframe. There are two channel control connectors for each load slot, one for each channel, if applicable. Use the channel control connector to externally:

- Turn on/off loads.
- Supply a reference voltage.
- Monitor the load input.

For further details on channel control and the interface, refer to pages 100 and 313.

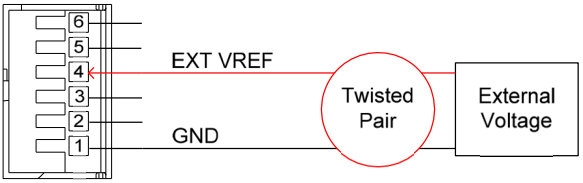


The Channel Control input/output pinout is shown below.



External Voltage Connection

The external voltage reference input must be 0-10 V.



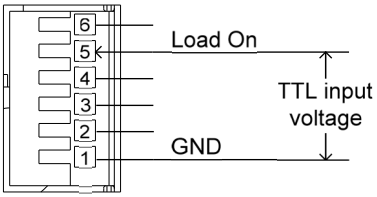
WARNING

Ensure the external voltage reference is stable and has low noise. The External Voltage should be no more than 10 V.

You can use an external voltage of no more than 12 V. More than 12 V may damage the load.

Load on connection

To turn a load on, you must apply an active low voltage (0-1 V) across Load On (pin 5) and GND (pin 1). Similarly, you must apply an active high voltage (4-5 V) to turn a load off. The Load On input must be TTL.

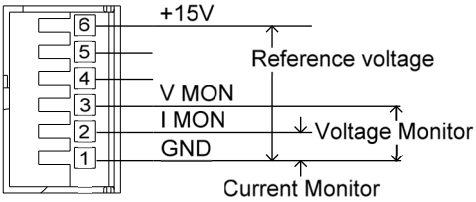


Voltage and Current Monitor Output

The Voltage Monitor Output (VMON) and Current Monitor Output (IMON) output the load input voltage and load input current as a percentage of rating current/voltage, where 0 V = 0% rating and 10 V = 100% load input rating voltage or current.

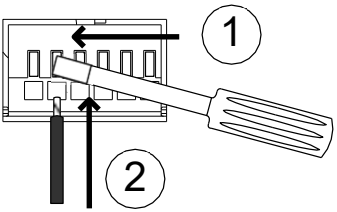
The voltage monitor output is across pins 1 and 3, and the current monitor output is across pins 1 and 2. Pin 6 outputs a +15 V reference voltage.

The following diagram shows the voltage and current monitor output pin configuration.



Connector Connect ion

The channel control connector is a screwless clamp connector. You must open the internal clamp mechanism before you can insert a wire. To open the internal clamp, push the button above the wire socket. To close, release the button. Ensure that at least 10 mm is stripped from the wire. The diagram below shows the wire insertion procedure.




WARNING

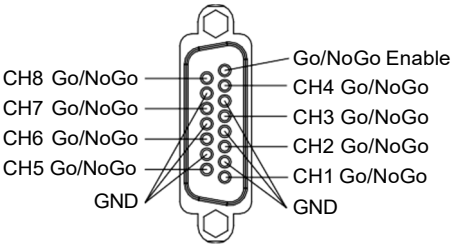
All connections to the channel control connector must use a 24 AWG wire gauge.

Go/NoGo Connection

Background

The Go/NoGo port is a 15-socket port. Each channel has a dedicated line for a Go/NoGo output. The ports are open-collector with active high (30 V) indicating a pass and active low (1.1 V) indicating a fail (an alarm). The Go/NoGo terminal is a DB-15 female.

For more details on the Go/NoGo interface, refer to page 318.



OPERATING DESCRIPTION

Operating Mode Description

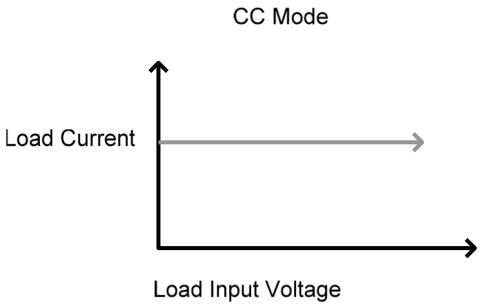
There are four basic operating modes: constant current (CC), Constant Resistance (CR), Constant Voltage (CV/CV+CC) and Constant Power (CP). All channels operate using any of the modes. Each mode has a number of configurable options including slew rate, levels, protection modes, Go/NoGo and extensive save options.

Constant Current Mode

Background

In Constant Current Mode, the load units sink the amount of current programmed. Regardless of the voltage, the current stays the same. There are two ranges in CC mode: High and Low. There are two main modes in CC mode: Static and Dynamic. You can use static mode for stability tests and dynamic mode to test transient load conditions.

Go/NoGo is supported for both High and Low range as well as Static and Dynamic mode.



Range

There are two selectable ranges for constant current mode: high and low range.

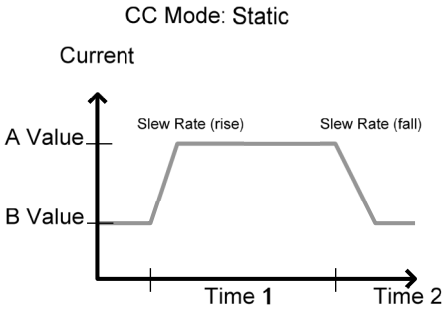
Low range has a higher resolution, but a lower range. If the current exceeds the Low Range, you must use High range.

Static Functions

Static mode tests the stability of the voltage output from a power source. Single-channel load modules can have two current levels: A (A Value) and B (B Value). A and B have the same range. Pressing the A/B key on the module load cycles through the A and B states. Alternatively, the mainframe can select the A or B Value.

Dual-channel load modules have only one current level (A Value) per channel in static mode.

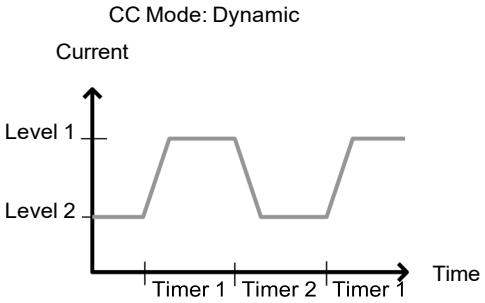
Static Mode: Single Channel Load module.



Dynamic Functions

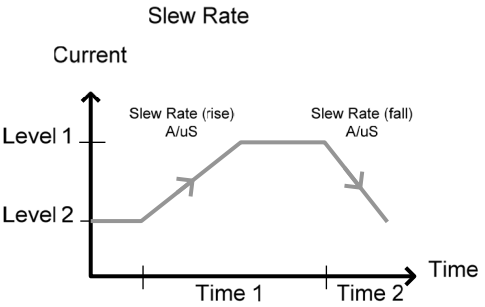
Dynamic load functions allow you to set load levels (Level 1 or Level 2), load time (Timer 1 or Timer 2), and the slew rate (rising or falling). Depending on the settings, the load switches automatically between levels 1 and 2.

You can use dynamic loading for charge discharge cycle testing, and so on.



Slew rate

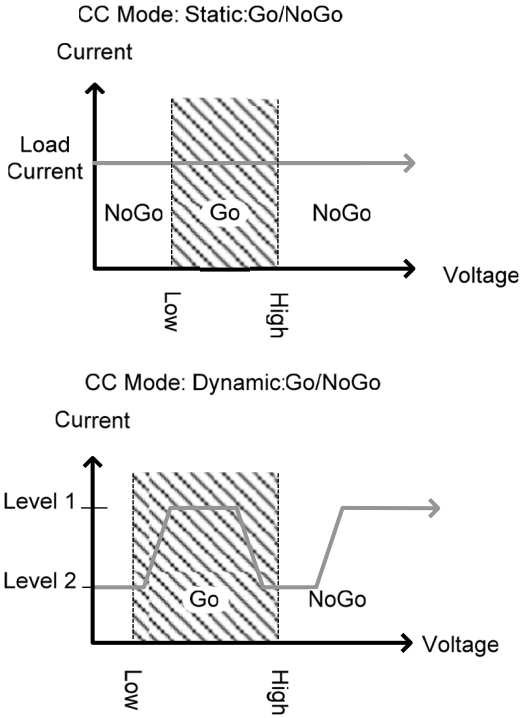
The slew rate is the rate at which the current increases to a set level. There are two slew rates: rising slew rate and falling slew rate. In CC mode, the slew rate is defined as A/uS.



As shown above, the rising and falling slew rate need not be the same.

Go/NoGo

Using Go/NoGo, you can set the Center, High, and Low voltage limits for both Static and Dynamic modes. You also can set a delay time of up to 1 second.

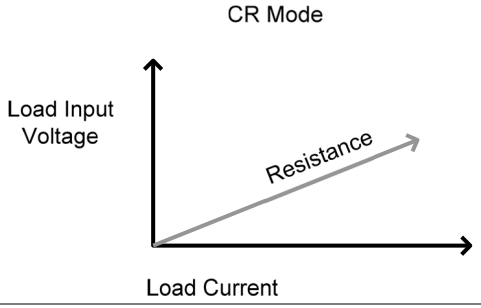


GO is specified as between the Low and High Go/NoGo limits. NoGo is specified as outside the Go/NoGo limits.

Constant Resistance Mode

Background

In constant resistance mode, the load units linearly sink current and voltage to match a set resistance. CR mode has two values (single load modules), two ranges, and rising and falling slew rates. Like CC mode, constant resistance mode supports both dynamic and static loads. As with the other modes, Go/NoGo is supported.



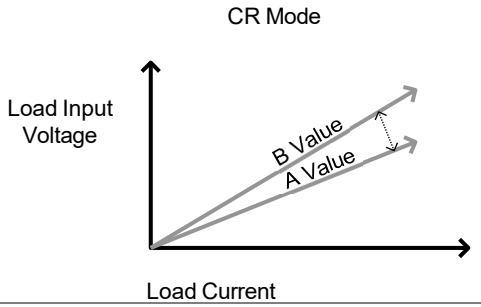
Resistance Range

There are two ranges: high and low. The low range is for low-voltage ranges, while the high range is for high-voltage ranges. The current range always remains in high range, regardless of the selected resistance range.

Static Functions A/B range

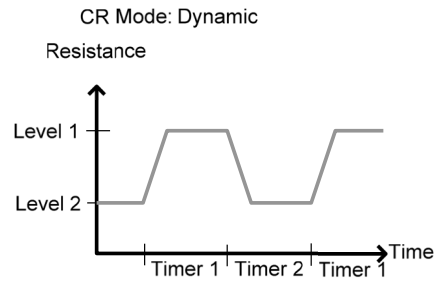
For static mode, single-channel load modules have two resistance levels, A and B Value. A and B have the same range. Use the A/B key to switch between these resistance levels. Dual-channel load modules have only one resistance level, A Value.

Single Load Module

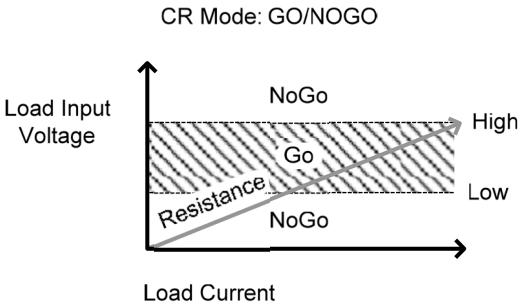


Dynamic Functions

CR mode supports Dynamic loading. Dynamic load has two resistance levels (Level 1 and 2), and two timers (Timer 1 and 2) to switch between the resistance levels. You can set rising and falling slew rates to determine the speed at which the load switches between load levels.



Slew Rate	The rising and falling slew rate (A/uS) determines the speed at which the load levels change from A to B Value (static mode) or from Level 1 to 2 (synamic mode) and vice versa.
Go/NoGo	Go/nogo is also supported. You can set center, high, and low limits as either percentages or voltage values. You also can set delay time of up to 1 second.



Constant Voltage Mode

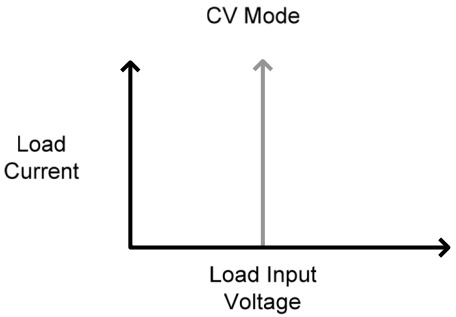
Background

In constant voltage mode, the load units sink current while keeping the voltage constant.

Single-channel load modules support two values (A Value and B Value) and have an adjustable cut-off current limit. Dual-channel load modules have only A value.

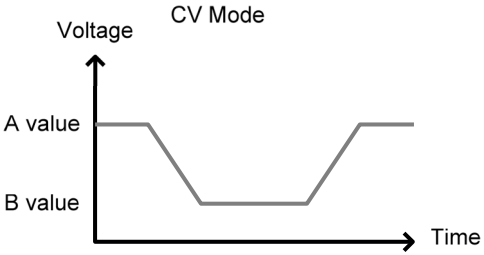
You also can set response speed to fast (Fast) or slow (Slow). The response speed relates to the current response's slew rate.

Go/NoGo functionality is also supported either as a percentage or as a current value.



Voltage levels

You can set two voltage levels: A and B (single channel load module).

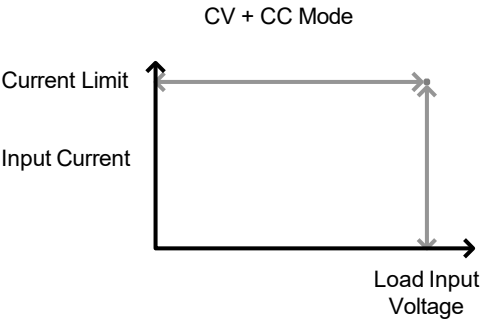


CV + CC

When using CV mode, you can set a current limit for CV + CC mode.

When the voltage input is greater than A Value (load voltage), the channel operates in CV mode if the input current is less than the current limit. When the input current exceeds the current limit, the channel operates in CC mode.

When the voltage input is less than A Value (load voltage), current stops flowing.



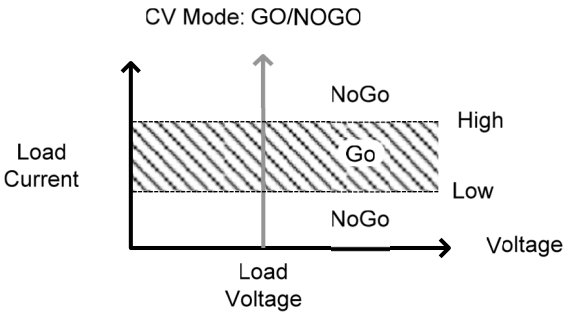
Response Speed

You can set response speed to fast or slow. The load module specifications determine fast response and slow response. Slow response speeds are suitable for large loads, as quick current changes induce induction that can cause large voltage drops. The RMX series tries to rectify any voltage drops. However, if voltage drops are too large, they may cause the load to go into oscillation. Large voltage drops that line voltage induction causes may damage the machine.

Range	Fast	Slow
	1 kHz	100 Hz

Go/NoGo

Go/nogo testing can be with either current (Ampere) values (High or Low) or percentage values (Center, High %, or Low %). You also can set a delay time of up to 1 second.



Constant Power Mode

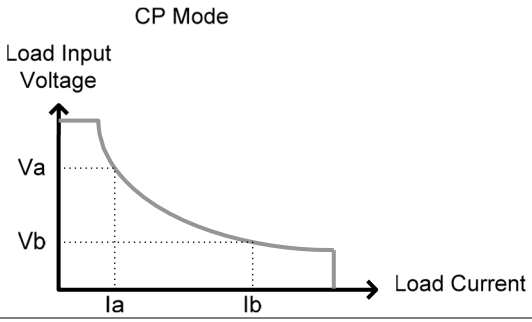
Background

In constant power mode, the load units ensure a constant power load for the power supply.

Single-channel load modules support two values (A Value and B Value) and have an adjustable cut-off current limit. Dual-channel load modules have only A value.

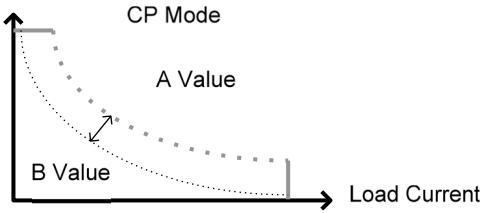
Constant power mode can operate in high or low range.

Constant power mode also supports Go/NoGo functionality as either a percentage or current value.



Power Levels

You can set two power levels: A and B (single-channel load module).



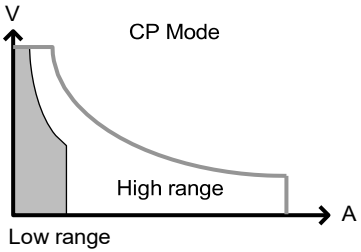
CP + CC

When using CP mode, you can set a current limit for CP + CC mode.

When the constant power current is less than current limit, the channel operates in CP mode. When the constant power current exceeds the current limit, the channel operates in CC mode.

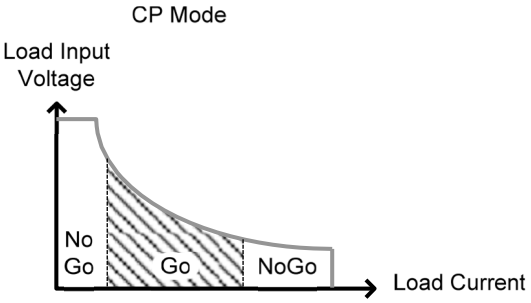
High/Low Range

There are two ranges: high and low. The how range is for low power ranges, while the high range is for high power ranges.



Go/NoGo

Go/nogo testing can set high and low current limits as a value (in amperes) or as a percentage. You also can set a delay time of up to 1 second.



Group Unit Mode

Background

Use the Group Unit menu to configure load modules of the same type and rating as a single unit when used in parallel. This eliminates the need to configure each channel individually.

Group Unit is supported under only CC and CR mode.

Group Unit has three configuration settings: Total Unit, Group Mode, and Display Mode.

Total Unit

This configuration setting sets the number units to be used in parallel and enables or disables the Total Unit mode.

Group Mode

The Group Mode setting determines how the current levels/resistance values are set when used in parallel. There are two settings: para and sync.

The para setting allows the all the parallelized load modules to be operated as a single large load module.

Sync mode allows the settings of a single unit to be synchronized across all the other parallelized load modules.

CC Example

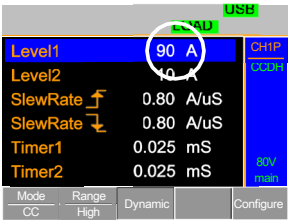
Consider three load modules set to CC mode in Parallel.

In CC mode, the total current for all units is the sum of each unit.

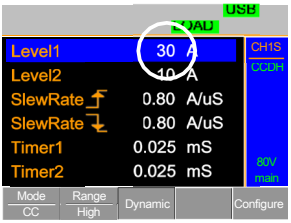
$$\text{Total } I = I_1 + I_2 + I_n$$

For example, to set a total load current of 90 A, the current level setting in para mode would be 90 A, while it would be 30 A sync mode.

Para Mode



Sync Mode



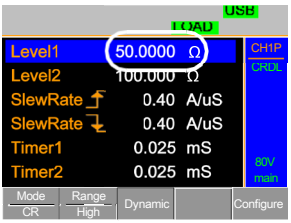
CR Example

When used in CR mode, the equation for equivalent resistance for all parallel loads is:

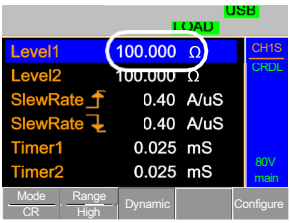
$$\frac{1}{\mathrm{R}_{eq}} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{Rn}$$

For example, if two load modules have a set resistance of 100 Ω each, the equivalent resistance of the load modules would be 50 Ω. The Level setting in para mode would be 50 Ω, and 100 Ω in sync mode.

Para mode



Sync mode



Display Mode

Display mode determines what units are displayed on the local load modules: V/I, V/W, I/W, and S. You can control the displayed units through only this menu.

Run Program

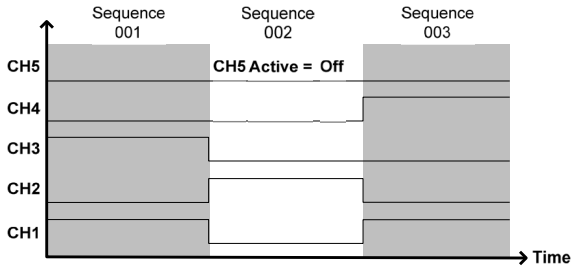
Background

The program function on the RMX-400x Series supports a total of 12 programs at any one time, with 10 sequences to each program. You can chain up to 12 programs. The program function can create several go/nogo tests.

Group Mode does not support Run Program (refer to page 80).

Program Sequence

A program sequence is a single load test. A program is a battery of each of these tests run in succession. Each sequence loads the settings for each channel from memory mata (memory MXXX). The memory data stores settings such as the operating mode and range for each channel. Each sequence loads all channels at the same time, unless programmed otherwise. Sequences for each channel run synchronously.

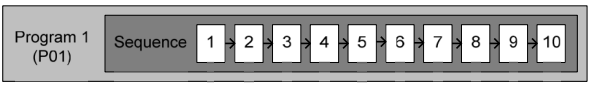


Each sequence has several configuration options that apply to all the channels equally.

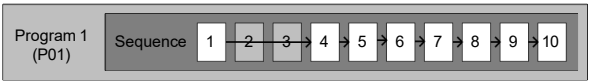
Sequence Item	Description
Memory	Loads the channel settings for each load module. Range: M001-M120
Run	Sets the running configuration for the current sequence. You can skip the sequence, run it, or run manually only. Range: Auto | Skip | Manual
On-Time	Sets the Sequence Run On-Time Range: 0.1 s-60.0 s
Off-Time	Sets the sequence off-time Range: Off | 0.1 s-60.0 s
Short-Time	Sets the sequence short-time. Range: Off | 0.1 s-On-Time
P/F-Time	Sets the sequence Pass/Fail time Range: Off | 0.1 s-(On-Time+Off-Time)-0.1s
Short Channel	Selects which channel is shorted during the sequence Range: CH1-CH8

Program

Sequences are run sequentially to create a program. There are 10 sequences in each program.



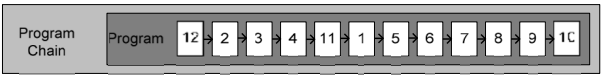
If you want less than 10 sequences in a program, you can skip any additional sequences.



Sequence 2 and 3 are skipped.

Program Chain

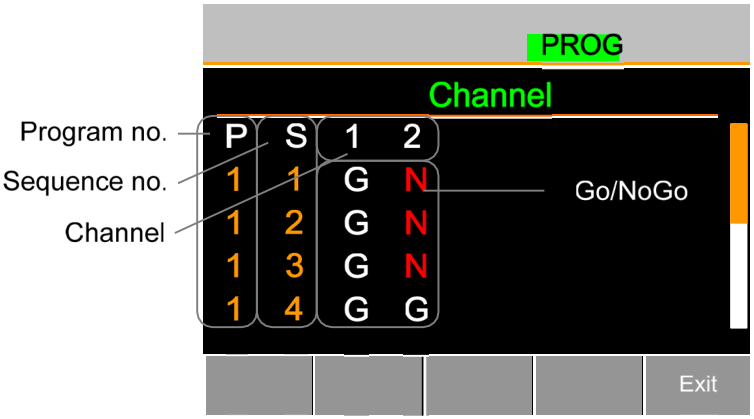
You can chain any of the 12 programs to create a program chain. Unlike program sequences, you don't need to run program chains sequentially in numerical order. You can chain any program to any program. You also can chain programs into an infinite loop to continue a program indefinitely.



Above, a program chain running sequences out-of-order.

Go/NoGo Results

If you have configured go/nogo limits, the pass/fail results for each channel are displayed for all sequences and programs.



Sequence

Background

Use the sequence function to create high-resolution load simulations. You can configure each sequence to create a unique load profile to accurately simulate loads in real time. Sequences are applicable for only CC (Static) and CR (Static) modes.

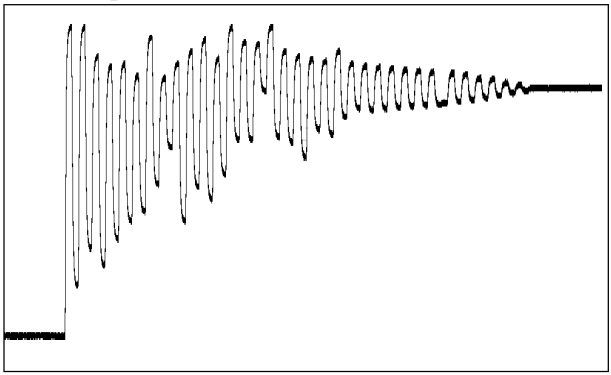
Note

Note: Do not confuse sequences with the sequences used to create a program. They are not the same, and you cannot use them interchangeably. You cannot use sequences (SEQ memory) in programs, and programs cannot load Sequences.

Load Profiling

The sequence function can simulate a load to a high resolution. Each channel can change its load sink within 25 us - 60000 s per point independently. When used in parallel, you can set multiple loads concurrently to simulate the loads placed on multiple output power sources.

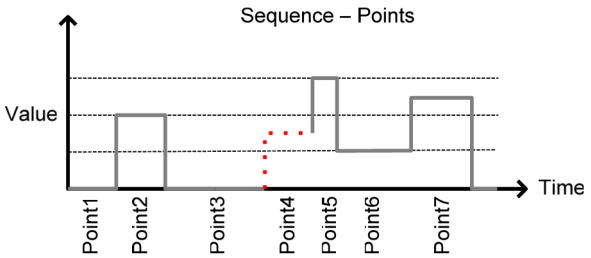
The following diagram shows a DUT load profile at start-up.



Points

You can use up to 120 points with each sequence. Each point can have a different duration, slew rate, and value.

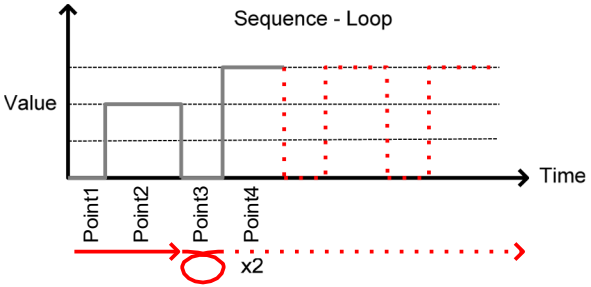
You can insert or delete a new point at any stage of a sequence. Any new point you insert has a value averaged from its neighbors as default.



A new point inserted after Point 3.

Loop

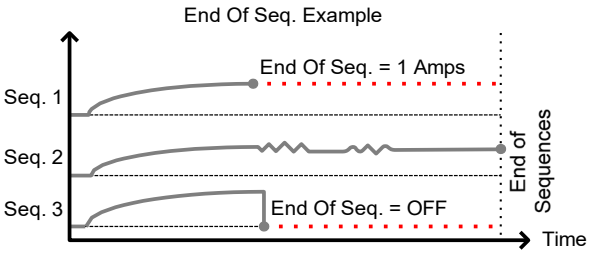
You can program sequences to loop a number of times starting from any point in the sequence.



From Point 3, the sequence is looped two times.

On End Of Seq. function

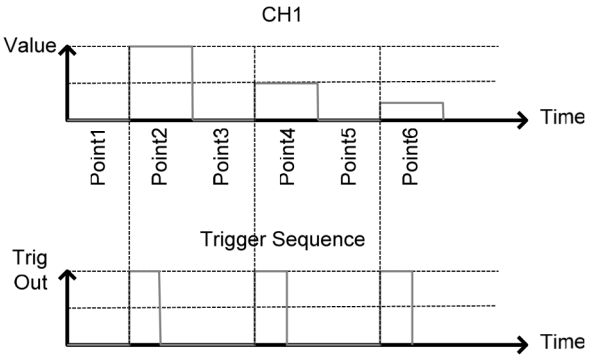
If you program more than one sequence on the mainframe, the On End Of Seq. function holds the load current (of the selected sequence) to a designated value until all other sequences finish running.



In the example above, sequence 1 holds the load current at 1 A at the end of its sequence until the last sequence finishes. Sequence 2 is the longest sequence, and as such the End of Sequence setting is not applicable. Sequence 3 is turned off after its sequence has finished (0 amps).

Trig Out

The Trigger Out function allows a trigger sequence signal to be output from a channel via PIN 4 on frame link connector 1 when using sequences. The Trig Out function is in the Channel Duration menu.



As shown above, a trigger sequence signal is output for every rising edge point.

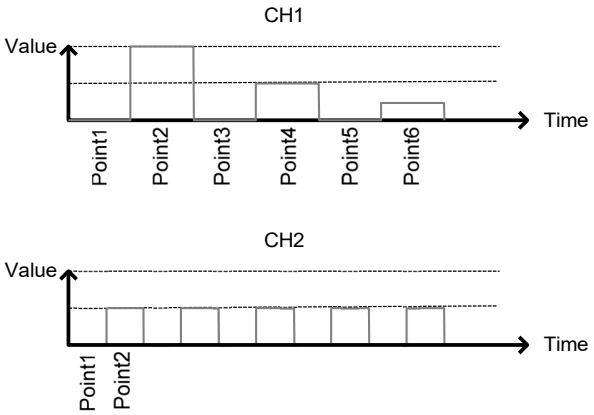
Trig In

The Trigger In setting allows a sequence to start after a trigger (Trig Out) is received via the frame link connector. The Trig In setting is for frame linked mainframes.

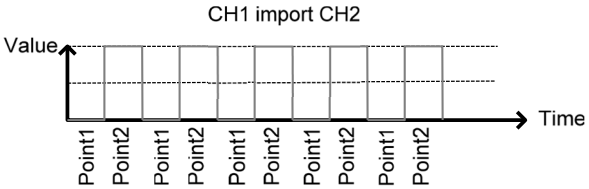
Channel Duration Time Setting

The Channel Duration Time Setting feature allows the point time duration of one sequence to be imported by another sequence. If the receiving sequence does not have enough points, more are created (without values).

For example, the sequences for CH1 and CH2 are shown below. CH1 has a total of six points with long durations, while CH2 has only two points, looped five times. The points from CH2 are also significantly shorter in duration.



The following figure shows the resulting sequence when CH1 imports CH2. CH1 imports the duration time settings and number of points from CH2, but not the value data.



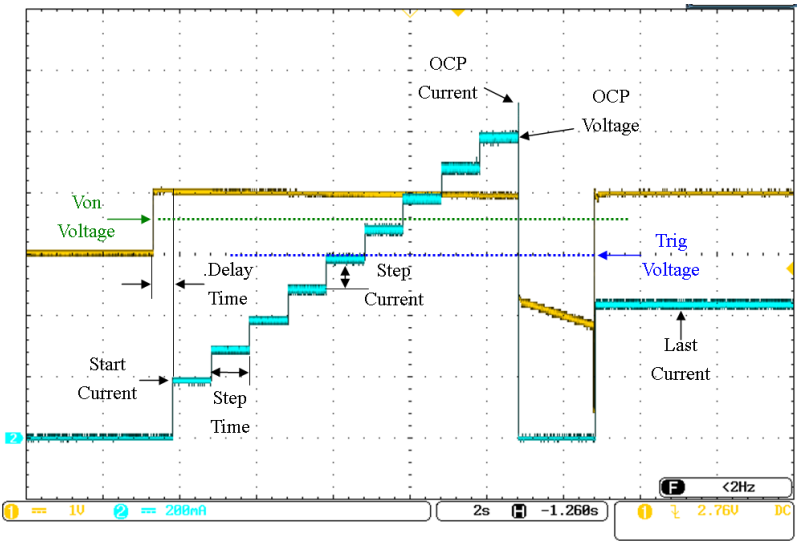
OCP Test Automation

Background

The OCP Test Automation function creates an automatic test to test the over current protection of power supply products. Refer to page 189 for operation details.

This test finds when the over current protection of a power supply is tripped and returns the measurements for the voltage and current when the over current protection was tripped. The RMX-400x series also has a user-defined OCP setting in the event that the power supply OCP fails.

The diagram below shows an example of the OCP Test Automation function.



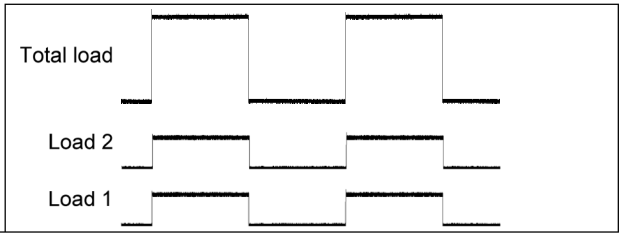
Parallel Dynamic Loading

Background

The RMX-400x Series of DC electronic loads support parallel dynamic loading. This means that when the load modules of a mainframe are connected in parallel and set to dynamic mode, they can perform dynamic tests synchronously following the same clock. Under dynamic mode, load current or resistance is pulsed between two preset levels. When used in parallel, you can test higher powered outputs. This ability gives the RMX-400x Series the flexibility to perform dynamic tests over a wide range of power outputs.

For connection details, refer to the *Parallel Load Connections* section on page 58.

The diagram below shows how two load modules can sink a higher load when used in parallel under dynamic mode.



Note

You must use the same type of load modules operated in parallel.

Configurations Description

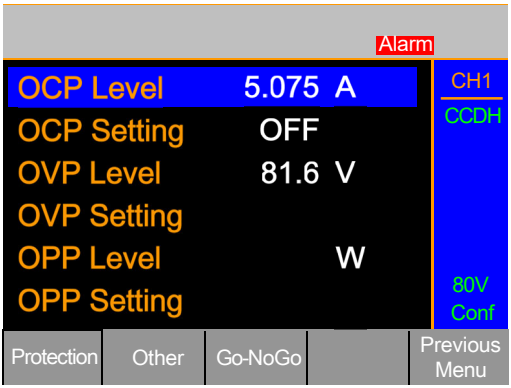
There are several configurations for the RMX series, including protection modes, operating configurations, and file system configurations. This section describes what the configurations are for and how they are relevant to different operations.

Protection Modes

Background

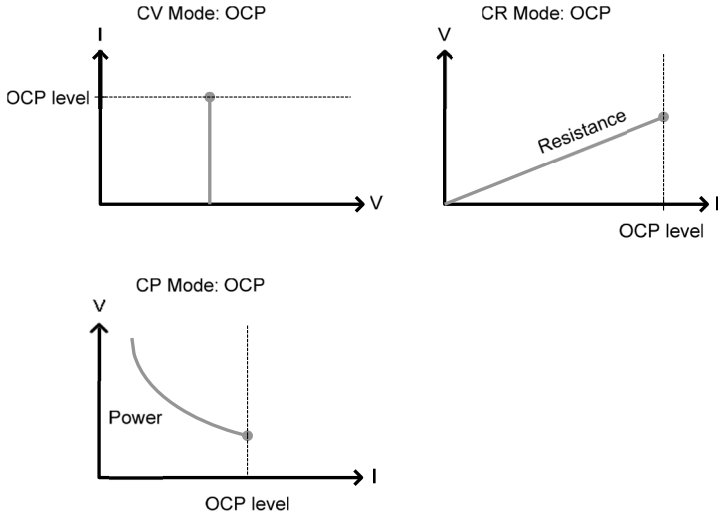
The RMX-400x Series includes several protection modes: over current protection, over voltage protection, over power protection, under voltage protection, and constant power protection.

The protection modes are useful to protect both the load modules and the DUT(s). You can set a buzzer to notify when a protection setting is tripped. When a protection feature is activated and tripped, the load unit displays an alarm. The mainframe also displays an alarm. When an alarm is tripped, the load stops sinking current/voltage. There are three over load protection settings: on, off, and clear.



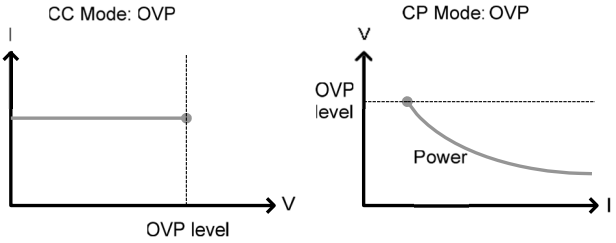
Over Current Protection

When a load unit is operating in CR, CV, or CP mode, the unit may need over current protection to prevent excessive current being set. Over current protection stops the load from sinking more current than its recommended limit, which can damage the unit.



Over Voltage Protection

Over voltage protection limits the amount of voltage sunk. If the OVP trips, the RMX-400x series load stops sinking voltage.



Over Power Protection	Use over power protection to limit the amount of power sunk. When OPP is tripped, power ceases to be sunk.
Reverse Voltage Protection	Reverse voltage protection prevents reverse voltage damage to the RMX-400x Series up to the specified rating. When reverse voltage protection is tripped, an alarm tone sounds until the reverse voltage is removed. Refer to the specifications for more details.
Under Voltage Protection	Under voltage protection turns off the load when the voltage drops below a set limit.
Constant Power Protection	Constant power protection prevents excessive power draw.

Operating Configurations

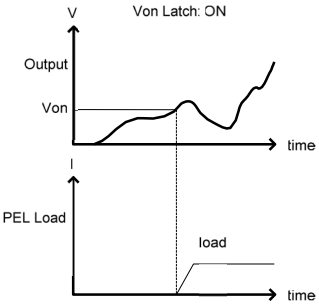
Background	There are operating configuration settings for the following: CC Vrange, Von Voltage, Von Latch, CH Cont, Independent, load D-Time, Response settings, Step resolution settings, and Short settings.
CC Vrange	Use CC Vrange (refer to page 201) to set the voltage range as high or low for CC mode. CC voltage range depends on the load module specifications.

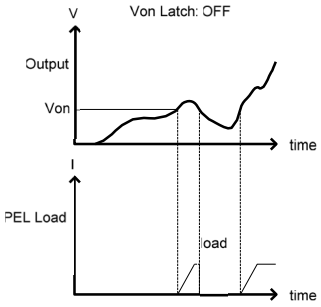
Von Voltage

Von voltage is the voltage limit at which the load starts to sink current. There are two operation modes for Von voltage -- Von latched: on and Von latched: off.

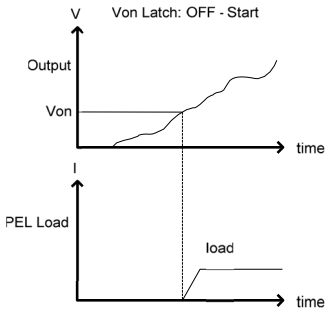
Latched: off sinks current when Von is tripped, and continues to sink current even if the voltage drops below the Von voltage.

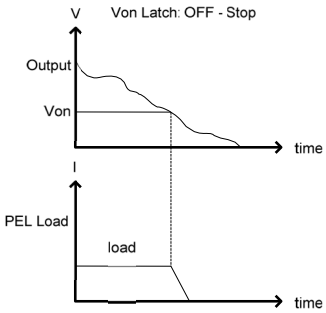
Von latched: off sinks current when Von is tripped, but stops sinking current when the voltage drops below the Von voltage setting.





As shown below, when Von latch is set to off, the load module starts to sink current when the Von-voltage limit is tripped. It stops sinking current when the output drops below the Von voltage limit.





Short

When short mode is on, the load unit can simulate a short circuit.

You can set shorting individually for each channel when programming sequences.

Use the short key to initiate a short circuit manually. You can us it at any time during an operation. It does not affect the settings. After a short circuit finishes, the load unit resumes the previous operation.

You can set the short key to toggle or hold. When pressed in toggle mode, shorts are toggled on and off. When pressed in hold mode, you need to hold the key to short the load.

Note

A short circuit may trip a protect ion mode if too much current is sunk.

CH CONT

Channel Control. When channel control is activated (external), you can use it to monitor the load voltage and current output as well as turn loads on or off remotely from the channel control (CH CONT) connectors on the rear panel.

For more information about channel control, refer to external voltage control on page 100.

Independent

Use the independent setting to control the load modules independently from the mainframe.

Load D-Time

Use load delay time to delay activating a load (up to 10 seconds) after pressing the load key. However, the load delay time setting works for only loads initiated manually or when the RMX-400x series mainframe is configured to auto load (refer to page 226) at run time.

Response

The Response setting sets the bandwidth of the load to 1 kHz (normal) or 100 kHz (fast). The Response setting is particularly important for limiting startup current.

Step Resolution

For each channel, you can configure the step resolution for the current, resistance, voltage, and power setting. The step resolution refers to the *coarse adjustment* step resolution of these settings. You cannot configure the *fine adjustment*; refer to page 213 for details.

For example, if the step resolution for CCH (CC high range) is 0.5 A, you can increment the resolution in 0.5A steps:

8.0←→8.5←→9.0←→9.5

The step resolution parameters apply to the following:

CCH Step – CC high range

CCL Step – CC low range

CRH Step – CR high range

CRL Step – CR low range

CVH Step – CV high range

CVL Step – CV low range

CPH Step - CP high range

CPL Step - CP low range

Step Resolution Range

The step resolution range depends on the load module and the range:

Max resolution: Module dependent
Min resolution: Module dependent

Short Key

When short mode is on, the load unit can simulate a short circuit.

You can set shorting individually for each channel when programming sequences.

Use the short key to initiate a short circuit manually. You can use it at any time during an operation. It will not affect the settings. After a short circuit has finished, the load unit resumes the previous operation.

You can set the short function ON or OFF. When set to ON, the short key is enabled. When set to OFF, the short key is disabled.

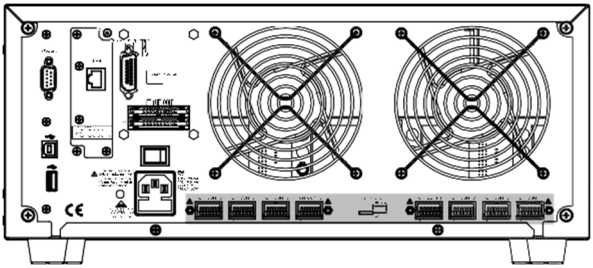
You can set the short key to toggle or hold. When you press the short key in toggle mode, shorts are toggled on and off. When you press the short key in hold mode, you must hold the key to short the load.

You can use the Short Safety to set the short operation mode. When set to ON, you must use the short function in the case of Load ON. When set to OFF, you can use the short function directly.

Channel Control

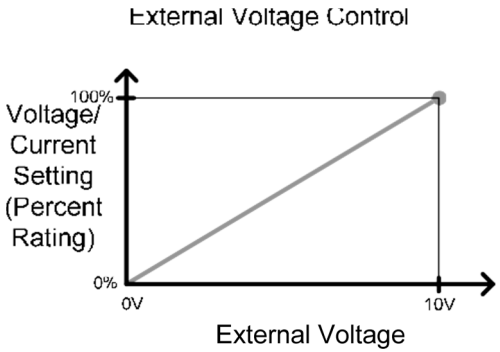
Background

Use external channel control with the Channel Control connectors. Each channel control connector can activate each load, monitor voltage and current, and has an external voltage reference input. The voltage and current monitors output 0-100% of the rated current/voltage as a voltage of 0-10 V.



External Voltage Reference

A voltage reference of 0-10 V represents 0-100% of a load module's rating voltage/current. As shown below, the external voltage reference and the rating voltage/current have a linear relationship. Varying the reference voltage between 0-10 V changes the voltage/current setting accordingly.



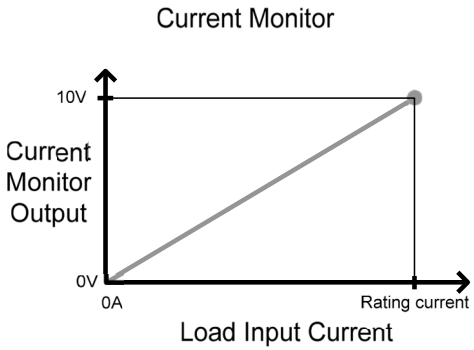
To determine the Percent Rating (voltage or current load input), use the following formula:

$$Load\ \ Input = \frac{External\ Voltage}{10(V)} \times Rating\ \ _{VorA}$$

where *Rating V or A* is the load module's rating voltage/current.

Current Monitor

You can monitor the load current input externally using the IMON pin of a channel control connector. The IMON pin outputs a voltage of 0-10 V to represent the input current as a percentage (0-100%) of rating current.



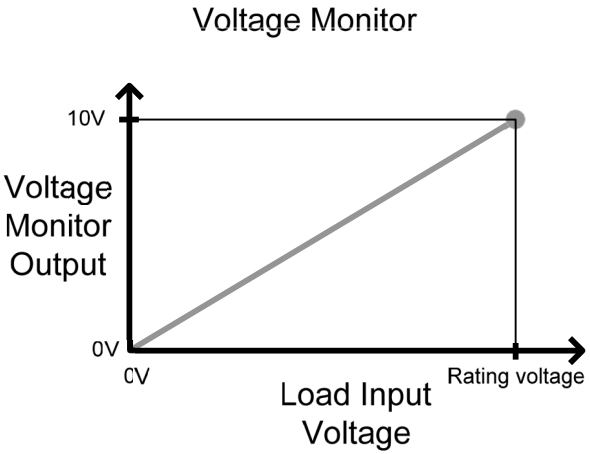
To determine the Current Monitor Output (IMON), use the following formula:

$$IMON = \frac{Load\ input\ current}{Rating\ \ A} \times 10V$$

where *Rating A* is the load module's rating current.

Voltage Monitor

Like the load input current, you can monitor the input voltage externally with the channel control connectors. The channel control connector VMON pin outputs a voltage of 0-10 V to represent the load input voltage as a percentage (0-100%) of the rating voltage.



To determine the Voltage Monitor Output (VMON), use the following formula:

$$VMON = \frac{Load\ input\ voltage}{Rating\ V} \times 10V$$

where *Rating V* is the load module's rating voltage.

Turning On the Load

To turn on a load, set the Load On input to On (active low). To turn off a load, set the Load On input to Off (active high).

When you turn on a load from the channel control interface, you can turn off the load from the mainframe, the local module, and via remote control. However, the opposite is not true; when you turn off a load using the channel control interface, you cannot turn on the load via the mainframe, the local module, or via remote control.

For connections and configurations, refer to pages 63 and 313, respectively.

Interface and System

Interface

Background

The RMX-400x series supports RS232, LAN, and USB remote frame control. The series supports only one type of connection at any one time. For more information about remote control, refer to the National Instruments website at ni.com or contact your local distributor about the RMX-400x series programming manual.

For connection options and configurations, refer to the following options.

RS-232 configuration	Page 251
RS-232 pin connection	Page 312
USB configuration	Page 253
Configuring Ethernet connection	Page 253

File System

Background

The RMX series can save and recall several data types for each channel:

- Presets
- Memory
- Setup
- SEQ (Sequence)

You can save and recall all data types to internal memory or save them to a USB flash drive. Each channel has its own dedicated memory for each data type. Thus, you can save and recall files for

each channel and data type.

Preset Data

You can save preset data into 10 memory slots for each channel. Preset data contains the mode, range, CV response speed, and Go/NoGo settings.

Internal Format	P0-P9
External Format	400X_XX.P

Preset Contents

Preset data contains the following data:

CHAN	• Mode • Range	• Static/dynamic • CV response speed
Go/NoGo	• SPEC test • High • Center	• Entry mode • Low

Memory Data

Each channel can save up to 120 different Memory data types (M001-M120) into internal memory. Memory data contains general channel settings, and you use it when programming sequences. You can store memory data both internally and externally to USB. Preset data and Memory data store the same contents.

Internal Format	M001-M120
External Format	400X_XX.M

Memory Contents

Memory data contains the following data:

CHAN	• Mode • Range	• Static/dynamic • CV response speed
Go/NoGo	• SPEC test • High • Center	• Entry mode • Low

SEQ Data

SEQ data contains Sequence data. You can save SEQ data only to and from USB. SEQ refers to Sequence data, not Program sequences.

Internal format	N/A (Internal buffer)
External format	400X_XX.A

SEQ Contents

SEQ data contains the following data:

Seq.Edit	• No. (Points) • Slew rate ↑ • Duration time	• Value • Slew rate ↓
Loop	• Repeat • On end load	• Start of loop • CC Vrange

Setup Data

You can save setup data to four internal memory slots. Setup data contains memory data, program sequence, chain data, configuration settings, and operation settings for every channel. You can save setup data to internal memory or USB.

Internal format	Setup memory 1-4
External format	400X_XX.S

Setup Contents

Setup data contains the following data:

Program	• PROG • Memory • On-time • P/F-time • Short channel	• SEQ (program sequence number) • Run • Off-time • Short-time
Chain	• Start	• Program sequence (P01-P12)

	Run	•	Active channel (CH01-08)	
	CHAN	•	Mode	• Static/dynamic
		•	Range	• CV response speed
	Go/NoGo	•	SPEC test	• Entry mode
		•	High	• Low
		•	Center	

Save: Internal Memory

When saving data to internal memory, you can save either the current channel or all channel data. Not all data types can save the current channel or all channel data.

Data type	Current channel	All channels
Preset	✓	✓
Memory	✓	✓
SEQ	✓ (Single save)	—
Setup	—	✓

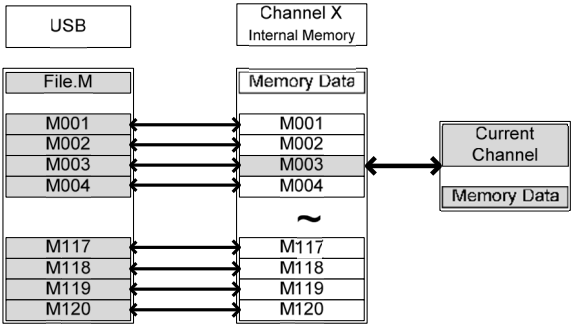
Save: External Memory

You can save only SEQ, memory, and preset data for a single channel to USB. All four data types (SEQ, memory, setup, preset) can save all channels to USB.

Data type	Current channel	All channels
Preset	✓	✓
Memory	✓	✓
SEQ	✓	✓
Setup	—	✓

Save/Recall USB

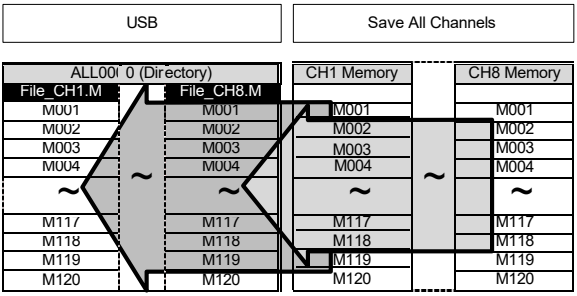
To save data from a single channel to USB, you first must save data to the internal memory. After you save data to internal memory, you can save all the files to USB.



To recall saved files, the reverse is also true. You must recall files from the USB flash drive to internal memory. Then from internal memory, you can recall the data to each channel (excluding SEQ data).

Save/Recall All

You can save the SEQ, preset, memory, or setup data from every channel into USB. SEQ, preset, and memory data is saved to a directory (ALL0000-ALL0099) with a file for each channel, while setup data is saved in a single file.

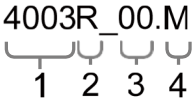


To recall saved files, the reverse is not true. You must recall files to each channel separately.

File Format

Current Channel — Filename Format

Memory data
Preset data
SEQ data



1: RMX-400x load module type:

4003 = RMX-4003

4004 = RMX-4004

4005 = RMX-4005

4006 = RMX-4006

2: Channel locat ion or voltage range of single channel model:

R = Right

L = Left or single channel low voltage model

H = High voltage model

3: Save file number:

0-99

Incremented after each consecut ive save.

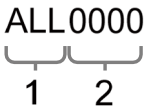
4: File extension

M = Memory data

P = Preset data

A= SEQ data

All Channel — Directory Format



1: All Channel common directory name

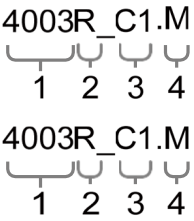
2: Directory number:

0000 - 0099

All Channel

Memory data
Preset data
SEQ data
Setup Data

Filename Format



1: RMX-400x load module type:

4003 = RMX-4003

4004 = RMX-4004

4005 = RMX-4005

4006 = RMX-4006

4000 = RMX-4000

4002 = RMX-4002

2: Channel, voltage range of single channel model or mainframe indicat ion

R = Right

L = Left or single channel low voltage model

H = Single channel high voltage model

F = Mainframe

3: Channel number:

C1 = CH1

C2 = CH2

Etc.

00 = All channels (setup data)

4: File extension

M = Memory data

P = Preset data

A= SEQ data

S= Setup data

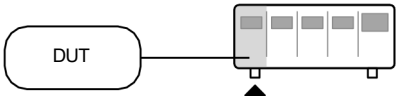
TUTORIALS

Step-by-Step Operations

Local Loads

Local mode operation is useful for quickly testing loads using the load module control panel rather than the mainframe control panel. You can configure local load modules to operate independently to the mainframe. This can be useful when settings need to remain unchanged on the mainframe. However, note that the local modules cannot change the modes (CC, CV, CR, CP); the modules can change only the values.

Group Unit mode is not supported for local module control.

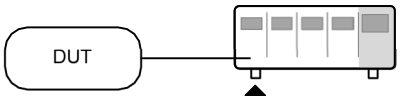


Step		Description	Details
1.	Setup	Ensure that the channel load is set up as desired.	Pages 42 and 49
2.	Channel selection	Ensure that the correct channel or Value (A/B) is selected by using the R/L or A/B key.	Page 130
3.	Measurement mode selection	If in CC or CR mode, you can select static or dynamic mode.	CC Pages 131 and 143 CR Pages 149 and 151
4.	Run the load	Press the LOAD key to start/end loading the device under test.	Page 132
Optional			
5.	Short configuration	Configure the SHORT settings.	Page 133
6.	Display	To change the display output, use the DISPLAY key.	Page 133
7.	Shorting the load	To short the load, use the SHORT key.	Page 133

8.	Independent load	You can set the local load modules to independent load.	Page 209
9.	Independent control	You can configure slave knobs to be independent from the mainframe.	Page 233
10.	Configure slave knob settings	Display measured or set values with the selector knob.	Page 237

Single Channel Load

Use single-channel loads to manually test a DUT quickly or to configure channel settings for program sequences using the mainframe panel.

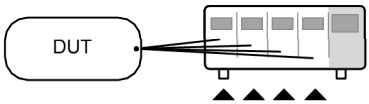


Step		Description	Details
1.	Setup	Choose the appropriate load module and make sure it is installed.	Page 42
2.	Connection	Connect the terminals to the DUT.	Page 49
3.	Channel selection	Select the load channel on the mainframe.	Page 136
4.	Measurement mode selection	Select measurement mode (CC, CV, CR, or CP mode).	CC Page 139 CV Page 154 CR Page 144 CP Page 160
5.	Range selection	Set the range to high or low (CC, CR, CV, and CP mode).	CC Page 140 CR Page 147 CP Page 164
6.	Mode selection	Choose static or dynamic mode (CC and CR mode only).	CC Pages 141 and 143 CR Pages 149 and 151
7.	Dynamic levels (CC and CR)	Set the dynamic levels, slew rate, and timers (CC and CR mode only).	CC Page 141 CR Page 149
8.	Static Values (CC, CR, CV, and CP)	Set the A (B) Value, slew rate (CC, CR) and current limit (CV, CP).	CC Page 144 CR Page 152 CV Page 155 CP Page 161

9.	Go/NoGo	Set the Go/NoGo configurations, if applicable.	Page 217
10.	Protection modes	Configure the protection modes.	Page 197
11.	Run	Activate the load by pressing the load key.	
Optional			
12.	Configuration	There are number of configurations that apply to all channels. For details refer to the Configuration Tutorial.	Page 126

Parallel Load Modules

Use the Group Unit setting for quick and easy parallel setup for load modules of the same type and rating. (The Group Unit settings apply to only CC and CR modes.)

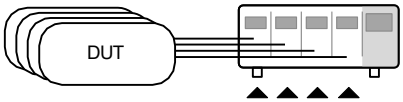


Step		Description	Details
1.	Setup	Choose the appropriate load modules and make sure they are installed. All load modules must be of the same type and rating.	Page 42
2.	Connection	Connect the terminals to the DUT.	Page 49
3.	Group Unit mode configuration	Enable Group Unit mode and configure.	Page 221
4.	Measurement mode selection	Select measurement mode (CC and CR mode).	CC Page 139 CR Page 144
5.	Range selection	Set the range to high or low (CC and CR mode).	CC Page 140 CR Page 147
6.	Mode selection	Choose static or dynamic mode.	CC Pages 141 and 143 CR Pages 149 and 151
7.	Dynamic levels	For dynamic mode, set the dynamic levels, slew rate, and timers.	CC Page 141 CR Page 149
8.	Static values	For static mode, set the A(B) Value and slew rate.	CC Page 144 CR Page 152

9.	Go/NoGo	Set the Go/NoGo configurations, if applicable.	Page 217
10.	Protection Modes	Configure the protection modes.	Page 197
11.	Run	Activate the load by pressing the load key.	
Optional			
12.	Configuration	There are number of configurations that apply to all channels. For details, refer to the configuration tutorial.	Page 126

Programming

When you create a program sequence or chain, all channels are used at the same time unless programmed otherwise. Program sequences use the channel settings stored from memory data. Program sequences primarily perform a battery of pass/fail tests on DUTs.

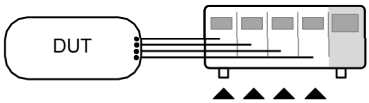


Step	Description	Details
1. Setup	Choose the appropriate load module(s).	Page 42
2. Connection	Connect the terminals to the DUT.	Page 49
3. Channel selection	Select the load channel(s) on the mainframe.	Page 136
4. Channel setup	Refer to the single-channel load tutorial to configure a single channel. Do not activate the load.	Page 115
5. Save channel	Save the configured channel.	Page 257
6. Multiple channels	If you need to configure multiple channels, follow steps 1-5 for any remaining channels.	
7. Program menu	Enter the Program menu.	Page 160
8. Configure the sequence	Configure the program.	
9. Save sequences	Save the program in the FUNC →Program menu.	
10. Program chains	You can create program chains if required.	Page 171

11.	Save Program	Save the chain in the Chain menu.	
12.	Save Setup	Save everything to the internal setup memory.	Page 276
13.	Run	Run the program sequence/chain.	Page 173

Sequences

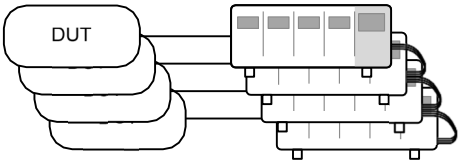
Use sequences to accurately simulate loads. As each sequence is independent, sequences are ideally suited to test multiple output power sources.



Step		Description	Details
1.	Setup	Choose the appropriate load module(s).	Page 42
2.	Connection	Connect the terminals to the DUT.	Page 49
3.	Channel selection	Select a load channel with the mainframe.	Page 136
4.	Channel setup	Create a sequence.	Page 179
5.	Sequence loop	Create a sequence loop if necessary.	Page 181
6.	Multiple channels	If you need to configure multiple channels, follow steps 1-5 for any remaining channels.	
7.	Channel Duration menu	Edit the sequence channel duration information. Ensure that the channels containing sequences are not set to OFF.	Page 184
8.	Trigger settings	Set trigger out and in channels, if appropriate.	
9.	Run	Run the sequence(s)	Page 186

Frame Link

Use frame link connections to connect up to four slave main frames to a master main frame. When using frame link connections, you can perform several operations in parallel under the master unit's control.

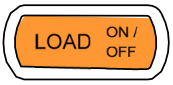
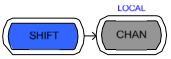


Step		Description	Details
1.	Setup	Connect the mainframes.	Page 61
2.	Configure	Configure the frame CONT to ON for all mainframes.	Page 231

At first, both the master and slaves are independent. You can see FRM (frame master) on the top panel of each mainframe. When a mainframe is connected as a slave unit, the FRM icon changes to FRS (frame slave). The front panel keys are disabled on slave units when in slave mode (FRS).

Slave mode	FRM → FRS
Master/independent	FRM

3.	Program	Refer to the tutorial sections for programming or channel configuration.	Pages 115 and 117

4.	Run	Run the loads. To run the loads, press the LOAD key on the master mainframe. To stop, press again. When the LOAD key is pressed, all loads are active.	
Options			
5.	Load preset memory	Load preset memory on the mainframe and all frame-linked slaves.	Page 306
6.	Load setup memory	Load setup memory on the mainframe and all frame-linked slaves	Page 305
7.	Set slave to indepen-dent	Press shift + CHAN on the slave unit to enable local control on a slave unit.	

FRS → FRM

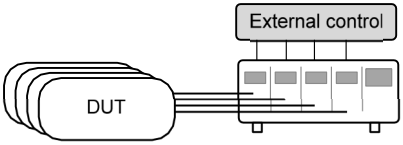
Note

When a load is run or memory is recalled from the master mainframe, the slave unit returns to mainframe control.

Ensure that the same firmware is installed on both master and slave mainframes.

Channel Control

Use the Channel Control connectors on the rear panel to control and monitor the status of up to eight channels. For more information about channel control, refer to page 100.



Step		Description	Details
1.	Setup	Ensure that the load and RMX series mainframe is turned off.	
2.		Choose the appropriate load module(s).	Page 42
3.	Connection	Connect the terminals to the DUT.	Page 49
4.		Connect the channel control connectors on the rear panel.	Page 63 and 313
5.		Turn on the RMX series mainframe and DUT (load).	
6.	Configure	Select the mode* and range* via the front panel.	CC Pages 139 and 140 CV Page 154
7.		Activate channel control for each channel used for external control (that is, set CH CONT to External).	Page 208
8.	Run	Run the load. Turn the load on by either outputting an active low signal to the appropriate channel control connector or pressing the LOAD key on the load module or mainframe**.	Page 63 and 100

9.	Monitor	Use IMON and VMON to monitor the current and voltage of load outputs.	Page 100
10.	End	To turn the load off, output an active high signal to the channel control connector or press the LOAD key on the load module or mainframe**.	

*You cannot configure mode and range via the channel control (CH CONT) interface. You can configure mode and range only via the front panel.

**You cannot always use the LOAD key to turn on/off the load. Refer to page 100 for details.

General Configuration Options

Each channel has several options, which are described below.

Options	Description	Details
1. CC Vrange	Configure the CC voltage range from high or low.	Page 201
2. Von voltage	Configure the Von voltage settings.	Page 203
3. Short settings	Configure the short key settings.	Page 205
4. CH CONT	Turn channel control on/off.	Page 208
5. Independent load	Turn the load module control to dependent (via mainframe) or independent control.	Page 209
6. Delay time	Configure the load delay time for each channel (0-10 seconds).	Page 211
7. Clear all protection	Clear all the protection alarms.	Page 200
8. Display	Adjust display settings.	Page 228
9. Control type	Configure the knob control.	Page 233
10. Slave knob setting	Display measured or set values with the selector knob.	Page 237
11. Alarm	Configure alarm settings.	Page 234
12. Step resolution	Configure the step resolution (CC high and low range, CR high and low range, CV high and low range, and CP high and low range).	Page 213
13. Response	Configure the response setting.	Page 217
14. Sound	Turn the sound on/off for the mainframe IU.	Page 228

OPERATION

The following chapters describe RMX series operation. The sections are divided into small operations. For detailed electronic load operation examples, refer to the tutorial section on page 113.

Local Mode Operation

Local load modules can edit each channel. Depending on the configuration, the mainframe can reflect local changes. In this section, all operations refer to knobs and buttons on the local load module panels, unless stated otherwise.

Selecting a Channel

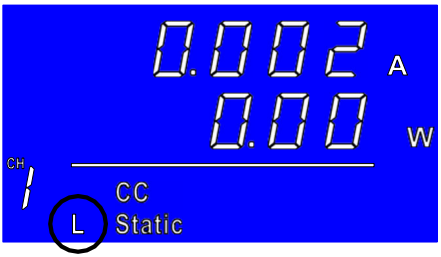
Background	You can select each channel individually by using its load module panel. Changing channels on a load module applies only to dual-channel load modules.
Single Channel Panel Operation	Press any key on a load module to select its channel.
Dual Channel Panel Operation	For dual-channel load modules, press any key on a load module that has the desired channel. Press the R/L key to cycle between the channels on the load module. L or R is displayed on the bottom left hand to indicate which channel (left or right side) is active on the load module.

LR

Note

On single channel modules, pressing the A/B key repeatedly changes the level from A or B when in static mode.

You cannot select channels in Group Unit mode.



Selecting Static/Dynamic

Background

You can switch each load channel individually from static to dynamic using the local load module.

1. Select a channel on the load module. Page 130

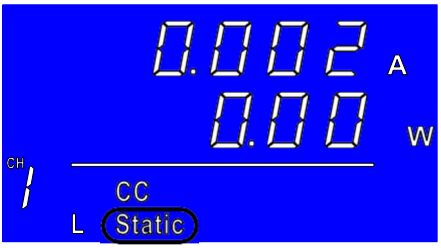
Panel Operation

2. Press the STATIC/DYNA. key to switch from dynamic to static mode and vice versa.

Note

All changes are shown on the display and, depending on the configuration, reflected on the mainframe.

You cannot select static/dynamic in parallel mode.



Turning On the Load

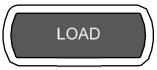
Background

Use local operation to select loads individually to be turned on.

1. Select a channel on the load module. Page 130

Panel Operation

2. Press the LOAD key to turn on the load.

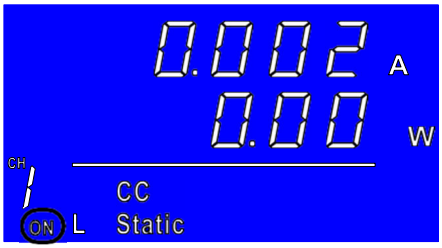


Note

When you activate a channel load, the load on symbol appears under the channel number.

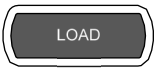
Range

L-ON	Left channel
R-ON	Right channel
ON	Single channel



Turning the load off

3. Press the LOAD key.



Shorting

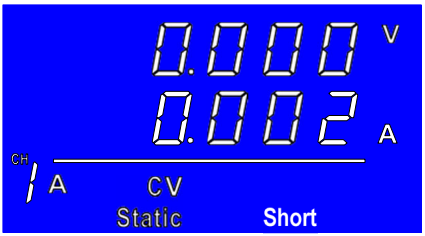
Background

You can set the short key to simulate a short circuit.

1. Configure the short settings. Page 130
2. Select a channel on the load module. Page 130

Panel Operation

3. Press the SHORT key to enter the shorting modes.



Shorting

4. a. Press the SHORT key (toggle mode).

or

b. Hold the SHORT key (hold mode).

Note

You cannot short the load from the local load module in Group Unit mode.

Display Output View

Background

Use the DISPLAY key to switch the display output to different views.

Panel Operation

1. Press the DISPLAY key repeatedly to switch between the different views.

V	Voltage
A	Current
W	Power
S	Load on time

Note

You cannot change the display mode in Group Unit mode.

Editing CC/CR/CV/CP A/B Value

Background

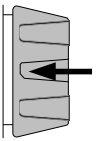
Use the slave knob to edit the A Value or B Value (single-channel load module) when in static mode. The slave knob also can operate in fine or coarse editing mode.

Panel operation

1. Ensure that the mode is in static mode. Page 131

2. Choose a channel (or choose A or B Value) by pressing the R/L or A/B key.

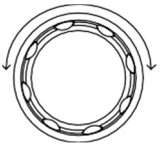
3. Press the slave knob to toggle between fine and coarse editing mode.
SEt_C = coarse mode.
SEt_F = fine mode.



Fine mode example:

Coarse mode example:

4. Turn the slave knob to edit the A/B Value for the selected mode.



Note

When the slave knob is set to Measure, you must press the slave knob first to display the values on the load module display.

You cannot edit the A/B Value using this method in Group Unit mode.

Mainframe Basic Operation

In this section, all operations refer to the knobs and keys on the main configuration panel, unless otherwise stated.

Help Menu

Background

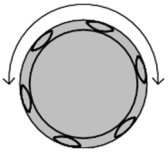
When you press any function key or open a menu, use the HELP key to display a detailed description.

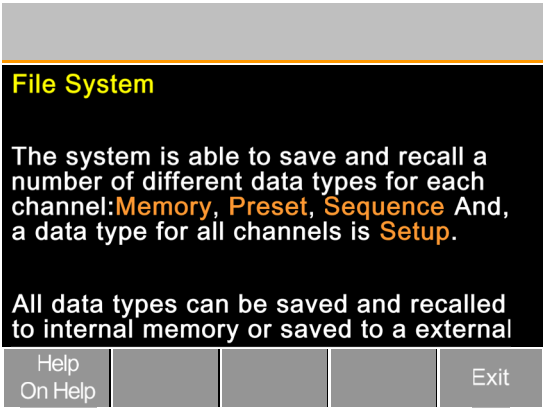
1. Press a function or system key on the front panel or open a menu.

Help Selection

2. Press the HELP key to display the built-in help. A description of the function or menu item appears, as shown below.

3. Use the scroll wheel to scroll down if necessary. A





4. Press F5 to exit.

Channel Selection

Background

There are up to two channels per load module, depending on the model. Use the main display to control each channel individually.

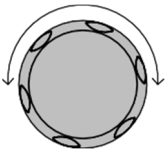
Note

When Group Unit mode is enabled, channel selection is disabled.

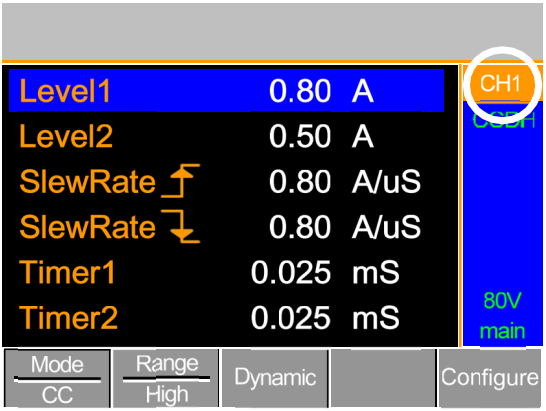
Mainframe Channel Selection

1. Press the CHAN button.

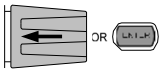
2. Select a channel by turning the variable knob.



The channel selection appears highlighted in orange on the top right of the screen.



3. Press the selector knob or Enter to confirm.

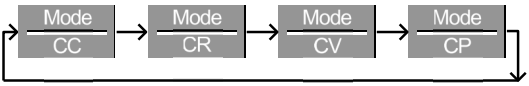


Select CC Mode

Background

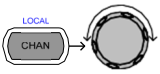
The RMX-400x series loads operate in four different modes: constant current (CC), constant resistance (CR), constant voltage (CV), and constant power (CP).

When a channel is active, use the F1 key to switch between operating modes.



Panel Operation

1. Select a channel using the CHAN button and selector knob.



2. Press F1 repeatedly until CC mode is displayed in the display panel.

Note

Changing the operating mode affects only the current (active) channel. Changes do not affect other channels.

Select CC Range

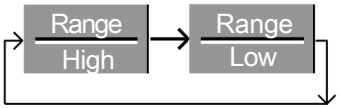
Background

Constant current mode can run in high and low range. Maximum range depends on the load module. Some models are only high range.

Ensure that the menu is in CC mode. Refer to page 139.

Panel Operation

1. Press the F2 (range) key repeatedly until high or low range is selected.



The range is reflected in both the bottom menu system and the Current Operation Channel Status panel.

CC dynamic low	CCDL
CC dynamic high	CCDH
CC static low	CCL
CC static high	CCH

Note

Changing the range affects only the current (active) channel. Changes do not affect other channels.

Not all load modules support dual ranges. If only one range is supported, it is usually high range.

Select CC Dynamic Mode

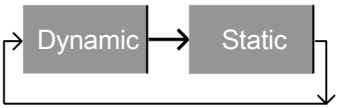
Background

You can set constant current mode to dynamic or static mode. Use dynamic mode to set varying load rates automatically.

Ensure that the menu is in CC mode. Refer to page 139.

Panel Operation

1. Press the F3 key until dynamic range mode is selected.



Note

Changing from static to dynamic mode affects only the current (active) channel.

Editing CC Dynamic Parameters

Background

Dynamic constant current mode has two operating current levels: slew rates and timers.

Slew rates determine the speed at which the load changes from one level to the next.

The timers determine how long the load module/channel stays at level 1 or level 2.

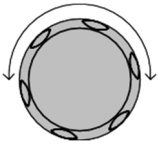
Ensure that the menu is in CC dynamic mode. Refer to page 141.

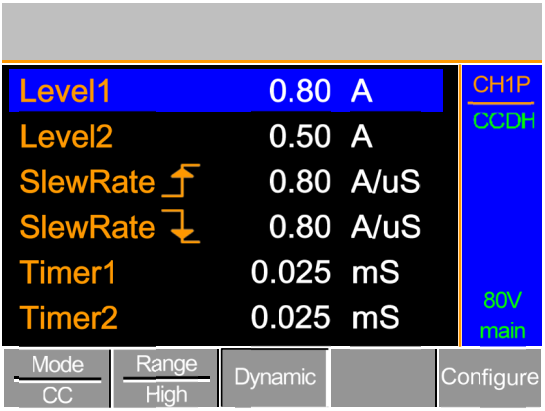
Parameters	Level1	0 - Setting Max A
	Level2	0 - Setting Max A
	SlewRate ↑	Load module dependent
	SlewRate ↓	
	Timer1	0.025-30000.0 ms
	Timer2	0.025-30000.0 ms

Note In Group Unit mode, the Level1 and Level2 range is the combined rating of all units used in Group Unit mode.

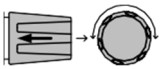
Panel Operation

1. Use the selector knob to highlight Level1.



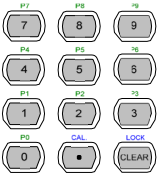


2. Press the selector knob to edit the selected level, then turn to increase or decrease the value*.

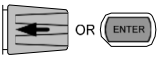


or

Use the number pad to enter a number.



3. Press the selector knob or to confirm the selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

You can set Level1 and Level2 for both high and low range.

*Press Shift to toggle between coarse and fine adjustment when editing the Level1 and Level2 parameters. Refer to page 213 for details.

Select CC Static Mode

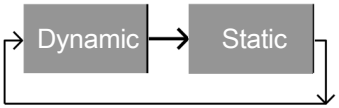
Background

You can set constant current mode to dynamic or static mode. Static mode is for manually varying the load for single-channel load modules or setting a static load on dual-channel modules.

Ensure that the menu is in CC mode. Refer to page 138.

Panel Operation

1. Press the F3 key until static mode is selected.



Note

Changing from static to dynamic mode affects only the current (active) channel.

Editing CC Static Parameters

CC Values

When using a single channel load module, Static Constant Current mode has two operating current values, A and B. If a dual channel load is used, only one current value is available per channel: A Value.

If Group Unit mode is enabled, an additional parameter, Switch Value, is available to switch from A Value to B Value.

Ensure the menu is in CC Static mode. Refer to page 143.

Parameters

A Value 0 - Setting Max A

B Value 0 - Setting Max A

SlewRate ↑ Load module dependent

SlewRate ↓

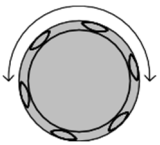
Switch Value A/B (Group Unit mode only)

Note

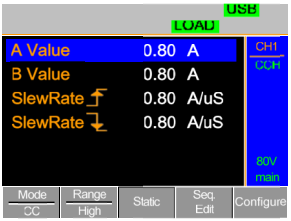
When Group Unit mode is enabled, the A Value and B Value range is the combined rating of all the units used in Group Unit mode. Refer to page 80.

Panel Operation

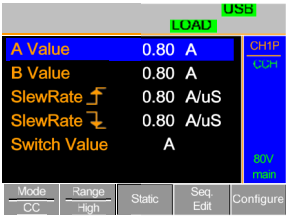
1. Use the Selector knob to highlight A Value.



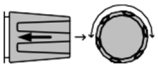
Single Channel Configuration



Group Unit Mode Configuration

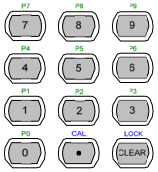


2. Press the Selector knob to edit the selected value, then turn to increase or decrease the value*.

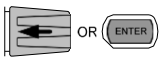


OR

Use the number pad to enter a number.



3. Press the selector knob or Enter to confirm selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

The last value (A Value or B Value) set becomes the active setting. To switch between A Value and B Value, use the A/B keys on the local load module. This is not applicable to Group Unit mode.

For Group Unit mode, use the Switch Value parameter to switch between A and B Value.

You can set A/B Value and rising/falling Slew Rate for both High and Low Range.

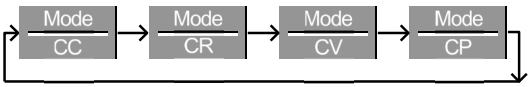
*Press Shift to toggle between coarse and fine adjustment when editing the A Value and B Value parameters. Refer to page 213 for details.

Set to CR Mode

Background

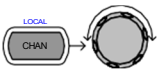
The RMX-400x Series load operates in four different modes, constant current (CC), constant voltage (CV), constant resistance (CR) and constant power (CP). Constant resistance mode maintains a constant resistive load, using variable current and voltage levels.

When a channel is active, use the F1 key to switch between each operating mode.



Panel Operation

1. Press the CHAN button and use the selector knob to select a channel.



2. Press F1 until CR mode is displayed in the display panel.

Note

Changing the operating mode affects only the current (active) channel. Changes do not affect other channels.

Select CR Range

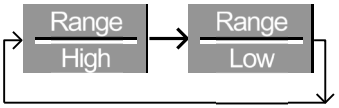
Background

Constant resistance mode can run in high and low range. Range is dependent on the load module.

Ensure that the menu is in CR mode. Refer to page 144.

Panel Operation

1. Press the F2 (Range) key repeatedly until high or low range is selected.



The range is reflected in both the bottom menu system and current operation channel status panel.

CR Static Low	CRL
CR Static High	CRH
CR Dynamic Low	CRDL
CR Dynamic High	CRDH

Note

Changing the range affects only the current (act ive) channel. Changes do not affect other channels.

All resistance values and slew rates depend on range (that is, A Value in low range can be different from A Value in high range).

Select CR Dynamic Mode

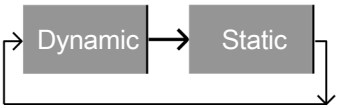
Background

You can set constant resistance mode to dynamic or static mode. Use dynamic mode to set varying load rates automatically.

Ensure that the menu is in CR mode. Refer to page 144.

Panel Operation

1. Press F3 until dynamic range mode is selected.



Note

Changing from static to dynamic mode affects only the current (active) channel.

Editing CR Dynamic Parameters

CR levels

Dynamic constant resistance mode has two operating resistance levels: slew rates and timers.

Slew rates determine the speed at which the load changes from one level to the next.

The timers determine how long the load module/channel stays at level 1 or level 2. Refer to the CR operating description on page 72 for details about slew rates and timers.

Ensure that the menu is in CR dynamic mode.
Refer to page 149.

Parameters

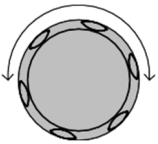
Level1	Minimum- rating Ω
Level2	Minimum- rating Ω
SlewRate ↑	Load module dependent
SlewRate ↓	
Timer1	0.025-30000.0 ms
Timer2	0.025-0000.0 ms

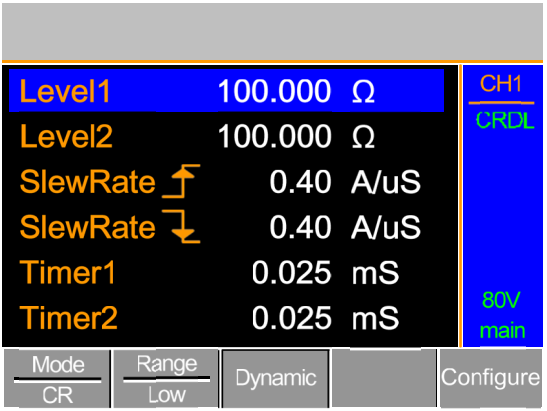
Note

In Group Unit mode, the Level1 and Level2 range is the combined rating of all units used in Group Unit mode.

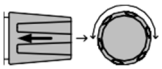
Panel Operation

1. Use the selector knob to highlight Level1.



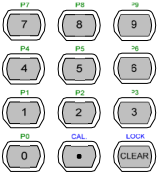


2. Press the selector knob to edit the selected level, then turn to increase or decrease the value*.

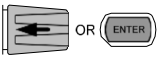


or

Use the number pad to enter a number.



3. Press the selector knob or Enter to confirm the selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

You can set Level1 and Level2 for both high and low range.

*Press Shift to toggle between coarse and fine adjustment when editing the Level1 and Level2 parameters. Refer to page 213 for details.

Select CR Static Mode

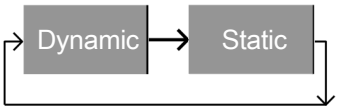
Background

You can set constant resistance mode to dynamic or static mode. Static mode is for manually varying the load for single-channel load modules or setting a static load on dual-channel modules.

Ensure that the menu is in CR mode. Refer to page 144.

Panel Operation

1. Press the F3 key until static mode is selected.



Note

Changing from static to dynamic mode affects the current (active) channel.

Editing CR Static Parameters

Background

Single-channel load modules have two resistance levels, A Value and B Value. Dual-channel load modules have only one resistance level per channel, A Value.

When Group Unit mode is enabled, an additional parameter, switch value, is available to switch from A Value to B Value.

Ensure that the menu is in CR static mode. Refer to page 151.

Parameters

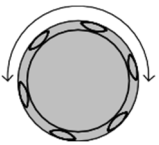
A Value	Setting Min - Rating Ω
B Value	Setting Min - Rating Ω
SlewRate ↑	Load module dependent
SlewRate ↓	
Switch Value	A/B (Group Unit mode only)

Note

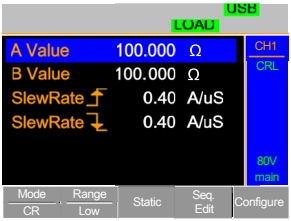
When Group Unit mode is enabled, the A Value and B Value range is the combined rating of all units used in Group Unit mode.

Panel Operation

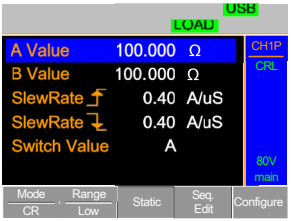
1. Use the selector knob to highlight A Value.



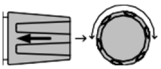
Single Channel Configuration



Group Unit Mode Configuration

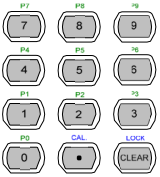


2. Press the selector knob to edit A Value /B Value, then turn to increase or decrease the value*.

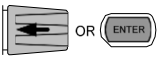


or

Use the number pad to enter a number.



3. Press the selector knob or Enter to confirm the selection.



4. Repeat steps 1-3 for B Value (if applicable) and rising and falling SlewRate.

Note

The last Value (A Value or B Value) you set becomes the active setting. To swap between A Value and B Value, use the A/B keys on the local load module (not applicable to Group Unit mode).

For Group Unit mode, use the switch value parameter to switch between A and B Value.

You can set A/B Value and rising/falling SlewRate for both high and low range.

*Press Shift to toggle between coarse and fine adjustment when editing the A Value and B Value parameters. Refer to page 213 for details.

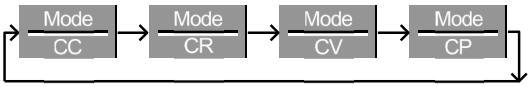
Select CV Mode

Background

The RMX-400x Series electronic load operates in four different modes, constant current (CC), constant resistance (CR), constant voltage (CV), and constant power (CP).

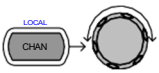
You cannot use CV mode with the Group Unit mode.

When a channel is active, you can use the F1 key to switch between each operating mode.



Panel Operation

1. Press the CHAN button and use the selector knob to select a channel.



2. Press F1 until CV mode is displayed in the display panel.

Mode	Range	Response		Configure
CV	High	Slow		

Changing the operating mode affects only the current (active) channel. Changes do not affect other channels.

CV mode only operates in high range.

Editing CV Parameters

Background

Constant voltage mode can be set to a maximum limit (Curr Limit). Using the current limit enables limiting the current draw.

When using CV mode on single-channel load modules, you can set two voltage levels, A Value and B Value. On a dual-channel load module, you can set only one voltage level per channel: A Value.

Ensure that the menu is in CV mode. Refer to page 154.

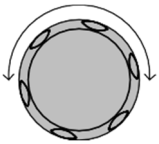
Mode	Range	Response		Configure
CV	High	Slow		

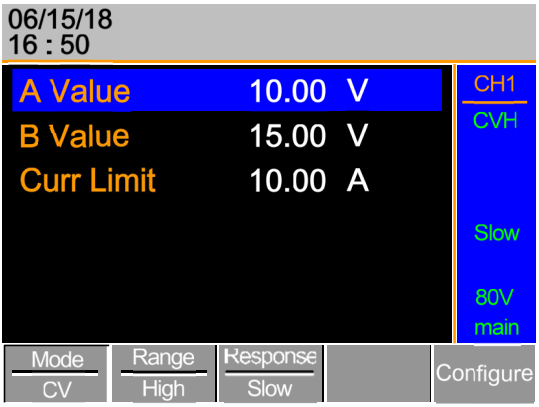
Parameters

A Value	0 - Setting Max V
B Value	0 - Setting Max V
Curr Limit	Load module dependent

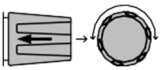
Panel Operation

1. Use the selector knob to highlight A Value.



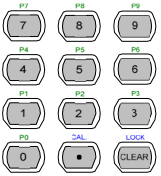


2. Press the selector knob to edit the selected value, then turn to increase or decrease the value*.

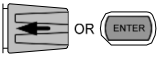


or

Use the number pad to enter a number.



3. Press the selector knob or Enter to confirm the selection.



4. Repeat steps 1-3 for the remaining parameters.

Note

The last value (A Value or B Value) you set becomes the active setting. To swap between A Value and B Value, use the A/B keys on the local load module.

When setting the current limit, ensure that the current limit is within the test device's limits.

You can set A/B Value for both High and Low range.

*Press Shift to toggle between coarse and fine adjustment when editing the A Value and B Value parameters. Refer to page 213 for details.

Select CV Range

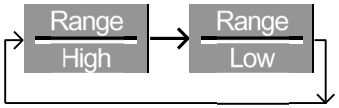
Background

Constant Voltage mode can run in high and low range. Range depends on the load module.

Ensure that the menu is in CV Mode. Refer to page 154.

Panel Operation

1. Press the F2 (Range) key repeatedly until High or Low range is selected.



The range is reflected in both the bottom menu system and the Current Operation Channel Status panel.

CV High Range	CVH
CV Low Range	CVL

Note

Changing the range affects only the current (active) channel. Changes do not affect other channels.

Select CV Response Speed

Background

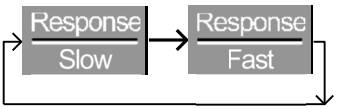
Constant voltage mode has fast and slow response speeds. Quick current changes can induce line voltage, making it more difficult for the RMX-400x series load to maintain a constant current. In these types of conditions, slow response speed is recommended.

Maximum current range depends on the load module type.

Ensure that the menu is in CV mode. Refer to page 154.

Panel Operation

1. Press F3 (response) to switch between fast and slow response speeds.



Response speed settings are reflected in the Current Operation Channel Status panel.

CV slow response	Slow
CV fast response	Fast

Note

Changing the response speed affects only the current (active) channel. Changes do not affect other channels.

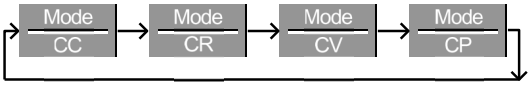
Select CP Mode

Background

The RMX-400x Series electronic load operates in four different modes, constant current (CC), constant resistance (CR), constant voltage (CV), and constant power (CP).

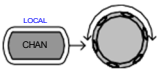
You cannot use CP mode with the dedicated Group Unit mode.

When a channel is active, you can use the F1 key to switch between each operating mode.



Panel Operation

1. Press the CHAN button and use the selector knob to select a channel.



2. Press F1 until CP mode is displayed in the display panel.

Note

Changing the operating mode affects only the current (active) channel. Changes do not affect other channels.

Editing CP Parameters

Background

You can set constant power mode to have a maximum limit (Curr Limit). Using the current limit enables limiting the current draw.

When using CP mode on a single-channel load module, you can configure two power levels, A Value and B Value. On a dual-channel load module, you can configure only one power level per channel: A Value.

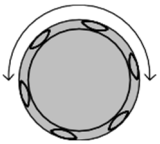
Ensure that the menu is in CP mode. Refer to page 154.

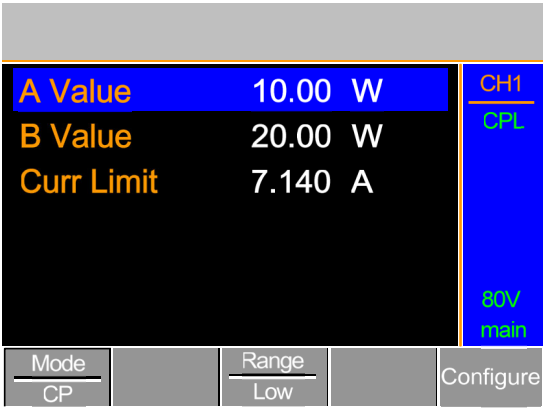
Parameters

A Value	0 - Setting Max W
B Value	0 - Setting Max W
Curr Limit	Load module dependent

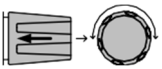
Panel Operation

1. Use the selector knob to highlight A Value.



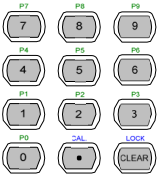


2. Press the selector knob to edit the selected value, then turn to increase or decrease the value*.



or

Use the number pad to enter a number.



3. Press the selector knob or Enter to confirm the selection.

4. Repeat steps 1-3 for the remaining parameters.

Note

The last Value (A Value or B Value) you set becomes the active setting. To swap between A Value and B Value, use the A/B keys on the local load module.

You can set A/B Value for both High and Low range.

When setting the current limit, ensure that the current limit is within the test device's limits.

*Press Shift to toggle between coarse and fine adjustment when editing the A Value and B Value parameters. Refer to page 213 for details.

Select CP Range

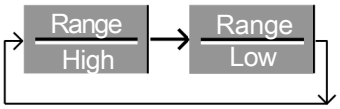
Background

Constant Power mode can run in High and Low range. The maximum range depends on the load module. Some models are only High range.

Ensure that the menu is in CP Mode. Refer to page 154.

Panel Operation

2. Press the F2 (Range) key repeatedly until high or low range is selected.



The range is reflected in both the bottom menu system and the Current Operation Channel Status panel.

CP High Range	CPH
CV Low Range	CPL

Note

Changing the range affects only the current (active) channel. Changes do not affect other channels.

Not all load modules support dual ranges. If a module supports only one range, it is usually high range.

Creating a Program Sequence

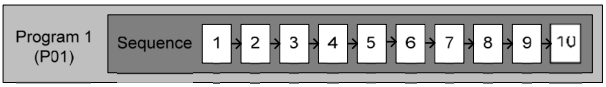
Background

The RMX-400x Series has 12 programs and 10 sequences to each program, for 120 configurations.

Each sequence in each program uses the settings saved from memory data (Memory MXXX). memory data contains settings such as the mode and range for each channel. Different sequences can use the same memory data repeatedly. Each sequence loads all channels at the same time, unless programmed otherwise.

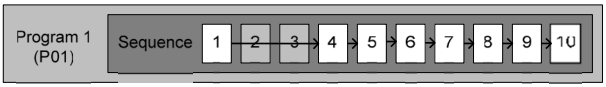
Sequence1	
CH1 M001	Run
CH2 M001	On-Time
CH3 M001	Off-Time
CH4 M001	Short-Time
CH5 M001	P/F-Time
CH6 M001	Short CH1
CH7 M001	~
CH8 M001	Short CH8

Sequences run sequentially to create a program. There are 10 sequences in each program.



If you want fewer than 10 sequences for a program, you can skip (not run) any additional Sequences.

In the following program, sequences 2 and 3 are skipped.



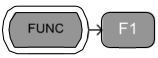
Parameters		
	Memory	M001-M120
	Run	Skip-auto-manual
	On-Time	0.1-60.0 seconds
	Off-Time	Off – 0.1-60.0 seconds
	P/F Time	Off – 0.1 (On-Time+Off-Time)-0.1
	Short-Time	Off – 0.1-On-Time
	Short Ch	Off – 1-8 (CH1-CH8)

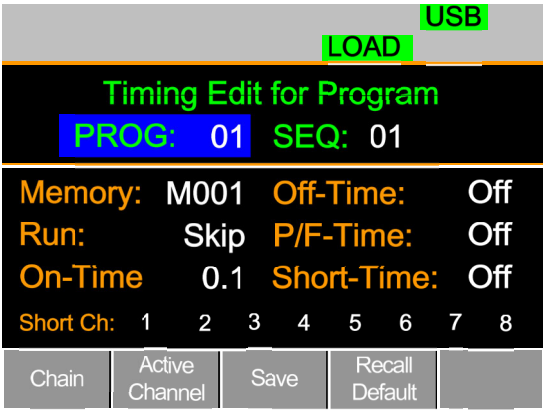
Note

Before you create a program, you first must preconfigure the settings for each sequence for every channel in the program and save them into channel memory (MXXX). Refer to the Save/Recall chapter for further details.

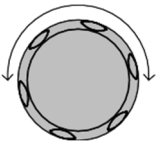
Sequence Settings

1. Press the FUNC key and then F1 (Program) to access the Program menu.





2. Use the selector knob to highlight PROG:.

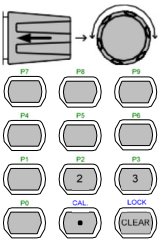


3. Press the selector knob to edit PROG:, then turn to select the program number.

   or

   Use the number pad to enter a program number.

   Program: 01-12

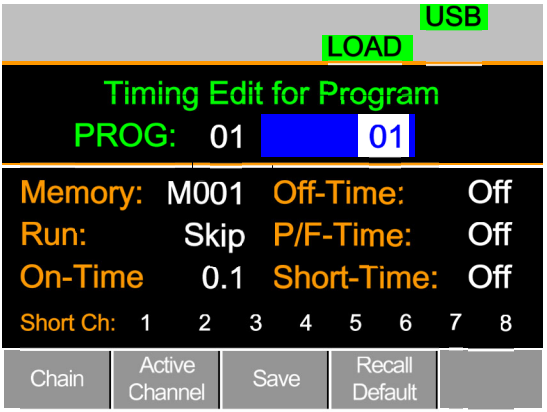


4. Press Enter or the selector knob to confirm.

Repeat steps 2-4 to choose the sequence number (SEQ:).

Sequence: 01-10

5. As sequences are executed sequentially, start at SEQ: 01.



6. Repeat steps 2-4 to configure the following for the current program sequence:

Memory: M001-M120

Choose the memory data for the sequence. M001-M0120

Run: Skip – Auto - Manual

Choose whether to run the sequence in the program automatically, skip the sequence, or manually start the sequence.

On-Time: 0.1-60.0 seconds

Determines how long the sequence runs (seconds).

Off-Time: Off – 0.1-60.0 seconds

Sets how long the sequence will stay off (in seconds) between each sequence. Assuming short time is not set to OFF, Off-Time always runs after On-Time.

Short Time: Off – 0.1-On-Time (seconds)

Determines how long a short circuit lasts (seconds). However, the shorting time cannot be longer than the On-Time. Short Time starts at the same time as On-time.

P/F Time: Off – 0.1 - (On-Time+Off-Time)-0.1 (seconds)

You can set the Pass(P)/Fail(F) Delay Time to 0.1 seconds less than the total test time. The total test time is defined as:

On-Time + Off-Time (seconds)

If Go/NoGo is turned on, but the pass fail time is off, Go/NoGo test continues, but there will not be a specified pass/fail time window.

Short Channel: Off – 1-8 (CH1-CH8)

You can set each channel individually to simulate a short circuit (CH1-8) or can have shorting disabled (Off). When you set Short Channel to Off, the channel ignores the execution of Short-Time.

7. Repeat the above steps for all 10 sequences for the same (current) program.

Save Sequence

8. Press F3 (Save) to save all sequence data for all the program.


Note

The program data is not yet saved into setup memory. To save the program to setup memory, refer to page 274.

Recall Default

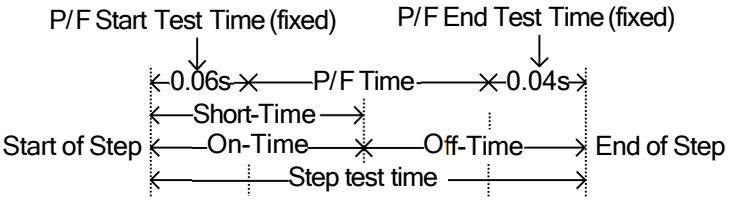
9. To recall the default program settings, press F4.

Note

If you recall the default, all data is lost. This does not include the internal setup memory. To see the default sett ings, refer to page 331.

Timing Diagram for Single Step

Below is a timing diagram of a single step in a program.



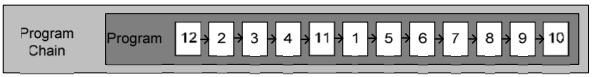
Program Chains

Background

On the RMX-400x, there are up to 12 different programs containing 10 sequences.

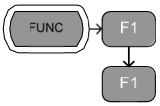
If 10 sequences in a program sequence are not enough for testing, the RMX-400x Series can chain programs, effectively making a larger program sequence.

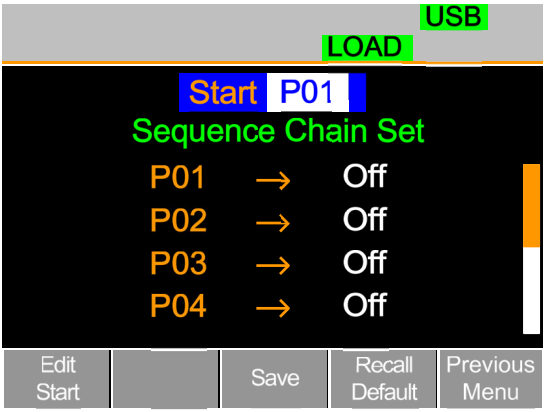
Unlike program sequences, program chains do not need to be run in numerical order. You can chain up to 12 program sequences.



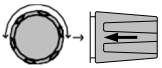
Panel Operation

1. Create one or more program sequences. Page 160
2. If you created program sequences in a different session, ensure that you have loaded the programs from setup memory. Page 274
3. Press the FUNC key, then program (F1), followed by chain (F1).

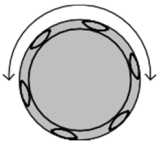




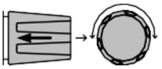
4. Press F1 (Edit Start) and use the selector knob to edit Start and confirm which program sequence (PXX) starts the program chain. You can use any program (P01-P12) to start a program chain.



5. Use the selector knob to scroll down to P01 (program 1).



6. Use the selector knob to choose the program that will execute after P01 (P02-P12).



or

Select (Off) to end the program chain after (P01).

or

Select (P01) to execute after P01. This creates a continuously looping program chain.

P01 → Off – P01-P12

7. Repeat the above procedure for P02-P12 to complete the program chain.

The program chain ends at the first program (PXX) followed by Off. You can create continuously looping program chains.

Save Program Chain

8. Press F3 (Save) to save the program chain.

Note

The program chain data is not yet saved into setup memory. To save the program chain to setup memory, refer to page 274.

Recall Default

9. To recall the default program chain, press F4.

Note

If the default is recalled, Start reverts to P01 and all program sequences are set to Off.

Previous Menu

10. Press F5 (Previous Menu) to return the sequence menu.

Running a Program

Background

Once you create a program chain/program sequence, you can execute it. As program sequences apply to all the channels, you can program any channels that do not need to be active (load off) in the Active Channel menu. At default, all channels are set to (load) Off.

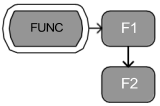
EXT is shown next to any channels set to external channel control.

Panel Operation

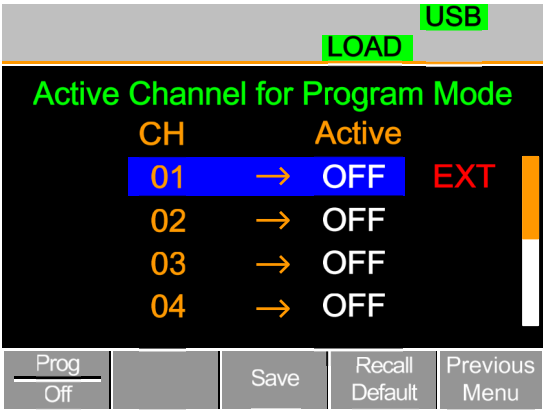
1. Create one or more program sequences. Page 160.

2. Create a program chain. Page 171.

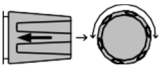
3. Press the FUNC key, Program (F1), and Active Channel (F2).



Channel 1 (CH01) is highlighted. Note that CH1 has CH CONT set to External.

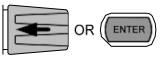


4. Edit the channel using the selector knob.



CH 01-08: ON (activate channel) – OFF (not activated)

5. Press Enter or the selector knob to confirm the selection.



6. If needed, repeat steps 4-5 for the remaining channels.

Note

If all channels are Active OFF, you cannot run a program because there are no active channels.

Save Program

7. To save, press F3.

Recall Default

8. To recall default settings, press F4.

Note

If you recall the default, all channels revert to Active OFF.

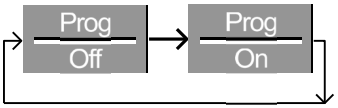
Previous Menu

9. Press F5 (Previous Menu) to return to the Sequence menu.

Turn Program On/Off

10. Press F1 (Prog) to turn the current program on or off.

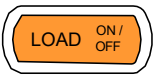
Pressing F1 will cycle from program on to off.



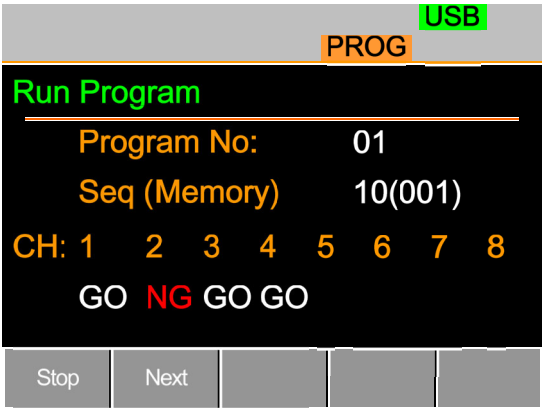
11. PROG appear on the mainframe status panel when the program is turned on.

Run Program

12. Press the load key on the mainframe to start the program.



13. The Run Program screen appears, and the PROG icon turns orange.

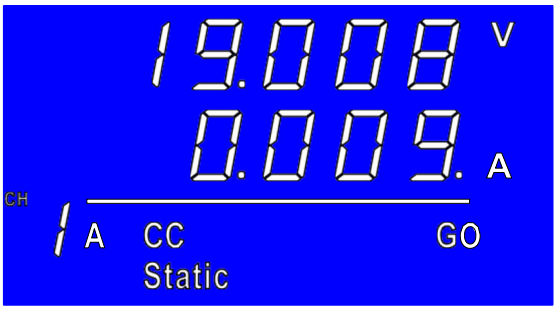


As each sequence or program is completed, the screen updates to display the active sequence/program. Notice that if you have set up a channel with Go/NoGo limits, a pass (GO) or fail (NG) is displayed on the main display and the local load module display.

The program icon becomes orange when a program has started.

Note

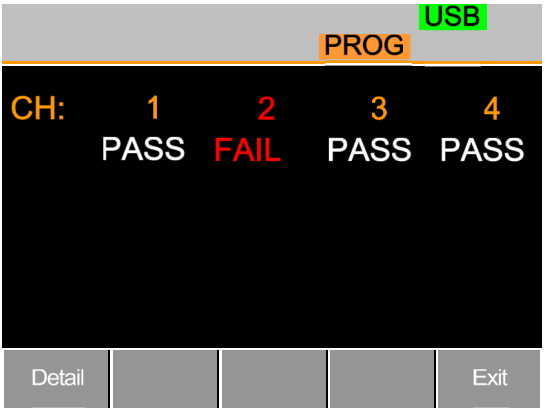
If the Active is OFF for all the channels, *No Active Channel* is displayed instead of channel numbers.



Each active load module displays the output as the program runs.

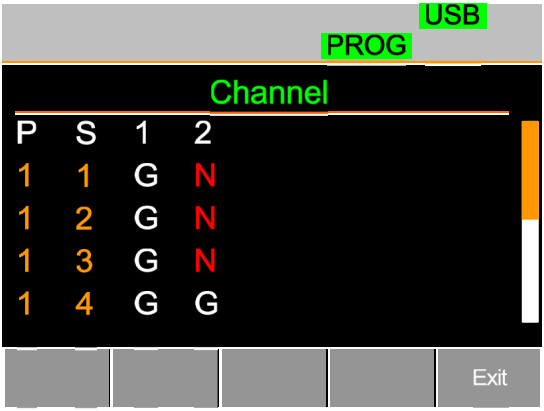
14. If you configured Run to manual in any program sequence, press F2 (Next) to continue the program sequence; otherwise, the program continues automatically.

15. Press F1 (Stop) at any time to abort the program when it is running.



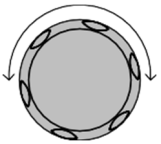
When the program finishes, the physical channels that have run are displayed, and a PASS or FAIL is displayed if you have set Go/NoGo testing.

16. When the program finishes, press F1 to see any result details.



The program (P) and sequence (S) numbers for the program are displayed on the left side, and the Go/NoGo (G/N) results are displayed on the right side for each channel in the program.

Use the selector knob to scroll down to view the rest of the list if necessary.



17. Press F5 to exit at any time.

Upon exiting, the previous menu before running the program loads.

Edit Sequence

Background

You can configure the sequence function to create a unique load profile to accurately simulate loads in real time for single or multiple loads. You can use sequence with only CC static or CR static modes. For details, refer to page 85.

Each sequence is composed of several points with customizable current/resistance, slew rate, and duration times. You can loop each sequence an infinite amount of times. Sequences are applicable for only CC (Static) and CR (Static) modes.

Note

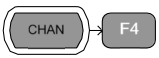
Do not confuse the sequence funct ion with program sequences. You cannot use program sequences with the sequence funct ion and vice versa.

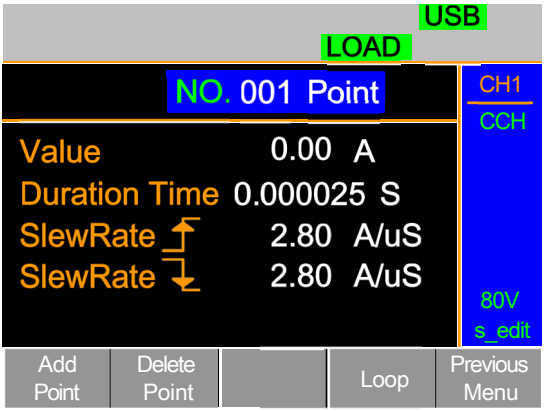
Parameters

Value	Setting Min-Setting Max Ω/A
SlewRate ↑	Load module dependent
SlewRate ↓	
Duration Time	0.000025-60,000 seconds

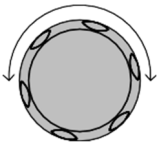
Panel Operation

1. Choose a channel and mode. Pages 136 and 139
2. Press the CHAN key, F4 (Seq. Edit) to enter the Sequence Edit menu.

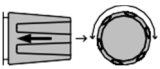




3. Use the selector knob to highlight Value.

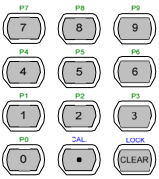


4. Press the selector knob to edit the value, then turn to increase or decrease the value.

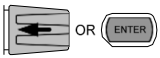


or

5. Use the number pad to enter a number.



6. Press the selector knob or Enter to confirm the selection.



7. Repeat for rising and falling slew rate and duration time.

Add Point

8. To add an extra point after the current point, press Add Point (F1).

Range 001-120

Note

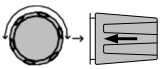
Add Point inserts a new point directly after the current point. The current/resistance value of the inserted point is the average of the point before and after. All other sett ings remain unchanged.

Delete Point

9. To delete the current point, press Delete Point (F2).

Edit Previous Point

10. Use the selector knob to change the current point number.



Note

You can change the point number only if you already have added more points.

Save Sequence

11. Press Save (F3) to save the sequence.

Note

The save icon appears only after you have made a change in the menu.

Create Sequence Loop

Background

You can loop sequences can be looped many times. You can start the loops at any point in the sequence. The start of loop function determines which point starts each repeating loop.

The On End of Seq. function holds the load current (of the selected sequence) to a designated value until all other sequences finish running.

CC Vrange sets the range in CC mode for sequences.

Refer to page 85 for more details.

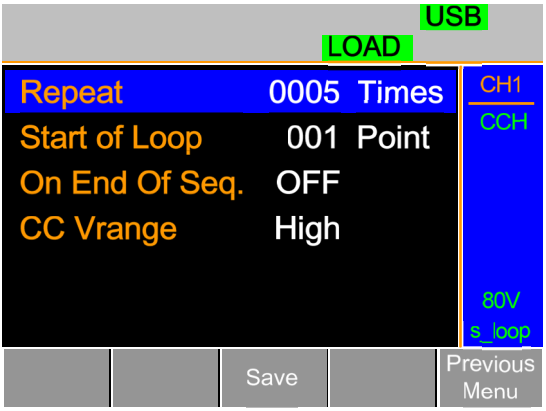
Ensure that the menu is in the Seq. Edit menu and that you have created a sequence. Refer to page 179.

Parameters

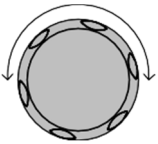
Repeat	1-9999/Infinity (0)
Start of Loop	001-last point
On End of Seq.	OFF/Setting Min-Setting Max
CC Vrange (CC mode only)	High/low

Panel Operation

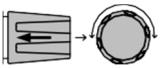
1. Press Loop (F4) to enter the Loop menu.



2. Use the selector knob to highlight Repeat.



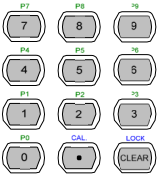
3. Press the selector knob to edit Repeat, then turn to increase or decrease the value.



or

4. Use the number pad to enter a number.

   Select 0 to choose infinity.



5. Press the selector knob or Enter to confirm the selection.

6. Repeat for the remaining parameters.

Save Loop

7. Press Save (F3) to save the loop.

Channel Duration Time Settings

Background

Each sequence can have the timing duration data of another sequence. For example, CH1's sequence can import the timing duration settings of CH2's sequence.

This is useful to quickly compare two different loads to the same timing characteristics. Refer to page 85 for more details.

You can turn off each channel's sequence by configuring the channel setting to OFF. If a channel uses the same channel number, (for example, CH 01 → 01), the duration time settings are not altered for that channel.

At least one channel must output a Trigger Sequence Signal via PIN4 of the first frame link connector (master) if a sequence is run. For more details, refer to page 85.

The Trigger In signal starts any sequence with TRIG set to IN. The trigger input signal is input via PIN4 of the second frame link connector (slave).

For more details, refer to page 85.

Any channels with channel control (CH CONT) set to external are shown on the right side as EXT. Refer to page 208 for details of setting channel control.

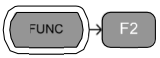
Parameter

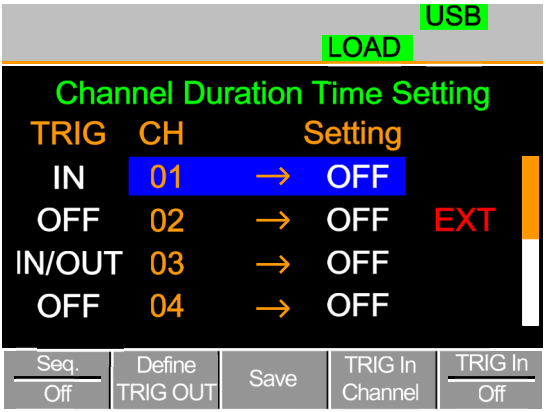
CH 01-08 Setting	OFF-maximum channels
CH 01-08 TRIG	IN, OUT, IN/OUT, OFF

Ensure that you have created and saved at least one sequence. Refer to page 179.

Panel Operation

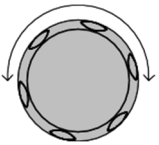
1. Press FUNC, then Sequence (F2) to enter the Channel Duration Time menu.



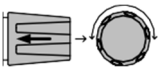


Note that CH3 is set to TRIG OUT, while CH1 and CH3 are set to TRIG IN. CH2 has no trigger settings and has CH CONT set to external.

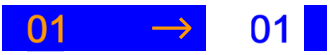
2. Use the selector knob to highlight a channel.



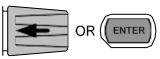
3. Press the selector knob to edit the channel, and then turn to choose which channel's duration time setting to import.



Range	Ch 01-08 / OFF



4. Press the selector knob or Enter to confirm the selection.



Trigger Out Channel

5. Press Define TRIG OUT (F2) if you want the currently selected channel to output the Trigger sequence signal.

You must set one channel as the TRIG OUT channel.

Trigger In Channel

6. Press TRIG In Channel (F4) to allow the current sequence to be triggered with the Input trigger.

Trigger In On/Off

7. To turn the Input trigger source on, press Trig In (F5).

8. Repeat the previous steps for any other remaining channels.

Save Settings

9. Press Save (F3) to save the settings.

Run Sequence

Background

Like programs, you must turn on sequences before you can run them.

When running a Sequence, the front panel function keys, number pad, operation keys, and selector knob are disabled for the specific channel(s). The load module panel is also disabled (except the display key) for the specific channel.

You still can edit channels that do not have a sequence by changing channels via the CHAN key or by using the local load module.

Ensure that you have created and saved at least one sequence.

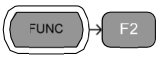
Page 179

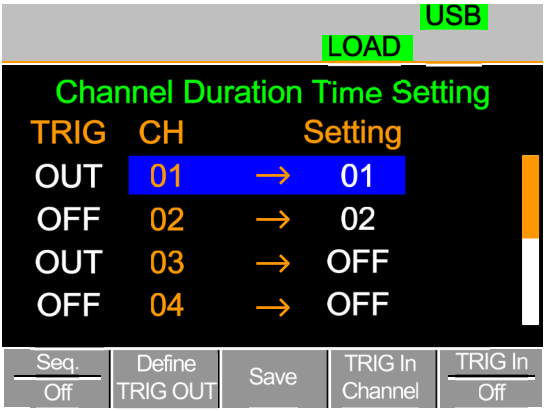
Ensure that you also have configured the channel duration time settings and that no sequence (CH01-08) that you want to run is set to off.

Page 184

Panel Operation

1. Press FUNC, then Sequence (F2) to enter the Channel Duration Time Setting menu.



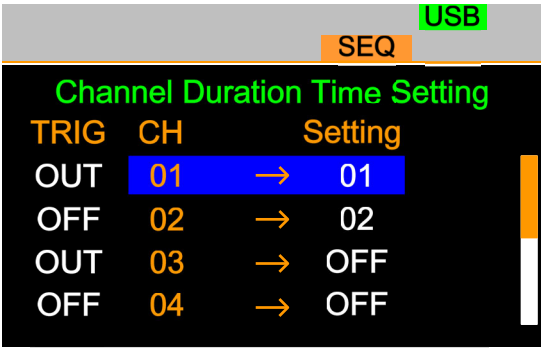


2. Press Seq. (F1) to turn on the sequences.

3. SEQ is displayed on the Mainframe Status panel.

4. Press the LOAD key to run all sequences. If a channel has TRIG set to IN, that channel now waits for a trigger before running.

5. Run SEQ Mode is displayed on the bottom of the display for the specific channels. On the Mainframe Status panel, SEQ turns orange.



Stop the load	6.	Press the LOAD key again or wait for the sequence (if not infinitely looped) to end/stop the load.	
Turn off SEQ	7.	Press Seq. (F1) to turn off the sequence(s) when the load is not running.	

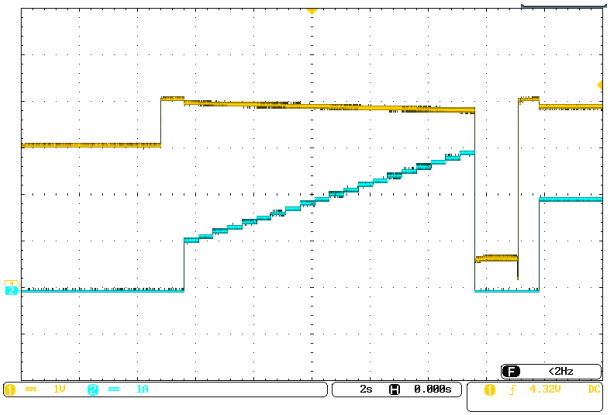
Note

All UI keys/knobs are disabled for all channels that run a sequence, except the funct ion keys and R/L keys.

OCP Test Automation

Background

The OCP test function creates an automatic test to test the OCP of power supply products.



Parameters

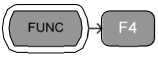
Active Channel	Applies the setting to the load channel.
Range	High (CC mode high) or low (CC mode low)
Start Current (Start C)	Starting current value for the test.
End Current (End C)	The current value that ends the test. The value must be higher than the OCP value of the DUT you are testing. This parameter is a fail-safe if the DUT over current protection fails.
Step Current (Step_C)	Sets the step resolution of the current.

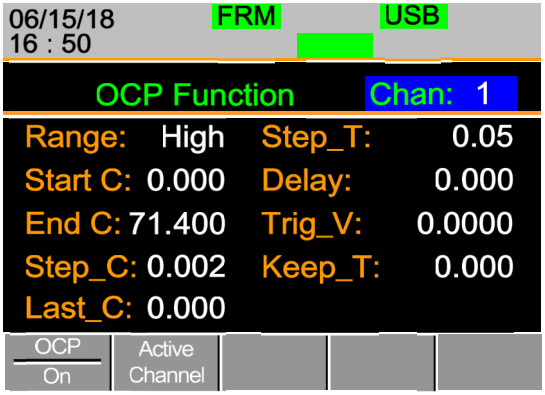
	Last Current (Last_C)	Sets the final current value after OCP has tripped. This is the steady-state current draw after the OCP has tripped.
	Step Time (Step_T)	Sets each step's execution time. (50 ms-1600 s)
	Delay Time (Delay)	The OCP testing delay time. Sets the how long to delay starting the test after you press the Load On key. (0-160 s)
	Trig Voltage (Trig_V)	Sets the voltage trigger level needed to see whether the power supply OCP has been triggered. When the power supply OCP has triggered, its voltage output drops. Use the voltage trigger level to test to see whether the voltage output has been dropped.
	Keep Time (Keep_T)	Set how long to enter the Last Current after detecting the OCP. (0-160 s)

Note Use this mode only under CC mode.

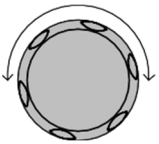
Panel Operation

1. Press the FUNC key F4 (OCP) to enter the OCP Test Automation menu.

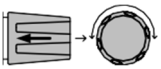




2. Use the selector knob to highlight the parameter you want to edit.

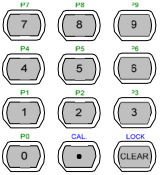


3. Press the selector knob to edit the parameter, then turn to increase or decrease the value.



or

Use the number pad to enter a number.

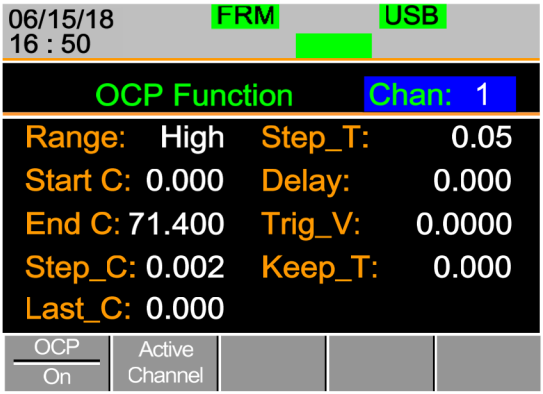


4. Press the selector knob or Enter to confirm the selection.

5. Repeat steps 2-4 for all parameters.

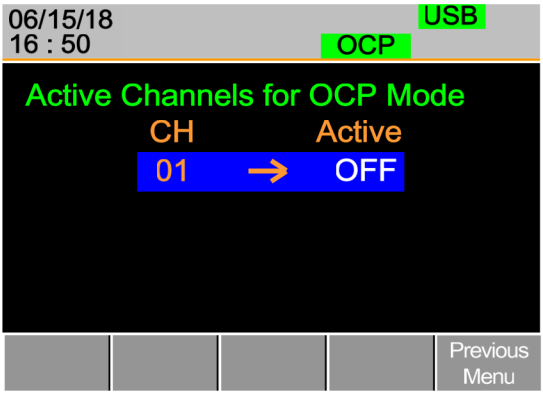
Save the OCP Test Automation Settings

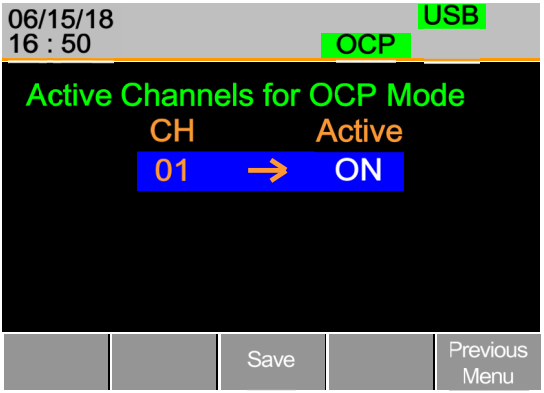
6. Press Save (F3) to save the OCP Test Automation settings.



Select Active Channel

7. To select the load channels for the test, press Active Channel (F2).





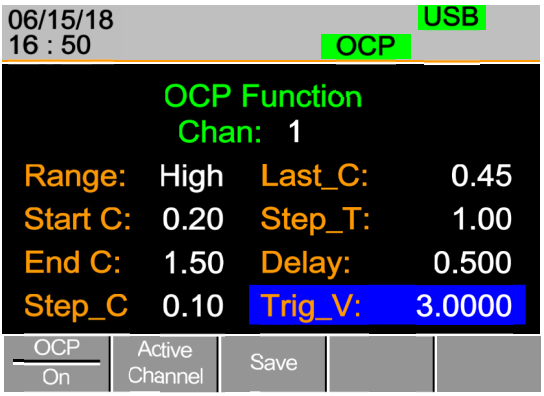
8. Use the selector knob to Enter key to turn the Active value to on.

Save the OCP Test Automation Channel

9. Press Save (F3) to save the OCP test automation channel.

10. Press Previous Menu (F5) to return to the OCP Test Automation menu.

11. Press OCP (F1) to turn OCP to on.



Save the OCP Test Automation Parameters

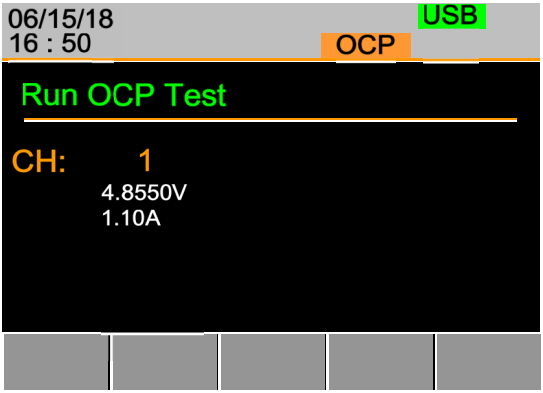
12. Press Save (F3) to save the OCP test automation parameters.

Start the OCP Test Automation

13. Press the Load key to start OCP Test Automation.

Test Results

14. Review the test results.



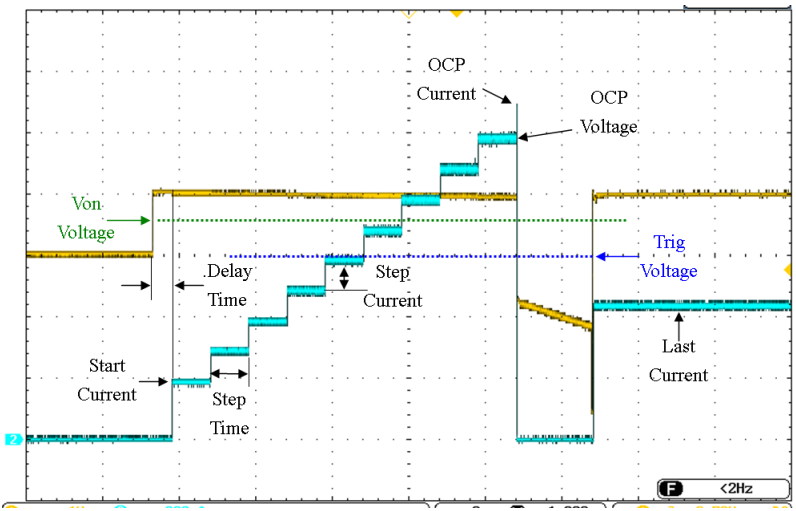
Voltage reading: The DUT voltage before the OCP was triggered.

Current reading: The DUT current before the OCP was triggered.

Note

In addition to the setting the OCP test parameters as described above, you also must set the Von voltage settings according to the DUT output characteristics.

The following image shows an OCP Test Automation example using actual current and voltage waveforms.



Channel Configuration

This chapter describes the configuration options for individual channels. Any configuration settings you change apply to only the current channel; other channels are not changed.

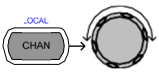
Accessing the Configuration Menu

Background

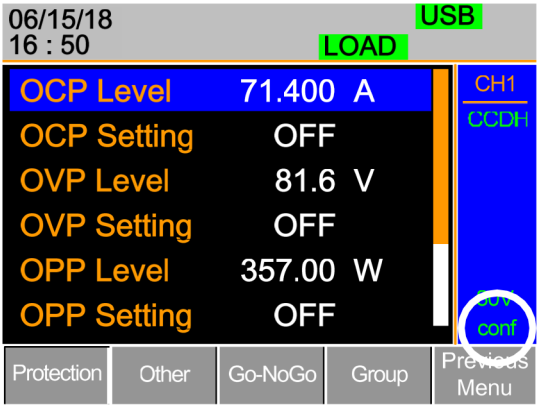
Use the configuration menu to access instrument settings and properties and set the protection levels for each channel.

Panel Operation

1. Select the channel to be configured by pressing the CHAN key and using the selector knob.



2. Press the F5 (Configure) key to enter the configuration (Protection) menu.



Setting OCP/OVP/OPP/UVP

Background

Use over protection to set the voltage, current, or power limit. In the event that the current, voltage, or power exceeds the over protection settings, the load module display shows an error message and beeps an alarm.

When tripped, under voltage protection (UVP) will turn off the load. UVP trips when the load voltage drops below a set limit.

The protection modes are active only when the protection settings are set to on (XXP Setting -On).

You can set all protection settings to 2% higher than specification rating.

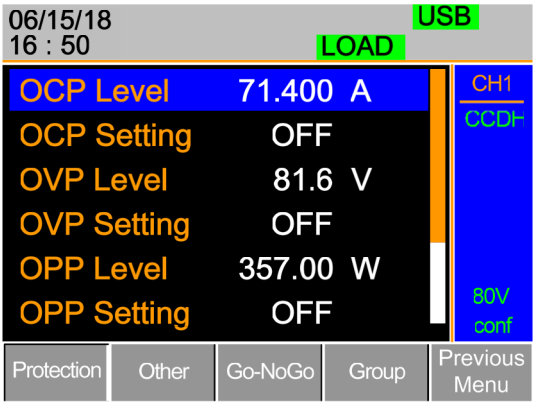
Parameters

OCP Level	1.25% Rating A-102% Rating A
OCP Setting	ON/OFF/Clear
OVP Level	1.25% Rating V-102% Rating V (0.5% Rating V-102% Rating V for RMX-4006)
OVP Setting	ON/OFF/Clear
OPP Level	RMX-4003 : 1 W-102 W RMX-4004 (L) : 0.9 W-30.6 W RMX-4004 (R) : 1.25 W-255 W RMX-4005 : 1.75 W-357 W RMX-4006 : 1.75 W-357 W
OPP Setting	ON/OFF/Clear
UVP Level	OFF—current using operating voltage range of slave module.
UVP Setting	Clear

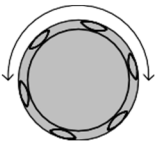
Protection Clear All

Panel Operation

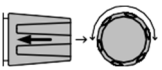
Ensure that you are in the configuration menu. Refer to page 196.



1. Use the selector knob to highlight OCP Level.

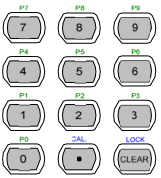


2. Press the selector knob to edit the selected level, then turn to increase or decrease the value.

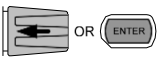


or

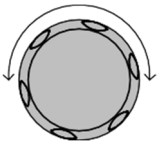
3. Use the number pad to enter a number.



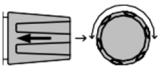
4. Press the selector knob or Enter to confirm the selection.



5. Use the selector knob to highlight OCP Setting.



6. Use the selector knob to turn ON, turn OFF, or CLEAR the OCP Setting.



7. Repeat steps 1-5 for:
   OCP Level
   OVP Level
   OVP Setting
   OPP Level
   OPP Setting
   UVP Level
   UVP Setting

Clearing an Alarm

When any protection setting is tripped, Alarm displays on the Mainframe Status Panel, and an alarm tone sounds by default.

On the local load module, the tripped protection setting is displayed.

OCP
OVP
REV*
OPP
OTP*
CPP*
UVP

8. Turn the load off by pressing the Load key, and turn off the load input.

9. Change the XXP Setting to Clear to clear the alarm.

Note

*You cannot clear REV, OTP, and CPP using this method. You must use the Protection Clear function instead. Refer to page 200.

Refer to pages 67 and 318 to output alarms via the Go/NoGo output terminal.

The configuration settings apply to only the current channel.

Protection Clear

Background

When any protection circuit tripped, use the Protection Clear function to reset the alarms.

Alarm will display on the Mainframe Status Panel, and an alarm tone sounds by default when any protection setting is tripped.

On the local load module, the tripped protection setting is displayed.

Example: Reverse Voltage Protection

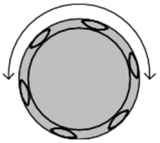
OCP
OVP
REV
OPP
OTP
CPP
UVP

Panel Operation

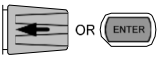
Ensure that the menu is in the configuration menu. Refer to page 196.

1. Turn the load off by pressing the load key if necessary.

2. Use the selector knob to scroll down to Protection Clear.



3. Press the selector knob or Enter to clear all.



Note

The configuration settings apply to only the current channel. Other channels are not affected.

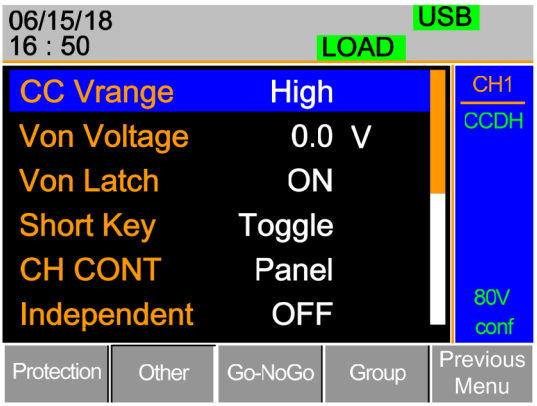
Setting the CC Voltage Range

Background	You can set the Constant Current Voltage range to high or low.
Parameter	CC Vrange High/Low

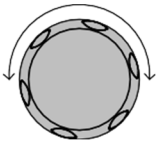
Panel Operation

Ensure that the menu is in the configuration menu. Refer to page 196.

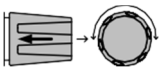
1. Press the F2 (Other) key to enter the Other menu.



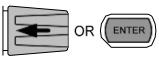
2. Use the selector knob to highlight CC Vrange.



3. Press the selector knob to edit CC Vrange, then turn to increase or decrease the range.



4. Press the selector knob or Enter to confirm the selection.



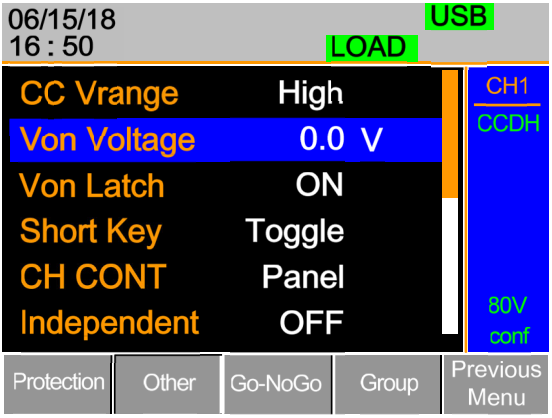
Note

The configuration settings apply to only the current channel.

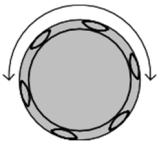
Adjusting the Von Voltage and Latch

Background	The Von voltage is the voltage point at which the load module will start to sink current. When Von latch is set to ON, the load continues to sink current after being tripped, even if the voltage drops below the Von voltage level. The step resolution of Von voltage is load module dependent.
Parameters	Von voltage 0.0-Rating volts Von latch ON/OFF
Panel Operation	Ensure that the menu is in the configuration menu. Refer to page 196.

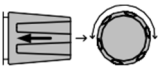
1. Press the F2 (Other) key to enter the Other menu.



2. Use the selector knob to highlight Von voltage.

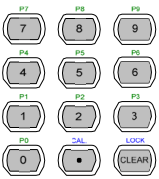


3. Press the selector knob to edit the selected value, then turn to increase or decrease the value.

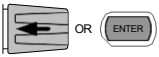


or

Use the number pad to enter a number.



4. Press the selector knob or Enter to confirm the selection.



5. Repeat steps 3 to 5 to turn Von latch ON or OFF

For details of Von and Latch settings, refer to page 94.

Note

The configuration settings apply to only the current channel. Other channels are not affected.

Configuring the Short Settings

Background

Use the Short Key option to simulate a short circuit.

Use the Short Function option to set whether the short function is enabled or disabled.

You can configure the Short Key option to toggle (press SHORT on the load module to toggle ON or OFF) or Hold (hold the SHORT key to short the load).

Use the Short Safety option to set whether enabling the short function depends on Load ON. When set to ON, the short function is enabled only when Load ON mode is enabled. When set to OFF, the short function is directly enabled independent of the Load ON mode.

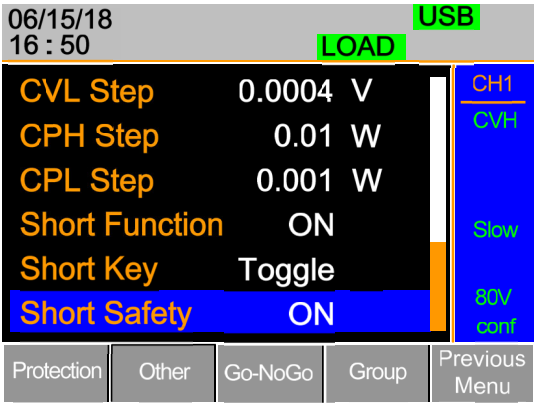
Parameter

Short Function	ON/OFF
Short Key	Hold/Toggle
Short Safety	ON/OFF

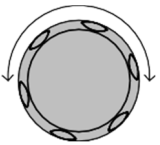
Panel Operation

Ensure that the menu is in the configuration menu. Refer to page 196.

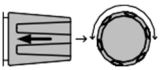
1. Press the F2 (Other) key to enter the Other menu.



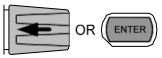
2. Use the selector knob to highlight Short Function.



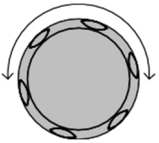
3. Press the selector knob to edit the selected setting, and turn to change the setting.



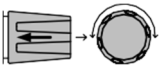
4. Press the selector knob or Enter to confirm the selection.



5. Use the selector knob to highlight Short Key.

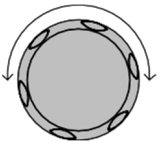


6. Press the selector knob to edit the selected setting, and turn to change the setting.

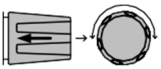


7. Press the selector knob or Enter to confirm the selection.

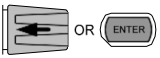
8. Use the selector knob to highlight Short Safety.



9. Press the selector knob to edit the selected setting, and turn to change the setting.



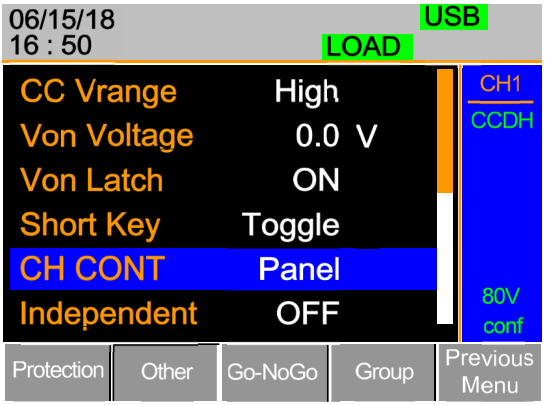
10. Press the selector knob or Enter to confirm the selection.



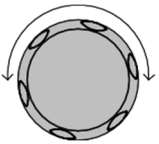
Configuring Channel Control

Background	When you set channel control (CH CONT) to external, it disables editing the active channel load. You still can use instrument buttons and knobs to access the menu for the active channel or to edit other channels that do not have channel control active. This prevents settings on the active channel from being changed on the local machine. Refer to pages 63 and 100 for details.
Parameter	CH CONT Panel/External
Panel Operation	Ensure that the menu is in the configuration menu. Refer to page 196.

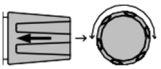
1. Press the F2 (Other) key to enter the Other menu.



2. Use the selector knob to highlight CH CONT.



3. Press the selector knob to edit the selected setting, and turn to change the setting from panel to external.



4. Press the selector knob or Enter to confirm the selection.

Channel control is now activated. To turn channel control off, you must set CH CONT to panel again. When channel control is active, EXT is displayed on the side panel for the active channel.

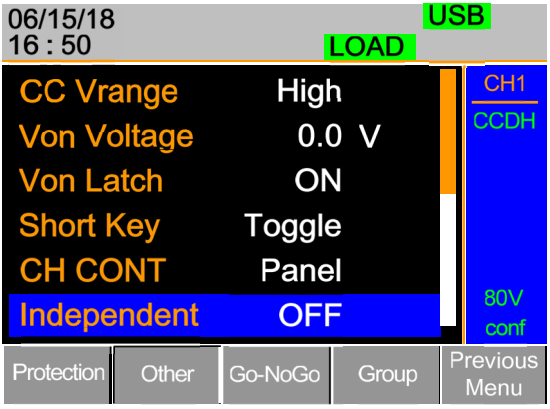
Note

You can activate channel control on only the active channel; other channels are not affected.

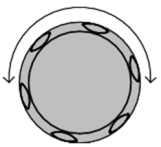
Configuring the Independent Setting

Background	The independent setting allows a channel to be load independent from the mainframe. This means that a load module with independent set to on can load from only the local load module. If you press the LOAD ON/OFF key from the mainframe, the mainframe does not affect the channel with independent set to on, except when running a program.
Parameter	Independent ON/ OFF
Panel Operation	Ensure that the menu is in the configuration menu. Refer to page 196.

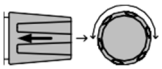
1. Press the F2 (Other) key to enter the Other menu.



2. Use the selector knob to highlight Independent.



3. Press the selector knob to edit the selected setting, and turn to change the setting.



4. Press the selector knob or Enter to confirm the selection.

When you set a channel to independent, an asterisk(*) appears next to the channel number indicator in the Current Operation Channel Status panel.

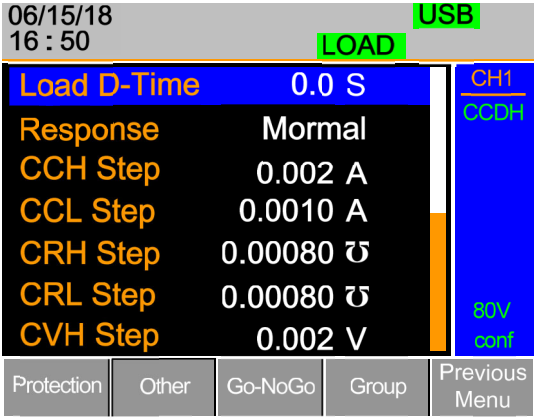
Note

The configuration settings apply to only the current channel. Other channels are not affected.

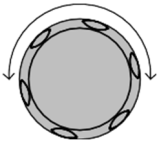
Configuring the Load Delay Time

Background	The mainframe can delay loading a channel by up to 10 seconds. However, the delay time applies only to manual loading. Delay time does not apply to programs or sequences.
Parameter	Load D-Time 0-10 s
Panel Operation	Ensure that you are in the configuration menu. Refer to page 196.

1. Press the F2 (Other) key to enter the Other menu.

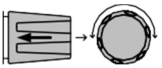


2. Use the selector knob to highlight Load D-Time.



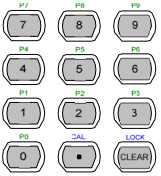
Note: Load D-Time is below Independent, off screen.

3. Press the selector knob to edit the selected setting, and turn to change the setting.

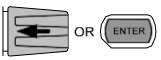


or

Use the number pad to enter a number.



4. Press the selector knob or Enter to confirm the selection.



Note

The Delay Time applies to only the current channel; other channels are not affected.

Delay time applies only when you manually turn on the load or during start up with the Auto Load On setting (refer to page 226).

Configuring Step Resolution

Background

You can edit the CC, CR, CV, and CP step resolution settings in the configuration menu. These step resolution settings directly correspond to the step resolution of the coarse adjustment when setting the CC, CR, CV, and CP parameters.

The minimum and maximum step resolution you can set for each channel is dependent on the load module. For more information about step resolution, refer to page 94.

Step Resolution		Minimum*1	Maximum*2	Unit
RMX-4003	CCH Step	HR/20000	HR/2	Amperes A
	CCL Step	LR/20000	LR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/40000	HR/2	Voltage V
	CVL Step	LR/40000	LR/2	Voltage V
	CPH Step	HR/10000	HR/2	Watt W
	CPL Step	LR/10000	LR/2	Watt W
RMX-4004 (L)	CCH Step	HR/40000	HR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/40000	HR/2	Voltage V
	CVL Step	LR/40000	LR/2	Voltage V
	CPH Step	HR/30000	HR/2	Watt W

RMX-4004 (R)	CCH Step	HR/40000	HR/2	Amperes A
	CCL Step	LR/40000	LR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/40000	HR/2	Voltage V
	CVL Step	LR/40000	LR/2	Voltage V
	CPH Step	HR/25000	HR/2	Watt W
	CPL Step	LR/25000	LR/2	Watt W

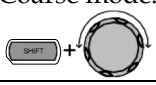
RMX-4005	CCH Step	HR/35000	HR/2	Amperes A
	CCL Step	LR/35000	LR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/40000	HR/2	Voltage V
	CVL Step	LR/40000	LR/2	Voltage V
	CPH Step	HR/35000	HR/2	Watt W
	CPL Step	LR/35000	LR/2	Watt W
RMX-4006	CCH Step	HR/20000	HR/2	Amperes A
	CCL Step	LR/20000	LR/2	Amperes A
	CRH Step	HR/40000	HR/2	Siemens ℧
	CRL Step	LR/40000	LR/2	Siemens ℧
	CVH Step	HR/50000	HR/2	Voltage V
	CVL Step	LR/50000	LR/2	Voltage V
	CPH Step	HR/35000	HR/2	Watt W
	CPL Step	LR/35000	LR/2	Watt W

*1 HR = High range rated value. LR = Low range rated value.
*2 Maximum value = HR (LR)/2 * 1.02.

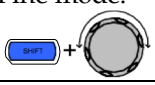
Note

Use the Shift key to toggle between coarse and fine adjustment mode when editing the CC, CR, CV, and CP values with the Selector knob on the main display. The fine adjustment resolution varies between the function and load module used.

Coarse mode:



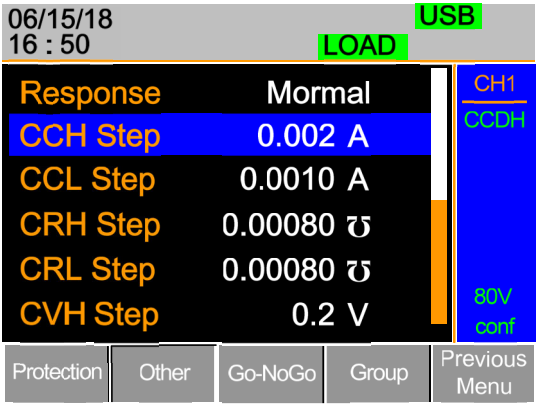
Fine mode:



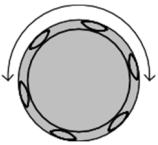
Panel Operation

Ensure that you are in the configuration menu. Refer to page 196.

1. Press the F2 (Other) key to enter the Other menu.



2. Use the selector knob to scroll down to highlight CCH Step.

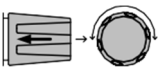


Note: CCH Step is off screen when entering the Other menu.

Note

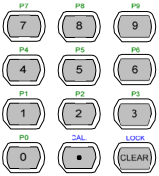
CCH Step is off-screen when entering Other menu.

3. Press the selector knob to edit the selected setting, and turn to change the setting.



or

Use the number pad to enter a number.



4. Press the selector knob or Enter to confirm the selection.

5. Repeat steps 2-4 to edit the step resolution of:

   CCL Step
   CRH Step
   CRL Step
   CV Step

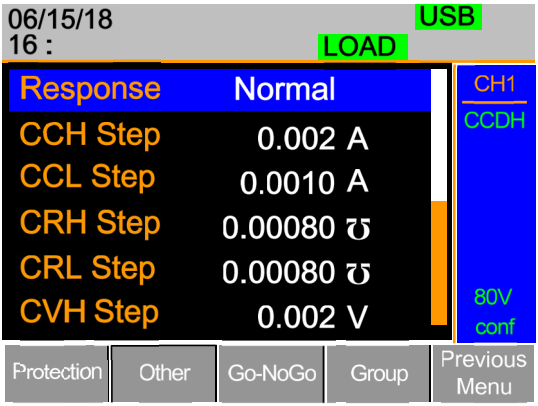
Note

The Step resolution settings apply to only the active channel; other channels are not affected.

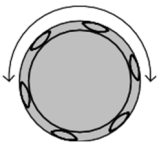
Configuring Response Time

Background	Use the Response time setting to limit current draw when input voltage is less than 1 V. The Response setting sets the load bandwidth to fast (100 MHz) or normal (1 kHz).
Parameters	Response Normal, Fast
Panel Operation	Ensure that you are in the configuration menu. Refer to page 196.

1. Press the F2 (Other) key to enter the Other menu.



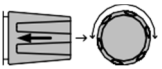
2. Use the selector knob to scroll down to highlight Response.



Note

Response is offscreen when entering Other menu.

3. Press the selector knob to edit the selected setting, and turn to change the setting.



4. Press the selector knob or Enter to confirm the selection.

Note

The Response settings apply to only the active channel; other channels are not affected.

Go/NoGo

Background

Use Go/NoGo mode to set threshold limits. When a load is within the limit(s), it is considered to be "Go"; when the load exceeds the limit, it is considered to be "NoGo."

You can set Go/NoGo limits as either absolute values (entry mode set to "Value") or a percentage offset from a nominal (center) value (entry mode set to "Percent").

You can use Go/NoGo in both high and low ranges, as well as CC, CV, CR, and CP modes. You can read the Go/NoGo status using the rear Go/NoGo output.

You also can impose a delay time for up to 1 second.

Note

Any Go/NoGo configuration applies to only the current channel with the same mode and range.

Parameters

	Value	Percent
CC Mode CR Mode	High: V Low: V	High: % Low: % Center: V
CV Mode CP Mode	High: A Low: A	High: % Low: % Center: A
Delay Time	0.0-1.0 seconds	
SPEC Test	ON/OFF	

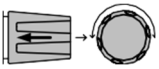
Panel Operation

Ensure that you are in the Configuration menu. Refer to page 196.

Choose Absolute/ Percentage Limits

1. Press Go-NoGo (F3) to access the Go/NoGo menu.

2. Use the selector knob to edit Entry Mode.

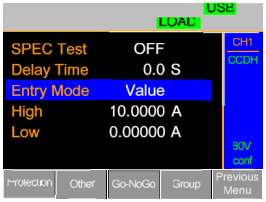


3. Choose Value for absolute limits or Percent for percentage offset limits.

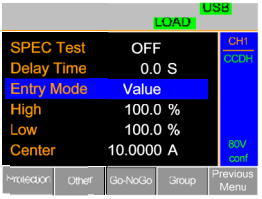
Or

4. The menu changes according to the selection.

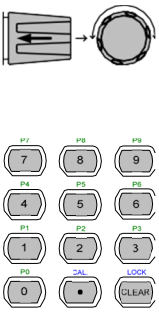
Value



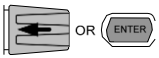
Percent



5. Use the selector knob and number pad to edit Delay time, High, Low, and Center (percent mode only).

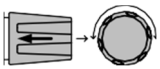


6. Press the selector knob or Enter to confirm each value.



Turn Go/NoGo On/Off

7. Use the selector knob to edit SPEC test.



8. Choose ON to turn on Go/NoGo.

9. Choose OFF to turn off Go/NoGo.

When SPEC test is set to ON, SPEC appears on the Current Operation Channel Status panel.

Group Unit

Background

Use the Group Unit menu to configure load modules of the same type and rating as a single unit when used in parallel. You can use up to four load modules in this mode.

Operating the RMX-400x series load modules in Group Unit mode is almost the same as using the load modules separately. The only difference is that you need to set up the channel configuration for only channel 1 and not individually for each channel.

There are two mode types: para and sync. Use the para setting to operate the all parallelized load modules as a single large load module. Use sync mode to synchronize the settings of a single unit across all other parallelized load modules.

The display mode determines which parameters are displayed on the local load modules.

Note

You can use only CC or CR mode in Group Unit.

The single channel load modules, RMX-4005 and RMX-4006, fully support these two modes (Para, Sync) of group function.

The RMX-4004 does not support group function.

The dual channel RMX-4003 does partially support group function. It can support grouping two units of the same module under the Sync mode only. That means the RMX-4003 can be 2 ch x 100 W or 1 ch x 200 W.

Ensure that you use the same firmware for both units.

Parameters

Total Unit	2/3/4/OFF
Group Mode	Para/Sync
Display Mode	V,I/,V,W/I,W/ S

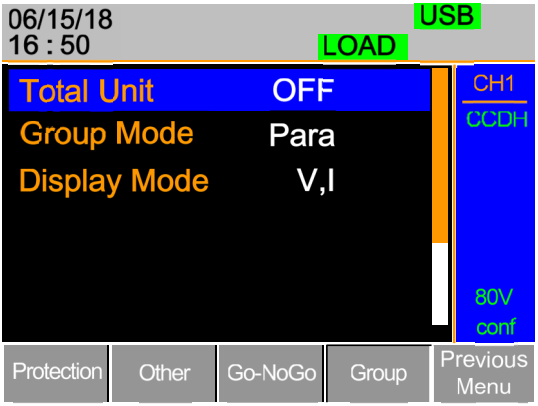
Panel Operation

1. Ensure that the current channel is selected as the active channel. Refer to page 137.

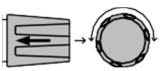
2. Ensure that the menu is in the Configuration menu. Refer to page 196.

Parallel Setup

3. Press Group (F4) to access the Group menu.



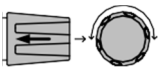
4. Use the selector knob to change Total Unit from the OFF setting to the number of parallel units.



5. Press the selector knob or Enter to confirm.

Parallel Mode

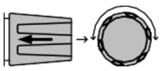
6. To change the type of mode, use the selector knob to edit Group Mode.



7. Choose Para to operate the units as a single large load module, or Sync to synchronize the load settings across each parallel unit.

Display Mode

8. Use the selector knob to change the display settings on the local load modules.



9. Choose from V,I/V,W/I,W, or S.

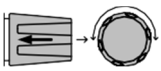
When para unit is active, an indicator appears on the screen. The indicator depends on the Group mode. P appears for para mode and S appears for sync mode.

CHXP	Para mode
CHXS	Sync mode

The RMX-400x is now ready to operate in parallel mode.

Turn Parallel Mode Off

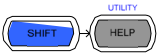
10. To disable parallel mode, use the selector knob to change Total Unit to OFF.

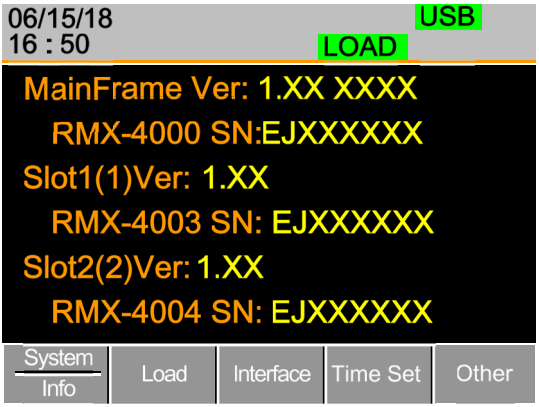


Mainframe Configuration

This chapter describes configuration settings that apply to all channels and general interface settings.

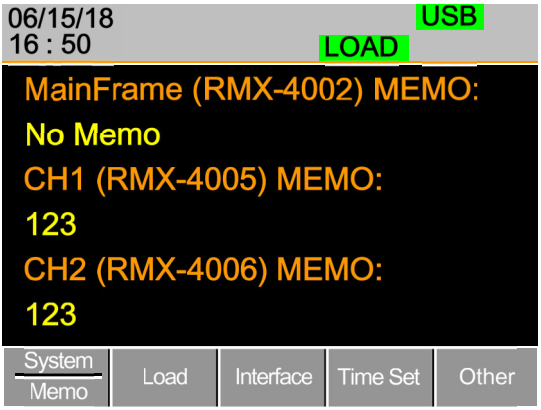
Accessing System Information

Background	The system information displays the mainframe and load module(s) serial numbers.
Parameters	Mainframe Ver: Mainframe firmware version and date (month/day). RMX-400x SN: Mainframe serial number. SlotX(Y) Ver: The version number of the *X*th load module occupying the *X*th slot with channel number *Y*. RMX-400x SN: The serial number and module model of the *X*th load module *Y* designates the channel of each installed load module. For example, if dual channel load modules are installed, Ch (1,2) is for the firmware and serial number.
Panel Operation	1. Press the Shift key and then Help key to access the Utility menu/System Info menu. 



Note

If you have set Memo through commands, you can see the Memo information by pressing System Info (F1) once again. (Refer to the chapter describing the :MEMo and :CHANnel:MEMo commands in the programming manual for details.)

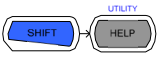


Accessing the Load Menu

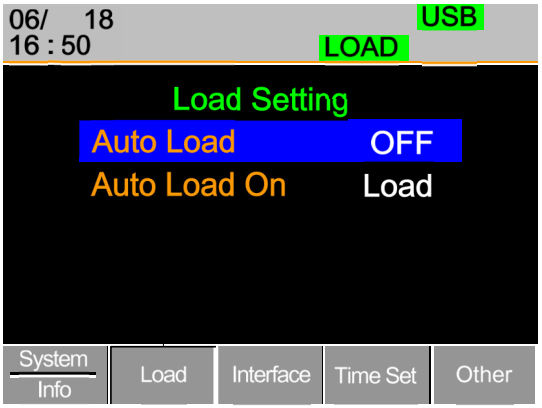
Background	The RMX-400x series can automatically start loading from the last program or load setting. If you set Auto Load On to Load, the last load setup used before the machine was reset automatically starts to load on startup. If program is set to the auto load on configuration, the last program executed starts on the next startup.	
Parameters	Auto Load	ON/OFF
	Auto Load On	Load/program

Panel Operation

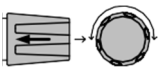
1. Press the Shift key and then the Help key to access the Utility menu.



2. Press F2 (Load).



3. Press the selector knob and then turn to choose Auto Load.



4. Press the selector knob or Enter to confirm the selection.

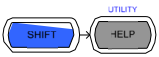
5. Scroll to Auto Load On and choose Load or Program for the next time the RMX-400x starts.

Adjusting the Speaker

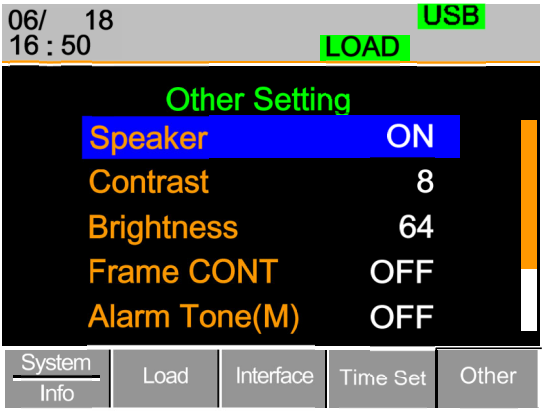
Background	The RMX series has an internal speaker for both the mainframe and load modules. The speaker function turns the UI sound on or off (key presses and scrolling). The speaker setting does not alter the sound for protection or Go/NoGo alarms.
Parameter	Speaker ON/OFF

Panel Operation

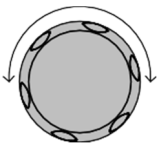
1. Press the Shift key and then the Help key to access the Utility menu.



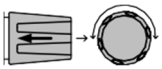
2. Press F5 (Other menu).



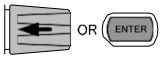
3. Use the selector knob to highlight Speaker.



4. Press the selector knob to edit Speaker, then turn to change from on to off and vice versa.



5. Press the selector knob or Enter to confirm the selection.

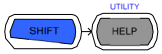


Adjusting the Display Settings

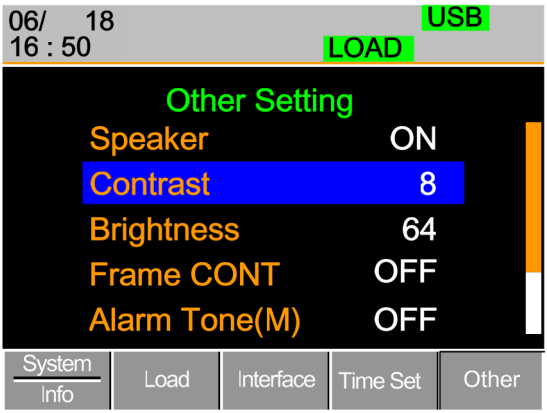
Background	The RMX series has a TFT LCD display. Use the Utility menu to control the display brightness and contrast.			
Parameters	Brightness	50-90	50 (low)	90 (bright)
	Contrast	3-13	3 (low)	13 (high)

Panel Operation

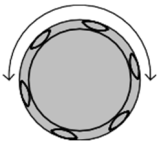
1. Press the Shift key and then the Help key to access the Utility menu.



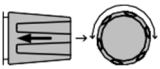
2. Press F5 (Other menu).



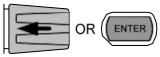
3. Use the selector knob to highlight Contrast.



4. Press the selector knob to edit contrast, then turn to increase or decrease the value.



5. Press the selector knob or Enter to confirm the selection.



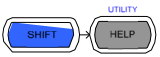
6. Repeat steps 3-5 for the brightness.

Adjusting the Frame Control

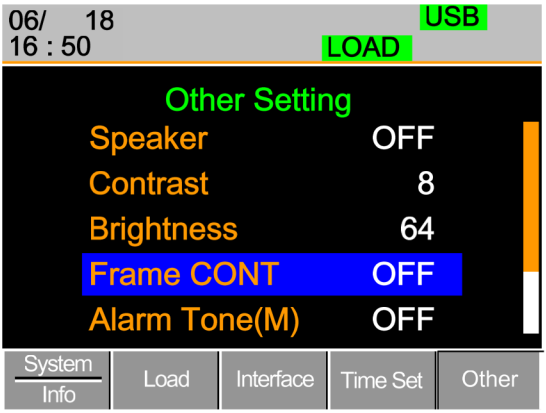
Background	Use frame control to control several frame-linked mainframes (slaves) with a master mainframe. For information about frame control, frame control interface, and connection, refer to pages 61 and 315.
Note	When using frame control, ensure that the same firmware is installed in both master and slave units.
Parameters	Frame CONT ON/OFF

Panel Operation

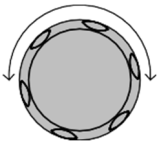
1. Connect the mainframes using a frame link connection. Page 61.
2. On the master mainframe, press the Shift key and then the Help key to access the Utility menu.



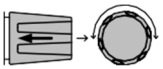
3. Press F5 (Other menu).

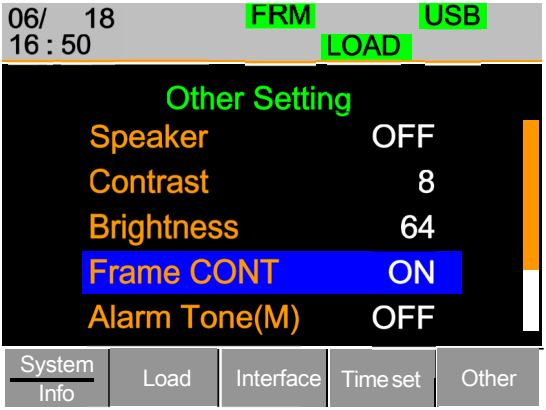


4. Use the selector knob to highlight Frame CONT.



5. Press the selector knob to edit, then turn to turn frame control on or off.





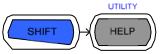
When Frame CONT is set to on, the mainframe displays FRM (master) or FRS (slave) at the top of the display.

6. Repeat the above steps for any connected slave mainframe units.

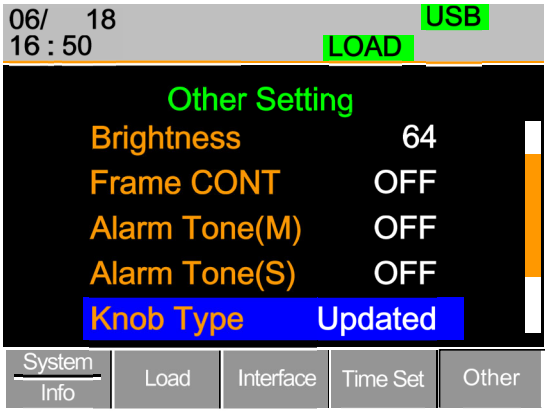
Frame control is now ready for both master and slave mainframes.

Adjusting the Knob Control Type

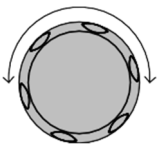
Background	You can set the mainframe control knob to Update or Old mode. When set to Update mode, rotating the mainframe knob changes the load module setting value at the same time. When set to Old mode, rotating the mainframe knob does not change the load module setting value unless you press the knob or Enter key.
Parameter	Knob Type Updated/old
Panel Operation	1. Press the Shift key and then the Help key to access the Utility menu.



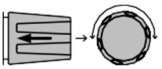
2. Press F5 (Other menu).



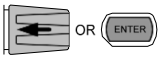
3. Use the selector knob to move the cursor down to Knob Type (below the initial screen).



4. Press the selector knob to highlight Knob Type, then turn to change to Old/Updated.



5. Press the selector knob or Enter to confirm the selection.



Configuring Alarm Sound

Background

The RMX series has two different types of alarms, one on the mainframe (alarm tone M) and one for each load module (alarm tone S).

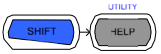
You can set alarm tones M and S individually to on or off.

Parameter

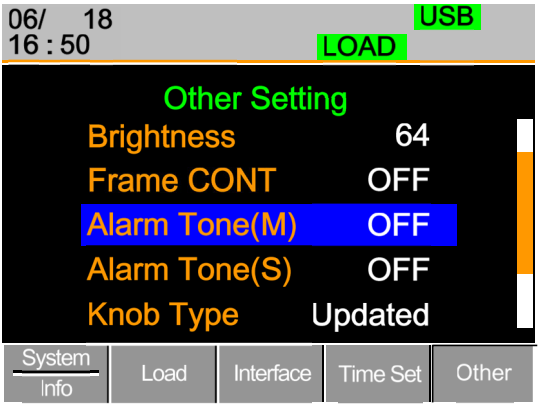
Alarm Tone (M)	ON/OFF
Alarm Tone (S)	ON/OFF

Panel Operation

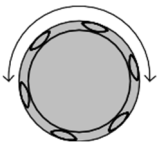
1. Press the Shift key and then the Help key to access the Utility menu.



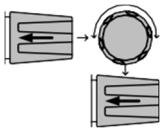
2. Press F5 (Other menu).



3. Use the selector knob to highlight the master alarm, Alarm Tone (M).



4. Press the selector knob to select Alarm Tone (M), turn to edit, and press to confirm the selection.



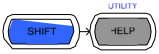
5. Repeat the steps to edit the slave alarm, Alarm Tone(S).

Configuring Go/NoGo Alarm Sound

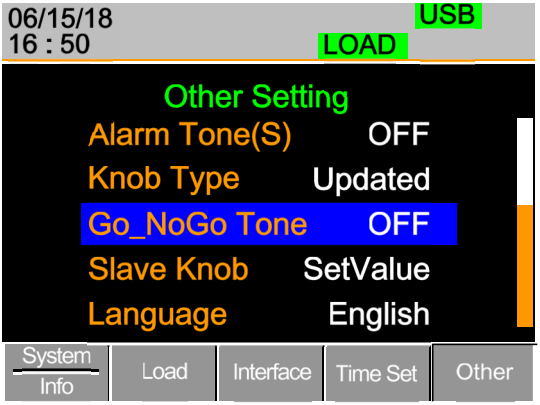
Background	You can set an alarm to sound when any Go/NoGo limits are tripped from any channel. The Go_NoGo tone alarm settings apply to all channels.
Parameter	Go_NoGo Tone On/off

Panel Operation

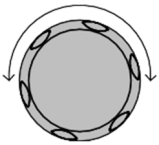
1. Press the Shift key and then the Help key to access the Utility menu.



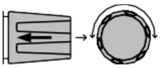
2. Press F5 (Other menu).



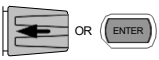
3. Use the selector knob to move the cursor down to Go_NoGo Tone (below the initial screen).



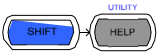
4. Press the selector knob to highlight Go_NoGo Tone, then turn to change to ON/OFF.

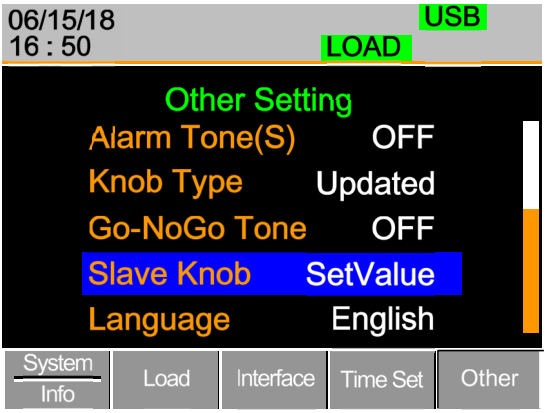


5. Press the selector knob or Enter to confirm the selection.

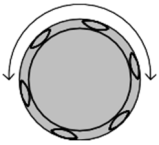


Adjusting Slave Knob Settings

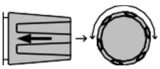
Background	You can edit channel loads using the local load module or the mainframe. When using the slave knob to edit a load, you can set the load module display to two different types: SetValue and Measured. When a load is on, SetValue always displays the set value (A Value, B Value) on the local load module display, while Measure shows the actual measured value when editing the load. These settings apply to all channels. You can temporarily disable the Measure setting by pressing the slave knob to display the SetValue instead of the Measure value in the local load module display.
Parameter	Slave Knob Measure/SetValue
Panel Operation	1. Press the Shift key and then the Help key to access the Utility menu.  2. Press F5 (Other menu). 



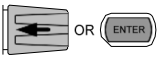
3. Use the selector knob to move the cursor down to Slave Knob (below the initial screen).



4. Press the selector knob to highlight Slave Knob, then turn to change to Measure/SetValue.



5. Press the selector knob or Enter to confirm the selection.



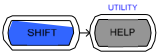
View Language Settings

Background

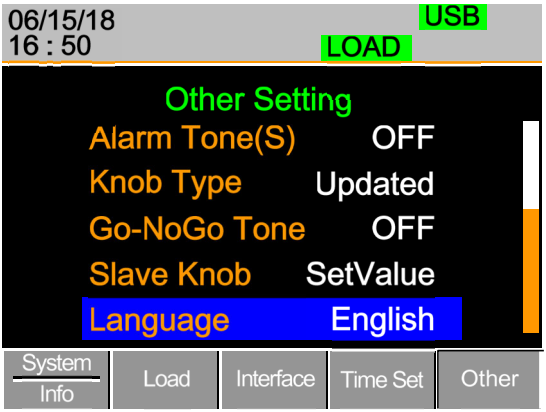
Use the Utilities menu to view the language settings.

Panel Operation

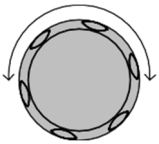
1. Press the Shift key and then the Help key to access the Utility menu.



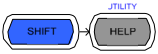
2. Press F5 (Other menu).

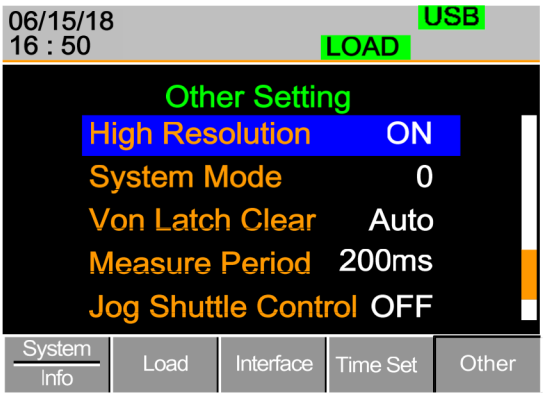


3. Use the selector knob to move the cursor down to Language (below the initial screen).

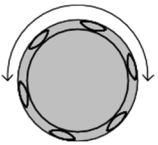


Adjusting the High Resolution

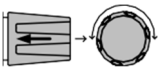
Background	ON: When there is a difference between the measured value of the voltage, current, or power displayed on the module panel and the setting value, the system fine tunes the load value so that the measured value is close to the setting value. The system performs and completes this action in 1 second after loading is on. OFF: The system performs no action when there is a difference between the measured value of the voltage, current or power displayed on the module panel and the setting value.
Parameter	High Resolution ON/OFF
Panel operation	1. Press the Shift key and then the Help key to access the Utility menu.  2. Press F5 (Other menu). 



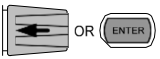
3. Use the Selector knob to highlight High Resolution.



4. Press the Selector knob to edit High Resolution, then turn to change from ON to OFF and vice versa.



5. Press the Selector knob or Enter to confirm selection.

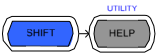


Adjusting the System Mode

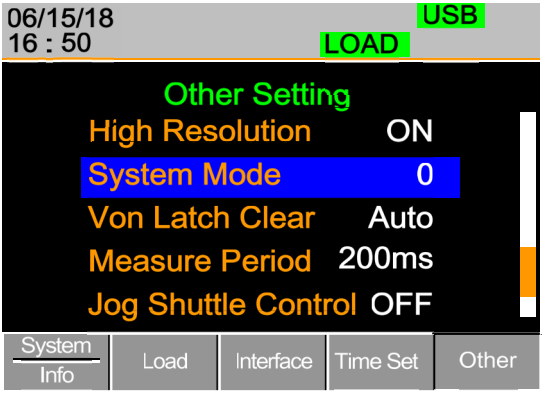
Background	1: When any command is received, the Master panel automatically enterf the Remote fast mode. 0: The Master panel will not enter the Remote fast mode automatically.
Note	For details about remote mode fast/normal, refer to the UTILity:REMote:MODE command in the programming manual.
Parameters	System Mode 0/1

Panel operation

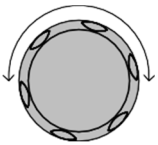
1. Press the Shift key and then the Help key to access the Utility menu.



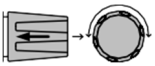
2. Press F5 (Other menu).



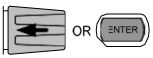
3. Use the Selector knob to highlight System Mode.



4. Press the Selector knob to edit System Mode, then turn to change from 0 to 1 and vice versa.



5. Press the Selector knob or Enter to confirm selection.

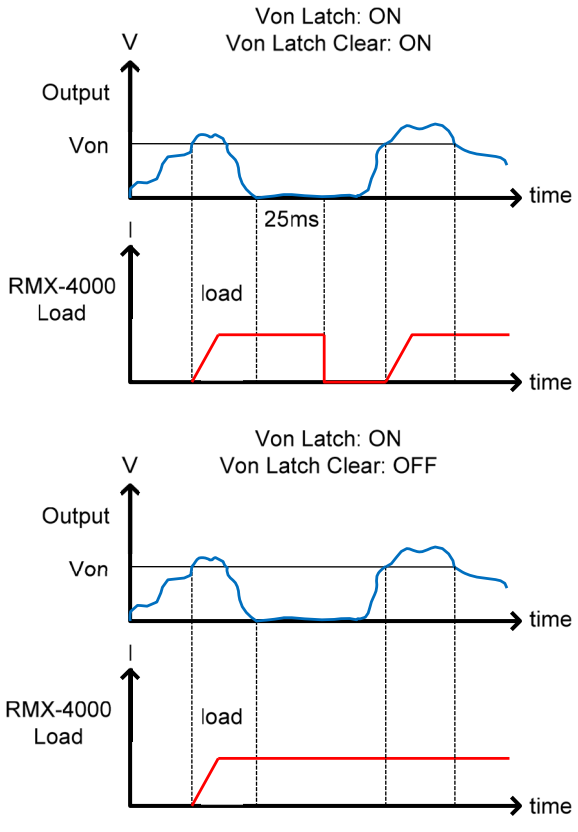


Adjusting the Von Latch Clear

Background

Auto: The load starts when the module terminal voltage exceeds the Von value. The system stops loading when the module terminal voltage is close to 0 V for more than 25 ms, and the system is detecting Von again.

Manual: The load starts when the module terminal voltage exceeds the Von value. Loading continues even if the module terminal voltage is close to 0 V.

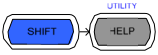


Note This feature is available only when Von Latch is set to ON.

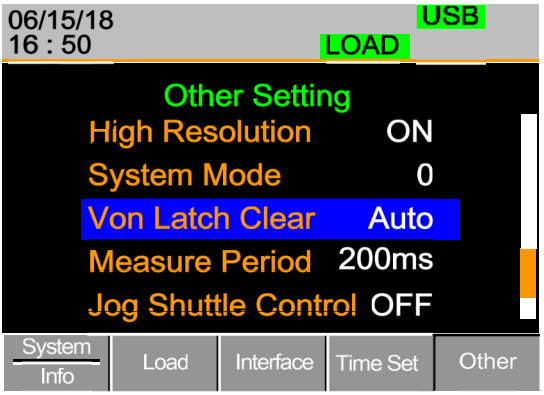
Parameters Von Latch Clear Auto/Manual

Panel operation

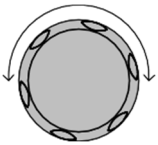
1. Press the Shift key and then the Help key to access the Utility menu.



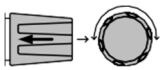
2. Press F5 (Other menu).



3. Use the Selector knob to highlight Von Latch Clear.



4. Press the Selector knob to edit Von Latch Clear, then turn to change from Auto to Manual and vice versa.



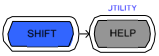
5. Press the Selector knob or Enter to confirm selection.

Adjusting the Measure Period

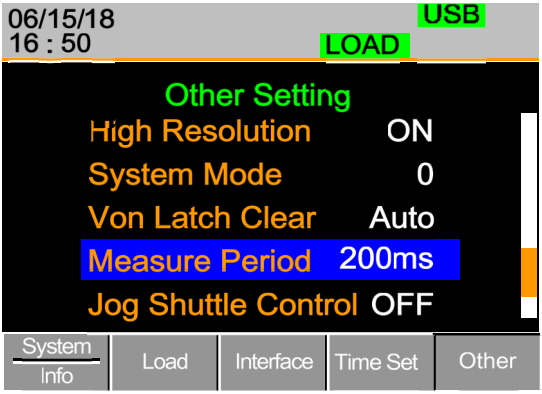
Background	Use this setting to select a measure sample rate. Rates of 200 ms or 20 ms are available for voltage and current sampling rate.	
Parameter	Measure Period	200 ms/20 ms

Panel operation

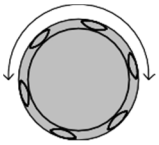
1. Press the Shift key then the Help key to access the Utility menu.



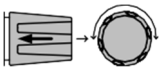
2. Press F5 (Other menu).



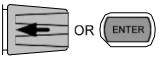
3. Use the Selector knob to highlight Measure Period.



4. Press the Selector knob to edit Measure Period, then turn to change from 200 ms to 20 ms and vice versa.



5. Press the Selector Knob or Enter to confirm selection.



Adjusting the Jog Shuttle Control

Background

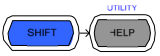
ON: After you enable this setting, the slave knob adjusts the setting value in Jog Shuttle mode when you adjust the setting value. The interval value is adjusted according to the knob speed.

OFF: If you disable this setting, the slave knob adjusts the setting value in the form of fixed compartment when you adjust the setting value.

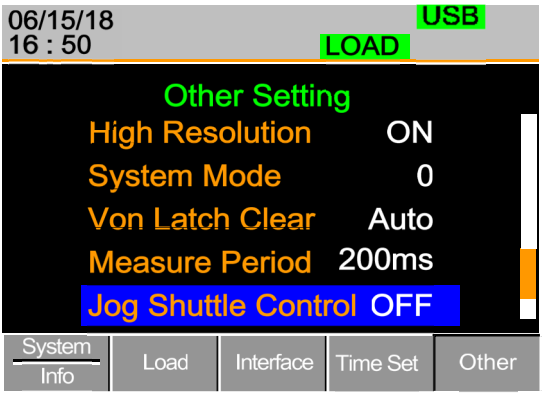
Parameter — Jog Shuttle Control — ON/OFF

Panel operation

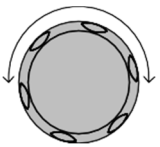
1. Press the Shift key and then the Help key to access the Utility menu.



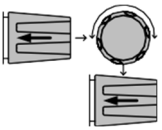
2. Press F5 (Other menu).



3. Use the selector knob to highlight Jog Shuttle Control.



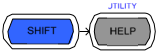
4. Press the Selector knob to edit Jog Shuttle Control, then turn to change from OFF to ON and vice versa.

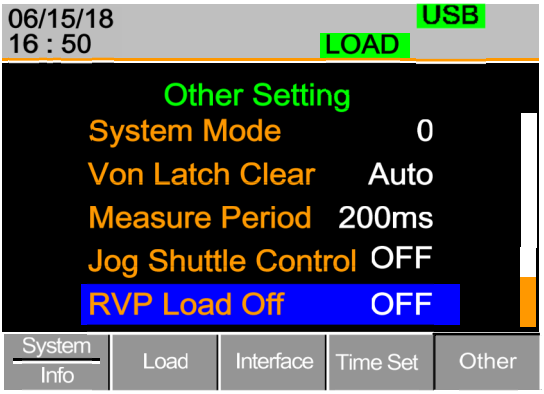


5. Press the Selector knob or Enter to confirm selection.

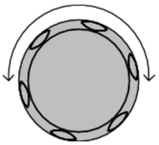
Adjusting the RVP Load Off

Background	ON: When RVP is detected, Alarm displays on the screen, and loading stops. OFF: When RVP is detected, Alarm displays on the screen, but loading remains on.
Note	This setting applies to all channels. But each channel independently detects RVP, emits the alarm, and stops the load.
Parameter	RVP Load Off ON/OFF
Panel operation	1. Press the Shift key and then the Help key to access the Utility menu. 2. Press F5 (Other menu).

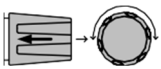




3. Use the Selector knob to highlight RVP Load Off.



4. Press the Selector knob to edit RVP Load Off, then turn to change from OFF to ON and vice versa.



5. Press the Selector Knob or Enter to confirm selection.

Setting the Date and Time

Description

Use the date and time settings to time stamp files when saving them.

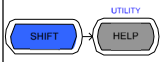
- The date is shown at the top of the display.

Parameters

Month	1-12
Day	1-31
Year	1990-2038
Hour	0-23
Minute	0-59

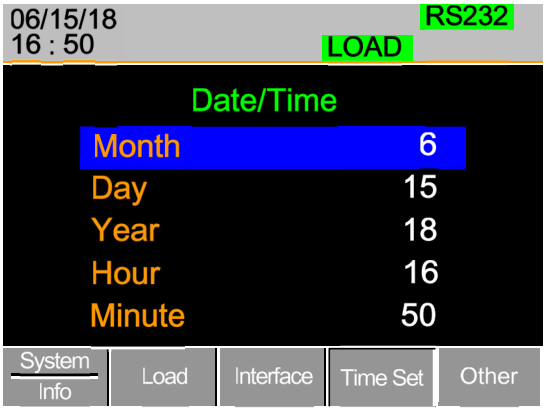
Panel operation

1. Press the Shift key then the Help key to access the Utility menu.



2. Press F4 (Date/Time menu).

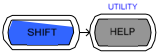
Settings: Month, Day, Year, Hour, Minute

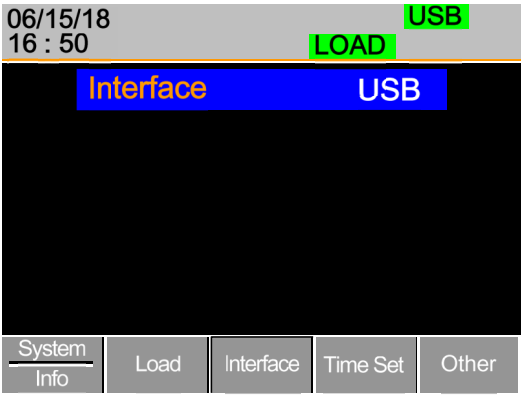


Interface Configuration (Settings)

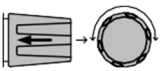
This chapter describes configuration settings that apply when using the RMX-400x mainframe with a remote connection. There are three interface options for remote control: RS232 and USB. You can use only one interface at a time. For more details about remote control and interface connections, refer to the Interface section on page 311.

Configuring RS232 Connection

Background	When using RS232, you need to set several parameters. These include baud rate, stop bit, and parity. When setting RS232 parameters, ensure that they match those of the host machine.	
Parameters	Baud Rate	2400/4800/9600/19200/38400
	Stop Bit	1-2
	Parity	None/odd/even
Panel Operation	1. Press the Shift key and then the Help key to access the Utility menu.	
	2. Press F3 (Interface menu).	



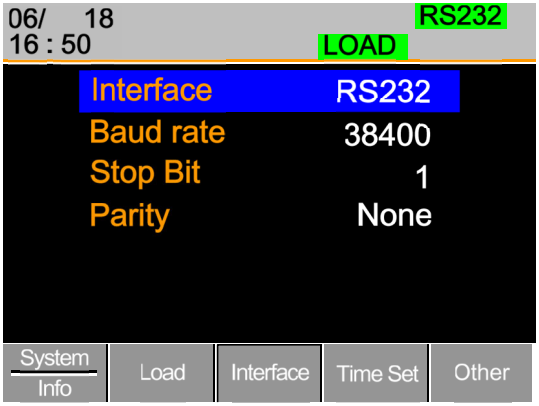
3. If the Interface mode is not RS232, turn the selector knob to RS232.



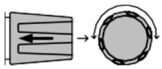
4. Choose RS232.

5. Press the selector knob to confirm.

6. The RS232 menu appears.



7. Use the selector knob to edit Baud rate, Stop Bit, and Parity.



Note

The baud rate, stop bit, and parity must match that of the host machine.

For RS232 function check, refer to the *RS232 and USB CDC Function Check* section on page 263.

Configuring USB Connection

Background

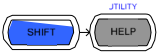
Of the three interface options, USB is the easiest to use.

USB connection

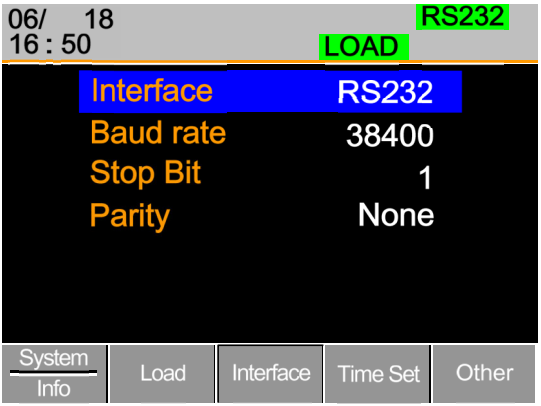
PC side connection	Type A, host
RMX-4000 side connector	Type B, device
Speed	1.1/2.0 (full speed)

Panel Operation

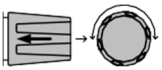
1. Press the Shift key and then the Help key to access the Utility menu.



2. Press F3 (Interface Menu).

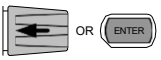


3. If the Interface mode is not USB, use the selector knob to edit Interface.

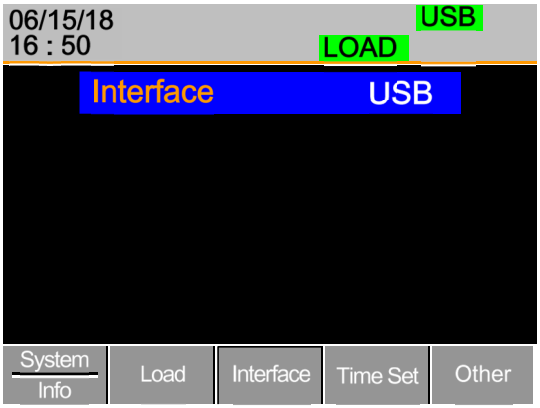


4. Choose USB.

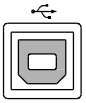
5. Press the selector knob to confirm.



6. The Interface becomes USB.



7. Connect the USB cable to the USB-B slave port on the rear.



8. If the PC asks for the USB driver, select RMX-4000.inf (downloadable from the National Instruments website, www.ni.com, RMX-4000 product page).

Note

For USB CDC function check, refer to the *RS232 and USB CDC Function Check* section on page 263.

Configuring Ethernet Connection

Background

When using Ethernet, you need to set several parameters including DHCP On/Off, IP Address, Subnet Mask, and Gateway. When setting Ethernet parameters, ensure they match the network parameters.

Parameters

DHCP	On/Off				
IP Address	0-255	0-255	0-255	0-255	
Subnet Mask	None/Odd/Even				
Gateway	0-255	0-255	0-255	0-255	

Configuration

This configuration example configures the RMX-4000 socket server.

The following configuration settings manually assign the RMX-4000 an IP address and enable the socket server. The socket server port number is fixed at 2268.

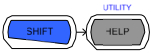
Steps

1. Connect an Ethernet cable from the network to the rear panel Ethernet port. You will see the LED indicator next to Ethernet port turn on.

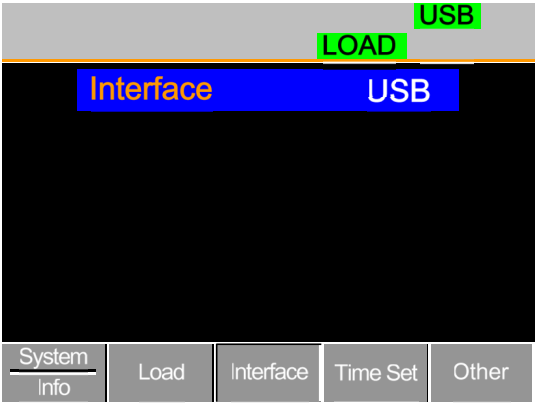
2. Power on the RMX-4000.

Panel operation

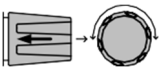
3. Press the Shift key and then the Help key to access the Utility menu.



4. Press F3 (Interface menu).



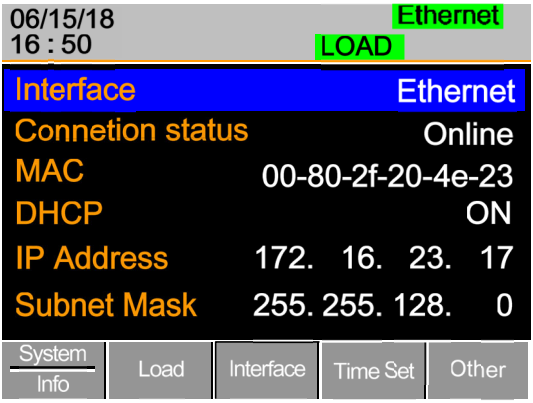
5. If the Interface mode is not Ethernet, use the Selector knob to edit Interface.



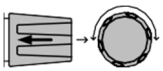
6. Choose Ethernet.

7. Press the Selector knob to confirm.

8. The Ethernet menu appears.



Use the Selector knob to edit the DHCP, IP Address, Subnet Mask, and Gateway settings.



Note

If the DHCP is set to ON, the network DHCP server configures the IP Address, Subnet Mask, and Gateway sett ings automat ically. These sett ings appear after the RMX-4000 gets the informat ion by DHCP.

Note

If the DHCP is set to OFF, make sure the IP address, Subnet Mask, and Gateway sett ings match those of the network.

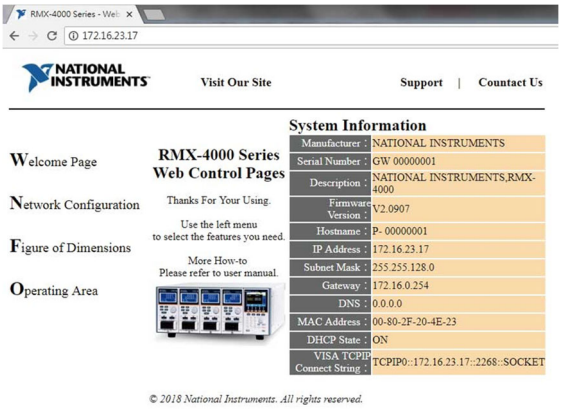
Web Server Function Check

Functionality check

The web server allows you to check the RMX-4000 function settings.

Enter the RMX-4000 IP address in a web browser.

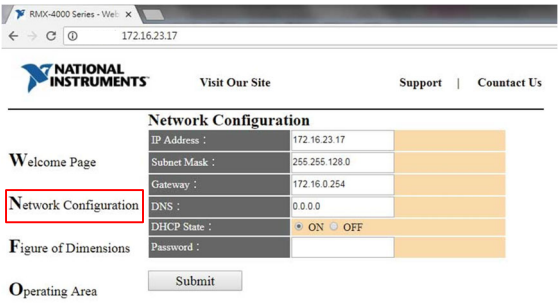
The web browser interface appears.



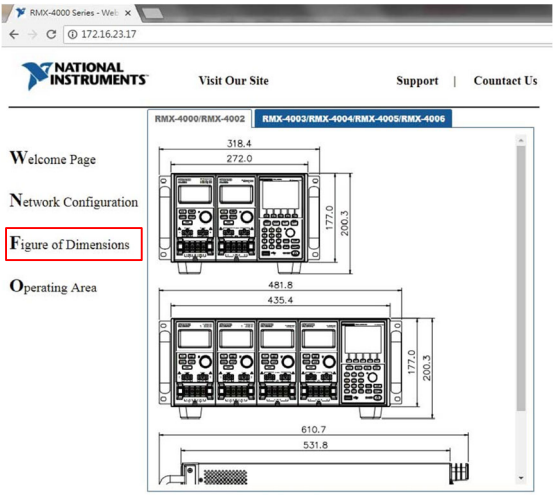
The web browser interface allows you to access the following:

- Network configuration settings
- RMX-4000 dimensions
- Operating area diagram

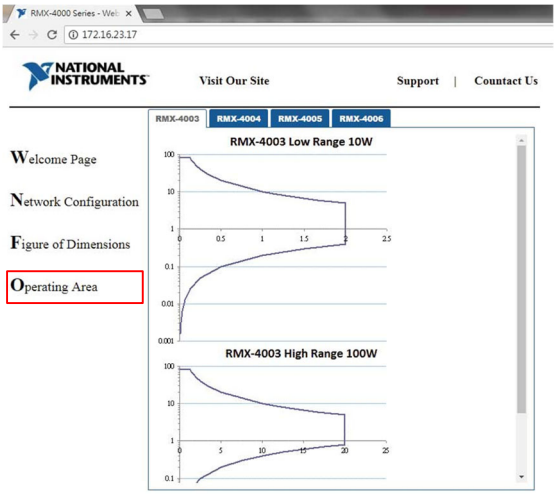
Click **Network Configuration** to see the configuration information.



Click **Figure of Dimensions** to see the device dimensions information.



Click **Operating Area** to see the load operating area.

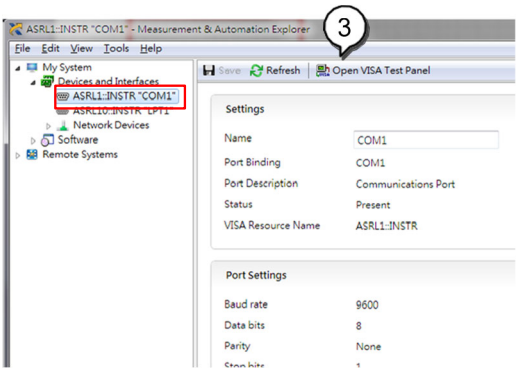

RMX-4000 Series - Wel
172.16.23.17
NATIONAL INSTRUMENTS
Visit Our Site
Support | Countact Us
Welcome Page
Network Configuration
Figure of Dimensions
Operating Area
RMX-4003
RMX-4004
RMX-4005
RMX-4006
RMX-4003 Low Range 10W
RMX-4003 High Range 100W

RS232 and USB CDC Function Check

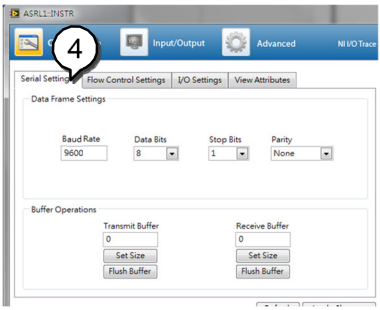
Background	You can use National Instruments Measurement & Automation Explorer (MAX) to test the RS232 and USB CDC functionality. This program is available on the NI website, www.ni.com, via a search for the VISA run-time engine page, or you can download it at www.ni.com/visa/.
Requirements	Operating system: Windows XP, 7, 8, 10
Note	You can perform a functionality check only after connecting the cable and setting the RMX-4000 interface.

Functionality check

1. Start MAX. In Windows, select **Start>>All Programs>>National Instruments>> Measurement & Automation**.
2. In **My System>>Devices and Interfaces** in MAX, select the corresponding port connected to the RMX-4000 via the USB or RS232 interface.
3. In this example (NI MAX Version 18.0.0f0), assume the RMX-4000 is connected to COM 1(ASRL1). After selecting **ASRL1::INSTR "COM1"**, click **Open VISA Test Panel**.



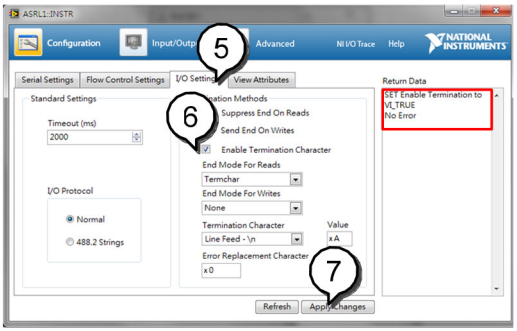
4. On the ASRL Settings page, you can see the **Serial Settings** information.



5. Click **I/O Settings**.

6. Make sure the **Enable Termination Character** check box is checked and the terminal character is *\n (Value: xA)*.

7. Click **Apply Changes**.



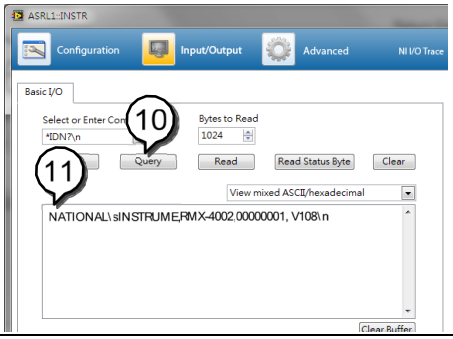
8. Click the **Input/Output** icon.

9. Enter **IDN?\n* in the **Select or Enter Command** dialog box if it is not already entered.

10. Click the **Query** button.

11. The *IDN?\n query returns the manufacturer, model name, serial number, and firmware version in the dialog box.

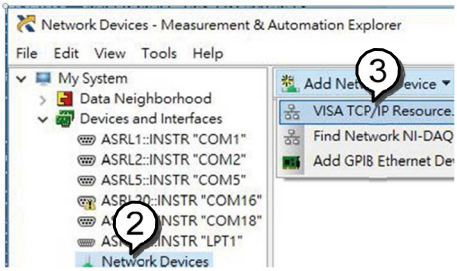
    NATIONAL\sINSTRUME,RMX-4002,00000001, V108\n

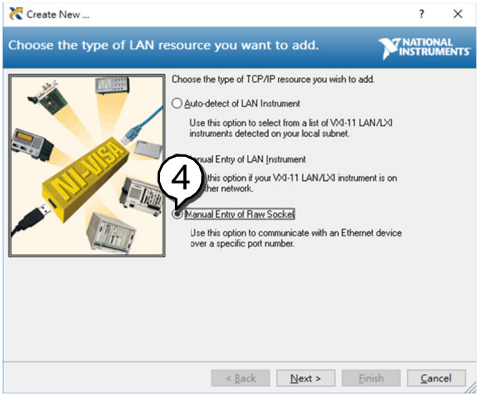


Note

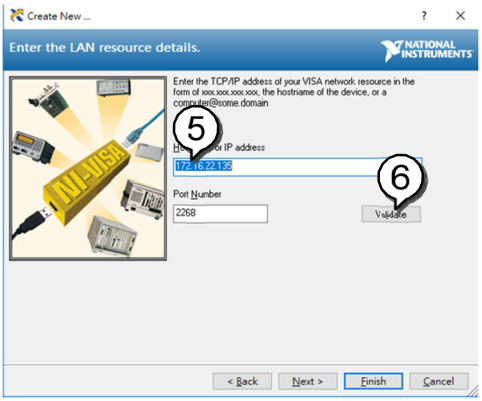
The COM port corresponding to the USB CDC exists until the USB driver is installed. To do the USB CDC function check, change the VISA resource name to the COM port that the USB CDC protocol occupies as a virtual COM port in your system.

Socket Server Function Check

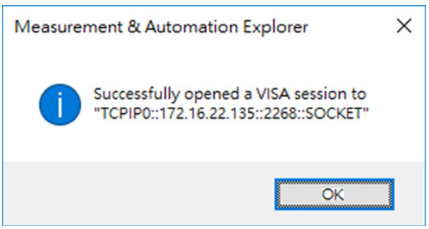
Background	You can use National Instruments Measurement & Automation Explorer (MAX) to test the socket server functionality. This program is available on the NI website, www.ni.com, via a search for the VISA run-time engine page, or you can download it at www.ni.com/visa/.
Requirements	Operating system: Windows XP, 7, 8, 10
Functionality check	1. Start MAX. In Windows, select **Start>>All Programs>>National Instruments>> Measurement & Automation**. 2. In MAX, select **My System>>Devices and Interfaces>>Network Devices**. 3. Select **Add New Network Device>>VISA TCP/IP Resource**.  4. Select **Manual Entry of Raw Socket** from the popup window.



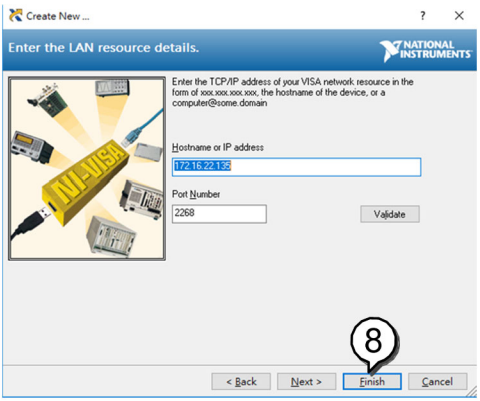
5. Enter the RMX-4000 IP address and port number. The port number is fixed at 2268.
6. Click **Validate**.



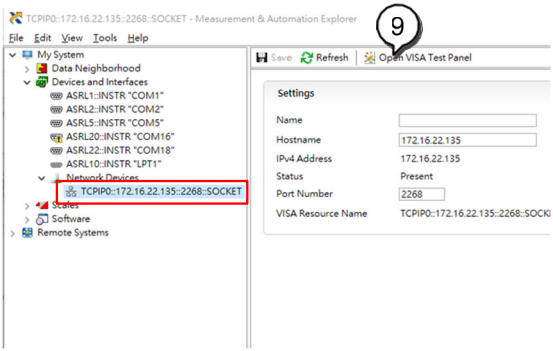
7. A popup appears if a connection is successfully established. If not, check the load device IP address configuration, then click **OK** and **Next**.



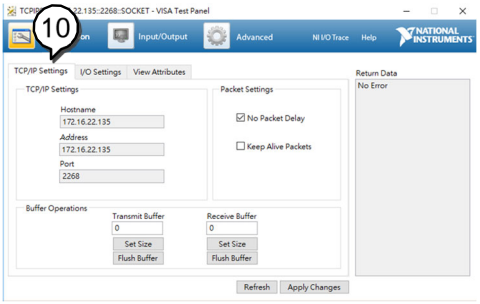
8. Click **Finish**.



9. You can see that the network device is set up successfully. Click **Open VISA Test Panel**.



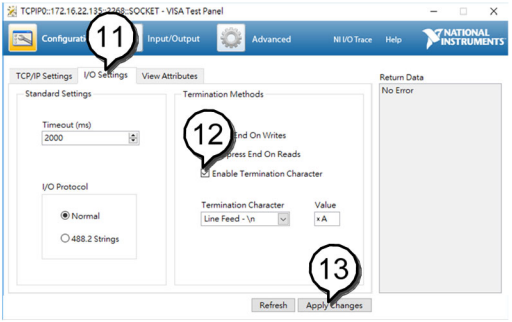
10. On the TCP/IP Settings page, you can see the TCP/IP information.



11. Click **I/O Settings**.

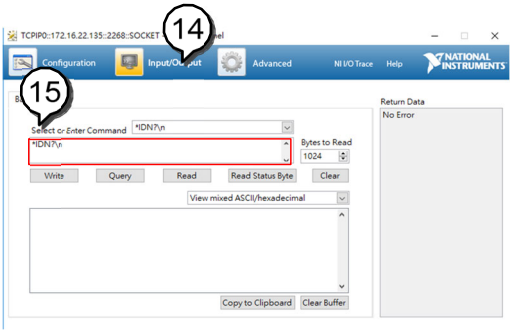
12. Make sure the **Enable Termination Character** check box is checked and the terminal character is *\n (Value: xA)*.

13. Click **Apply Changes**.



14. Click the **Input/Output** icon.

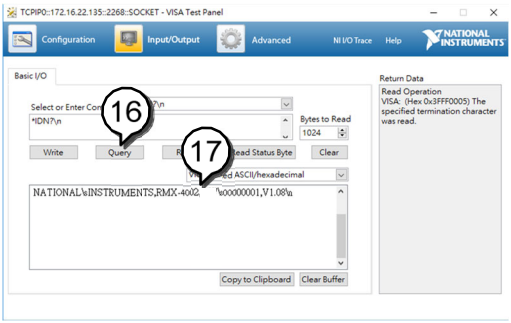
15. Enter **IDN?\n* in the **Select or Enter Command** dialog box if it is not already entered.



16. Click the **Query** button.

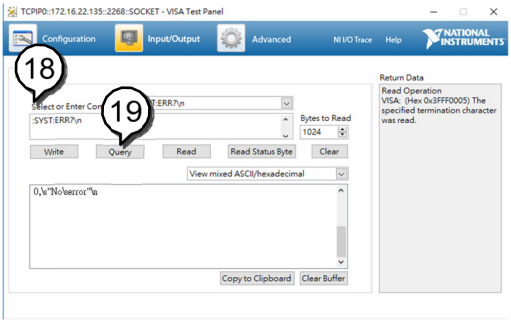
17. The *IDN?\n query returns the manufacturer, model name, serial number, and firmware version in the dialog box.

    NATIONAL\sINSTRUME,rMX-4002, \s00000001, V108\n



18. Enter the command *:SYST:ERR\n*.

19. Click the **Query** button. You will get an error message.



Saving/Recalling Channels

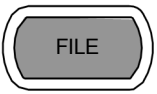
Background

The RMX-400x Series can save data for up to 120 channel configurations. Using the onboard memory, 120 memory slots represent each channel.

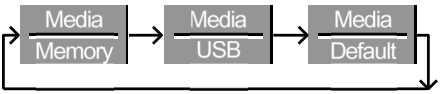
Program sequences and individual channel setups use memory. For further memory details, refer to page 104.

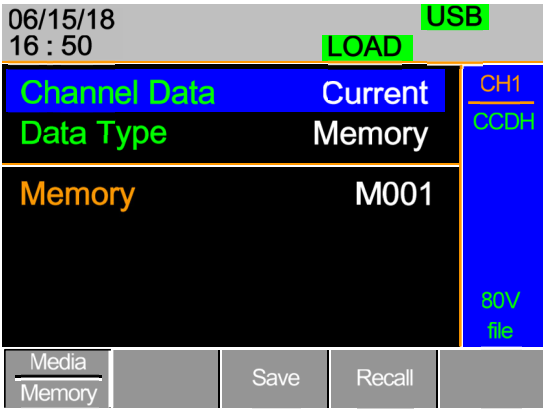
Panel Operation

1. Press the File key.

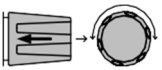


2. Press F1 repeatedly until the Media Memory menu appears.



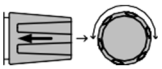


3. Use the selector knob to edit Channel Data and Data Type.



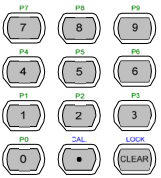
4. Choose Current or All and Memory.

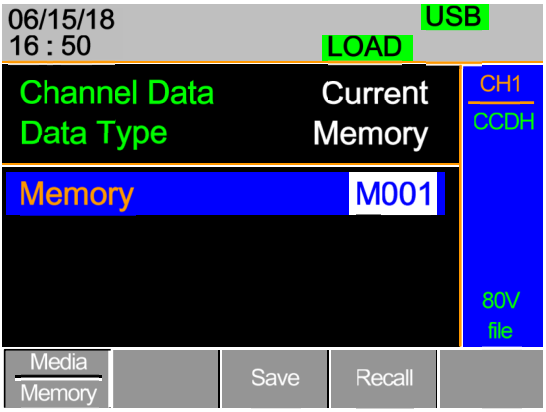
5. Press the selector knob to edit Memory (M001-M120)



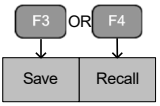
or

Use the number pad to enter a number.





6. Press F3 to Save or F4 to Recall the memory settings.



7. A message indicates when a save has been successful.

Memory No 001 Save OK

Note

The display reverts to the channel menu after recalling memory.

Saving/Recalling Preset memory

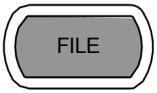
Background

The RMX-400x Series can store up to 10 presets for each channel. You can save or recall the presets either individually for each channel (Channel Data: Current) or at the same time (Channel Data: All), using the All option.

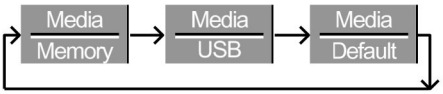
For further memory details, refer to page 104.

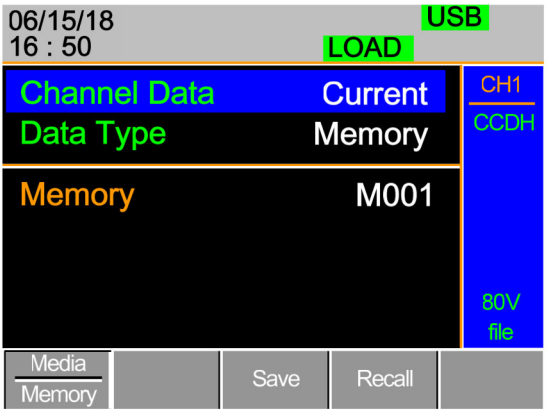
Panel Operation

1. Press the File key.

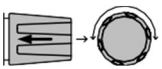


2. Press F1 repeatedly until the Media Memory menu appears.





3. Use the selector knob to edit Channel Data and Data Type.

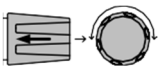


4. To save or recall only the active channel, choose Current and Preset. To save or recall all the presets, choose All and Preset.

Save / Recall Current Channel

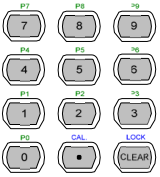
Save / Recall All Channels

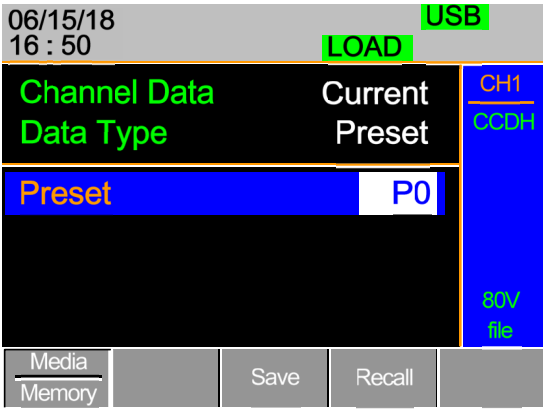
5. Press the selector knob to edit Preset (P0-P9)



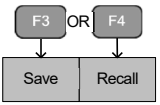
or

Use the number pad to enter a number.





6. Press F3 to Save or F4 to Recall the Presets.



7. A message displays when the save is complete.

Preset P0 Save OK

Note

The display reverts to the channel menu after recalling memory.

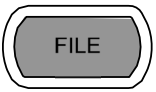
Saving/Recalling Setup Memory

Background

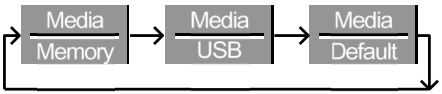
The RMX-400x Series can store up to four setups using the onboard memory. You can save each setup from the file menu. Using Setup Memory saves each channel. For further memory details, refer to page 104.

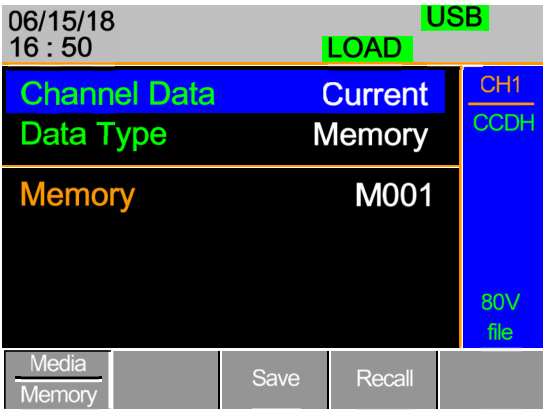
Panel Operation

1. Press the File key.

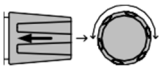


2. Press F1 repeatedly until the Media Memory menu appears.



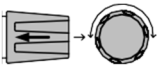


3. Use the selector knob to edit Channel Data and Data Type.



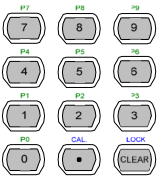
4. Choose All and Setup.

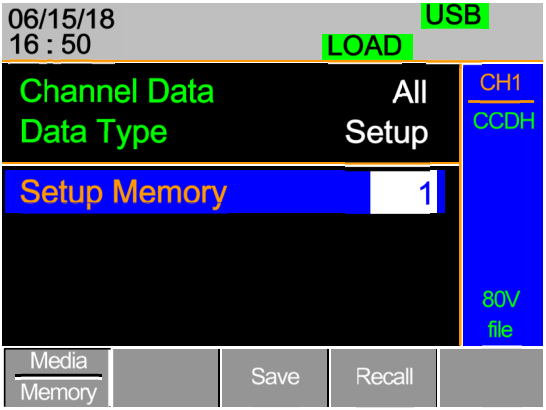
5. Press the selector knob to edit Setup Memory (1-4)



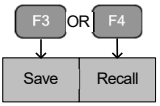
or

Use the number pad to enter a number.





6. Press F3 to Save or F4 to Recall the Setup Memory.



7. A message displays when the save/recall is complete.

Setup Memory 1 Save OK
Setup Memory 1 Recall OK

Setting the Default USB Path/File

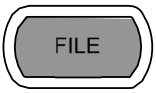
Background

When saving files to a USB memory stick, the files are saved into the root directory if a file path has not been set.

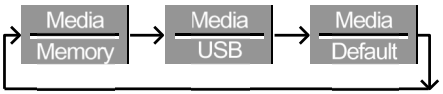
Panel Operation

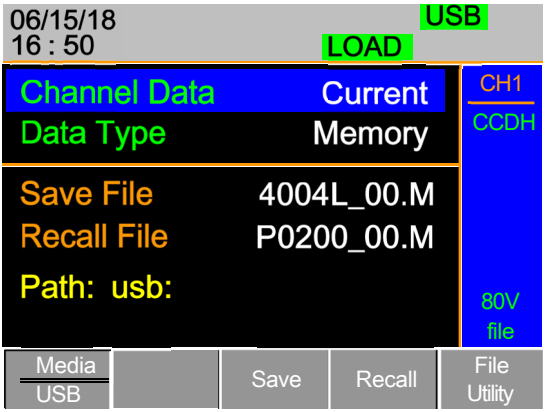
1. Insert a USB flash drive into the front panel USB slot.

2. Press the File key.

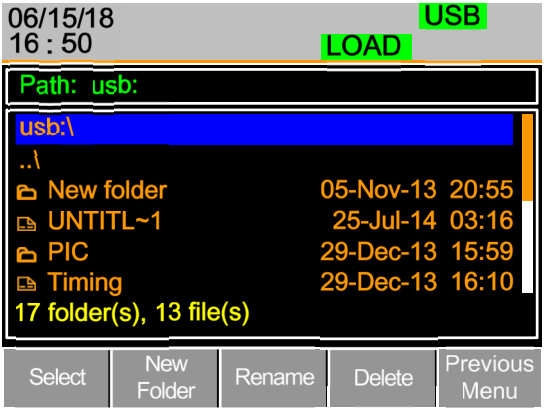


3. Press F1 repeatedly until the Media USB menu appears.





4. Press F5 (File Utility).



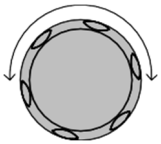
The top section (window) shows the current USB path.

There are four options:

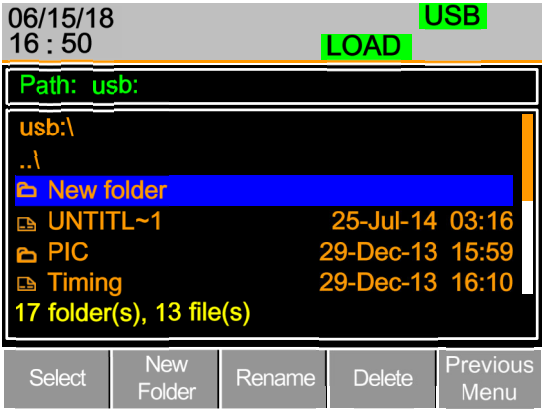
- **Select**—Selects the current USB path as the default file path to save (Step 5).
- **New Folder**—Creates a new folder (Step 7).
- **Rename**—Renames the current folder/path (Step 13).
- **Delete**—deletes the current file/path name. (Step 20).

Select Default Path

5. Use the selector knob to highlight the new path directory



6. Press F1 (Select) to select the new default directory path.

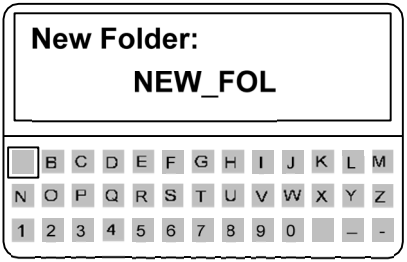


The new path is shown in the upper Path box in green.

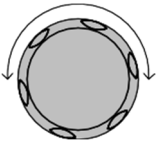
Create New Folder

7. To create a new directory, Press F2 (New Folder)

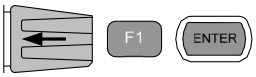
The onscreen keyboard (OSK) appears. The directory has an eight-character size limit.



8. Use the selector knob to scroll left and right through the keys.



9. When a key is highlighted, use the selector knob, F1, or Enter to confirm a key entry.



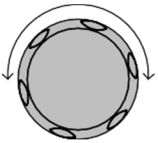
10. Use F2 (backspace) to delete any previous entries/mistakes.

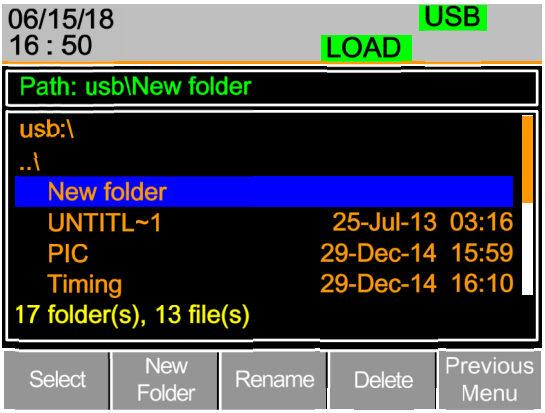
11. Press F3 (save) to save the directory name.

12. Press F5 (previous menu) to continue to the previous menus.

Rename Folder

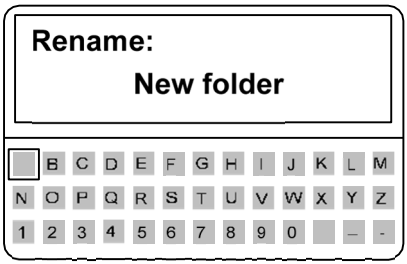
13. Use the selector knob to highlight the file/directory that you need to rename.



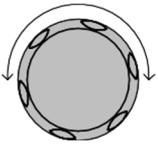


14. Press F3 (Rename).

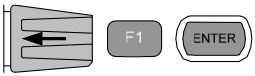
The onscreen keyboard appears



15. Use the selector knob to scroll left and right through the keys.



16. When a key is highlighted, use the selector knob, F1, or Enter to confirm a key entry.



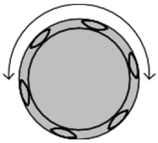
17. Use F2 (backspace) to delete any previous entries/mistakes.

18. Press F3 (save) to save the directory name.

19. Press F5 (previous menu) to continue to the previous menus.

Delete Filename

20. Use the selector knob to highlight a file/directory.

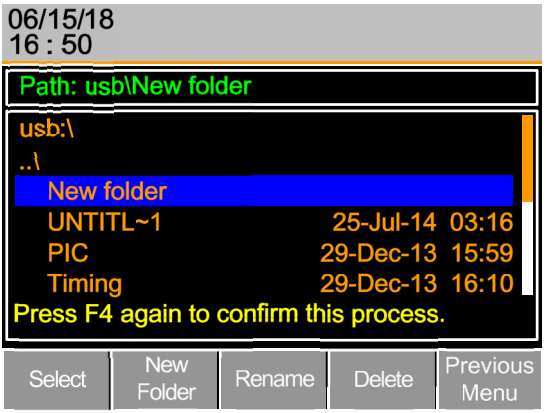


21. Press F4 (delete).

Note

If there is any content in the folder, you cannot delete it and the message **Error! This folder may be not empty!** will be displayed on the screen.

22. To confirm deletion, press F4 again.



Saving Setups to USB Memory

Background

Setup data contains all channel data including memory, presets, and program sequences.

There are four setups in internal memory. When saving to USB, save all four setups. Conversely, when recalling, recall all four setups to main memory.

The file extension *.S is for Setup data only.

Parameters

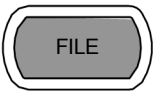
Save File 400X_XX.S

Panel Operation

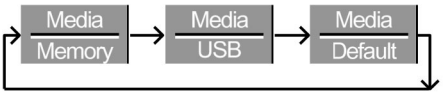
1. Insert a USB flash drive into the front panel USB slot.

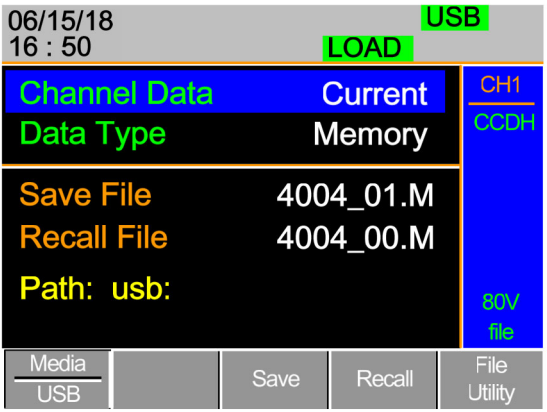
2. Ensure that the USB path is set. Refer to page 278.

3. Press the File key.

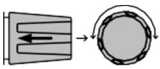


4. Press F1 repeatedly until the Media USB menu appears.

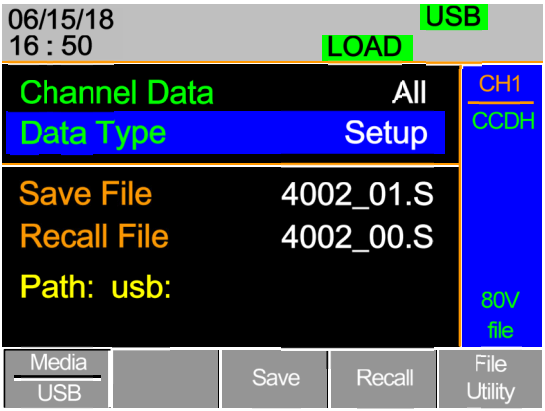




5. Use the selector knob to edit Save Chan and Data Type.



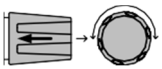
6. Choose All and Setup.



The screen updates to show only Setup files (*.S) available to save/recall in the root directory. Press F5 (File Utility) to select the directory to save.

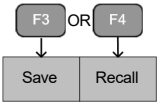
Save/Recall Setups to USB

7. Use the selector knob to edit Save File or Recall File. Rotating the selector knob scrolls through all available setup files (*.S).



8. Choose a filename (20XXX_XX.S).

9. Press F3 (Save) to save the setup data or F4 (Recall) to recall the setup data.



10. A screen message appears when the save/recall is complete.

400X_01.S Save Ok
400X_00.S Recall Ok

Note

You can save setups only if you have saved them to internal memory first. For details on how to save to internal memory, refer to page 274.

Saving/Recalling Memory Data to USB

Background

There are two options to save memory data to a USB flash drive:

Save Chan Current: Saves the active channel's memory data (M001-M120) to the root directory (400X_XX.M). Press F5 (File Utility) to select the directory to save.

Save Chan All: Saves every channel's memory data (CH1 M001-120 to CH8 M001-M120) to a directory (ALL00XX) as separate files for each channel (P0X0X_C1.M-P0X0X_C8.M).

Recall File: Recalls the selected file to the active channel's memory (MXXX). You cannot update all channels at once; you can recall only one channel at a time.

The file extension *.M is for memory data only.

For more information about the file structures, refer to page 104.

Parameters

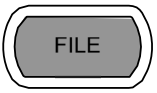
Save Channel Data: All	Directory ALL0000-ALL0099
	File: 400X_CX.M
Save Channel Data: Current	File: 400X_CX.M
Recall Channel Data: Current	File: 400X_CX.M

Panel Operation

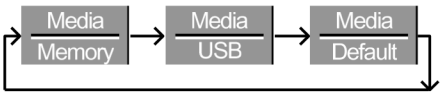
1. Insert a USB flash drive into the front panel USB slot.

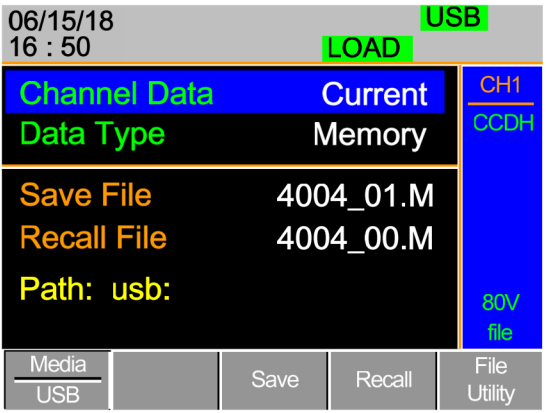
2. Ensure that the USB path has been set. Refer to page 278.

3. Press the File key.



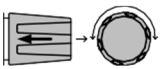
4. Press F1 repeatedly until the Media USB menu appears.



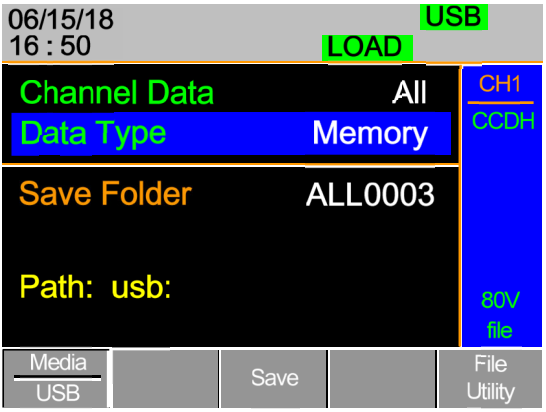


Save all Channels

5. Use the selector knob to edit Save Chan and Data Type.

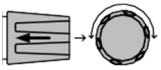


6. Choose All and Memory



The screen updates to show Save Folder. Note that you cannot recall all channels at once; you can only save them.

7. Use the selector knob to edit Save Folder.



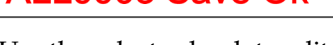
8. Choose a directory name (ALL0000-ALL0099).

Note

Used directories are not available. You cannot overwrite older directories. You must delete them first.

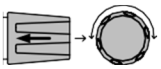
9. Press F3 (Save).

10. A screen message displays when complete.

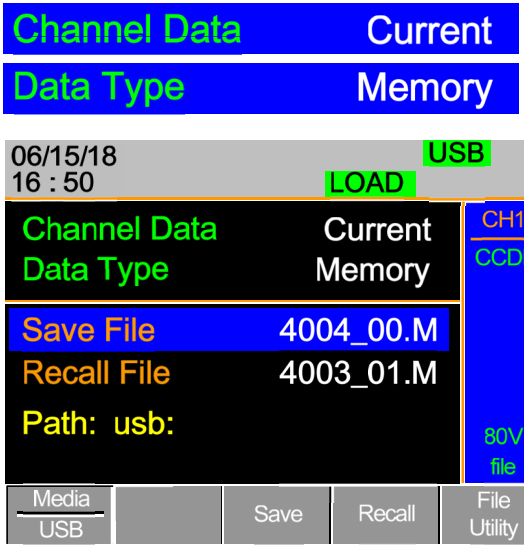


Save /Recall File

11. Use the selector knob to edit Save Chan and Data Type.



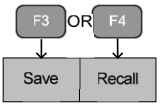
12. Choose Current and Memory.



13. Use the selector knob to edit Save File or Recall File.

14. Choose a filename.

15. Press F3 (Save) to save or F4 (Recall) to recall the current channel memory.

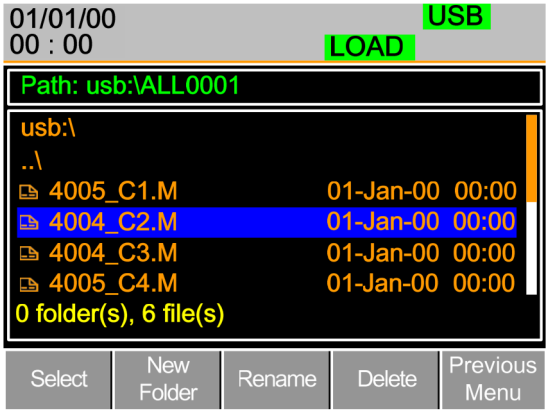


16. A save or recall message displays when complete.

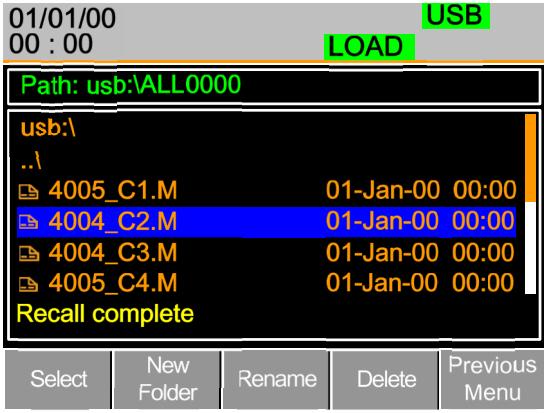
4004_00.M Save Ok
4004_00.M Recall Ok

Recall File from USB Path

17. Press F5 (File Utility).
18. Use the selector knob to select path for saving memory: usb:\ALLXXXX\File: 400X_XX.M.



19. Press the selector knob, Enter or F1.
20. A recall message displays when complete.



Note

Remember that only the data you saved to internal memory is saved to USB. Only the act ive channel is saved.

If you try to recall data that originated from a load module different than the active channel, an error message appears. The filename must reflect the active channel's load module type.

Machine Type Error

Saving/Recalling Presets to USB

Background

There are two options to save channel presets to a USB flash drive:

Save Chan Current: Saves the active channel's presets (P0-P9) into the root directory (400X_XX.P). Press F5 (File Utility) to select the directory to save.

Save Chan All: Saves every channel's presets (CH1 P0-P9 - CH8 P0-P9) into a directory (ALL00XX) as separate files for each channel (400X_C1.P-400X_C8.P).

Recall: Recalls the selected file to the active channel's presets (P0-P9). You cannot update all channels at once; you can recall only one channel at a time.

The file extension *.P is for channel Presets only.

For more information about the file structures, refer to page 104.

Parameter

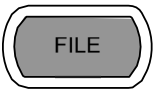
Save Channel Data: All	Directory: ALL0000-ALL0099 File: 400X_CX.P
Save Channel Data: Current	File: 400X_XX.P
Recall Channel Data: Current	File: 400X_XX.P

Panel Operation

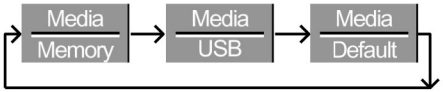
1. Insert a USB flash drive into the front panel USB slot.

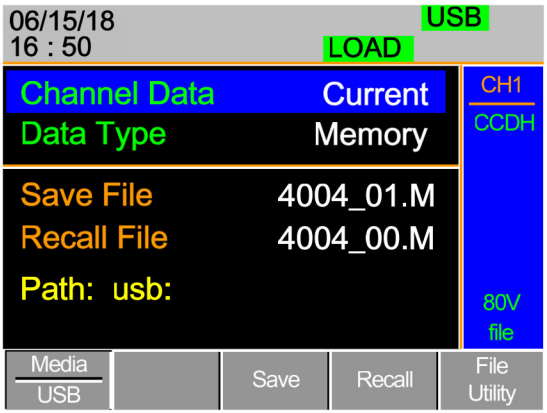
2. Ensure that the you have set the USB path. Refer to page 278.

3. Press the File key.



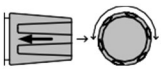
4. Press F1 repeatedly until the Media USB menu appears.



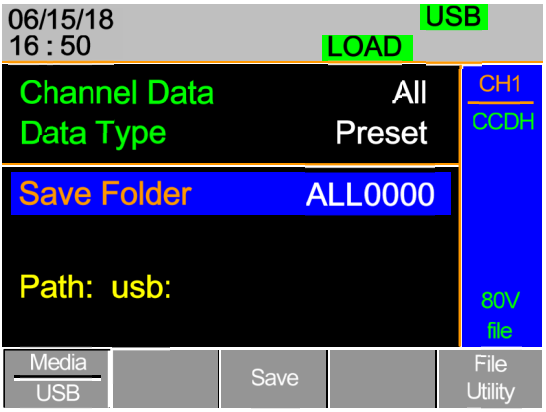


Save all Channel Presets

5. Use the selector knob to edit Save Chan and Data Type.

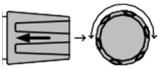


6. Choose All and Preset



The screen updates to show Save Folder. Note that you cannot recall all presets at once; you can only save them.

7. Use the selector knob to edit Save Folder.



8. Choose a directory name (ALL0000-ALL0099).

Note

Used directories are not available. You cannot overwrite older directories. You must delete them first.

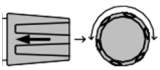
9. Press F3 (Save)

10. A screen message displays when the save is complete.

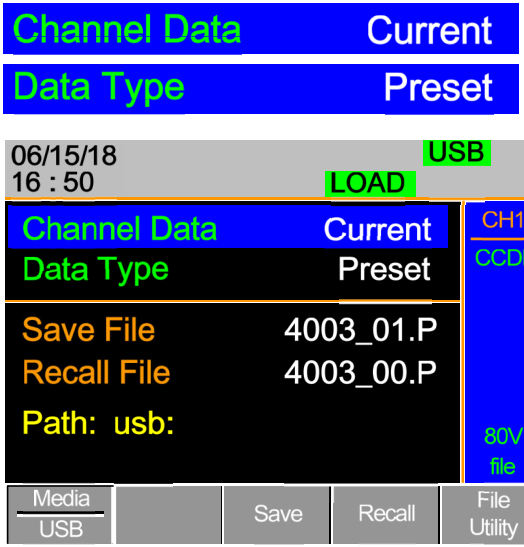
ALL0001 Save Ok

Save/Recall Preset (current channel)

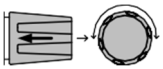
11. Use the selector knob to edit Save Chan and Data Type.



12. Choose Current and Preset.

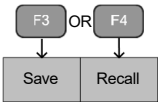


13. Use the selector knob to edit Save File or Recall file.



14. Choose a filename.

15. Press F3 (Save) to save or F4 (Recall) to recall the channel presets.

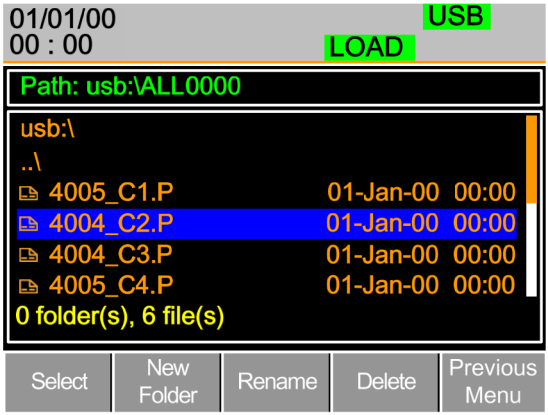


16. A message displays when the save or recall has completed.

4003_01.P Save Ok
4003_01.P Recall Ok

Recall File from USB Path

17. Press F5 (File Utility).
18. Use the selector knob to select path for saving preset: usb:\ALLXXXX\File: 400X_XX.P.



19. Press the selector knob, Enter, or F1.
20. A recall message displays when complete.

Note

Remember that only data you have saved to internal memory is saved to USB. Only the act ive channel presets are saved.

If you try to recall data that originated from a load module different than the active channel, an error message appears. The filename must reflect the active channel's load module type.

Machine Type Error

Saving/Recalling Sequences to USB

Background

There are two options to save sequences to a USB flash drive. You can save sequences from either all channels or the current channel only.

Save All: All channels' sequences are saved to a directory (ALL00XX) as separate files for each channel (400X_C1.A-400X_C8.A).

Save Current: The current channel's sequence is saved to the root directory (400X_XX.A). Press F5 (File Utility) to select the directory to save.

Recall: You can recall sequences for only the current channel. You cannot recall all channels' sequences at once.

The file extension *.A is for sequences only.

For more information about the file structures, refer to page 104.

Parameters

Save Channel Data: Current	Directory: ALL0000-ALL0099 File: 400X_C1.A
Save Channel Data: Current	File: 400X_XX.A
Recall Channel Data: All	File: 400X_XX.A

Panel Operation

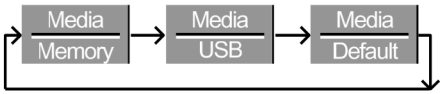
1. Insert a USB flash drive into the front panel USB slot.

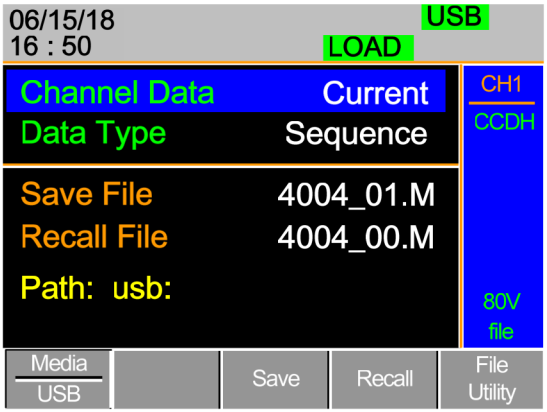
2. Ensure that the USB path has been set.

Refer to page 278.

3. Press the File key.

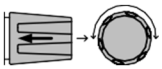
4. Press F1 repeatedly until the Media USB menu appears.



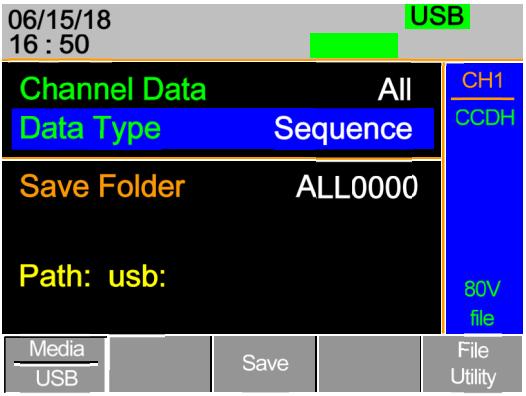


Save all Channel SEQ

5. Use the selector knob to edit Save Chan and Data Type.

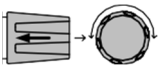


6. Choose All and Sequence.



The screen updates to show Save Folder. Note that you cannot recall all Sequence data at once; you can only save it.

7. Use the selector knob to edit Save Folder.



8. Choose a directory name (ALL0000-ALL0099).

Note

Used directories are not available. You cannot overwrite older directories. You must delete them first.

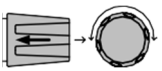
9. Press F3 (Save)

10. A screen message displays when saving.

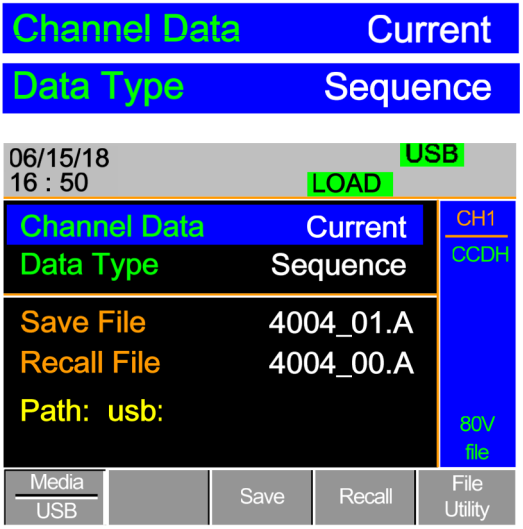
Save All Chan in ALL0000

Save/Recall SEQ (current channel)

11. Use the selector knob to edit Save Chan and Data Type.



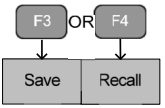
12. Choose Current and SEQ.



13. Use the selector knob to edit Save File or Recall File.

14. Choose a filename.

15. Press F3 (Save) to save or F4 (Recall) to recall the current channel's sequence.

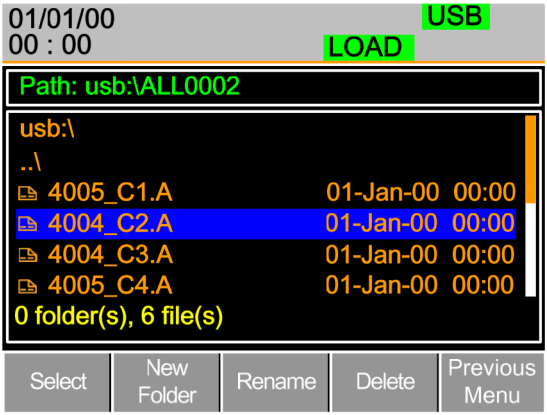


16. A message displays when you save/recall the file.

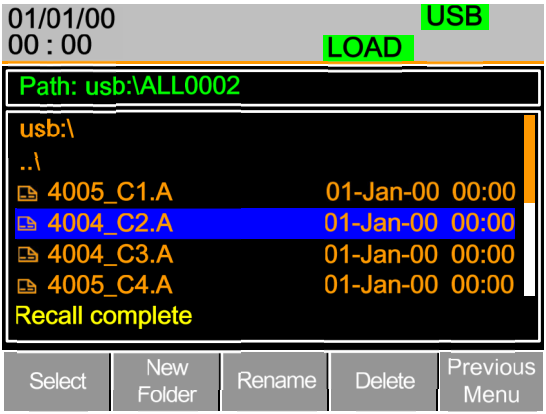
4004_01.A Save OK
4004_01.A Recall OK

Recall File from USB Path

17. Press F5 (File Utility).
18. Use the selector knob to select path for saving sequence: usb:\ALLXXXX\File: 400X_XX.A.



19. Press the selector knob, Enter, or F1.
20. A recall message displays when complete.



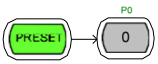
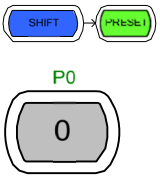
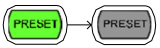
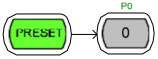
Note

Remember that you must save a sequence to the internal buffer before you can save it to USB.

If you try to recall data that originated from a load module different than the active channel, an error message appears. The filename must reflect the active channel's load module type.

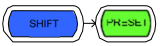
Machine Type Error

Quick Preset Recall/Save

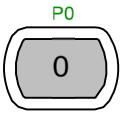
Background	The RMX-400x Series mainframes have up to 10 channel presets (P0-P9). Quick recalling or saving presets applies to only the active channel. For example, P1 on CH1 is not the same as P1 on CH2.	
Parameter	Presets P0-P9 (current channel)	
Panel Operation	1. Remove any USB devices from the front panel.	
	2. Select the channel to which you want to save channel presets.	Refer to page 136.
Save Current Channel Preset	3. To save a channel preset, press the Preset key and hold any number key (0-9) for a short time until you hear a beep. 0 = P0, 1= P1, etc.	
Save All Channel Presets	4. To save all channel presets, press the Shift and Preset keys and hold any number (0-9) for a short time until you hear a beep. 0 = P0, 1= P1, etc.	
	5. Press the Preset key again to deactivate it.	
	The preset is saved to the one of 10 presets depending on the number you chose.	
Recall Current Channel Preset	6. Press the Preset key and any number key. 0 = P0, 1= P0, etc. Only the current channel preset is recalled.	

Recall All Channel Presets

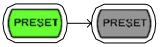
7. Press the Shift and Preset keys and any number key.



0 = P0, 1= P0, etc.



8. Press the Preset key again to deactivate it.



Only the active channel's channel preset is recalled.

Recall Setup Memory (Frame Link).

Background

A master mainframe can command all mainframes (master and slave) to recall setup memory from their internal memory. No setup data is recalled from the master mainframe to the slave units.

Parameter

Setup memory 1-4.

Panel Operation

1. On the master mainframe, follow the procedure for recalling setup memory for all channels.

Refer to page 276

All mainframes update setup memory on recall.

Note

You must save setup data before recalling both master and slave. If you do not save the setup data first, there will be no value change after recalling.

Recall Preset Memory (Frame Link)

Background

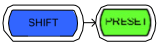
A master mainframe can command all units to recall preset memory from their internal memory. You can recall only the first three preset memories (P0-P2).

You can recall channel presets via the file menu or using the quick recall feature using the number pad.

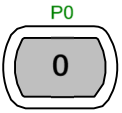
Parameters Presets P0-P2 (current channel)

Panel Operation: Quick Keys

1. Remove any USB devices from the front panel.
2. On the master mainframe, press the Shift and Preset keys.



3. Press any number key (0-2).
   0 = P0, 1= P1, etc.



The screen flashes momentarily when the presets are recalled.

Panel Operation: File menu

4. On the master mainframe, follow the procedure to recall preset memory for all channels.

Refer to page 274

The screen flashes momentarily when the presets are recalled.

Note

You must save preset data before recalling both master and slave. If you do not save preset data first, the value after recalling will be the factory default setting.

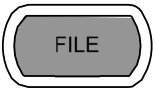
Recall Factory/User's Defaults

Background

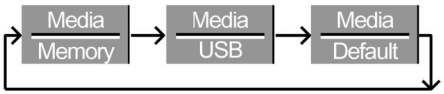
You can save or recall the factory/user's defaults at any time. For details about the factory defaults, refer to the default settings in the appendix, page 331.

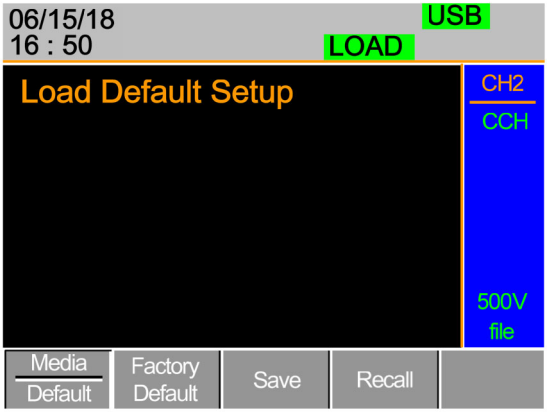
Panel Operation

1. Press the File key.

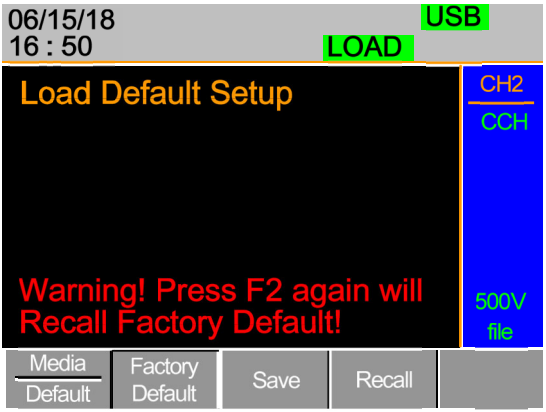


2. Press F1 repeatedly until the Media Default menu appears.



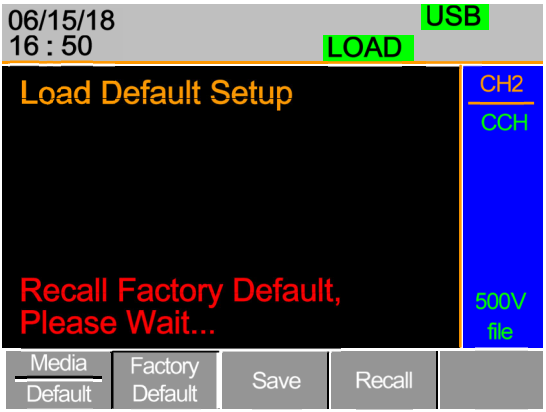


3. Press Factory Default (F2) to recall the factory default settings.



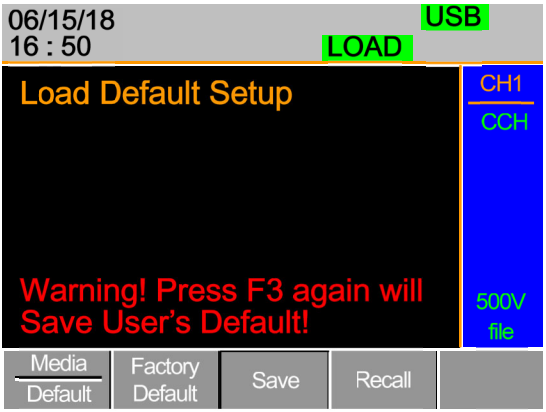
4. Press F2 again to ensure recall factory default setting.

F2



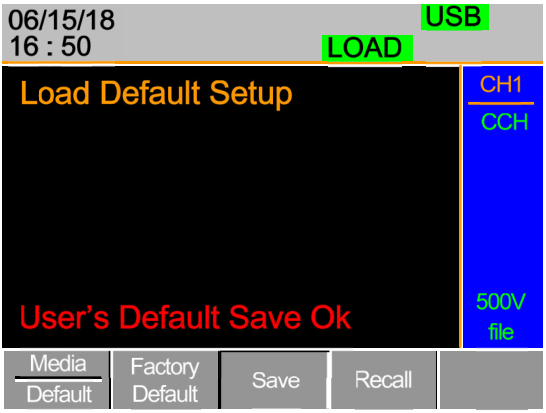
5. Wait a short time for the settings to be recalled.
6. Press Save (F3) to save the user's default.

F3

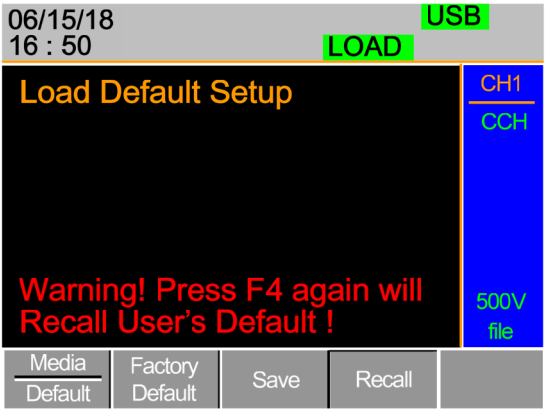


7. Press Save (F3) again to ensure saving the user's default.

8. Wait a short time for the settings to be saved.

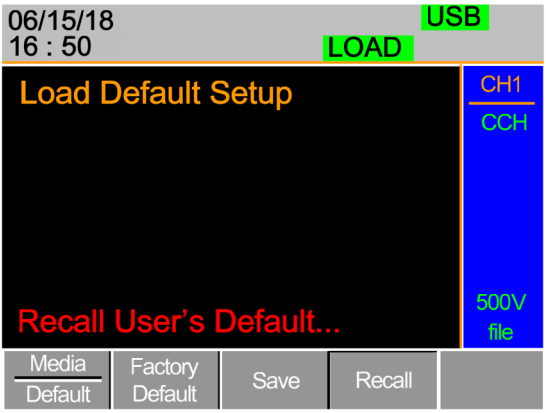


9. Press Recall (F4) to recall the user's default.



10. Press Recall (F4) to ensure recalling the user's default

11. Wait a short time for the settings to be saved.



INTERFACE

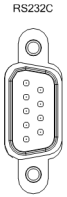
This chapter details the pin configuration of the RS232, frame link, channel control and go/nogo interfaces.

Interface Configuration

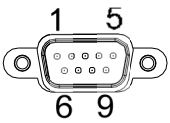
Configure RS-232C Interface

RS-232C Configuration	Connector	DB-9, male
	Baud rate	9600
	Parity	None
	Data bit	8
	Stop bit	1

Connect the RS232C cable (National Instruments part no. GTL-232) to the rear panel port: DB-9 male connector.



Pin Assignment



2: RxD (Receive data)

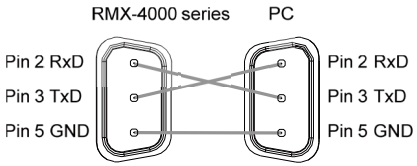
3: TxD (Transmit data)

5: GND

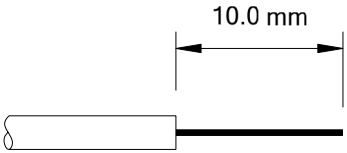
1, 4, 6,7, 8, 9: no connection

PC Connection

Use the null modem connection as shown in the diagram below.

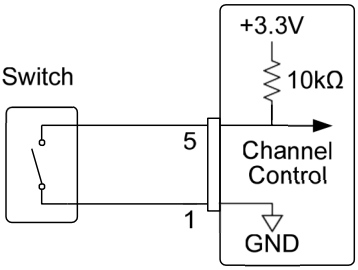
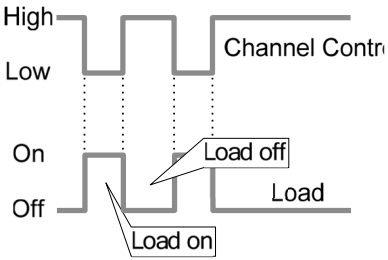


Configure Channel Control Interface

Channel Control Configuration	Connector	Screwless connector.
	Wire gauge	22-28 AWG (24 AWG recommended).
	Wire connection	10 mm strip gauge for connection.
		
	Input	0-10V.

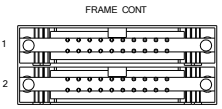
Pin Assignment

1 GND	Negative potential of the load input terminal.
2 I MON (OUTPUT)	Load input current monitor; where 0 V = 0% of input current and 10 V = 100% of input current.
3 V MON (OUTPUT)	Load input voltage monitor; where 0 V = 0% of input voltage and 10 V = 100% of input voltage.
4 Ext Voltage ref (INPUT)	External voltage reference, where 0 V = 0% of rating voltage/current and 10 V = 100% of rating voltage/current. The external voltage reference is for CC and CV mode.

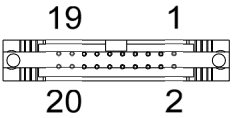
5 Load On	Load On Input. Load on = Active low. Load off = Active high. (Pin 5 of the connector is internally pulled up to 3.3 V with a 10 kΩ resistor when the switch is open. Thus, when the switch is open, pin 5 is logically high. When the switch is closed, pin 5 is pulled down to the GND ground level, making pin 5 logically low.)  Load On/Off determines whether the external switch is closed (low) or open (high). 
6 +15V	Internal power output. Max 50 mA.

Channel Control Interface Constraints	Mode/Range	You can select mode and range configuration via only the front panel.

Configure Frame Link Interface

Connection	Connect the frame link cable (MIL 20 pin connector) to the rear panel port: 20-pin male connector.	

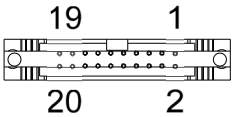
Pin Assignment (Frame Link Connector 1)



Pin Number	Pin Name	Description
Pin1	A	Input, Recall Preset memory 0 (all channels)
Pin2	B	Input, Recall Preset memory 1 (all channels)
Pin3	C	Input, Recall Preset memory 2 (all channels)
Pin4	Reserved	Reserved
Pin5	MEM_1	Input, Recall Setup memory 1 (all channels)
Pin6	MEM_2	Input, Recall Setup memory 2 (all channels)
Pin7	MEM_3	Input, Recall Setup memory 3 (all channels)
Pin8	MEM_4	Input, Recall Setup memory 4 (all channels)

Pin9	Enable	Input, Enable Load (On/Off), recall Preset memory (0-3) and Setup memory (1-4)
Pin10	Load On/Off	Input, Load On/Off
Pin11	NC	No connection
Pin12	NC	No connection
Pin13	NC	No connection
Pin14	NC	No connection
Pin15	Load Status	Output, load on status
Pin16	Alarm Status	Output, alarm activated
Pin17	+5V	Power source output, +5V, 100 mA
Pin18	NC	No connection
Pin19	GND	Ground
Pin20	GND	Ground

Pin assignment (Frame link connector 2)



Pin Number	Pin Name	Description
Pin1	Sync._A	Output, Sync signal, Recall Preset memory 0 (all channels)
Pin2	Sync._B	Output, Sync signal, Recall Preset memory 1 (all channels)

Pin3	Sync._C	Output, Sync signal, Recall Preset memory 2 (all channels)
Pin4	Reserved	Reserved
Pin5	Sync._MEM_1	Output, Sync signal, Recall Setup memory 1 (all channels)
Pin6	Sync._MEM_2	Output, Sync signal, Recall Setup memory 2 (all channels)
Pin7	Sync._MEM_3	Output, Sync signal, Recall Setup memory 3 (all channels)
Pin8	Sync._MEM_4	Output, Sync signal, Recall Setup memory 4 (all channels)
Pin9	Sync._Enable	Output, Sync signal, Enable Load (On/Off), recall Preset memory (0-3) and Setup memory (1-4)
Pin10	Sync._Load On/Off	Output, Sync signal, Load On/Off
Pin11	NC	No connection
Pin12	NC	No connection
Pin13	NC	No connection
Pin14	NC	No connection
Pin15	Load Status	Output, load on status
Pin16	Alarm Status	Output alarm activated
Pin17	N.C	No connection

	Pin18	+5V	Power source output, +5V, 100 mA
	Pin19	GND	Ground
	Pin20	GND	Ground

Explanation

- Input: active low (0-1 V)
  active high (4-5 V)
- Note: Input type is internally pulled up to 5 V with a 10 kΩ resistor.
- Output: high (floating)
  low (0-1 V)
- Note: Output type is internally Open collector outputs, maximum 30 VDC with 1.1 V saturation voltage (100 mA).
- When Enable (pin9) is on (active low), the following is disabled from the mainframe: Load On/Off (pin 10) activating loads and recalling preset (pin 1-3) or setup memory (pin 5-8).

Frame Link Constraints

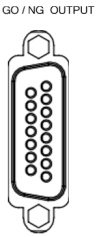
- You can link up to five devices (one master and four slave units) with a maximum cable length of 30 cm for each cable.
- You must turn on all connected devices.
- No loop or parallel connections.

Configure Go/NoGo Interface

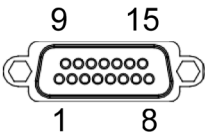
Connection

Use a DSUB (DB-15 female) connector to connect to the go/nogo port.

The go/nogo port is an output-only port.



Pin assignment



Pin1	Ch1_GO/NG	Pin9	Ch5_GO/NG
Pin2	GND	Pin10	GND
Pin3	Ch2_GO/NG	Pin11	Ch6_GO/NG
Pin4	GND	Pin12	GND
Pin5	Ch3_GO/NG	Pin13	Ch7_GO/NG
Pin6	GND	Pin14	GND
Pin7	Ch4_GO/NG	Pin15	Ch8_GO/NG
Pin8	GO/NG_Enable		

Connection Type: Open collector output maximum 30 VDC with 1.1 V saturation voltage (100 mA).

30 V DC (high)	Pass (go) or SPEC test: off
1.1 V DC (low)	Fail (nogo)

USB Interface Connection

Connection: For USB remote connection, use the USB-B port on the mainframe rear panel.

FAQ

Q1. The load voltage indicated on the load module is below the expected voltage.

A1. Ensure that the load leads are as short as possible, twisted, and use the appropriate wire gauge. Ensure that you use voltage sense; this can help alleviate the voltage drop across the load leads.

Q2. When I try to start a program sequence, it does not run. “No Active Channel” is displayed.

A2. Ensure that the channel(s) is activated (not set to off) in the FUNC→Program→Active Channel menu.

Q3. When trying to save to USB, the USB memory stick is unresponsive.

A3. Try restarting the RMX-400x mainframe. If this does not solve the problem, ensure that the USB memory is cleanly formatted.

Q4. When I try to clear an alarm, it does not work.

A4. Before clearing an alarm or using the Protection Clear All function, you must turn off the DUT. When the DUT is off, you can clear the alarm(s).

For more information, contact your local dealer or National Instruments at www.ni.com.

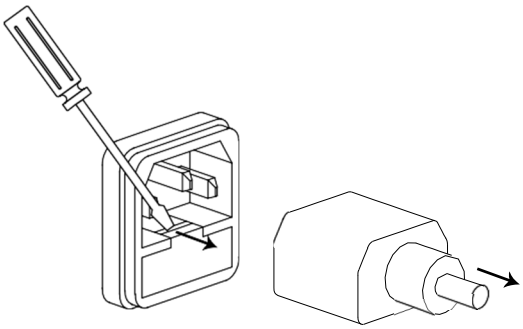
APPENDIX

Fuse Replacement

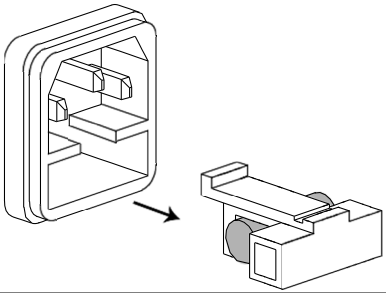
Step

1. Turn off the power at the wall outlet and rear panel. Remove the power cord.

2. Remove the fuse socket using a minus driver.



3. Replace the fuse in the holder.



Rating T3.15 A, 250 V

Firmware Update

Background

You can update the RMX-400x firmware using a USB memory stick. For the latest firmware, contact your local National Instruments distributor or download the latest firmware from www.ni.com.

Filename

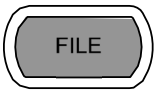
File: P2KAXXXX.UPG

Note

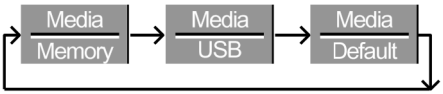
Copy the firmware file (*.UPG) to the root directory of a USB stick before proceeding with the firmware update.

Panel Operation

1. Insert a USB flash drive into the front panel USB slot.
2. Press the File key.

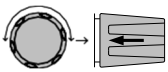


3. Press F1 repeatedly until the Media USB menu appears.



4. Press F5 (File Utility).

5. Use the selector knob to scroll down to the firmware file (*.UPG) and press the selector knob, Enter, or F1.

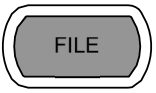


6. Press F1 to confirm the firmware upgrade.

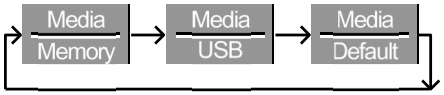
7. Wait for the firmware upgrade to finish. A message displays on completion.
8. Turn the power off.

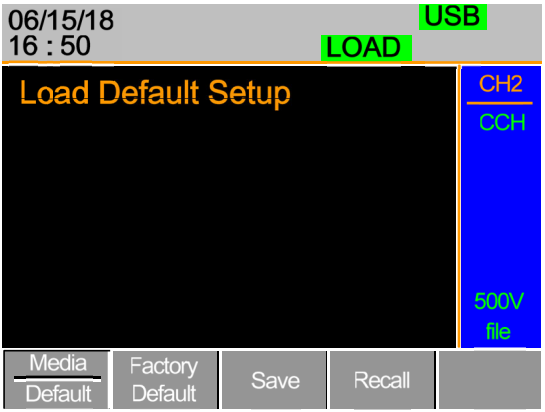
Recall Factory Default

9. Turn the power on.
10. Press the File key.



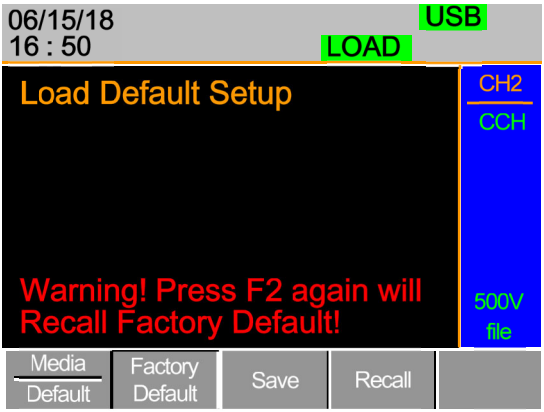
11. Press F1 repeatedly until the Media Default menu appears.



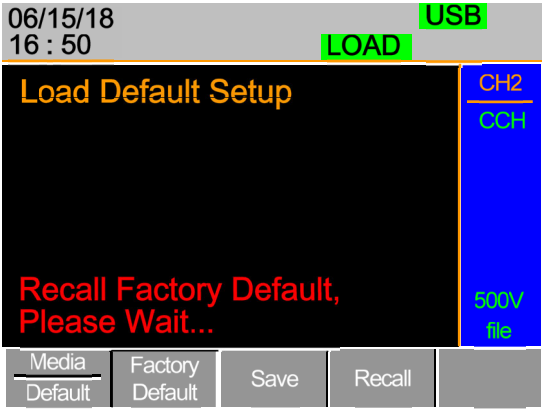


12. Press Factory Default (F2) to recall the factory default settings.

13. The firmware updating process is complete, and you can use the device now.



14. Press F2 again to ensure recalling the factory default setting.



15. Wait a short time for the settings to be recalled.

Calibration

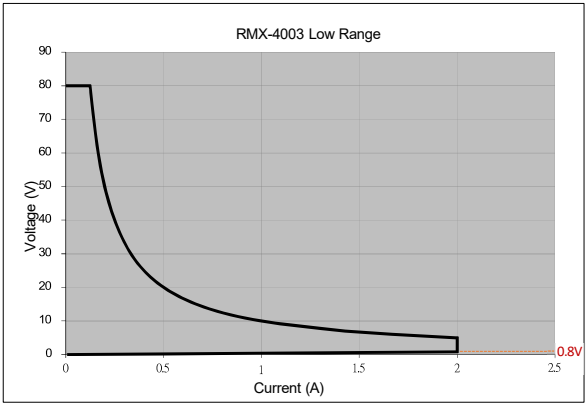
Background

Recommended calibration interval for the load modules is 12 months. If you require calibration, contact NI sales or service.

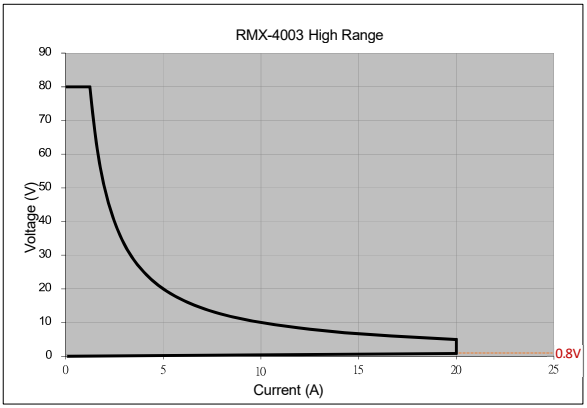
End-user calibration is not supported.

Range Chart

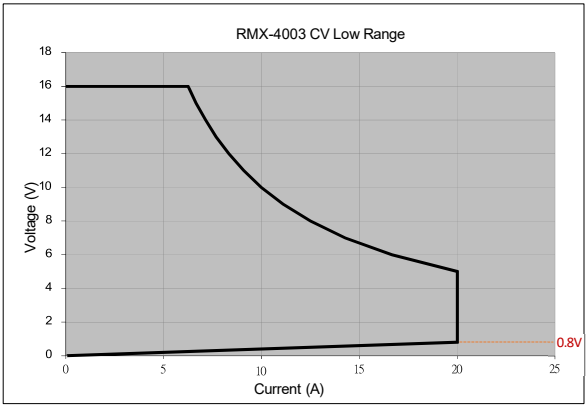
RMX-4003
Low Range
10 W



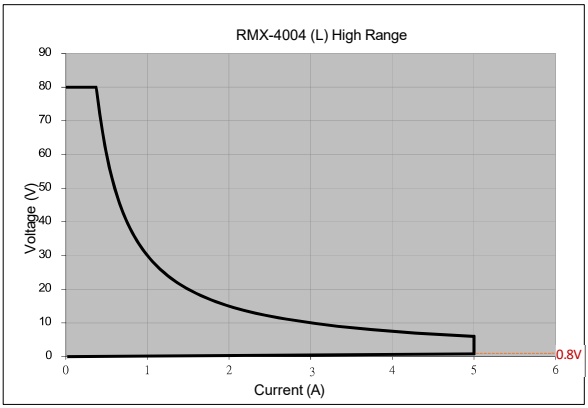
RMX-4003
High Range
100 W



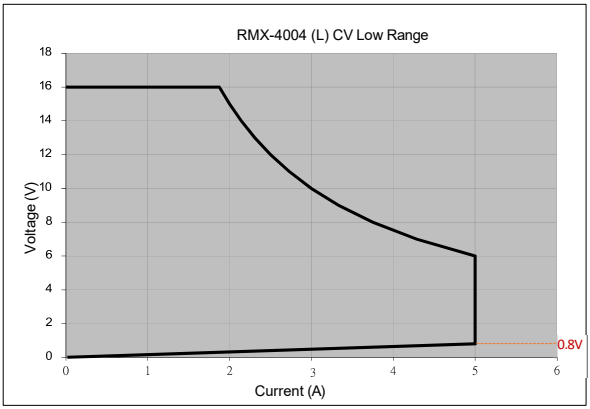
RMX-4003 CV Low Range



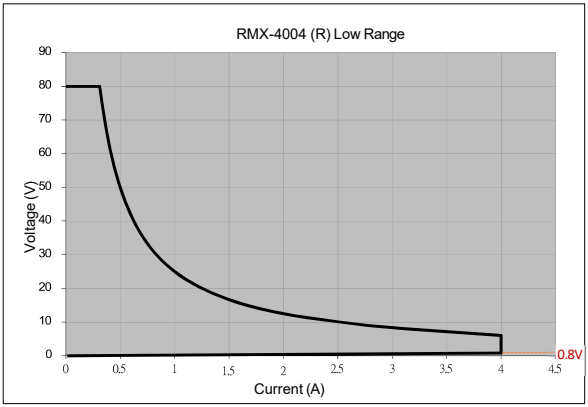
RMX-4004 (L) High Range 30 W



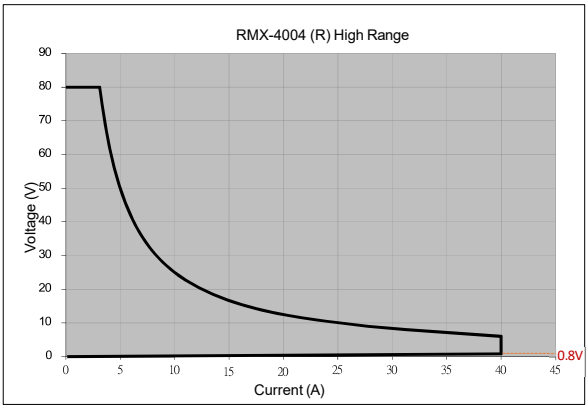
RMX-4004 (L) CV Low Range



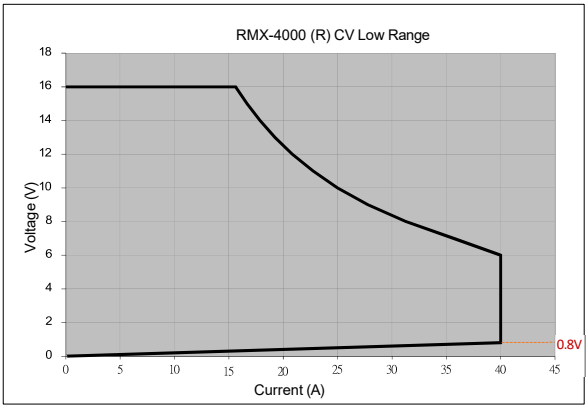
RMX-4004 (R)
Low Range
25 W



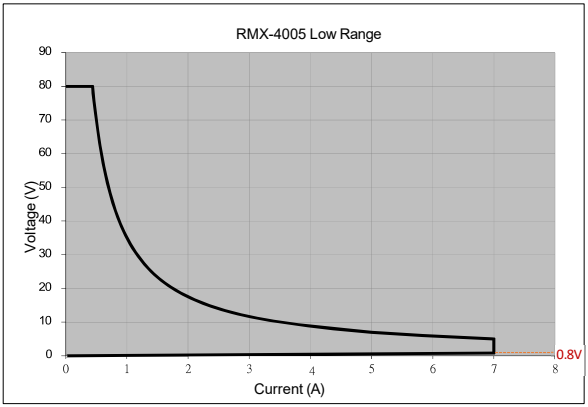
RMX-4004 (R)
High Range
250 W



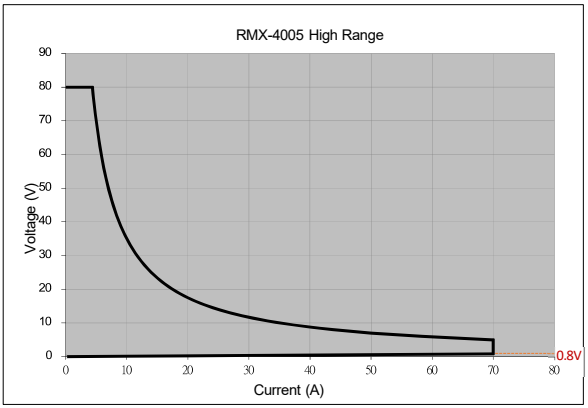
RMX-4004 (R)
CV Low Range



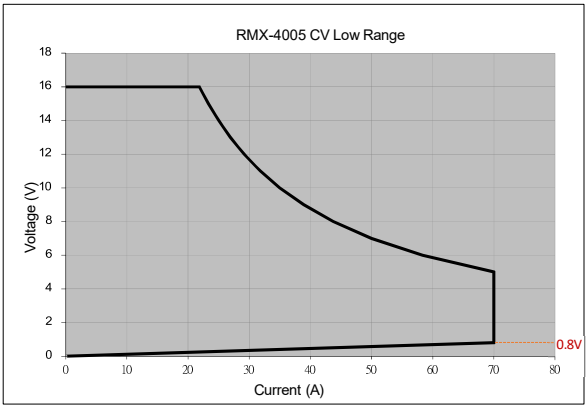
RMX-4005
Low Range
35 W



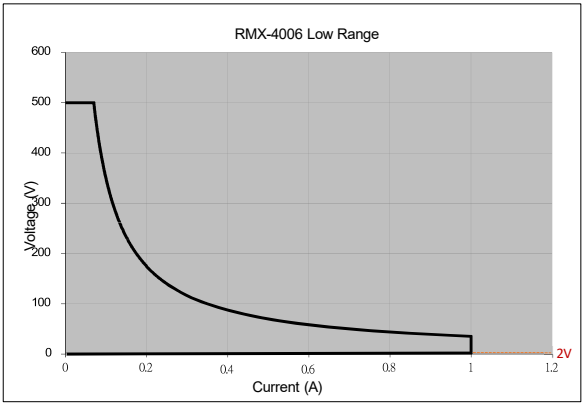
RMX-4005
High Range
350 W



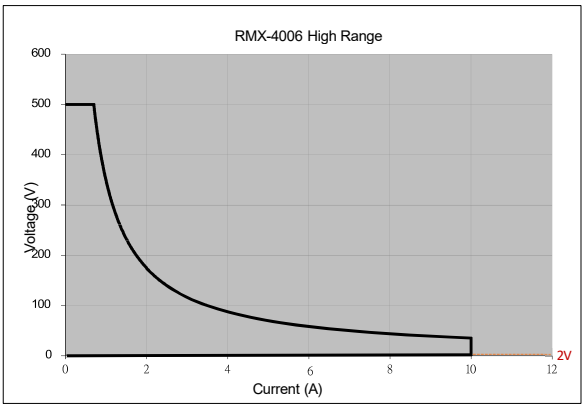
RMX-4005 CV
Low Range



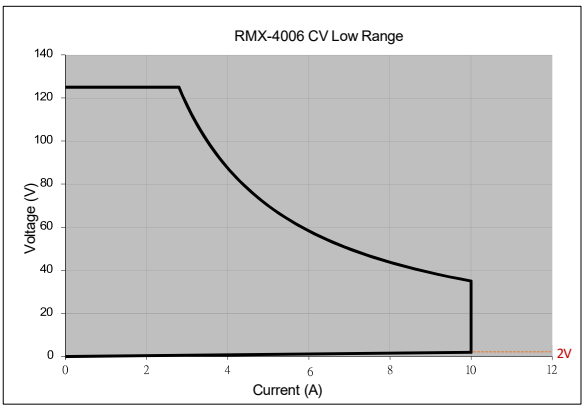
RMX-4006
Low Range
35 W



RMX-4006
High Range
350 W



RMX-4006 CV
Low Range



Default Settings

Menu Item		
CC Mode	Range: High	Mode: Static
	A/B Value: Min A	Rising Slew Rate: Max
	Falling Slew Rate: Max	
CR Mode	Range: High	Mode: Static
	A/B Value: Max Ω	Rising Slew Rate: Max
	Falling Slew Rate: Max	
CV Mode	Range: High	Response: Slow
	A/B Value: Max V	I Meas: High
	Curr Limit: Max A	
CP Mode	Range: High	A/B Value: Min W
	Curr Limit: Max A	
CHAN-Protection	OCP Level: Max	OCP Setting: OFF
	OVP Level: Max	OVP Setting: OFF
	OPP Level: Max	OPP Setting: OFF
	UVP Level: OFF	UVP Setting: Clear
	Protection Clear: All	
CHAN- Other	CC Vrange: High	Von Voltage: 0 V
	Von Latch: OFF	CH CONT: Pane
	Independent: OFF	Load D-Time: 0.0 s
	Response: Fast	CCH Step: Min
	CCL Step: Min	CRH Step: Min
	CRL Step: Min	CVH Step: Min
	CVL Step: Min	CPH Step: Min
	CPL Step: Min	Short Function: ON
	Short Key: Toggle	Short Safety: ON

CHAN-Group	Total Units: OFF	Group Mode: Para
	Display Mode: V, I	
CHAN- Seq. Edit	NO.: 001	Value: Min
	Rising/Falling SlewRate: Max	Duration Time: 0.000025 s
CHAN- Seq. Edit - Loop	Repeat: Infinity Times	Start of Loop: 001 Point
	On End Of Seq.: OFF A (CC mode) OFF Ω/OFF KΩ (CR mode)	CC Vrange: High
CHAN- Go/NoGo	SPEC Test: OFF	Delay Time: 0.0 s
	Entry Mode: Value	High: Max
	Low: Min	
FUNC- Program	PROG: 01	SEQ: 01
	Memory: M001	Run: Skip
	On-Time: 0.1 s	Off-Time: Off
	P/F-Time: Off	Short-Time: Off
	Short Channel: All channels	
FUNC- Program Chain	Start: P01	P01-P12→: Off
FUNC- Program-Active Channel	CH 01-08: Active: OFF	Prog: Off
FUNC- Sequence	Seq.: Off	TRIG In: Off
	TRIG: CH1: OUT	TRIG: CH2-08: IN
	Setting: CH01-CH08: OFF	
FUNC- OCP	OCP: Off	Chan: 1
	Range: High	Start C: Min
	End C: Setting Range Max	Step_C: Min
	Last_C: Min	Step_T: Min

	Delay: Min	Trig_V: Min
	Keep_T: Min	
FUNC- OCP- Active Channel	CH 01-08: Active: Off	
FILE- Memory	Channel Data: Current	Data Type: Memory
	Memory: M001	
FILE- USB	Channel Data: Current	Data Type: Memory
	Save File: No File	Recall File: No File
UTILITY- Load	Auto Load: OFF	Auto Load On: Prog
UTILITY - Interface	USB	
UTILITY - Other	Speaker: OFF	Contrast: 8
	Brightness: 70	Frame CONT: OFF
	Alarm (M): ON	Alarm (S): OFF
	Knob Type: Updated	Go_NoGo Tone: OFF
	Slave Knob: SetValue	Language: English
	High Resoultion: ON	System Mode: 0
	Von Latch Clear: Auto	Measure Period: 200 ms
	Jog Shuttle Control: OFF	RVP Load Off: OFF

Specifications

The specifications apply when the RMX-400x series is powered on for at least 30 minutes to warm up to a temperature of 25° C ± 5° C, unless specified otherwise.

	RMX-4000	RMX-4002
MODULE SLOTS	2	4
General		
Operating Environment		
Temperature	0 °C to 40 °C	
Altitude	Up to 2000 m	
Location	Indoor, no direct sunlight, dust free, almost nonconductive pollution.	
Storage Environment		
Temperature	-10 °C to 70 °C	
Relative humidity	< 90% RH	
Location	Indoor	
Power supply	AC input voltage range: 100-120 Vac / 200-240 Vac (90-132 Vac / 180-250 Vac) Frequency: 47-63 Hz Power rating: RMX-4002: 250 VA Max RMX-4000: 150 VA Max Transient overvoltage on the main supply is 2500 V.	
Fuse	T3.15 A/250 V	
Pollution degree	2	
Measurement category	1	
Rear panel USB class	USB 2.0 full speed (CDC-ACM)	
Weight	Approx. 17.1 kg (full modules)	Approx 28.4 kg (full modules)

	RMX-4003 (100 W x 2)	
Range	Low	High
Current	0-2 A	0-20 A
Voltage	0-80 V	
Min. operating voltage (dc) typ.	0.4 V at 2 A 0.2 V at 1 A	0.8 V at 20 A 0.4 V at 10 A

Static Mode		
Contant Current Mode		
Operating range	0-2 A	0-20 A
Setting Range	0-2.04 A	0-20.4 A
Resolution	0.1 mA	1 mA
Accuracy	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.)
Constant Resistance Mode		
Operating Range	0.075 Ω-300 Ω(100 W/16 V) 3.75 Ω-15 kΩ(100 W/80 V)	
Setting Range	0.075 Ω-300 Ω(100 W/16 V) 3.75 Ω-15 kΩ(100 W/80 V)	
Resolution	0.333 mS(100 W/16 V) 6.667 uS(100 W/80 V)	
Accuracy	300 Ω : ±(0.2% set + 0.1 s) 15 kΩ: ±(0.1% set + 0.01 s)	
Constant Voltage + Constant Current Mode		
Operating range	1-16 V	1-80 V
Setting range	0-16.32 V	0-81.6 V
Resolution	0.4 mV	2 mV
Accuracy	±(0.05% set + 0.1% F.S.)	
Current setting range	0-2.04 A	0-20.4 A
Resolution	0.1 mA	1 mA
Accuracy	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.*1)
*1: F.S. = Full scale of H range		
Constant Power + Constant Current Mode		
Operating range	1-10 W	1-100 W
Setting range	0-10.2 W	0-102 W
Resolution	1 mW	10 mW
Accuracy	±(0.5% set + 0.5% F.S.*1)	±(0.5% set + 0.5% F.S.)

Current Setting Range	0-2.04 A	0-20.4 A
Resolution	0.1 mA	1 mA
Accuracy	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.*1)

*1: F.S. = Full scale of H range

Dynamic Mode		
T1 and T2	0.025 ms – 10 ms / Res: 1 us 10 ms – 30 s / Res: 1 ms	
Accuracy	1 us/1 ms ± 100 ppm	

Constant Current Mode

Slew rate	0.32-80 mA/us	3.2-800 mA/us
Slew rate resolution	0.32 mA/us	3.2 mA/us
Slew rate setting accuracy	±(10% + 15 us)	±(10% + 15 us)
Current setting range	0-2.04 A	0-20.4 A
Current resolution	0.1 mA	1 mA
Current accuracy	±0.4% F.S.	

Constant Resistance Mode

Slew rate	3.2-800 mA/us
Slew rate resolution	3.2 mA/us
Slew rate setting accuracy	±(10% + 50 us)
Resistance setting range	0.075 Ω-300 Ω(100 W/16 V) 3.75 Ω-15 kΩ (100 W/80 V)
Resistance resolution	0.333 mS(100 W/16 V) 6.667 uS(100 W/80 V)
Resistance accuracy	300 Ω: ±(0.5% set + 0.1 s) 15 kΩ: ±(0.5% set + 0.01 s)

Measurment		
Voltage Readback		
Range	0-16 V	0-80 V
Resolution	0.32 mV	1.6 mV
Accuracy	±(0.025% set + 0.025% F.S.)	
Current Readback		
Range	0-2 A	0-20 A
Resolution	0.04 mA	0.4 mA

Accuracy	±(0.05% set + 0.05% F.S. *2)	

Power Readback

Range	0-10 W	0-100 W
Accuracy	±(0.1%s et + 0.1% F.S.*1)	

*1 : Power F.S. = Vrange F.S. x Irange F.S.

*2 : F.S. = Full scale of H range

Protective		
Over Power Protection		
Range	1-102 W	
Resolution	0.5 W	
Accuracy	±(2% set + 0.25% F.S.)	
Over Current Protection		
Range	0-25-20.4 A	
Resolution	0.05 A	
Accuracy	±(2% set + 0.25% F.S.)	
Over Voltage Protection		
Range	1-81.6 V	
Resolution	0.2 V	
Accuracy	±(2% set + 0.25% F.S.)	
Over temperature protection	85 ℃	
Rated Power Protection (CPP)		
Value	110 W	
Accuracy	±5% set	
General		
Short Circuit		
Current (CC)	2.2/2 A	≒22/20 A
Voltage (CV)	= 0 V	
Resistance (CR)	3.75 Ω	≒0.075 Ω
Input resistance (load off)	500 kΩ (typical)	
Temperature coefficient	100 ppm	
Weight	Approx. 3.8 kg	

	RMX-4004 (30 W/250 W)		
Range	Hight	Low	High
Current	0-5 A	0-4 A	0-40 A
Voltage		0-80 V	
Min Operating Voltage (dc)	0.8 V at 5 A 0.4 V at 2.5 A	0.4 V at 4 A 0.2 V at 2 A	0.8 V at 40 A 0.4 V at 20 A
STATIC MODE			
Constant Current Mode			
Operating range	0-5 A	0-4 A	0-40 A
Setting range	0-5.1 A	0-4.08 A	0-40.8 A
Resolution	0.125 mA	0.1 mA	1 mA
Accuracy	±(0.1% set + 0.1% F.S.)	±(0.1% set + 0.1% F.S.)*1	±(0.1% set + 0.2% F.S.)
Constant Resistance Mode			
Operating range	0.3 Ω-1.2 kΩ (30 W/16 V) 15 Ω-60 kΩ (30 W/80 V)	0.0375 Ω-150 Ω(250 W/16 V) 1.875 Ω-7.5 kΩ(250 W/80 V)	
Setting range	0.3 Ω-1.2 kΩ (30 W/16 V) 15 Ω-60 kΩ (30 W/80 V)	0.0375 Ω-150 Ω(250 W/16 V) 1.875 Ω-7.5 kΩ(250 W/80 V)	
Resolution	83.333 us (30 W/16 V)	0.666 mS(250 W/16 V)	
	1.666 us (30 W/80 V)	13.333 uS(250 W/80 V)	
Accuracy	1.2 kΩ: ± (0.2% set + 0.1 s) 60 kΩ: ± (0.1% set + 0.01 s)	150 Ω : ±(0.2% set + 0.1 s) 7.5k Ω: ±(0.1% set + 0.01 s)	
Constant Voltage + Constant Current Mode			
Operating range	1-16 V 1-80 V	1-16 V	1-80 V
Setting range	0-16.32 V 0-81.6 V	0-16.32 V	0-81.6 V
Resolution	0.4 mV 2 mV	0.4 mV	2 mV
Accuracy	±(0.05% set + 0.1% F.S.)	±(0.05% set + 0.1% F.S.)	

Current setting range	0-5.1 A	0-4.08 A	0-40.8 A
Resolution	0.125 mA	0.1 mA	1 mA
Accuracy	±(0.1% set + 0.2% F.S.)	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.*1)

*1 : F.S. = Full scale of H range

Constant Power + Constant Current Mode

Operating range	1-30 W	1-25 W	1-250 W
Setting range	0-30.6 W	0-25.5W	0-255 W
Resolution	1 mV	1 mV	10 mV
Accuracy	±(0.5% set + 0.5% F.S.)	±(0.5% set + 0.5% F.S.*1)	
Current setting range	0-5.1 A	0-4.08 A	0-40.8 A
Resolution	0.125 mA	0.1 mA	1 mA
Accuracy	±(0.1% set + 0.2% F.S.)	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.*1)

*1 : F.S. = Full scale of H range

Dynamic Mode			
T1 and T2	0.025 ms – 10 ms / Res: 1 us 10 ms – 30 s / Res: 1 ms		
Accuracy	1 us / 1 ms + 100 ppm		

Constant Current Mode

Slew rate	0.8 – 200 mA/us	0.64–160 mA/us	6.4–1600 mA/us
Slew rate resolution	0.8 mA/us	0.64 mA/us	6.4 mA/us
Slew rate setting accuracy	±(10% + 15 us)	±(10% + 15 us)	±(10% + 15 us)
Current setting range	0-5.1 A	0-4.08 A	0-40.8 A
Current resolution	0.125 mA	0.1 mA	1 mA
Current accuracy		±0.4% F.S.	

Constant Resistance Mode

Slew rate	0.8-200 mA/us	6.4-1600 mA/us
Slew rate resolution	0.8 mA/us	6.4 mA/us
Slew rate setting accuracy	±(10% + 50 us)	

Resistance setting range	0.3 Ω-1.2 kΩ (30 W/16 V) 15 Ω-60 kΩ (30 W/80 V)	0.0375 Ω-150 Ω (250 W/16 V) 1.875 Ω-7.5 kΩ (250 W/80 V)
Resistance Resolution	83.333 uS (30 W/16 V) 1.666 uS (30 W/80 V)	0.666 mS (250 W/16 V) 13.333 uS(250 W/80 V)
Resistance Accuracy	1.2 kΩ: ±(0.5% set + 0.1 s) 60 kΩ: ±(0.5% set + 0.01 s)	150 Ω: ±(0.5% set + 0.1 s) 7.5 kΩ: ±(0.5%set + 0.01 s)

Measurement				
Voltage Readback				
Range	0-16 V	0-80 V	0-16 V	0-80 V
Resolution	0.32 mV	1.6 mV	0.32 mV	1.6 mV
Accuracy	±(0.025%set + 0.025% F.S.)			
Current Readback				
Range	0-5 A		0-4 A	0-40 A
Resolution	0.1 mA		0.08 mA	0.8 mA
Accuracy	±(0.05% set + 0.05% F.S. *2)			
Power Readback				
Range	0-30 W		0-25 W	0-250 W
Accuracy	±(0.1%set + 0.1% F.S.*1)		±(0.1%set + 0.1% F.S.*1)	

*1: Power F.S. = Vrange F.S. x Irange F.S.
*2: F.S. = Full scale of H range

PROTECTIVE		
Over Power Protection		
Range	0.9-30.6 W	1.25-255 W
Resolution	0.15 W	1.25 W
Accuracy	±(2% set + 0.25% F.S.)	±(2% set + 0.25% F.S.)
Over Current Protection		
Range	0.0625-5.1 A	0.5-40.8 A

Resolution	0.0125 A	0.1 A		
Accuracy	±(2% set + 0.25% F.S.)	±(2% set + 0.25% F.S.)		
Over Voltage Protection				
Range	1-81.6 V	1-81.6 V		
Resolution	0.2 V	0.2 V		
Accuracy	±(2% set + 0.25% F.S.)	±(2% set + 0.25% F.S.)		
Over Temperature Protection		85 ℃		
Rated Power Protection (CPP)				
Value	33 W	275 W		
Accuracy		±5% set		
General				
Short Circuit				
Current (CC)	5.5/5 A	4.4/4 A		44/40 A
Voltage (CV)	0 V	= 0 V		0 V
Resistance (CR)	15 Ω	0.3 Ω	1.875 Ω	0.0375 Ω
Input resistance (load off)		500 kΩ (Typical)		
Temperature Coefficient		100 ppm		
Weight		Approx. 3.8 kg		

	RMX-4005		RMX-4006	
Range	Low	High	Low	High
Current	0-7 A	0-70 A	0-1 A	0-10 A
Voltage	0-80 V		0-500 V	
Min operating voltage (dc) typ.	0.4 V at 7 A	0.8 V at 70 A	1 V at 1 A	2 V at 10 A
	0.2V at 3.5 A	0.4 V at 35 A	0.5 V at 0.5 A	1 V at 5 A

Static Mode				
Constant Current Mode				
Operating range	0-7 A	0-70 A	0-1 A	0-10 A
Setting range	0-7.14 A	0-71.4 A	0-1.02 A	0-10.2 A
Resolution	0.2 mA	2 mA	0.05 mA	0.5 mA
Accuracy	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.)	±(0.1% set 0.1% F.S. *1)	±(0.1% set + 0.2% F.S.)
Constant Resistance Mode				
Operating range	0.025 Ω-100 Ω (350 W/16V) 1.25 Ω-5 kΩ (350 W/80 V)		1.25 Ω-5 kΩ (350 W/125 V) 50 Ω-200 kΩ (350 W/500 V)	
Setting range	0.025 Ω-100 Ω (350 W/16 V) 1.25 Ω-5 kΩ (350 W/80 V)		1.25 Ω-5 kΩ (350 W/125 V) 50 Ω-200 kΩ (350 W/500 V)	
Resolution	1 ms (350 W/16 V) 20 us (350 W/80 V)		20us (350 W/125 V) 0.5us (350 W/500 V)	
Accuracy	100 Ω: ±(0.2%set + 0.1 s) 5 kΩ: ±(0.1% set + 0.01 s)		5 kΩ: ±(0.2%set + 0.02 s) 200 kΩ: ±(0.1% set + 0.005 s)	
Constant Voltage + Constant Current Mode				
Operating range	1-16 V	1-80 V	2.5-125 V	2.5-500 V
Setting range	0-16.32 V	0-81.6 V	0-127.5 V	0-510 V
Resolution	0.4 mV	2 mV	2.5 mV	10 mV
Accuracy	±(0.05% set + 0.1% F.S.)		±(0.05% set + 0.1% F.S.)	
Current setting range	0-7.14 A	0-71.4 A	0-1.02 A	0-10.2 A
Resolution	0.2 mA	2 mA	0.05 mA	0.5 mA

Accuracy	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.*1)	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.*1)
Constant Power + Constant Current Mode				
Operating range	1-35 W	1-350 W	1-35 W	1-350 W
Setting range	0-35.7 W	0-357 W	0-35.7 W	0-357 W
Resolution	1 mW	10 mW	1 mW	10 mW
Accuracy	±(0.5% set + 0.5% F.S.*1)	±(0.5% set + 0.5% F.S.)	±(0.5% set + 0.2% F.S.*1)	±(0.5% set + 0.5% F.S.)
Current Setting Range	0-7.14 A	0-71.4 A	0-1.02 A	0-10.2 A
Resolution	0.2 mA	2 mA	0.05 mA	0.5 mA
Accuracy	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.*1)	±(0.1% set + 0.1% F.S.*1)	±(0.1% set + 0.2% F.S.*1)

*1 : F.S. = Full scale of H range

Dynamic Mode				
T1 and T2	0.025 ms-10 ms/Res: 1 us 10 ms – 30 s / Res: 1 ms			
Accuracy	1 us / 1 ms ± 100 ppm			
Constant Current Mode				
Slew rate	0.001-0.28 A/us	0.01-2.8 A/us	0.16-40 mA/us	1.6-400 mA/us
Slew rate resolution	0.001 A/us	0.01A/us	0.16mA/us	1.6mA/us
Slew rate setting accuracy	±(10% + 15 us)			
Current setting range	0-7.14 A	0-71.4 A	0-1.02 A	0-10.2 A
Current resolution	0.2 mA	2 mA	0.05 mA	0.5 mA
Current accuracy	±0.4% F.S.		±0.4% F.S.	
Constant Resistance Mode				
Slew rate	0.01-2.8 A/us		1.6-400 mA/us	
Slew rate resolution	0.01 A/us		1.6 mA/us	
Slew rate setting accuracy	±(10% + 50 us)			
Resistance setting range	0.025 Ω-100 Ω (350 W/16 V) 1.25 Ω-5 kΩ (350 W/80 V)		1.25 Ω-5 kΩ (350 W/125 V) 50 Ω-200 kΩ (350W/500 V)	

Resistance resolution	1 ms (350 W/16 V) 20 us (350 W/80 V)	20 us (350 W/125 V) 0.5us (350 W/500 V)
Resistance accuracy	100 Ω: ±(0.5% set + 0.1 s) 5 kΩ: ±(0.5% set + 0.01 s)	5 KΩ: ±(0.5% set + 0.02 s) 200 kΩ: ±(0.5% set + 0.005 s)

Measurement

Voltage Readback				
Range	0-16 V	0-80 V	0-125 V	0-500 V
Resolution	0.32 mV	1.6 mV	2.5 mV	10 mV
Accuracy	±(0.025% set + 0.025% F.S.)			

Current Readback				
Range	0-7 A	0-70 A	0-1 A	0-10 A
Resolution	0.14 mA	1.4 mA	0.02 mA	0.2 mA
Accuracy	±(0.05% set + 0.05% F.S. *2)			

Power Readback				
Range	0-35 W	0-350 W	0-35 W	0-350 W
Accuracy	±(0.1% set + 0.1% F.S.*1)			

*1 : Power F.S. = Vrange F.S. x Irange F.S.

*2 : F.S. = Full scale of H range

Protective

Over Power Protection	
Range	1.75-357 W
Resolution	1.75 W
Accuracy	±(2% set + 0.25% F.S.)

Over Current Protection		
Range	0.875-71.4 A	0.125-10.2 A
Resolution	0.175 A	0.025 A
Accuracy	±(2% set + 0.25% F.S.)	

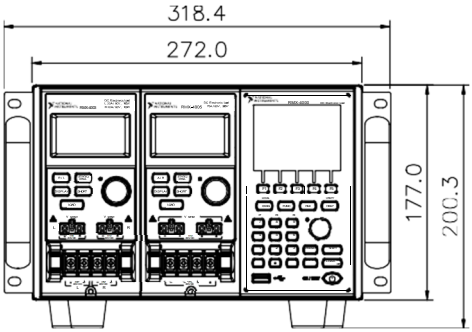
Over Voltage Protection		
Range	1-81.6 V	2.5-510 V
Resolution	0.2 V	1.25 V
Accuracy	±(2% set + 0.25% F.S.)	
Over temperature protection	=85 ℃	

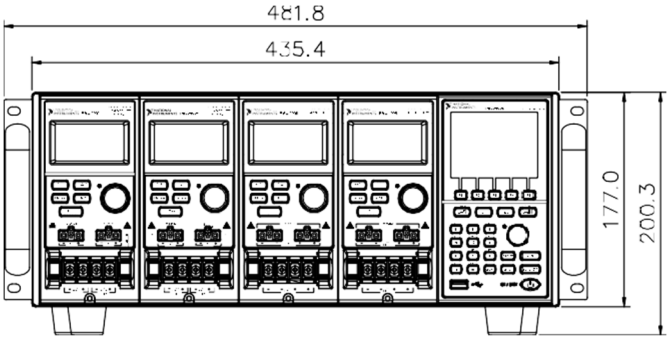
Rated Power Protection (CPP)	
Value	385 W
Accuracy	±5% set

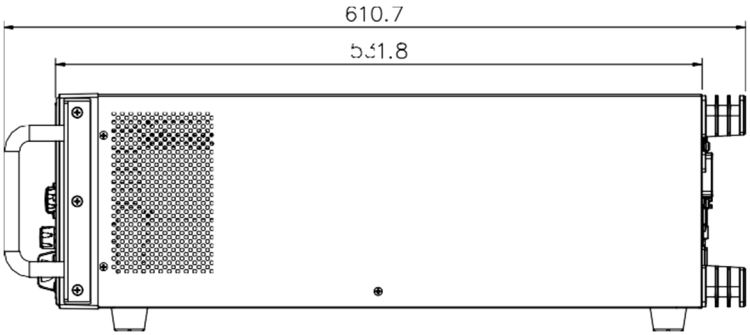
General				
Short Circuit				
Current (CC)	= 7.7/7 A	= 77/70 A	= 1.1/1 A	= 11/10 A
Voltage (CV)		= 0 V		
Resistance (CR)	1.25 Ω	0.025 Ω	50 Ω	1.25 Ω
Input resistance (load off)		500 kΩ (typical)		
Temperature coefficient		100 ppm		
Weight		Approx. 3.8 kg		

Dimensions

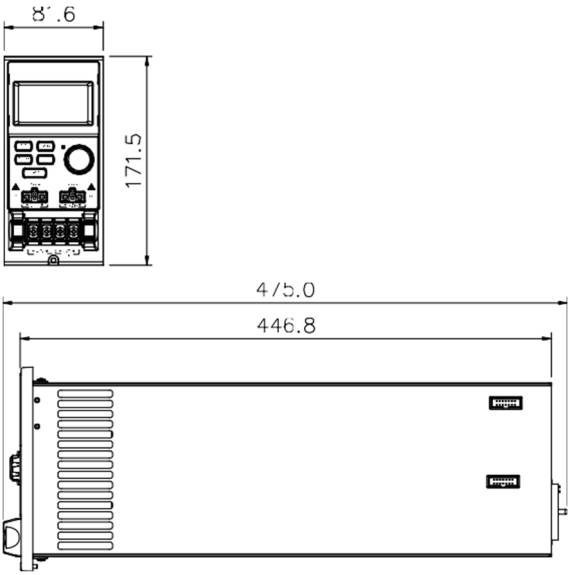
RMX-4000/RMX-4002







RMX-4003/RMX-4004/RMX-4005/RMX-4006



EC Declaration of Conformity

We declare that the below mentioned product

Type of Product: Programmable Electronic Load
Model number: RMX-4000, RMX-4002.
Load module: RMX-4003, RMX-4004, RMX-4005, RMX-4006.
are herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Law of Member States relating to Electromagnetic Compatibility (2014/30/EU) and Low Voltage Directive (2014/35/EU).

For the evaluation regarding the Electromagnetic Compatibility and Low Voltage Directive, the following standards were applied:

◎ **EMC**	
EN 61326-1: EN 61326-2-1:	Electrical equipment for measurement, control and laboratory use –– EMC requirements (2013)
Conducted & Radiated Emission EN 55011: 2009 +A1: 2010	Electrostatic Discharge EN 61000-4-2: 2009
Current Harmonics EN 61000-3-2: 2014	Radiated Immunity EN 61000-4-3:2006 +A1:2008+A2:2010
Voltage Fluctuations EN 61000-3-3: 2013	Electrical Fast Transients EN61000-4-4: 2012
----------	Surge Immunity EN 61000-4-5: 2006
----------	Conducted Susceptibility EN 61000-4-6: 2014
----------	Power Frequency Magnetic Field EN 61000-4-8: 2010
----------	Voltage Dip/ Interruption EN 61000-4-11: 2008
Low Voltage Equipment Directive 2014/35/EU	
Safety Requirements	EN 61010-1: 2010 EN 61010-2-030: 2010

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