Chroma

High Speed
DC Electronic Load
6330 Series
Operation Manual

Version 1.6
September 2009
P/N A11 000203

Legal Notices

The information in this document is subject to change without notice.

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CHROMA ATE INC.
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Warranty

All Chroma instruments are warranted against defects in material and workmanship for a period of one year after date of shipment. Chroma agrees to repair or replace any assembly or component found to be defective, under normal use during this period. Chroma's obligation under this warranty is limited solely to repairing any such instrument, which in Chroma's sole opinion proves to be defective within the scope of the warranty when returned to the factory or to an authorized service center. Transportation to the factory or service center is to be prepaid by purchaser. Shipment should not be made without prior authorization by Chroma.

This warranty does not apply to any products repaired or altered by persons not authorized by Chroma, or not in accordance with instructions furnished by Chroma. If the instrument is defective as a result of misuse, improper repair, or abnormal conditions or operations, repairs will be billed at cost.

Chroma assumes no responsibility for its product being used in a hazardous or dangerous manner either alone or in conjunction with other equipment. High voltage used in some instruments may be dangerous if misused. Special disclaimers apply to these instruments. Chroma assumes no liability for secondary charges or consequential damages and in any event, Chroma's liability for breach of warranty under any contract or otherwise, shall not exceed the purchase price of the specific instrument shipped and against which a claim is made.

Any recommendations made by Chroma for use of its products are based upon tests believed to be reliable, but Chroma makes no warranty of the results to be obtained. This warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for Chroma any liability in connection with the sale of our products other than set forth herein.

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Material Contents Declaration

A regulatory requirement of The People's Republic of China defined by specification SJ/T 11364-2006 mandates that manufacturers provide material contents declaration of electronic products, and for Chroma products are as below:

Part Name	Hazardous Substances					
	Lead	Mercury	Cadmium	Hexavalent Chromium	Polybrominated Biphenyls	Polybromodiphenyl Ethers
	Pb	Hg	Cd	Cr^{6+}	PBB	PBDE
PCBA	×	O	O	O	O	O
CHASSIS	×	O	O	O	O	O
ACCESSORY	×	O	O	O	O	O
PACKAGE	O	O	O	O	O	O

"O" indicates that the level of the specified chemical substance is less than the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

"×" indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards of SJ/T-11363-2006 and EU 2005/618/EC.

Chroma is not fully transitioned to lead-free solder assembly at this moment; however, most of the components used are RoHS compliant.
The environment-friendly usage period of the product is assumed under the operating environment specified in each product's specification.

Disposal
Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities. Contact your local government for information regarding the collection systems available. If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being. When replacing old appliances with new one, the retailer is legally obligated to take back your old appliances for disposal at least for free of charge.

CE-Conformity Declaration

For the following equipment:
Product Name: DC Electronic Load
Model Name:6334, 6332, 63301, 63302, 63303, 63305, 63306, 63307, 63308, 63312
Manufacturer's Name: Chroma ATE Inc.
Manufacturer's Address: 66 Hwa-Ya 1st Rd., Hwa-Ya Technical Park, Kuei-Shan Hsiang, Taoyuan Hsien, Taiwan

is herewith confirmed to comply with the requirements set out in the Council Directive on the Approximation of the Laws of the Member States Relating to Electromagnetic Compatibility (89/336/EEC) and electrical equipment designed for use within certain voltage limits (73/23/EEC;93/68/EEC)

For electromagnetic compatibility, the following standards were applied:

EMC: EN55011:1991(Group I Class A)
EN60555-2:1987--EN 61000-3-2(1995)
EN60555-3:1987--EN 61000-3-3(1995)
EN50082-1:1992 IEC 1000-4-2(1995):1991-8kV AD,4kV CD(Class B)
IEC 1000-4-3(1995)-3V/m
IEC 1000-4-4(1995)-0.5kV Signal Lines
1kV Power Lines

For safety requirement, the following standard was applied:

Safety: EN61010-1(1993)+A2(1995)

Taiwan	May 2005	
Place	Date	Vice President, Engineering

Warning:
This is a class A product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

SAFETY SUMMARY

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or specific WARNINGS given elsewhere in this manual will violate safety standards of design, manufacture, and intended use of the instrument. *Chroma* assumes no liability for the customer's failure to comply with these requirements.

BEFORE APPLYING POWER
Verify that the product is set to match the available line voltage and the correct fuse is installed.

PROTECTIVE GROUNDING
Make sure to connect the protective grounding to prevent an electric shock before turning on the power.

NECESSITY OF PROTECTIVE GROUNDING
Never cut off the internal or external protective grounding wire, or disconnect the wiring of protective grounding terminal. Doing so will cause a potential shock hazard that may bring injury to a person.

FUSES
Only fuses with the required rated current, voltage, and specified type (normal blow, time delay, etc.) should be used. Do not use repaired fuses or short-circuited fuse holders. To do so could cause a shock or fire hazard.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE
Do not operate the instrument in the presence of flammable gases or fumes.

DO NOT REMOVE THE COVER OF THE INSTRUMENT
Operating personnel must not remove the cover of the instrument. Component replacement and internal adjustment can be done only by qualified service personnel.

SAFETY SYMBOLS

	**DANGER** – High voltage.
	**Explanation:** To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instrument manual.
	**Protective grounding terminal:** To protect against electrical shock in case of a fault. This symbol indicates that the terminal must be connected to ground before operation of equipment.
WARNING	The **WARNING** sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a **WARNING** sign until the indicated conditions are fully understood and met.
CAUTION	The **CAUTION** sign denotes a hazard. It calls attention to an operating procedure, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the products. Do not proceed beyond a **CAUTION** sign until the indicated conditions are fully understood and met.

Revision History

The following lists the additions, deletions and modifications in this manual at each revision.

Date	Version	Revised Sections
May 2001	1.0	Complete this manual.
Nov. 2004	1.1	Add the section of "*Using the Synchronous Cable*" in Chapter of "*Local Operation*."
May 2005	1.2	Change the address and phone no. of Chroma ATE Inc.
Mar. 2006	1.3	Update the following: – Short Circuit specifications for Model 63301, 63302, 63303, 63305, 63306, 63307, 63308 and 63312. – Description of section "*Short On/Off*" in the chapter of "*Operation Overview*".
Mar. 2007	1.4	Add "*Material Contents Declaration*."
July 2008	1.5	Modify "*Specifications*" in the chapter of "*General Information*." Add "*Synchronizing Dynamic and Static*" section in the chapter of "*Operation Overview*."
Sep. 2009	1.6	Modify the "*CONSTANT RESISTANCE MODE Range*" of each model in the section of "*Specifications*."

Table of Contents

1. General Information

1.1 Introduction

This manual contains specifications, installation, and operation instructions for 6334, 6332 high-speed load mainframes as well as for 63301, 63302, 63303 ... high-speed load modules. Here “Load” means the high-speed load modules for Chroma 6330 series, and “Mainframe” is the 6334, 6332 high-speed load mainframes.

1.2 Description

The functions of 6334 and 6332 mainframes are the same except the former has four slots for Load modules while the latter two slots. The functions of 63301, 63302, 63303, …etc. are all the same except the variations on input voltage, load current, and power ratings. An individual module may have one or two channels. Each channel has its own channel number, load & measurement connectors, and operates independently in constant current (CC) mode, constant resistance (CR) mode, or constant voltage (CV) mode.

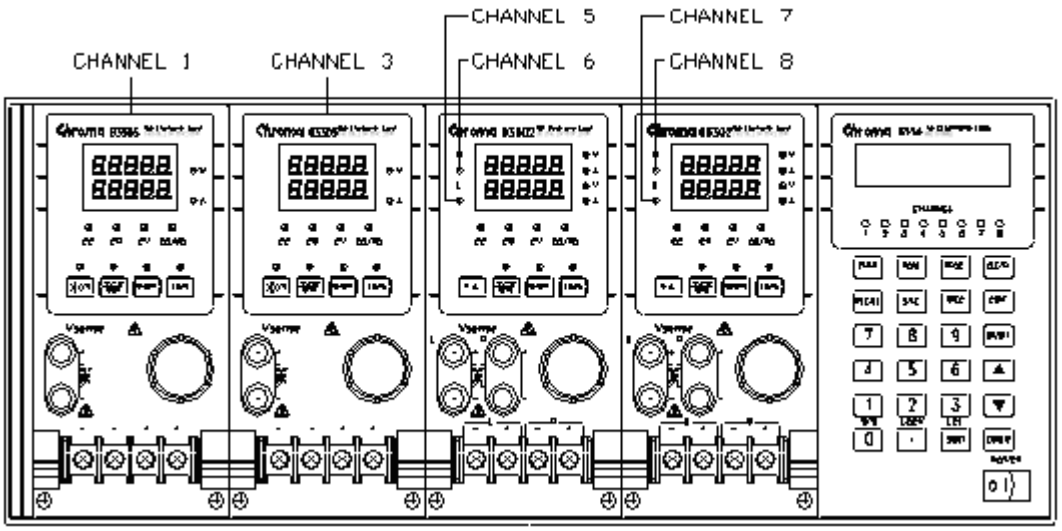


Figure 1-1 Front Panel of the Electronic Load

There are two groups of keypads on the electronic load front panel as shown in Figure 1-1. One is the Mainframe keypad. The other is the Load keypad. In this manual, Mainframe keypad is described as **MODE**, while Load keypad is **SHORT**.

1.3 Overview of Key Features

A. Mainframe

- Flexible configuration using plug-in electronic load modules to mainframes.
- Local operation from front panel keypad.
- Remote control via GPIB or RS-232C interface.
- Photo coupler isolation offers true floating Load.
- Automatic fan speed control to reduce noise.
- Up to 8 channels for one Mainframe.

B. Load

- Constant current (CC), constant resistance (CR) and constant voltage (CV) operation modes.
- Programmable slew rate, load levels, load periods and conduct voltage (Von).
- Programmable dynamic loading with speed up to 20KHz.
- Minimum input resistance allows load to sink high current even with low input voltage (1 V).
- Selective voltage and current ranges.
- Remote sensing capability.
- 100 sets of memories to save/recall user-definable setups.
- 10 sets of programs to link files for automatic test.
- 15-bit A/D converter with precision measurement.
- Short circuit simulation.
- Master/Slave parallel control mode, allow synchronous load control under static and dynamic loading mode
- Automatic GO/NG inspection to examine if UUT within spec.
- Independent GO/NG signals for each channel.

1.4 Specifications

Mainframe:	6334/6332
AC input:	115/230 interchangeable or 100/200 interchangeable Vac line
Fuse:	5A, 250V/2A, 250V
Amplitude:	±10%
Frequency:	47 to 63 Hz
Maximum VA:	180VA/100VA
Trigger output:	Vlo = 0.8V maximum at Ilo = 1 mA
	Vhi = 3.2V minimum at Ihi = –40μA
Weight:	24Kg/15Kg
Dimension:	
Width:	440mm/275mm
Height:	177.4 mm (excluding foot stock)
	186mm (including foot stock)
Depth:	560mm (including Load module)

★ The specifications of Load are listed from the next page on.

ⓘ NOTICE

1. All specifications are tested under 20°C ~ 30°C except otherwise stated.
2. The range for operation temperature is 0°C ~ 40°C.
3. The specifications of DC current accuracy are tested after the input is applied for 30 seconds.
4. The power of the load module of 6330 series is supplied from 6334/6332 mainframes.
5. The typical temperature coefficient is 100ppm.
6. The specifications of CR mode accuracy: v means 1/ohm.

MODEL	**63301**		**63305**	
POWER	20W	200W	30W	300W
CURRENT	0~4A	0~40A	0~1A	0~10A
VOLTAGE	1~80V		2.5~500V	
MIN. OPERATING VOLTAGE (DC)	1.0V at 4A	1.0V at 40A	2.5V at 1A	2.5V at 10A
CONSTANT CURRENT MODE Range	0~4A	0~40A	0~1A	0~10A
Resolution	1mA	10mA	0.25mA	2.5mA
Accuracy	0.1%+0.1%F.S.	0.1%+0.2%F.S.	0.1%+0.1%F.S.	0.1%+0.2%F.S.
CONSTANT RESISTANCE MODE Range	0.0375Ω~150Ω (200W/16V) 1.875Ω~7.5KΩ (200W/16~80V)		1.25Ω~5KΩ (300W/125V) 50Ω~200KΩ (300W/125~500V)	
Resolution	12 bits		12 bits	
Accuracy	150Ω : 0.1 mho +0.2% 7.5KΩ : 0.01 mho +0.1%		5KΩ : 20m mho +0.2% 200KΩ : 5m mho +0.1%	
CONSTANT VOLTAGE MODE Range	1~80V		2.5~500V	
Resolution	20mV		125mV	
Accuracy	0.05%±0.1%F.S.		0.05%±0.1%F.S.	
DYNAMIC MODE				
DYNAMIC MODE	C.C. MODE		C.C. MODE	
T1 & T2	0.025mS - 50mS/Res: 5uS 0.1mS - 500mS/Res: 25uS 10mS – 50S/Res: 2.5mS		0.025mS - 50mS/Res: 5uS 0.1mS - 500mS/Res: 25uS 10mS – 50S/Res: 2.5mS	
Accuracy	1μS /1mS+100ppm		1μS /1mS+100ppm	
Slew Rate	0.64~160mA/μS	6.4~1600mA/μS	0.16~40mA/μS	1.6~400mA/μS
Resolution	0.64mA/μS	6.4mA/μS	0.16mA/μS	1.6mA/μS
Current	0~4A	0~40A	0~1A	0~10A
Resolution	1mA	10mA	0.25mA	2.5mA
Current Accuracy	0.4% F.S.		0.4% F.S.	
MEASUREMENT SECTION				
VOLTAGE READ BACK				
Range	0~16V	0~80V	0~125V	0~500V
Resolution	0.5mV	2.5mV	4mV	16mV
Accuracy	0.05%+0.05% F.S.		0.05%+0.05% F.S.	
CURRENT READ BACK				
Range	0~4A	0~40A	0~1A	0~10A
Resolution	0.125mA	1.25mA	4mA	16mA
Accuracy	0.1%+0.1% F.S.		0.1%+0.1% F.S.	
PROTECTIVE SECTION				
Over Power Protection	≒20.8W	≒208W	≒31.2W	≒312W
Over Current Protection	≒4.08A	≒40.8A	≒1.02A	≒10.2A
Over Temperature Protection	≒85°C		≒85°C	
Over Voltage Protection	≒81.6V		≒510V	
GENERAL				
SHORT CIRCUIT				
Current (CC)	-	≒40A	-	≒10A
Voltage (CV)	-	0V	-	0V
Resistance (CR)	-	≒0.0375Ω	-	≒1.25Ω
INPUT RESISTANCE (LOAD OFF)	100KΩ (Typical)		100KΩ (Typical)	
SIZE	81(W)× 172(H)×495(D)		81(W)× 172(H)×495(D)	
WEIGHT (Approx.)	4.2Kg		4.2Kg	
EMC & SAFETY	CE		CE	

MODEL	**63302(100W*2)**		**63303**	
POWER	20W	100W	30W	300W
CURRENT	0~2A	0~20A	0~6A	0~60A
VOLTAGE	1~80V		1~80V	
MIN. OPERATING VOLTAGE (DC)	1.0V at 2A	1.0V at 20A	1.0V at 6A	1.0V at 60A
CONSTANT CURRENT MODE Range	0~2A	0~20A	0~6A	0~60A
Resolution	0.5mA	5mA	1.5mA	15mA
Accuracy	0.1%+0.1%F.S.	0.1%+0.2%F.S.	0.1%+0.1%F.S.	0.1%+0.2%F.S.
CONSTANT RESISTANCE MODE Range	0.075Ω~300Ω (100W/16V) 3.75Ω~15KΩ (100W/16~80V)		0.025Ω~100Ω (300W/16V) 1.25Ω~5KΩ (300W/16~80V)	
Resolution	12 bits		12 bits	
Accuracy	300Ω : 0.1 mho +0.2% 15KΩ : 0.01 mho +0.1%		100Ω : 0.1 mho +0.2% 5KΩ : 0.01 mho +0.1%	
CONSTANT VOLTAGE MODE Range	1~80V		1~80V	
Resolution	20mV		20mV	
Accuracy	0.05%±0.1%F.S.		0.05%±0.1%F.S.	
DYNAMIC MODE				
DYNAMIC MODE	C.C. MODE		C.C. MODE	
T1 & T2	0.025mS - 50mS/Res: 5uS 0.1mS - 500mS/Res: 25uS 10mS – 50S/Res: 2.5mS		0.025mS - 50mS/Res: 5uS 0.1mS - 500mS/Res: 25uS 10mS – 50S/Res: 2.5mS	
Accuracy	1μS /1mS+100ppm		1μS /1mS+100ppm	
Slew Rate	0.32~80mA/μS	3.2~800mA/μS	0.001~0.25A/μS	0.01~2.5A/μS
Resolution	0.32mA/μS	3.2mA/μS	0.001A/μS	0.01A/μS
Current	0~2A	0~20A	0~6A	0~60A
Resolution	0.5mA	5mA	1.5mA	15mA
Current Accuracy	0.4% F.S.		0.4% F.S.	
MEASUREMENT SECTION				
VOLTAGE READ BACK				
Range	0~16V	0~80V	0~16V	0~80V
Resolution	0.5mV	2.5mV	0.5mV	2.5mV
Accuracy	0.05%+0.05% F.S.		0.05%+0.05% F.S.	
CURRENT READ BACK				
Range	0~2A	0~20A	0~6A	0~60A
Resolution	0.0625mA	0.625mA	0.1875mA	1.875mA
Accuracy	0.1%+0.1% F.S.		0.1%+0.1% F.S.	
PROTECTIVE SECTION				
Over Power Protection	≒20.8W	≒104W	≒31.2W	≒312W
Over Current Protection	≒2.04A	≒20.4A	≒6.12A	≒61.2A
Over Temperature Protection	≒85°C		≒85°C	
Over Voltage Protection	≒81.6V		≒81.6V	
GENERAL				
SHORT CIRCUIT				
Current (CC)	-	≒20A	-	≒60A
Voltage (CV)	-	0V	-	0V
Resistance (CR)	-	≒0.075Ω	-	≒0.025Ω
INPUT RESISTANCE (LOAD OFF)	100KΩ (Typical)		100KΩ (Typical)	
SIZE	81(W)× 172(H)×495(D)		81(W)× 172(H)×495(D)	
WEIGHT (Approx.)	4.2Kg		4.2Kg	
EMC & SAFETY	CE		CE	

MODEL	**63307(30W,250W)**			**63306**	
POWER	30W	30W	250W	60W	600W
CURRENT	0~5A	0~4A	0~40A	0~12A	0~120A
VOLTAGE	1~80V			1~80V	
MIN. OPERATING VOLTAGE (DC)	1.0V at 5A	1.0V at 4A	1.0V at 40A	1.0V at 12A	1.0V at 120A
CC MODE Range	0~5A	0~4A	0~40A	0~12A	0~120A
Resolution	1.25mA	1mA	10mA	3mA	30mA
Accuracy	0.1%+0.1%F.S.	0.1%+0.1%F.S.	0.1%+0.2%F.S.	0.1%+0.1%F.S.	0.1%+0.2%F.S.
CR MODE Range	0.3Ω~1.2KΩ (30W/16V) 15Ω~60KΩ (30W/16~80V)		0.375Ω~150Ω (250W/16V) 1.875Ω~7.5KΩ (250W/16~80V)	12.5mΩ~50Ω (600W/16V) 0.625Ω~2.5KΩ (600W/16~80V)	
Resolution	12 bits		12 bits	12 bits	
Accuracy	12KΩ : 0.1 mho +0.2% 60KΩ : 0.01 mho +0.1%		150Ω : 0.1 mho +0.2% 7.5KΩ : 0.01 mho +0.1%	50Ω : 0.4 mho +0.5% 2.5KΩ : 0.04 mho +0.2%	
CV MODE Range	1~80V			1~80V	
Resolution	20mV			20mV	
Accuracy	0.05%±0.1%F.S.			0.05%±0.1%F.S.	
DYNAMIC MODE					
DYNAMIC MODE	C.C. MODE			C.C. MODE	
T1 & T2	0.025mS - 50mS/Res: 5uS 0.1mS - 500mS/Res: 25uS 10mS – 50S/Res: 2.5mS			0.025mS - 50mS/Res: 5uS 0.1mS - 500mS/Res: 25uS 10mS – 50S/Res: 2.5mS	
Accuracy	1μS /1mS+100ppm			1μS /1mS+100ppm	
Slew Rate	0.8~200mA/μS	0.64~160mA/μS	6.4~1600mA/μS	0.002~0.5A/μS	0.02~5A/μS
Resolution	0.8mA/μS	0.64mA/μS	6.4mA/μS	0.002A/μS	0.02A/μS
Current	0~5A	0~4A	0~40A	0~12A	0~120A
Resolution	1.25mA	1mA	10mA	3mA	30mA
Current Accuracy	0.4% F.S.			0.4% F.S.	
MEASUREMENT SECTION					
VOLTAGE READ BACK					
Range	0~16V	0~80V	0~16V	0~80V	0~16V	0~80V
Resolution	0.5mV	2.5mV	0.5mV	2.5mV	0.5mV	2.5mV
Accuracy	0.05%+0.05% F.S.			0.05%+0.05% F.S.	
CURRENT READ BACK					
Range	0~5A	0~4A	0~40A	0~12A	0~120A
Resolution	0.15625mA	0.125mA	1.25mA	0.375mA	3.75mA
Accuracy	0.1%+0.1% F.S.			0.1%+0.1% F.S.	
PROTECTIVE SECTION					
Over Power Protection	≒31.2W	≒31.2W	≒260W	≒62.4W	≒624W
Over Current Protection	≒5.1A	≒4.08A	≒40.8A	≒12.24A	≒122.4A
Over Temperature Protection	≒85°C			≒85°C	
Over Voltage Protection	≒81.6V			≒81.6V	
GENERAL					
SHORT CIRCUIT					
Current (CC)	-	-	≒40A	-	≒120A
Voltage (CV)	-	-	0V	-	0V
Resistance (CR)	- -	-	≒0.0375Ω	-	≒0.0125Ω
INPUT RESISTANCE (LOAD OFF)	100KΩ (Typical)			100KΩ (Typical)	
SIZE	81(W)× 172(H)×495(D)			162(W)× 172(H)×495(D)	
WEIGHT (Approx.)	4.2Kg			8.4Kg	
EMC & SAFETY	CE			CE	

MODEL	63308		63312	
POWER	60W	600W	120W	1200W
CURRENT	0~2A	0~20A	0~24A	0~240A
VOLTAGE	2.5~500V		1~80V	
MIN. OPERATING VOLTAGE (DC)	2.5V at 2A	2.5V at 20A	1.0V at 24A	1.0V at 240A
CONSTANT CURRENT MODE Range	0~2A	0~20A	0~24A	0~240A
Resolution	0.5mA	5mA	6mA	60mA
Accuracy	0.1%+0.1%F.S.	0.1%+0.2%F.S.	0.1%+0.1%F.S.	0.1%+0.2%F.S.
CONSTANT RESISTANCE MODE Range	0.625Ω~2.5KΩ (600W/125V) 25Ω~100KΩ (600W/125~500V)		6.25mΩ~25Ω (1200W/16V) 0.3125Ω~1.25KΩ (1200W/16~80V)	
Resolution	12 bits		12 bits	
Accuracy	2.5KΩ : 50m mho +0.2% 100KΩ : 5m mho +0.1%		25Ω : 0.8 mho +0.8% 1.25KΩ : 0.08 mho +0.2%	
CONSTANT VOLTAGE MODE Range	2.5~500V		1~80V	
Resolution	125mV		20mV	
Accuracy	0.05%±0.1%F.S.		0.05%±0.1%F.S.	
DYNAMIC MODE				
DYNAMIC MODE	C.C. MODE		C.C. MODE	
T1 & T2	0.025mS - 50mS/Res: 5uS 0.1mS - 500mS/Res: 25uS 10mS – 50S/Res: 2.5mS		0.025mS - 50mS/Res: 5uS 0.1mS - 500mS/Res: 25uS 10mS – 50S/Res: 2.5mS	
Accuracy	1μS /1mS+100ppm		1μS /1mS+100ppm	
Slew Rate	0.32~80mA/μS	3.2~800mA/μS	0.004~1A/μS	0.04~10A/μS
Resolution	0.32mA/μS	3.2mA/μS	0.004A/μS	0.04A/μS
Current	0~2A	0~20A	0~24A	0~240A
Resolution	0.5mA	5mA	6mA	60mA
Current Accuracy	0.4% F.S.		0.4% F.S.	
MEASUREMENT SECTION				
VOLTAGE READ BACK				
Range	0~125V	0~500V	0~16V	0~80V
Resolution	4mV	16mV	0.5mV	2.5mV
Accuracy	0.05%+0.05% F.S.		0.05%+0.05% F.S.	
CURRENT READ BACK				
Range	0~2A	0~20A	0~24A	0~240A
Resolution	0.0625mA	0.625mA	0.75mA	7.5mA
Accuracy	0.1%+0.1% F.S.		0.15%+0.15% F.S.	
PROTECTIVE SECTION				
Over Power Protection	≒62.4W	≒624W	≒124.8W	≒1248W
Over Current Protection	≒2.04A	≒20.4A	≒24.48A	≒244.8A
Over Temperature Protection	≒85°C		≒85°C	
Over Voltage Protection	≒510V		≒81.6V	
GENERAL				
SHORT CIRCUIT				
Current (CC)	-	≒20A	-	≒240A
Voltage (CV)	-	0V	-	0V
Resistance (CR)	-	≒0.625Ω	-	≒0.00625Ω
INPUT RESISTANCE (LOAD OFF)	100KΩ (Typical)		100KΩ (Typical)	
SIZE	162(W)× 172(H)×495(D)		324(W)× 172(H)×495(D)	
WEIGHT (Approx.)	8.4Kg		16.8Kg	
EMC & SAFETY	CE		CE	

* Before using CCL mode on model 63105 & 63108, it needs to set **CC Vrange Select** in Configuration to 2.LOW for access permission.

2. Installation

2.1 Introduction

This chapter explains how to install the Load to Mainframe and its connections. In addition, it also covers the power-on check procedure and application considerations.

2.2 Inspection

As soon as the instrument is unpacked, inspect any damage that might have occurred in shipping. Keep all packing materials in case that the instrument has to be returned. If any damage is found, please file a claim to the carrier immediately. Do not return the instrument to Chroma without prior approval.

In addition to this manual, be sure that the following items are also received along with the Mainframe and Load.
Mainframe: Power Cord, Manual
Load Module: Measurement and Load Cables

2.3 Installing the Modules

CAUTION
Load module can be damaged by electronic discharge (static electricity). Use standard anti-static work practices when you handle and install modules. Avoid touching the connector and the circuit board.

Chroma 6334 Mainframe has room for four single-width Loads (63302, 63303), or two double-width Loads (63306). Loads can be combined in the Mainframe in any order. Chroma 6332 mainframe has room only for two single-width Loads or one double-width Load. The module installation procedures for both Mainframes are the same. Only screwdriver is required when installing Load to Mainframe.

Procedures

1. Power off the Mainframe and disconnect the power cord.
2. Remove any packing materials on the Mainframe.
3. Start to install the modules in the slot (see Figure 2-1).
4. Slide the load module into the Mainframe slot along the rail.
5. Secure the module in place with screwdriver (see Figure 2-1).
6. Install each additional module in the next slot likewise.

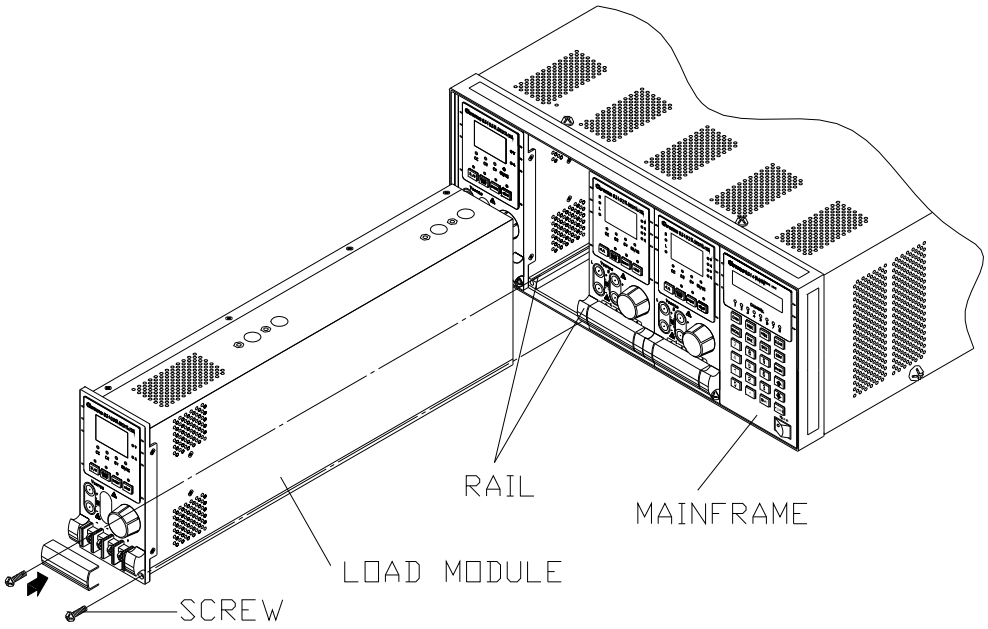


Figure 2-1 Installing Modules in the Electronic Load

☞ **WARNING**
If the Mainframe is not installed with all modules, the empty slot must be covered with the panel cover (Chroma Part No: L00 000190) for safety and airflow.

2.3.1 Channel Number

The channel number of the Load is determined by the module location in the Mainframe starting from the farthest left slot. As some Load (63302) has two channels in one module, channel 1 and 2 are always on the farthest left slot of the Mainframe, and channel 7 and 8 on the farthest right. The channel number is fixed for Mainframe even the Load module is empty. Figure 2-2 shows the channel assignments for a Chroma 6334 Mainframe containing two Loads of 63303 single channel/module, and two Loads of 63302 double channel/module. Channel number is automatically assigned to 1, 3, 5, 6, 7, and 8. Channel 2 and 4 are skipped as single module is applied. 6332 Mainframe has only four channels (1, 2, 3, 4).

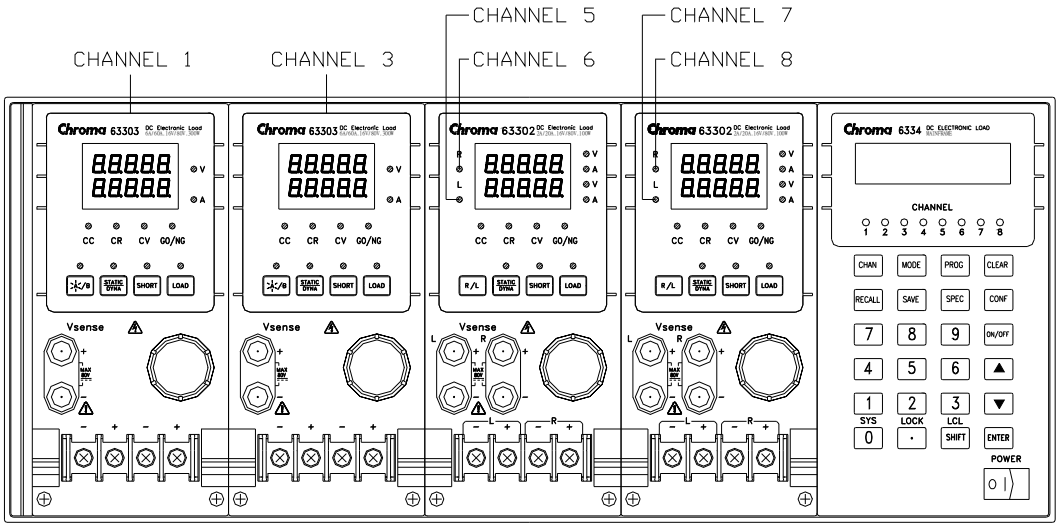


Figure 2-2 Example of Channel Number

2.4 Installing the Mainframe

The Electronic Load can operate well within temperature range from 0 to 40 degree C. However, you must install the Electronic Load in an area that has enough space around for adequate air flowing through and escaping from the back. You must leave at least 3 cm (1 inch) space above the unit for air circulation. Note that the unit foot stock has enough vertical space for air circulation when it is stacked. The Mainframe foot stock can be removed for rack mount.

If you install the equipment on top of your Electronic Load in a cabinet, you must use a filter panel above the unit to ensure adequate air circulation. A 1U (EIA standard) panel is sufficient.

2.4.1 Changing Line Voltage

The Electronic Load can operate with a 115/230 Vac input as indicated on the rear LINE label. The 100/200 line voltage input model is for Japan only. If the factory set voltage does not correspond to your nominal line voltage, turn off the Mainframe, and disconnect the power cord. Set the switch to correct line voltage as shown in Figure 2-3.

ⓘ NOTICE
Line fuses do not need to be changed when the line voltage is changed. The line fuses will protect the Electronic Load from incorrect voltage setting.

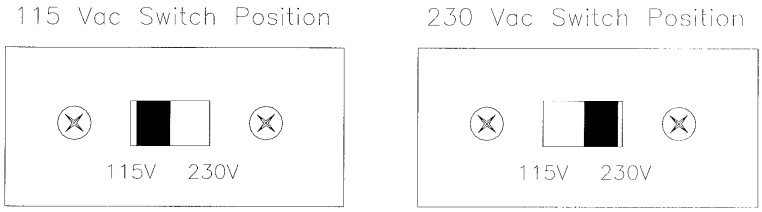


Figure 2-3 Line Voltage Switch

2.4.2 Turn-On Self-Test

Check the following before turning on the Load.

The unit has been factory set to the correct line voltage. Refer to the line voltage indicated on the rear panel.
The power cord is connected to the AC input socket.

☞ **WARNING**
The power cord supplies a chassis ground through a third connector. Be sure that your outlet is of three-conductor type with the correct pin connected to ground.

Power on the Load by the front panel switch on Mainframe and observe the display. Immediately after turning on, the Electronic Load executes a self-test that checks the GPIB interface board and the input circuitry of the installed modules. All of the LED segments on the front panel are momentarily activated. The Mainframe displays,

```
GPIB ADDRESS = 1
```

and then displays,

```
LOAD MODULE
CHANNEL SCANing
```

The LCD displays the GPIB address at power-on condition. The GPIB address switch is on the rear panel if the GPIB card is installed. If the GPIB card is not installed, the LCD will show `LOAD MODULE CHANNEL SCANing`. Mainframe checks the existing channels when the display appears `CHANNEL SCANing`. The LED segment on the front panel is momentarily activated. If the Mainframe fails the self-test, the LED will blink, and the LCD has no display. When the self-test completes, the Mainframe will display the active channel that is installed.

The Load module also executes a self-test that checks firmware and communication with Mainframe. All of the LEDs on the front panel are momentarily activated, and the 7-segment LED displays the model number as well as firmware version. If any error is

found during self-test, the display will stop here. Check the Load and Mainframe connection when an error occurs. When the self-test completes, the 7-segment will display measurement V & I. The double channel/module goes to L channel.

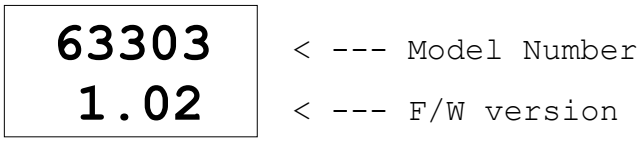


Figure 2-4 Module Panel Self-Test Display

In case of failure, return the Mainframe or Load module to Chroma sales or service office for repair.

2.5 Application Connection

2.5.1 Load Connections

☞ **WARNING**
To satisfy safety requirements, load wires must be heavy enough not to overheat while carrying the short-circuit output current of the device connected to the Electronic Load.

Before connecting load wires to Load module, remove the terminal cover from the Load. Install it after load wires are connected. Input connections are made to the + and – terminal block on the front of each Load module. The major considerations for input connections are the wire size, length and polarity. The minimum wire size required to avoid overheating may not be enough to maintain good regulation. The wires should be large enough to limit the voltage drop to less than 0.5V per lead. The wires should be as short as possible, and bundled or tied together to minimize inductance and noise. Connect the wire from the PLUS (+) terminal on the module to the HIGH potential output terminal of the power supply (UUT). Connect the wire from the MINUS (–) terminal on the module to the LOW potential output terminal of the power supply (UUT). Figure 2-5 illustrates the typical setup of the Load module to the UUT.

☞ **WARNING**
To prevent accidental contact with hazardous voltage, terminal cover must be installed correctly. Each terminal can carry 40 Amps at most. If the Load input current is over 40 Amps, you must use multiple terminals for connections.

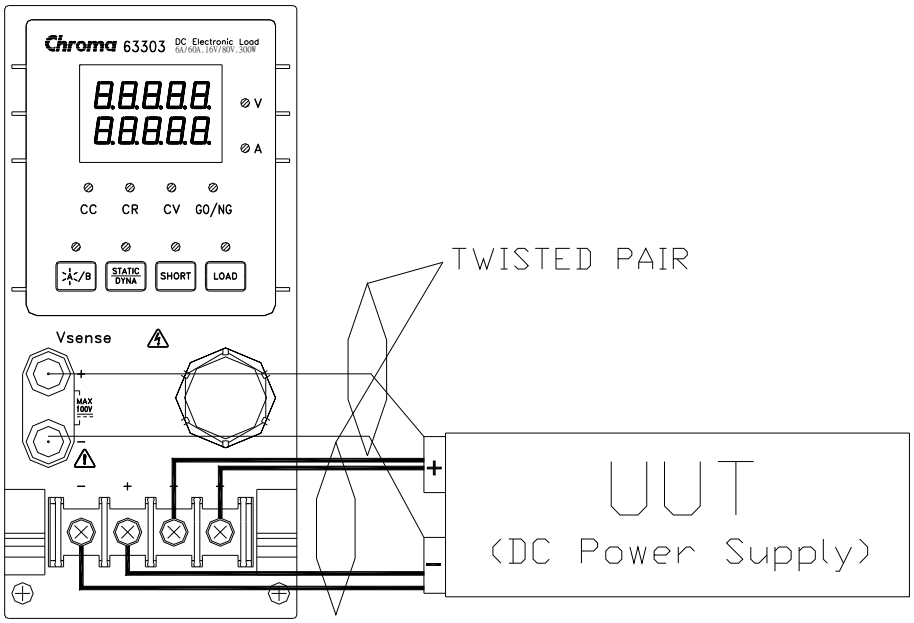


Figure 2-5 Load & Remote Sensing Connection

2.5.2 Remote Sensing Connections

There are two sensing points in the Electronic Load module. One is measurement at Load, terminal, and another is measurement at Vsense. The Load module will automatically switch to Vsense when Vsense terminals are connected to UUT, otherwise it will measure at Load terminals. Remote sensing compensates for voltage drop in applications that require long lead lengths. It is useful when a module is operating in CV or CR mode, or when it needs precise measurement. Figure 2-5 also illustrates a typical setup for remote sensing operation.

ⓘ NOTICE
The potential of Vsense red connector must be higher than that of Vsense black connector.

2.5.3 Parallel Connections

Figure 2-6 illustrates how modules can be paralleled to increase power dissipation. Modules can be directly paralleled in CC, CR modes for static operation, but cannot be paralleled in CV mode. Each module will dissipate the power it has been programmed. For example, if two modules are connected in parallel, one is programmed 10A, and another is 15A, the total current drawn from the source is 25A.

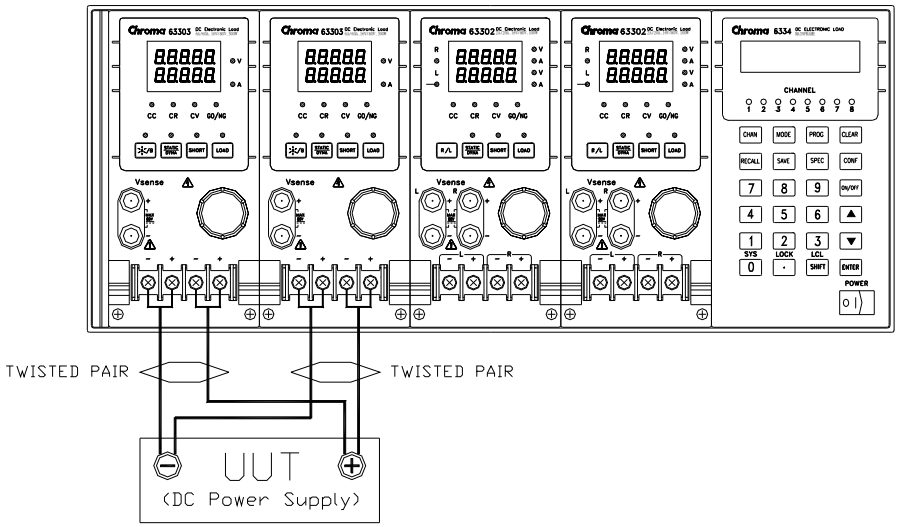


Figure 2-6 Parallel Connection

2.6 Remote Control Connection

The remote operation of Load can be done through GPIB or RS-232C. These connectors on the rear panel connect the Load to the controller or computer. The GPIB interface of the electronic load is optional. The 6330 series Remote Controller can control load through RS-232C port. Connect the Remote Controller to the Electronic Load before powering it on. If you have not done this, Load will shut down, or the fuse for remote controller in Mainframe will be broken.

3. Operation Overview

3.1 Introduction

Chroma 6334 and 6332 multiple electronic load mainframes are suitable for design, manufacturing, testing and quality assurance for electronic products. The Mainframe contains four (two) slots of load modules. Each Load module occupies either one or two slots depending on the power rating of the module. The Mainframe can dissipate up to 1200 watts when it is full loaded. It contains a processor, GPIB and RS-232C connectors, front panel keypad and display, and PASS/FAIL signals. The built-in remote control function enables you to control and read back the current, voltage and status. The SYNC function on the Mainframe synchronizes each module when the module current/voltage level changes. The Save/Recall feature allows you to save up to 100 files, 10 programs, and one default setting. All of them can be saved in Mainframe EEPROM for future use.

The Mainframe has three (two) cooling fans, and the module has one cooling fan. The fan speed automatically increases or decreases when the module power rises or falls. This feature reduces overall noise level as the fans do not always run at maximum speed.

Each module can operate independently in constant current (CC), constant resistance (CR), and constant voltage (CV) modes. An individual module may have one or two channels. Each of them has its own channel number with its own input connectors, and can be turned on/off or short-circuited independently. If your application requires a greater power or current capacity than one module can provide, you have to connect load modules in parallel in CC or CR mode.

Each load module can be controlled either remotely via GPIB/RS-232C or locally via the front panel. Once a channel is selected or addressed, all subsequent commands go to that channel till another channel is selected or addressed. The operation of all modules in the Mainframe is similar in spite of power ratings; meanwhile each module has a keypad to control itself.

3.2 Front Panel Description

The Mainframe front panel includes a 16 × 2 characters LCD display, 8 (4) channel indicators, and keypads. All parameters of Load are set through Mainframe. The LCD display also shows which function is being performed when you use the keypads. Three of the keys have two functions. The alternative function is labeled in blue above the key. It is selected by pressing the blue **SHIFT** key and the function key simultaneously. Figure 3-1 shows the front panel of Mainframe 6332.

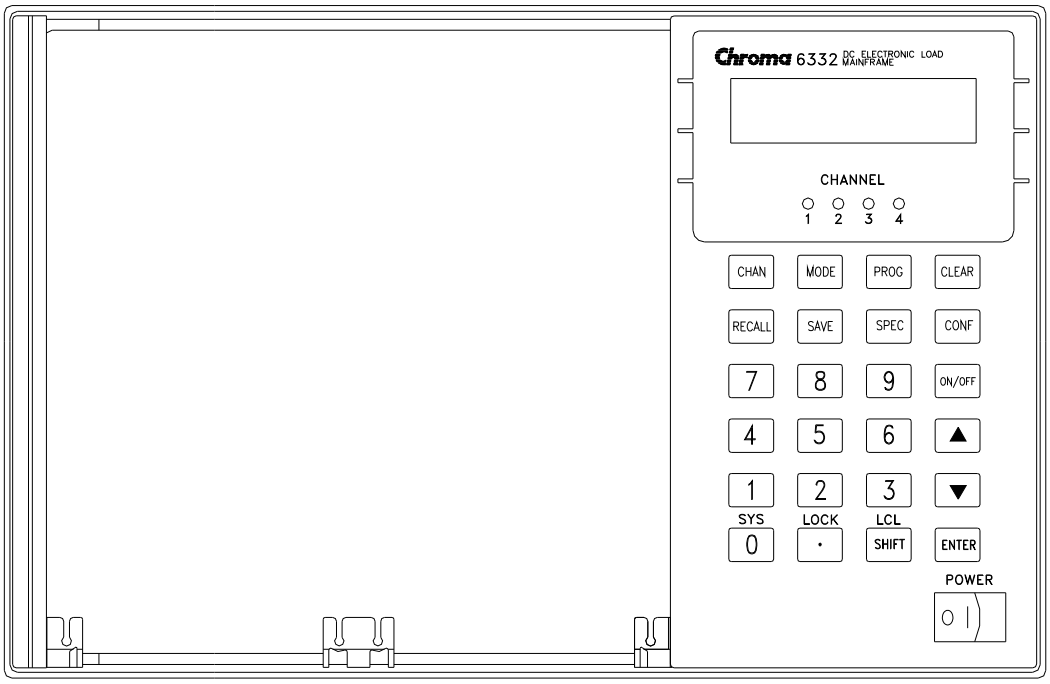


Figure 3-1 Front Panel of Mainframe 6332

3.3 Rear Panel Description

The Mainframe rear panel includes an RS-232C connector, a GO/NG output port, an AC LINE socket, a fuse holder, an optional GPIB connector, and three cooling fans. Figure 3-2 shows the rear panel of Mainframe 6334.

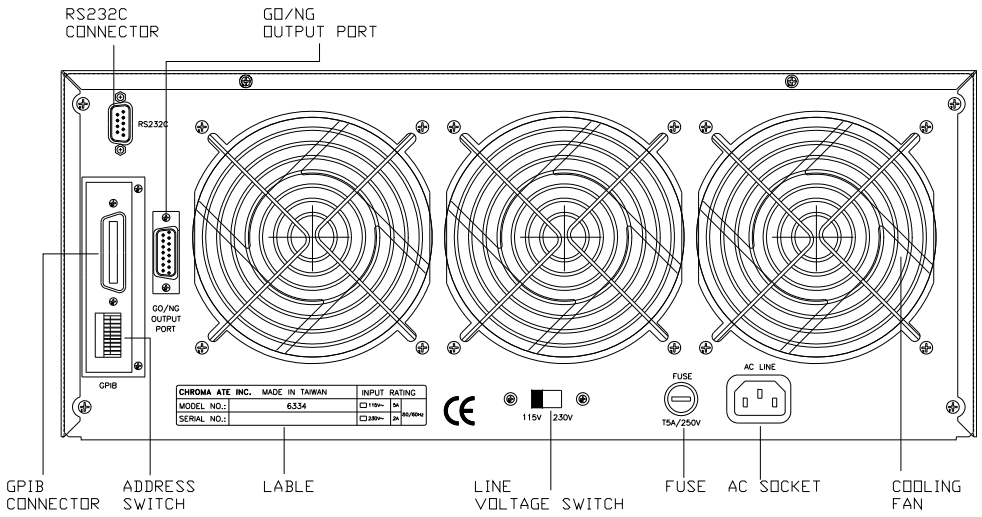


Figure 3-2 Rear Panel of Mainframe 6334

3.4 Local/Remote Control

Local (front panel) control is in effect immediately after the power is applied. The front panel keypad and display allow manual control of individual module when Load is used in bench test applications. Remote control goes into effect as soon as the Mainframe receives a command via GPIB or RS-232C. When the remote control is in effect, only the computer can control the Load. The front panel keypad has no effect except the **LCL** key. You can return to local control by pressing **LCL** key. The **SHIFT** key acts as **LCL** when Load is in remote state.

Most of the functions that perform remotely can be done locally too at the Mainframe front panel. The keypads on the module can perform simple functions like short, load on/off, static/dynamic, and load A/B or display selection R/L.

Details of local operation are given in Chapter 4 *Local Operation*. Fundamentals of remote programming are described in the *High Speed DC Electronic Load 6330 Series Programming Manual*.

3.5 Modes of Operation

There are three modes of operation: Constant Current (CC), Constant Resistance (CR), and Constant Voltage (CV).

When you press **ENTER** key to program a mode, the module will change to a new mode. In change of modes the module's input is momentarily disabled before a new mode is enabled. This ensures the minimum overshoots during mode change. The parameters in current, resistance or voltage mode can be programmed easily when the mode is selected.

All data set in CC/CR/CV mode will be rescaled to fit the resolution of current/voltage levels or slew rate. In local mode any value can be set from the keypad. There is no upper and lower limit that would cause an error. Mainframe automatically selects data, which is rescaled from the programmed value, truncates and checks high, low boundary before fitting it into the memory. When the programmed data is over the boundary, Mainframe will set the maximum or minimum level for Load module. In remote mode the programmed value cannot be over boundary. An error will occur when the data is over the maximum or minimum value.

3.5.1 Constant Current Mode

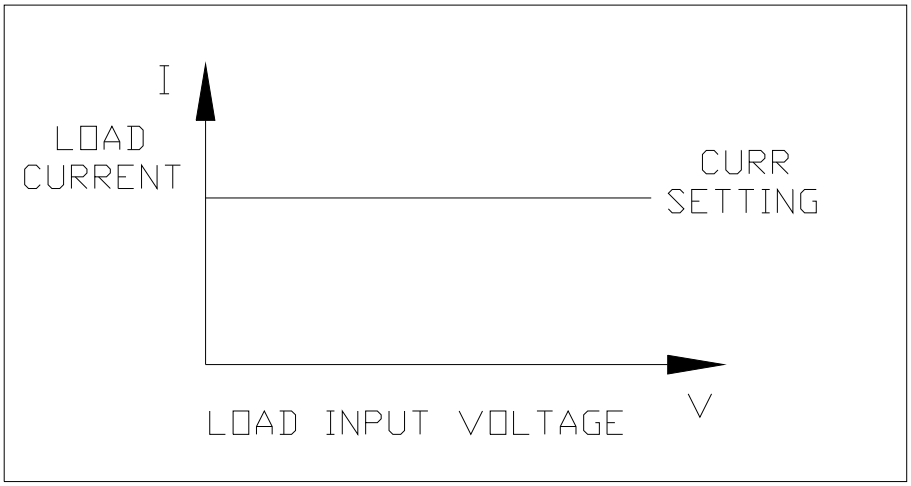


Figure 3-3 Constant Current Mode

In CC mode, the Load will sink a current in accordance with the programmed value regardless of the input voltage. The CC mode can be set by the **MODE** key in the front panel. When `MODE SELECT` appears, it means to select static low range `CCL` or static high range `CCH`.

Current Ranges (Low, High)

Current can be programmed in either of the two ranges, low range and high range. The low range provides better resolution at low current setting. If any value is over the maximum of low range, you must select the high range. Press **MODE** key first, then use ▲ or ▼ key to select the current range.

`MODE SELECT` `CCL`	Select Static Constant Current low range
`MODE SELECT` `CCH`	Select Static Constant Current high range
`MODE SELECT` `CCDL`	Select Dynamic Constant Current low range
`MODE SELECT` `CCDH`	Select Dynamic Constant Current high range

Press **ENTER** to select the range.
The mode change will affect the module, so will the change of range. Both of them will cause the input to go through an off state. If the CC mode of Load module is active, the new setting will change the input immediately at a rate determined by the slew rate setting.

STATic/DYNAmic Functions

In CC mode two operation functions (STATic, DYNAmic) are available for selection. STATic function checks the stability of output voltage from a power supply. In some modules (single channel/module) there are two current levels (A or B) for static function. Both A and B states use the same range. You can select A (CCL1 or CCH1) or B (CCL2 or CCH2) through the **A/B** key on the module's keypad or Mainframe keypad when level1 (A) or level2 (B) changes. Slew rate determines the rate at which Load level changes from one load level state to another. Figure 3-4 shows the current level of load module after pressing **A/B** key.

CCL1:4A, CCL2:2A, CCL ⎍: 0.2A/μS, CCL⎎ : 0.08A/μS

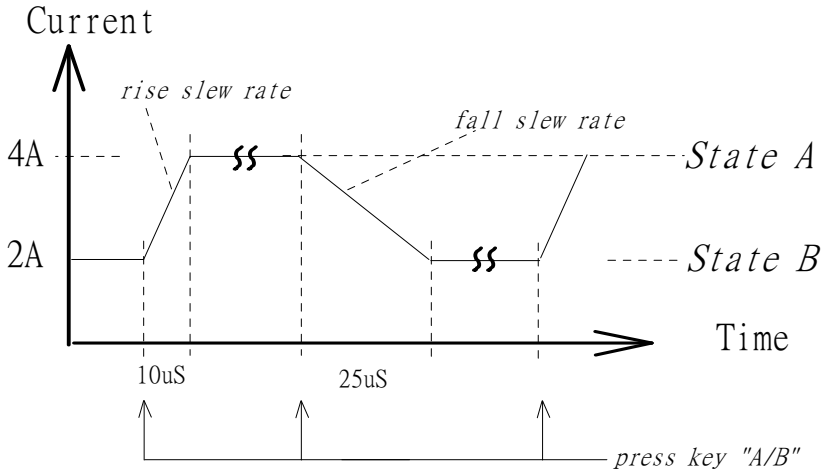


Figure 3-4 Load Level after Pressing **A/B** Key

Dynamic load operation enables you to program two load levels (CCDL1, CCDL2), load duration (CCDLT1, CCDLT2), and slew rate (CCDL⎍ , CCDL⎎). The loading level is switched between those two load levels according to your specific setting during operation. The dynamic load is commonly used to test the UUT's performance under transient loading condition. Figure 3-5 shows the current waveform of dynamic function.

CCDL1: 4A, CCDL2: 2A, CCDL ⎍:1A/μS, CCDL⎎ : 1A/μS, CCDLT1:10mS, CCDLT2:10mS

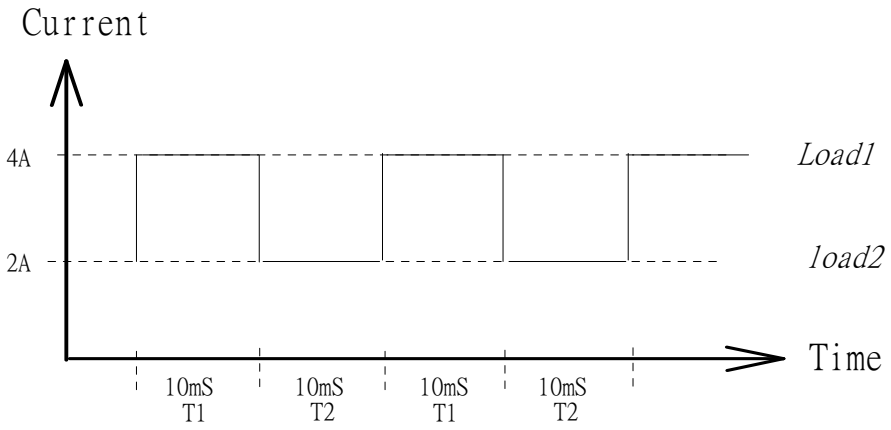


Figure 3-5 Dynamic Current Waveform

The STATic/DYNAmic functions can also be selected through **STATIC/DYNAMIC** key on the Load module.

Slew Rate (Rise, Fall A/μS or mA/μS)

Slew rate determines the rate at which the current input of a module change to a newly programmed value. There are two slew rate values, which are rise rate and fall rate.

Voltage Ranges (Low, High)

There are two voltage ranges for voltage measurement and Von voltage setting. The low range provides better resolution at low voltage measurements. If the value is over the maximum of low range, you must select the high range. The CC mode voltage range selection is in configuration setting.

3.5.2 Constant Resistance Mode

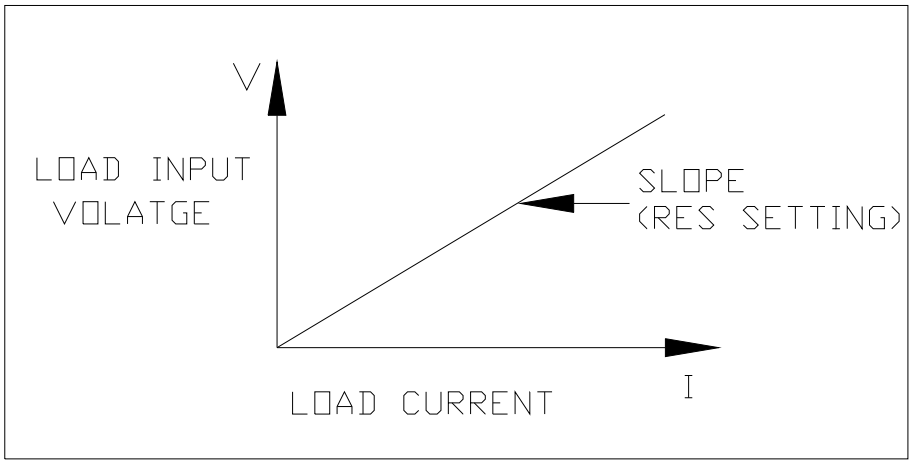


Figure 3-6 Constant Resistance Mode

In CR mode, the Load will sink a current linearly proportional to the input voltage in accordance with the programmed resistance. There is a double pole RC filter of input voltage, so the high frequency parts will be removed. The time constant of low pass filter is about 47 μS. The load sink current of CR mode is proportioned to the input voltage through a double pole RC filter. To avoid the load current change caused by the input voltage variation, the power source impedance should be as low as possible, and remote sensing cable must be used to sense load input voltage when high sink current (low setting resistance) is programmed.

Voltage Ranges (Low, High)

Resistance can be programmed in either of low or high range. The low range is used for input voltage in low voltage range while the high range is for input voltage over low voltage range. The current range in CR mode is high range.

MODE SELECT CRL	Select Constant Resistance low voltage range.
MODE SELECT CRH	Select Constant Resistance high voltage range.

Press **ENTER** to select the range.
If input voltage is over the maximum of low range, you must select the high range. Press **MODE** key, and then use ▲ or ▼ key to select the voltage range. In some modules (single channel/module) there are two resistance levels (A or B) for CR function. Both A and B states use the same range. You can select A (CRL1 or CRH1) or B (CRL2 or CRH2)

through the **A/B** key on the module's keypad. Slew rate determines the rate at which load level changes from one load level state to another.

Slew Rate (Rise, Fall A/μS)

Slew rate in constant resistance mode is programmed in Amps/second.

3.5.3 Constant Voltage Mode

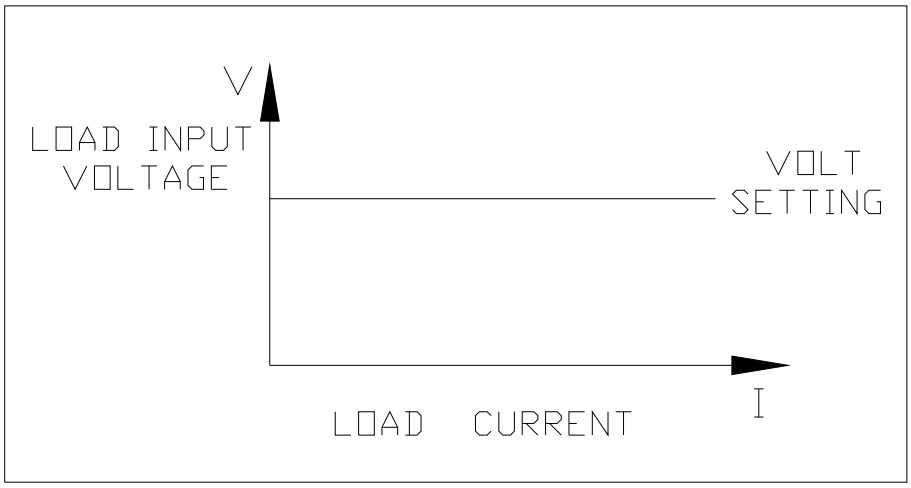


Figure 3-7 Constant Voltage Mode

In CV mode the Load will sink current to control the voltage source for programmed value. In some modules (single channel/module) there are two voltage levels (A or B) for CV function. You can select A (CV1) or B (CV2) through the **A/B** key on the module's keypad. There are two response speeds in CV mode: fast and slow. The fast/slow respond speed is the slew rate of current change.

Voltage & Current Range (High)

The voltage and current range in CR mode is high range.

3.6 Load Synchronization

Chroma 6334/6332 multiple electronic load mainframes contain eight and four load channels respectively. The channel on/off and load timing change is important. You can set module change synchronously through the SYNC RUN in configuration setting. If a channel is set to SYNC RUN ON, it means the channel on/off or load level change is synchronized with other Load modules. In other cases channel on/off can only be controlled by the module's **LOAD** key.

3.7 Measurements

Each module measures current and voltage of a UUT. The sampling rate is about 12 mS. Voltage and current measurements are performed with a 15-bit resolution of full scale ratings.

3.8 Slew Rate & Minimum Transient Time

Slew rate is defined by the change in current over time. A programmable slew rate allows a controlled transition from one load setting to another to minimize the induced voltage drops on inductive power wiring, or control the induced transients on a test device. If the transient from one setting to another is large, the actual transient time can be calculated by dividing the current transition by the slew rate. The actual transition time is defined as the time required for the change of input from 10% to 90% or from 90% to 10% of the programmed excursion. If the transition from one setting to another is small, the small signal bandwidth of Load will limit the minimum transition time for all programmable slew rates. Because of the limit, the actual transition time is longer than the expected time based on the slew rate. Therefore, both minimum transition time and slew rate must be considered when determining the actual transition time. The minimum transition time is from 24 μS to 6 mS that depends on the slew rate setting.

3.9 Start/Stop Sink Current

To simulate the transient characteristics of load to UUT, the critical problems are when and how the Load starts sinking current to UUT. You may set the conducting voltage Von to solve the problems. The Load will start or stop sinking current when the UUT output voltage reaches the Von voltage. You can start sinking current when the load is ON and the input voltage of the module is over Von voltage, but stop sinking when load is OFF or the input voltage is below Von voltage. See Figure 3-7 and 3-8 for start/stop sinking current.

There are two operation modes for Von control, latch and non-latch. Latch means that when voltage is over Von voltage, Load will start sinking current continuously in spite of input voltage drop is below Von voltage. Non-latch means that when input voltage is below Von voltage, Load will stop sinking current. The Von voltage and its operation mode are set in configuration.

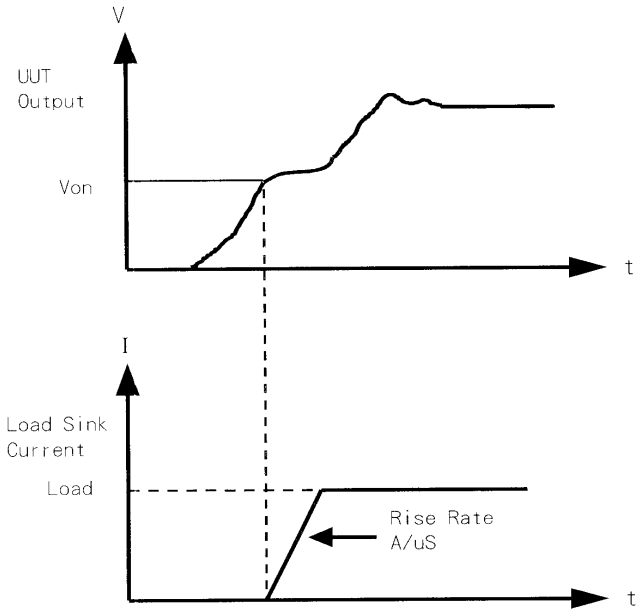


Figure 3-8 Start Sinking Current (Von Non-Latch)

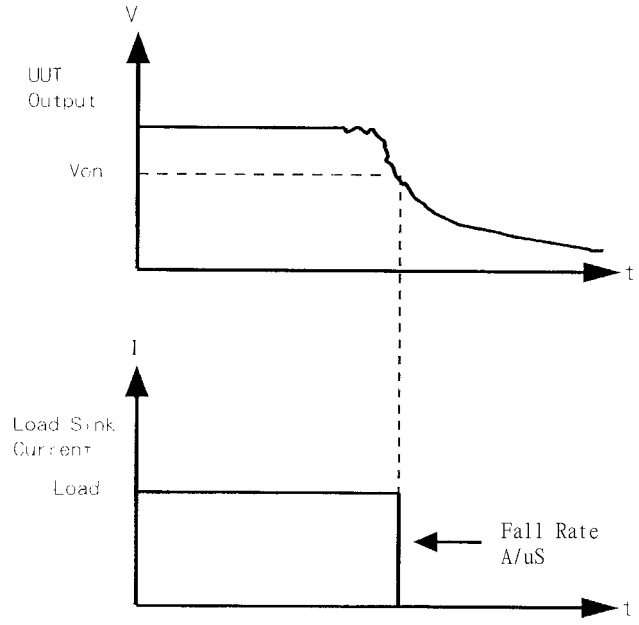


Figure 3-9 Stop Sinking Current (Von Non-Latch)

3.10 Short On/Off

Load module can simulate a short circuit at input by setting the load on with full-scale current. The short circuit can be on/off from the front panel or via remote control. There are two operations for **SHORT** key on the front panel. One is toggled on/off, and the other is controlled by key. They are selected in configuration. The **SHORT** key will be enabled only when Load is ON.

Toggled on/off means pressing **SHORT** once to enable short circuit, and again to disable. Controlled by key means pressing **SHORT** and holding it to enable short circuit, and releasing it to return to normal operation.

The actual value of electronic short depends on the mode and range that are active when the short is turned on. Its basic limit is the maximum power range the Load can supply. In CC mode it is equivalent to the programming of maximum current under maximum power limit. In CR mode it is equivalent to the programming of minimum resistance for present resistance range. In CV mode it is equivalent to the programming of zero voltage. Turning on the short circuit does not affect the programmed setting, and the Load input will return to the previous programmed values when short circuit is turned off.

Note that turning on the short circuit may cause the Load to sink so much current to trig protection circuit, and will turn off the Load.

ⓘ NOTICE
In order to prevent the voltage transient of UUT from damaging the Load, the electronic short function is not available in CC mode for L range.

3.11 Load On/Off

A module's input can be toggled on/off through the **ON/OFF** key on the Mainframe front panel, or the **LOAD** key on module, or the remote control. The on/off change for input is done according to the slew rate.

Turning off the load does not affect the programmed setting. The load will return to the previous programmed values when the Load is turned on again.

3.12 Protection Features

Each load module has the following protection features: Over voltage, Over current, Over power, Over temperature, and Reverse Voltage.

The appropriate bits in the Mainframe's status registers are set when any of the protection features listed above is active. The Load's buzzer will beep to inform you till the protection status is reset. When any of the protections occurs, the Load input will turn off.

- Over voltage
  The over voltage protection circuit is set at a level slightly above the voltage range specified in the Load specification. The over voltage (OV) and voltage fault (VF) status register bits are set when the OV condition occurs and will remain set till they are reset. The Load module will appear OVP when over voltage protection occurs.

- Over current
  When the Load is operating in CR or CV mode, it is possible for a module to attempt to sink current more than it is rated for. The limit level of current is set at a level slightly

above the current of the Load. The over current (OC) and current error (CE) status register bits are set when the OC condition occurs, and will remain set till they are reset. The Load module will appear OCP when over current protection occurs.

- Over power
  The overpower protection circuit is set at a level slightly above the power range specified in the Load specifications. The over power (OP) and power error (PE) status register bits are set when the OP condition occurs, and will remain set till they are reset. The Load module will appear OPP when overpower protection occurs.

- Over temperature
  Each Load has an over temperature protection circuit, which will turn off the load if internal temperature exceeds the safety limit. The over temperature (OT) and temperature error (TE) status register bits are set when the OT condition occurs, and will remain set till they are reset. The Load module will appear OTP when over temperature protection occurs.

- Reverse Voltage
  The Load conducts a reverse current when the UUT polarity connection is not correct. The maximum safe reverse current is same as the Load rated current. If the UUT reverse current is over the rated current of Load, the Load may be damaged. If a reverse voltage condition is detected, you must turn off the power to UUT immediately, and correct the connection. The reverse voltage (RV) and voltage fault (VF) status register bits are set when the RV condition occurs, and will remain set till they are reset. The Load module will appear REV when reverse voltage protection occurs.

All of the protection features will latch when they are tripped. When any of the protections occurs the module will turn off the load input, and beep till you remove the condition and reset the protection by pressing **LOAD** key on the module.

⚠ CAUTION
To protect the Electronic Load from possible damage, the input voltage must not exceed the maximum input voltage rating specification. In addition, the Load + terminal potential must be higher than the – terminal potential.

3.13 Save/Recall Setting

The Electronic Load setting for all channels can be saved and recalled for various test setup use. This simplifies the repetitive programming of different things. The present setting of mode parameters (CC, CR, CV), programs and power on status (DEFAULT) can be saved in the EEPROM using the **SAVE** key. Later you can recall the settings from the specified file via **RECALL** key. The **SAVE** and **RECALL** keys affect all channels simultaneously.

3.14 Program

The program feature is very powerful. It allows you to simulate various test conditions. There are ten programs in the Electronic Load. Each program has ten sequences. The settings map to the program sequences in file is one on one. It means that program 1, sequence 1 maps to file 1, and program 3, sequence 4 maps to file 24. Please see section 4.2.3 and 4.2.4 for setting and running the program

3.15 Synchronizing Dynamic and Static

Dynamic and Static loading in synchronization is provided for one FRAME and multiple FRAMES (maximum 5 in parallel.)

New options and GPIB command:
(1) Add << SYNC PARALLEL >> ON/OFF selection in CONF for sync parallel. The mapping GPIB command is SYNC: FRAME ON/OFF [1/0].
(2) Add <<MASTER/SLAVE SEL>> in CONF to set the FRAME to be MASTER or SLAVE. The mapping GPIB command is SYNC: TYPE MASTER/SLAVE [1/0].
(3) Add <<SYNC. PARALLEL >> CHANNEL selection in CONF. It sets the T1 & T2 parameters of CCDL or CCDH for the set CHANNEL to be the DYNAMIC T1 & T2 value. The mapping GPIB command is SYNC: CHANnel x [1/8].

Procedure for manual setting:
(1) Connect the parallel cable.
(2) Set all modules to the same work mode.
(3) Set the relative parameters in CONF.
(4) Execute LOAD ON/OFF.

Procedure for remote setting:
(1) Connect the parallel cable.
(2) Set all modules to the same work mode.
(3) Set the relative parameters in CONF.
(4) Execute SYNC ON/OFF.

Specification: The sync loading time error is ±5uS.

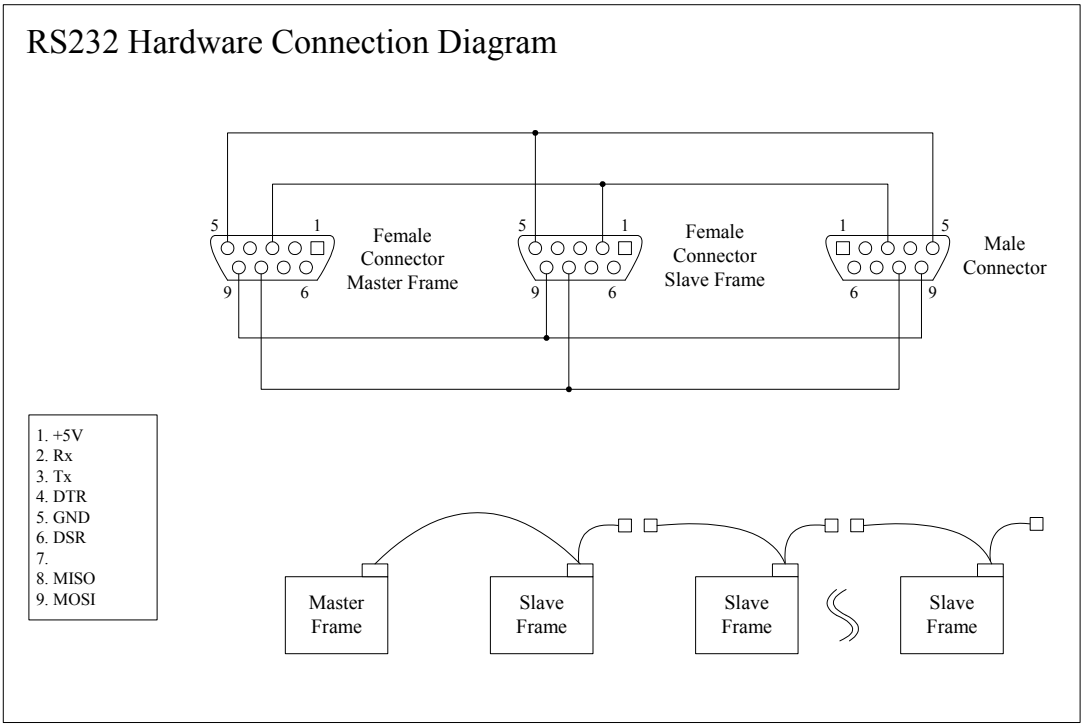


Figure 3-10 RS232 Hardware Connection Diagram

Test: 6334 mainframe x2 + 63303 load module x2
Condition: Set 12 V parallel two 63303 loads sync loading
63303 Load no.1: CC mode A: 2A ,B:14A ;T1:100uS; T2:100uS ; Slew rate sets to 0.5A/uS.
63303 Load no.2: CC mode A: 2A, B:14A ;T1:100uS; T2:100uS ; Slew rate sets to 0.5A/uS.

Current Probe ration: 5A/10mV

Ch1: Load no.1

Ch2: Load no.2

ChM: Sum of Load no.1 and Load no.2

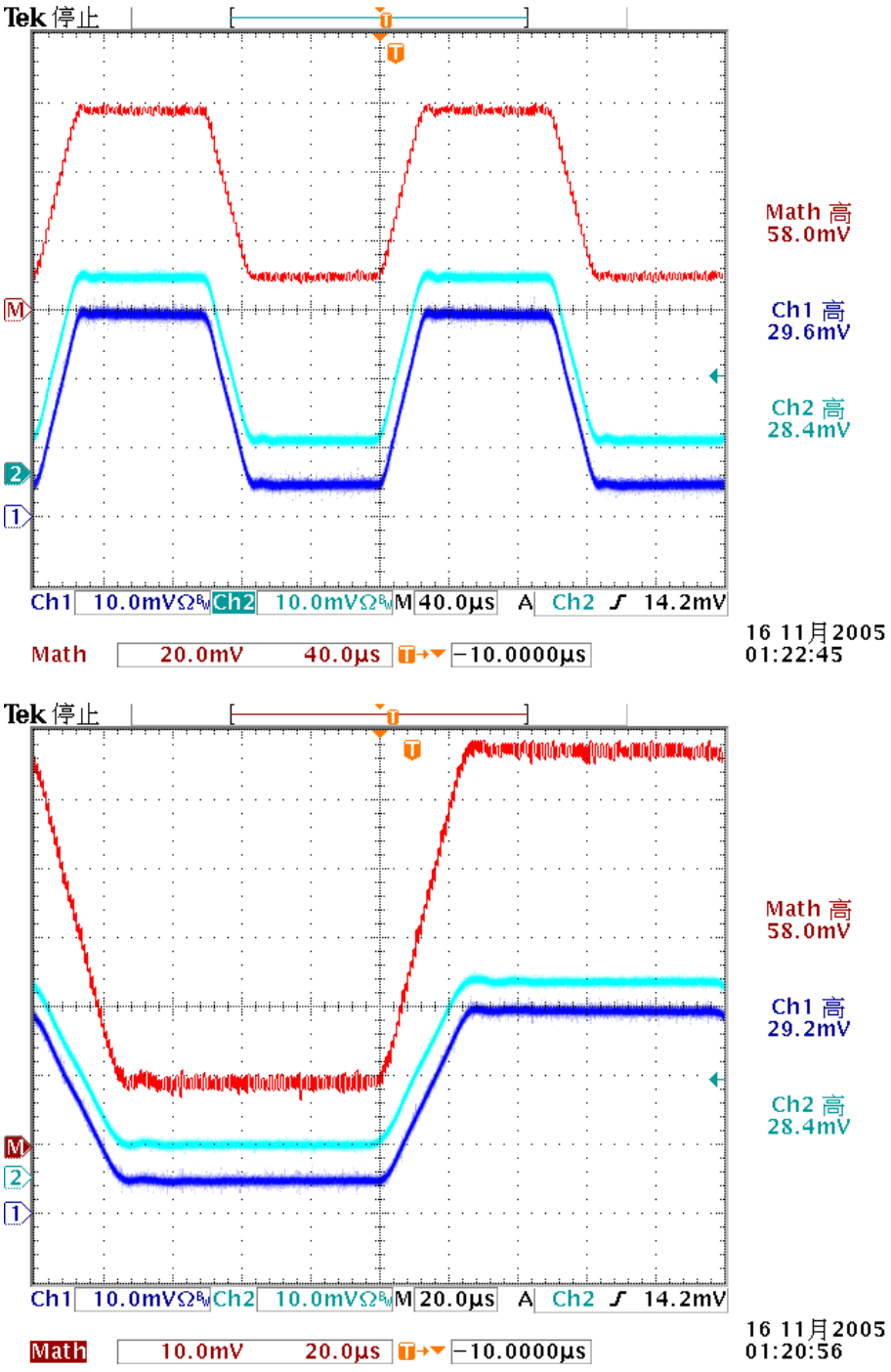


Figure 3-11 Synchronizing the Measurement Signal

4. Local Operation

4.1 Introduction

This chapter describes how to operate the electronic load from the local panel in details. The descriptions include: Mainframe panel control, Module panel control and indicators.

4.2 Local Operation of Load Mainframe

In order to use the front panel keys to control the electronic load, local operation must be in effect. Immediately after the power is applied, local operation will be in effect. When local operation is in effect, you can select a channel, and use the display with keypad on the front panel to control the Load. The display of Mainframe can be used to view the programmed setting of a selected channel. The input voltage/current is displayed on the module's display. The mainframe will scan module type during power-on, and memorize it for channel setting.

ⓘ NOTICE
When you edit the setting, the display will blink to let you know which setting is to be edited or has been selected.

In remote state, the keys on the front panel have no effect. Only remote controller can program the Load. The display of module will show the present input voltage and current readings or the last display while local state is in effect. The display of the Mainframe will show REMOTE message.

ⓘ NOTICE
When setting the load module level, the resolution of current, voltage, resistance and slew rate will be different from the entered values. The displayed or stored value for setting is the actual value of D/A programmed in the load module. The current, voltage and slew rate setting will be degraded when low values are entered. The resistance setting will be degraded when higher values are entered.

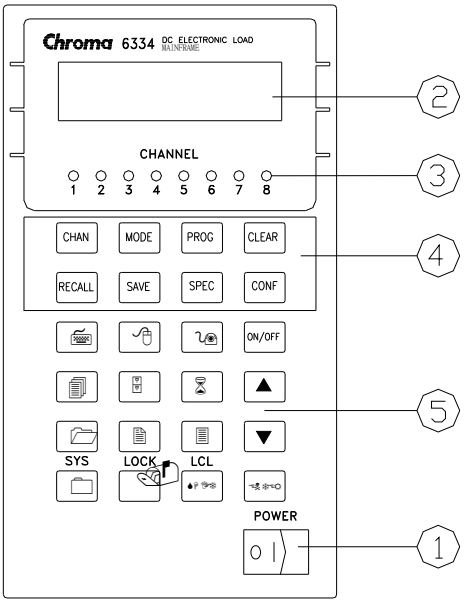


Figure 4-1 Front Panel of Mainframe

1. Line switch — Turn the ac power on/off.
2. LCD display — Display channel information normally.
   Channel indicator — Indicate the active channel setting.
   Function keys

CHAN — To select a channel for settings.

MODE — To select a mode for settings.

PROG — To select a program for settings or running.

CLEAR — To clear the digit entered from keypad. This key lets you correct the wrong digits before they are entered.

RECALL — To recall the saved settings from EEPROM, and all channel's settings from specified files (1 to 101). Recalling file 101 means to recall the factory default setting. The recall program is from PROG, number 1 to 10.

SAVE — To save all of the present mode settings of all channels in the specified files (1 to 100). The save program is from 1 to 10. Saving DEFAULT is to save the status of all channels for the next time the Electronic Load is turned on. All saved settings are stored in EEPROM, and will not be lost when ac power is cycled.

SPEC — To select specification data for editing, or to enable SPEC function.

CONF	To select configuration data for editing.
Entry keys	
▲ ▼	They let you scroll through choices in a parameter list that is applied to a specific command. Parameter lists are circular. You can return to the start position by pressing either of the keys continuously.
ON/OFF	It toggles the Electronic Load output between on and off states if channel SYNC RUN is set to on.
ENTER	It executes the entered value or the parameter of accessed command. The parameters you have entered with other keys are displayed but not entered into the Load until you press this key. Before pressing **ENTER** you can change or abort anything entered into the display beforehand.
SHIFT	It enables a shifted key to function (LOCK, SYS). When in remote control state, this key acts as a local key.
0 - **9**	They are used for entering numeric values.
.	It is a decimal point.

4.2.1 Selecting the Channel

The **CHAN** key is used to select one of the channels for local control. See channel number in section 2.3.1. To edit the channel settings, you must select a channel first. If the channel does not exist, it cannot be selected. If no module is installed in the mainframe, the display will show `DUMMY CHANNEL`. When you press **CHAN**, the channel number you want to select will automatically increase to the next existing channel. The mainframe will scan the module type at power-on and memorize it for channel editing.

4.2.2 Setting the Operation Mode

The **MODE** key and ▲, ▼ keys are used to select modes of channels for local control. Press **MODE** to display the selected channel that is in active mode. The active mode can be changed by ▲ or ▼ key followed by the **ENTER** key. The sequence of mode selection after pressing ▼ key is as follows:

CCL -> CCH -> CCDL -> CCDH -> CRL -> CRH -> CV go back to CCL.

Press **ENTER** key to select mode and confirm the setting.

ⓘ NOTICE
The eight operation modes of load module settings stored in the mainframe are independent. Changing any of the mode setting won't affect the others. Storing the settings to EEPROM (1-100) will store one mode setting only.

The load levels and slew rate are common to CC, CR modes. CV mode sets voltage level and response speed. There are two level settings for single channel/module of CC, CR, and CV modes. They can be switched by the module's **A/B** key.

Setting CC Values

There are four modes for CC operation: CCL, CCH, CCDL, and CCDH. The current levels are programmed in Amps. The slew rate levels are programmed in milliamps/μS at low range and in Amps/μS at high range. The timings are programmed in millisecond. The setting buffers of four CC modes are independent. Changing the operation range doesn't affect the settings of other ranges. The following examples show how to set the CC values of Load module for model 63303. Before observing the examples, select a channel first.

1. Select Range/Function
   Press **MODE**, and ▲ or ▼ key to select CCL followed by **ENTER** key.
   CCL: static low range CCH: static high range
   CCDL: dynamic low range CCDH: dynamic high range

```
MODE SELECT
    CCL
```

2. Set Current Level
   There are 4000 discrete steps from 0 to full scale in each range. Set level1 (A) current level to 2 amps by pressing **2**, **ENTER**. Set level2 (B) current level to 1 amp by pressing **1**, **ENTER**.

```
CCL1:   1.9995A
CCL2:   0.9990A
```

3. Set Slew Rate
   There are 250 discrete steps in each range. Set the rise 50 mA/μS and fall slew rates to 50 mA/μS by pressing **5**, **0**, **ENTER** for rise and **6**, **0**, **ENTER** for fall slew rate.

```
CCL_/‾ : 50mA/μS
CCL‾\_ : 60mA/μS
```

4. Set DYNAmic Function Periods
   Dynamic function has period T1 and T2 to be set. Set dynamic period 1 to 0.1 mS, period 2 to 0.2 mS by pressing **0**, **.**, **1**, **ENTER** and **0**, **.**, **2**, **ENTER**. The range of Dynamic period is from 0.025 μS to 30 Sec.

```
CCDLT1:  0.100mS
CCDLT2:  0.200mS
```

ⓘ NOTICE
If you press **ENTER** key, and the blinking data dose not go to the next, change the configuration setting Enter Data Next to YES.

Setting CR Values

The CR values for the selected channel are programmed by pressing **MODE**, ▲ and **ENTER** keys. The resistance values can be programmed in low voltage (CRL) or high voltage (CRH) range. The current is always in high range. ALL resistance levels are programmed in ohms. The slew rate is in A/μS.

Following examples illustrate how to set the CR values of Load module for model 63303.

1. Select Range
   Press **MODE** and ▲ or ▼ key to select CRL followed by **ENTER** key.

```
MODE SELECT
    CRL
```

2. Set Resistor Level
   There are 4000 discrete steps from 0 to full scale in each range. Set the main resistor level1 (A) to 2 ohms by pressing **2**, **ENTER**. Set the level2 (B) resistor to 1 ohm by pressing **1**, **ENTER**.

```
CCL1:  2.000Ω
CCL2:  1.000Ω
```

3. Set Slew Rate
   There are 250 discrete steps in each range. Set the rise and fall slew rates to 0.1 A/μS by pressing **.**, **1**, **ENTER** for rise slew rate and **.**, **2**, **ENTER** for fall slew rate.

```
CRL _/‾: 0.10A/μS
CRL ‾\_: 0.20A/μS
```

Setting CV Values

The CV values for the selected channel are programmed by pressing **MODE**, ▲ and **ENTER** keys. The voltage values can be programmed within one range. The voltage levels are programmed in volts, and the response speed is programmed in fast or slow operation.

Following examples illustrate how to set the CV values of Load module for model 63303. Select a channel first before going through the examples.

1. Select Range
   Press **MODE** and use ▲ or ▼ key to select CR followed by **ENTER** key.

```
MODE SELECT
      CV
```

2. Set Voltage Level
   There are 4000 discrete steps from 0 to full scale in each range. Set the main voltage level1 (A) to 5 volts by pressing **5**, **ENTER**. Set the level2 (B) voltage level to 6 volts by pressing **6**, **ENTER**.

```
CV 1:    5.00V
CV 2:    6.00V
```

3. Set Response Speed
   There are two response speeds for CV mode, fast and slow for different UUTs testing. Refer to Figure 4-2 and 4-3 for transfer functions.

```
  CV RESPONSE
1:FAST 2:SLOW
```

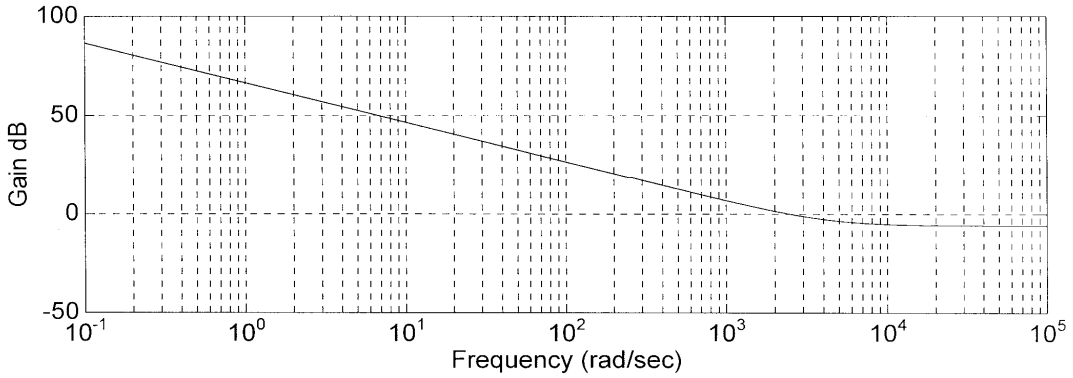


Figure 4-2 CV Response Transfer Function (FAST)

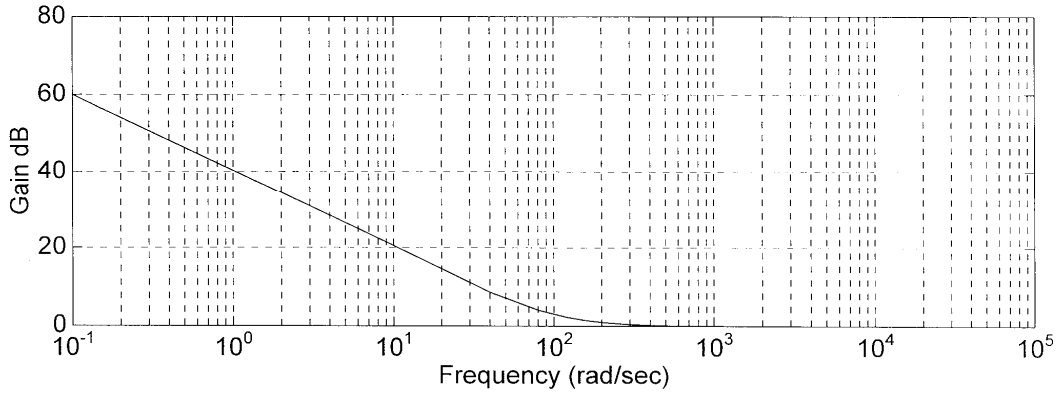


Figure 4-3 CV Response Transfer Function (SLOW)

4.2.3 Setting the Program

The Electronic Load is able to select customized basic tests, and link them into a program test for automatic execution.

The **PROG** key is used to select or recall program for local control. There are ten programs (1-10), and each of them has ten sequences to map files from 1 to 100. The program 1 maps files from 1 to 10. Table 4-1 shows the relationship between the program sequence and the corresponding files.

Program 1 Sequence No.	1	2	3	4	5	6	7	8	9	10
Corresponding File No.	1	2	3	4	5	6	7	8	9	10
Program 2 Sequence No.	1	2	3	4	5	6	7	8	9	10
Corresponding File No.	11	12	13	14	15	16	17	18	19	20
:										
Program 10 Sequence No.	1	2	3	4	5	6	7	8	9	10
Corresponding File No.	91	92	93	94	95	96	97	98	99	100

Table 4-1 Relationship of the Program Sequence and the Corresponding File

In running a program you must set its corresponding file parameters first. If one program sequence is not enough for you to test the UUT, you can use program chain function to get more sequences.

Press **PROG** key, and the LCD will display as follows. Press number 1 -10 followed by **ENTER** to recall the program from EEPROM, or use **▲**, **▼** keys to edit the program.

```
PROGRAM SELECT
No:  1
```

Setting the Active Channels

The LCD displays the active channels for the program to control. The LED channel indicators will be active if the channel is active. The channel can be active only when it exists and SYNC RUN mode is ON. When the channel is not selected or does not exist, the channel number will not appear. Press number 1 to 8 to enable or disable the active channel.

```
ACTIVE CHANNEL
1  3  5 6 7 8
```

1. Setting the Program Chain

   The chain function of program enables you to chain program so as to get more sequences for testing. Set program chain number to 0 means no program chain. Program chain function can chain itself for loop test, or chain other programs. Press **1**, **ENTER** to set chain itself for loop test. The default setting is 0.

```
PROGRAM CHAIN
No:  1
```

2. Setting the Sequence P/F Delay Time

The sequence Pass/Failure delay time let you set the delay time for P/F checking when load condition changes. The failure status of the sequence will latch when a program is executed. It means that any failure will be memorized even when the UUT becomes stable within the specifications later. The range of P/F delay time is from 0 to 60 seconds. Press **1**, **ENTER** to set the sequence P/F delay time for 1 second. The default setting is 0 second.

```
 SEQ. P/F DELAY
TIME:    1.0Sec
```

Setting the Sequence ON/OFF Time

The sequence ON/OFF time controls the Load input ON/OFF when the program sequence is executed. The range of ON/OFF time is from 0 to 60 seconds.

```
 SEQ. ON TIME
TIME:  1.0Sec
```

Press **0**, **ENTER** keys to set OFF time to 0 second. The default setting is 0 second for OFF time.

```
 SEQ. OFF TIME
TIME:   0.0Sec
```

Setting the Sequence Mode

There are three modes to control the sequence execution.

SKIP: Skip the sequence. Load will not change input status.

AUTO: Use ON/OFF time to control Load input on/off. When ON/OFF time passes, the Load will get to the next sequence automatically.

MANUAL: Use ▲ or ▼ or number **0** to **9** to control the execution sequence. Pressing number key lets you select a random sequence number for execution. Pressing **0** will go to sequence 10.

Press **2**, **ENTER** keys to set sequence 1 to manual mode. You must set ten sequence settings for one program. The default setting is SKIP.

```
SEQ  1:  SKIP=0
AUTO=1  MANUAL=2
```

Setting the Short Channel

When the sequence mode is not SKIP, you must set the short channel & time. The short channel is selected as active channel. For selection of short channel, press number 1 to 8 to enable or disable the corresponding module short function.

```
SEQ. 1 SHORT  CH.
 1   3   5 6 7 8
```

3. Setting the Short Time
   The range of short time is from 0 to 30 Sec. The short time must be ≤ SEQuence ON time. If the short channel is not selected or the short time is set to 0 Sec., the selected channel will not short. The default setting is channel 0 and 0 Sec.

```
SEQ. 1
SHORT TIME= 0.0S
```

4.2.4 Running the Program

Press ON/OFF to run program when program function is selected. The LED channel indicators will be active if the channel is active. The display shows as follows.

```
 PROG. 1 SEQ. 1
[ON][KEY][PASS]
```

The upper line appears the executed program and sequence number while the lower line shows the result status of Load, key and test.

ON/OFF: It shows Load input status.
KEY: It appears when MANUAL mode is active and waiting for key input.
PASS/FAIL: It shows the test result compared with SPEC setting.

When the program is executed, the setting sequence will recall files from EEPROM, and the SPEC function is always ON. All function keys are disabled until ON/OFF is pressed to stop the program execution, or the program run finishes. When the program run stops or finishes, the LCD will show as follows.

```
 PROGRAM OFF
RESULT :PASS
```

It means that all sequences are passed in the test program. If the test fails, LCD will show as follows.

```
PROG. XX :  1 2
3  4 5 6 7 8 9 10
```

PROG. XX indicates the file number the program fails, 1 to 10. In addition, 1, 2, 3...10 shown by LCD indicate the failed sequence numbers. The failed sequences are the results of all failed channels. The channel LED will also indicate the failed channel. During the program chain testing, if the failed program files are more than one set, you can use ▲ ▼ to read the contents of failed programs.

4.2.5 Setting the Specification

The **SPEC** key is to enable/disable SPEC function, or selects the settings of specifications. The Load will compare measurement data with the set specifications of HIGH and LOW

boundary when the SPEC TEST is ON, and the LED, GO/NG, is lit on the module panel. To set specifications for module, you must press **MODE**, **ENTER** and then **SPEC** key to go to mode for editing. In other operation modes, press **SPEC** to enable/disable the SPEC TEST function. The SPEC TEST ON/OFF function is global that means all modules installed on the Mainframe will do GO/NG comparison. The specification unit of CC, CR mode is volt while CV mode is current. There are three levels for each mode: CENTER, HIGH and LOW. The CENTER level must be set by the value of channel input reference level. The HIGH and LOW levels can be set by the value or percentage selected in configuration `SPEC. ENTRY MODE.` The HIGH/LOW percentage range is from 0 to 100%.

Press **MODE**, **ENTER**, **SPEC** to set the specifications of CC mode. Press **5**, **ENTER** to set CENTER level 5V.

```
  VOLTAGE SPEC.
 CENTER: 5.0000V
```

Press **5**, **ENTER** to set HIGH level 5%.

```
  VOLTAGE SPEC.
HIGH PCet:  5.0%
```

Press **5**, **ENTER** to set LOW level 5%.

```
  VOLTAGE SPEC.
LOW PCet:   5.0%
```

The default setting of HIGH and LOW is 100%. The CENTER value is half of the range. For selection of the specifications set by Value or Percentage please refer to 4.2.6.

4.2.6 Setting the Configuration

The Electronic Load provides useful features such as Von point, Current limit, Sync run, etc. To use these powerful features, you must set relevant parameters in accordance with application needs for configuration setup. This procedure is needed for initial setup only. The configuration of each channel is stored separately in the EEPROM of Mainframe. To set configuration you need to press **CONF**.

Set the voltage range of CC mode. There are two voltage ranges for CC mode. High range is for high voltage and low range for low voltage so as to get better voltage resolution. The default setting of Vrange is HIGH.

```
 CC Vrange Select
  1:HIGH   2=LOW
```

Set Von point. Von is the conduction voltage level when the Electronic Load starts to sink current and the UUT output reaches the Von voltage. The default setting for Von voltage is 1V.

```
Von POINT
VOLTAGE: 3.50V
```

Set Von latch. There are two operation modes for Von control. Von latch ON means the Load will sink current continuously when it reaches Von voltage. Von latch OFF means the Load will stop sinking current when UUT voltage is under Von voltage. The default setting of Von latch is OFF. Figure 4-4 and 4-5 show the Von LATCH ON and OFF current waveform respectively.

```
Von LATCH
1:ON   2:OFF
```

CAUTION

If Von is set to 0V, the Load circuit will be ON in spite of no UUT. This will get overshoot spike. If a UUT is applied, the overshoot may damage the UUT regardless of how small setting the Load current specified. So, do not set Von to 0V.

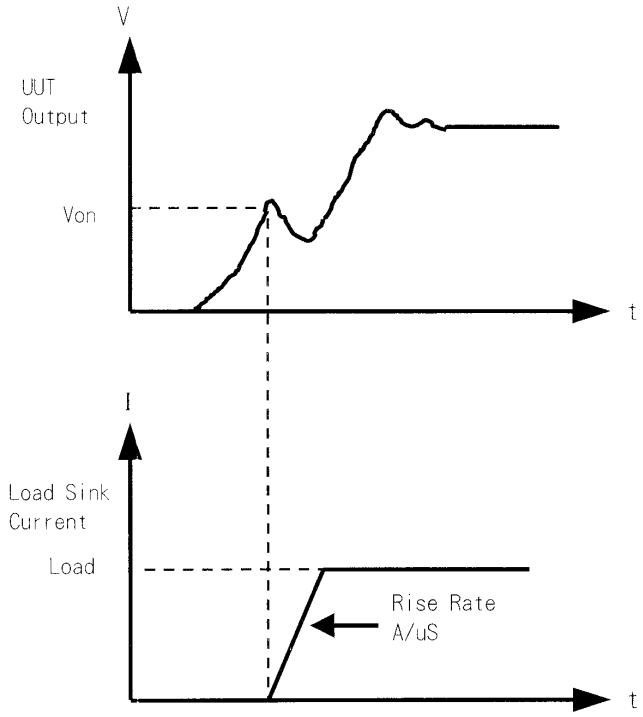


Figure 4-4 Von LATCH ON Current Waveform

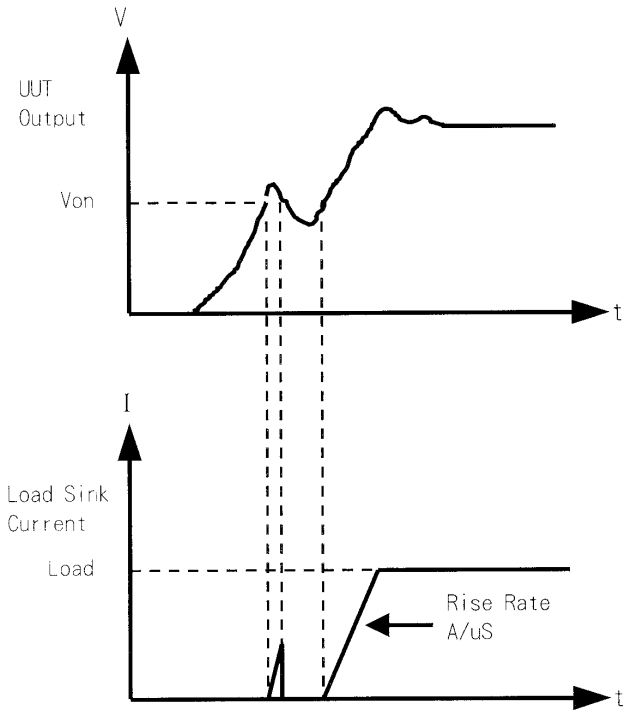


Figure 4-5 Von LATCH OFF Current Waveform

Set CV mode CURR_LIMIT. This function will limit the current sinking of Load to protect the UUT in CV mode. The default setting of current limit is the maximum Load current.

```
CV CURR_LIMIT
CURRENT:20.000A
```

Set sign of voltage for display. The Electronic Load will show minus sign for the voltage if you select MINUS. It will not show any sign if you select PLUS. The default setting is PLUS. Select MINUS of SIGN OF VOLT. will occupy one digit. The displayed digits are four.

```
SIGN OF VOLT.
1:PLUS 2:MINUS
```

Set the specifications of entry mode. The specifications of Load can be set by VALUE or Percentage for HIGH and LOW data. The percentage values refer to the CENTER value of specification. The default setting of SPEC entry mode is percentage.

```
SPEC. ENTRY MODE
 1:VALUE  2:PCet
```

Set SYNChronous run mode. When SYNC run is set to ON, the Load on/off is controlled by **ON/OFF** key on the Mainframe. Under other circumstances the Load on/off is simply controlled by **LOAD** key on the module. The default setting of SYNC run is ON.

```
SYNC. RUN
1:ON   2:OFF
```

Select data entry mode by **ENTER**. If ON is selected for data entry, the setting will go to the next one after pressing **ENTER**. If OFF is selected for data entry, the setting will remain at the same line for you to change it again and again. The default setting is ON.

```
Enter Data Next
 1:ON   2:OFF
```

Select module SOUND on/off. When you press the key on the module, it will produce a sound if sound = ON. The default setting of sound is ON.

```
SOUND
1:ON   2:OFF
```

Select Load module input status when it is powered ON. When ON is selected, the module will be active according to AUTO LOADON mode setting. The default setting of AUTO LOADON is OFF.

```
AUTO LOADON
1:ON  2:OFF
```

Select the load on mode for module if AUTO LOADON is ON. When LOAD is selected, the Load module will be active as DEFAULT setting. If PROG is selected, the module will be active using the program saved last time. The default setting is LOAD.

```
AUTO LOADON MODE
  1:LOAD  2:PROG.
```

Select Load module rotary knob type. There are two ways for you to change the load module data with rotary knob.

UPDATED means the data changed by rotary knob will be updated on the load module. When you press **LOAD** key to set the load module to ON, new data will be executed.
OLD means the data changed by rotary knob is invalid and the load module data remains the same if the load module is ON again. For the operation of rotary knob please refer to section 4.3.1 and 4.3.2.

```
LOADON KNOB TYPE
1=UPDATED 2=OLD
```

Select short key mode. Set **SHORT** key mode for Load module. The default setting of SHORT mode is TOGGLE.

```
SHORT
1:TOGGLE 2:HOLD
```

Select sync. parallel mode. Set the mainframe if to sync. in parallel run. The 6330 series have a master/slave paralleling control mode that allows synchronous load control in static and dynamic loading mode.

```
SYNC. PARALLEL
1 : ON    2 : OFF
```

Select Master / Slave mode. Set the specified mainframe to master or slave for sync. in parallel run.

```
MASTER / SLAVE SEL
1 : MASTER 2 : SLAVE
```

Select sync. parallel channel mode. Set the specified channel to T1 & T2 in sync dynamic mode for parallel loading.

```
SYNC. PARALLEL
CHANNEL SEL: 1 TO 8
```

Display the versions of load module & mainframe.

```
LOAD MODEL  63301
Version:   3103
```

Press ▼ key.

```
FRAME BOOT PROG.
Version:   1.40
```

Press ▼ key.

```
FRAME DOWN PROG.
Version:    1.21
```

Press ▼ key.

```
FRAME EXEC PROG.
Version:    1.41
```

4.2.7 Recalling Files

Press **RECALL** to recall files from 1 to 101. Files 1 to 100 are user data. File 101 is the factor set state. After a file is recalled, the display will go to mode editor for you to edit or view the file. Press **RECALL** the display will show the file No. recalled last time. The default file No. is 2 when the mainframe is powered on.

Press **RECALL**, **3**, **ENTER** to recall file number 3.

```
RECALL FILE
FILE NO:    3
```

The data of all channels will be recalled when you execute file recall.

4.2.8 Saving File/Default/Program

There are 100 file locations (1 to 100) for you to save files. Press **SAVE**, **2**, **0**, **ENTER** to save a file to location 20.

```
SAVE FILE
FILE NO:  20
```

Press **SAVE**, **▼** until the display shows as below. The DEFAULT state is used for Electronic Load after power-on. Press **1** to save the DEFAULT to EEPROM.

```
SAVE DEFAULT
1:YES  2:NO
```

Press **SAVE**, **▼** until the display shows as follows. Press **1** to save the program.

```
SAVE PROGRAM
1:YES  2:NO
```

4.2.9 Going To Local

The **SHIFT** key operates as local key, **LCL**, when Electronic Load is in remote mode. You can press **LCL** key to go to local operation when Load is in remote state. In local operation, **SHIFT** key operates as shift key.

4.2.10 Lock Operation

The lock operation disables all settings for change. When the data is locked, all settings cannot be changed. The operation of **ON/OFF** and **SPEC** keys will not be affected by lock function. Press **SHIFT** and **.** simultaneously to enable/disable lock function.

4.2.11 Setting System and RS-232C Connection

The parameters of RS-232C are set in the system. There are three parameters for you to set: Baud Rate, Parity Check and Data Bit number. Press **SHIFT** and **0** simultaneously to set the system data.

Baud Rate: 0:600, 1:1200, 2:2400, 3:4800, 4:9600 bits/second.
Parity Check: 0:EVEN, 1:ODD, 2:NONE.
Data Bit: 0:7 bits, 1:8 bits.

The RS-232C connector on the Mainframe rear panel is a 9-pin connector (DB-9, male connector). The RS-232C connector bus signal is defined as follows.

RS-232C Connector

Pin Number	Input/Output	Description
1	Output	+5V
2	Input	R×D
3	Output	T×D
4	Output	DTR
5	Output	GND
6	Input	DSR
7	NC	
8	NC	Master Input/Slave Output
9	NC	Maser Output/Slave Input

Note: Pin 1 (+5V) is for 6310 Series Remote Controller only.

4.2.12 Connecting the GO/NG Output Port

The GO/NG output port on the Mainframe rear panel is a 15-pin connector (DB-15, female connector). The GO/NG signals are TTL active low to indicate NG. They are defined as follows.

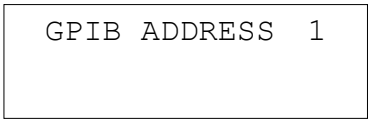
GO/NG Output Port Connector

Pin Number	Channel No.	Description
1	1	H:PASS or SPEC. OFF, L:FAIL
3	2	H:PASS or SPEC. OFF, L:FAIL
5	3	H:PASS or SPEC. OFF, L:FAIL
7	4	H:PASS or SPEC. OFF, L:FAIL
9	5	H:PASS or SPEC. OFF, L:FAIL
11	6	H:PASS or SPEC. OFF, L:FAIL
13	7	H:PASS or SPEC. OFF, L:FAIL
15	8	H:PASS or SPEC. OFF, L:FAIL
8	Enable	H:SPEC. OFF, L:SPEC. ON

Note: Pin 2, 4, 6, 10, 12, 14 are connected to GND.

4.2.13 Setting the GPIB Address

Please refer to the *High Speed DC Electronic Load 6330 Series Programming Manual* for GPIB address appears after RS-232C parameters in the system. You can use this feature to check GPIB address.



4.2.14 Using the Synchronous Cable

6330 Series supports up to 5 sets of mainframe synchronous load control, see 4.2.6 for the configuration setting. The connection between mainframe is via the RS-232C connector on the rear panel. Figure 4-6 shows the internal wiring of synchronous cable and MASTER/ SLAVE connection of mainframe. It requires another synchronous cable if one more SLAVE is desired. Be sure to connect the MASTER port to the EXTENDED port of previous cable and plug in the SLAVE port to mainframe, and so forth.

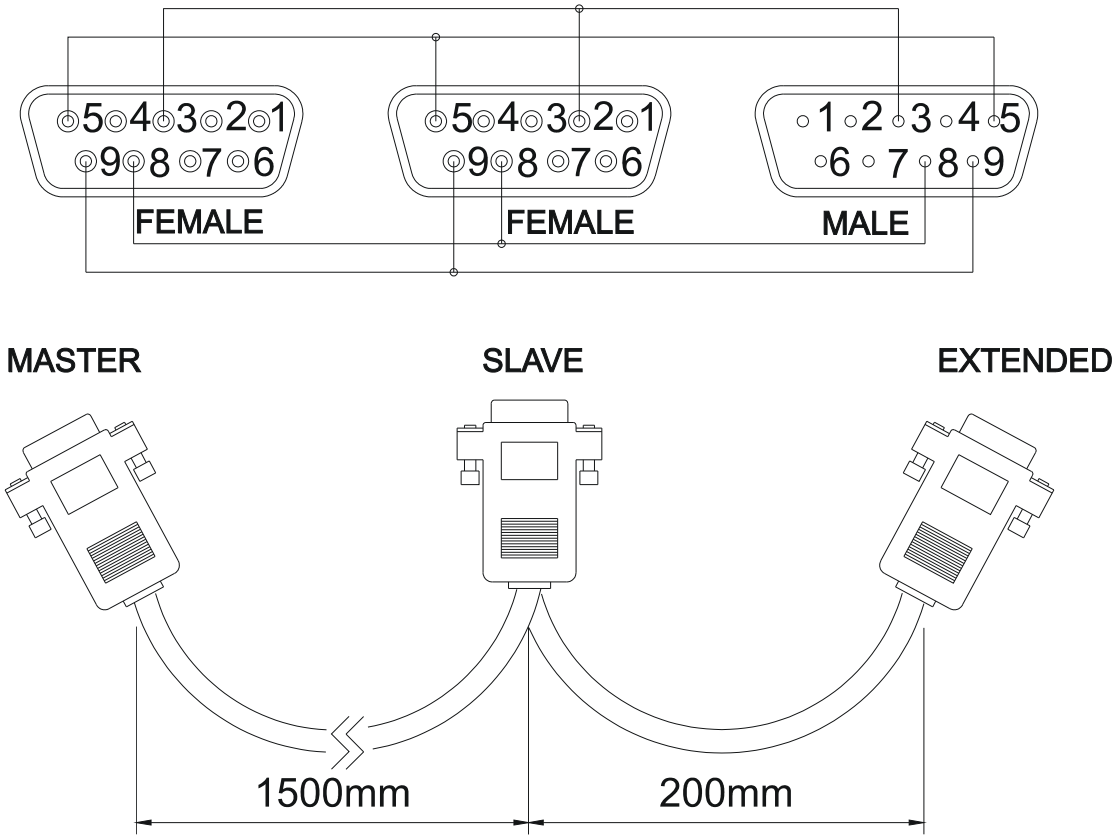


Figure 4-6 Synchronous Cable Connections

4.3 Local Operation of Load Module

There are two types of panels in Load module, single channel module panel and double channels module panel. There are four keys for each of the module panel. Only one key is different from the keypads. Figure 4-7 shows the single channel/module front panel.

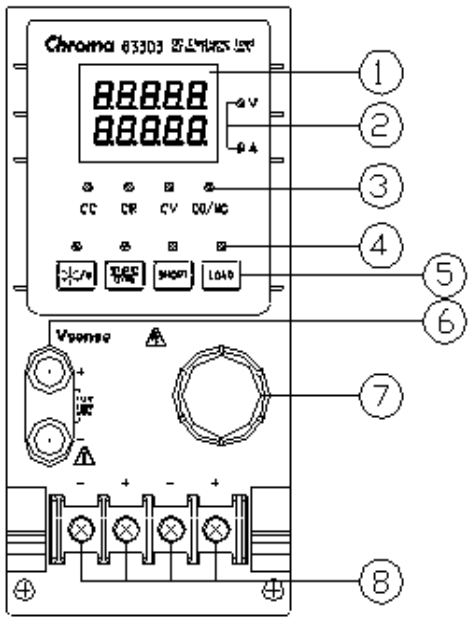


Figure 4-7 Single Channel/Module (Panel A)

4.3.1 Local Operation of Single Channel/Module (Panel A)

1. 7-segment LED Display
   It displays the measurement Voltage and Current. Each display has five digits.

2. 7-segment Display Unit Indicators
   They indicate the 7-segment display measurement unit V and I.

3. Operation Mode and GO/NG indicators
   They indicate the operation modes of CC, CR, CV and GO/NG in the Load module. GO/NG LED indicator has two colors. The green LED is on for GO (pass) while the red is on for NG (fail). The GO/NG LED is off when SPEC test is OFF.

4. Keypad Indicators
   The four LEDs indicate the keypad status. Each LED shows the key status under the LED. Refer to the next paragraph for LED on/off status.

5. Keypad
   There are four keys for you to select/control the operation of Load module. The **A/B** key is used to select static load level. Its LED will be on when the Load is in level1 (A) state and off when in level2 (B) state or others. The **A/B** key can be used to select fix mode for rotary knob setting too. Please refer to 4.3.3.

   The **STATIC/DYNA** key selects STATIC/DYNAmic mode. Its LED will be on when the Load is in DYNAmic mode. DYNAmic operation is only effective in CC mode. This key has no response in other modes.

The **SHORT** key enables Load to simulate short function. Its LED will be on when the short function of Load is enabled. It operates only when the Load input is enabled. It will not respond if Load input is not enabled.

The **LOAD** key controls the on/off of Load module input. Its LED will be on when the Load input is enabled.

6. Vsense Connectors
   These two connectors are Vsense measurement input. Refer to section 2.5.2 for remote sense connections.

7. Rotary Knob
   The knob changes the level when the Load input is enabled. Rotating the knob clockwise will increase the level whereas counterclockwise decrease the level. When you change the Load level with knob, the setting of Mainframe will not change. The changed Load level will hold unless the same setting is changed on Mainframe.

8. Load Terminals
   They are input connectors of Load for connecting to the UUT. Each of them can carry 40 Amps at most. If the current is over 40 Amps, you must connect two or more terminals for load connection. The PLUS (+) must be connected to the UUT high potential. Refer to section 2.5.1 for load input connection.

Examples

Following examples illustrate how to operate the module in CC mode.

1. Select Level1 (A) and Level2 (B)
   There are two levels of each mode for you to select in static function. The level1 (A) and level2 (B) can be selected through **A/B** key. Press **A/B** key to select current level1 or level2. When level1 (A) is selected, the LED of **A/B** key will be active. Press this key again to select level2 (B), and the LED will be inactive.

2. Select Dynamic Function
   There are two functions for CC mode: STATIC and DYNAmic. The two functions can be selected through **STATIC/DYNA** key. Press **STATIC/DYNA** key to select Dynamic function. Press this key again to select static function. When Dynamic function is selected, the LED of DYNA will be active.

3. Short the Load Input
   The Load can simulate a short circuit across the input. The short circuit will be enabled when **SHORT** is pressed, and Load input is active (on). If the input is shorted, the LED of short will be active. The **SHORT** key can be set in configuration to toggle on/off mode, or active by pressing.

4. Load Input On/Off
   The input can be toggled on or off by pressing **LOAD**. When the input is turned on, the load LED will be active.

4.3.2 Local Operation of Double Channels/Module (Panel B)

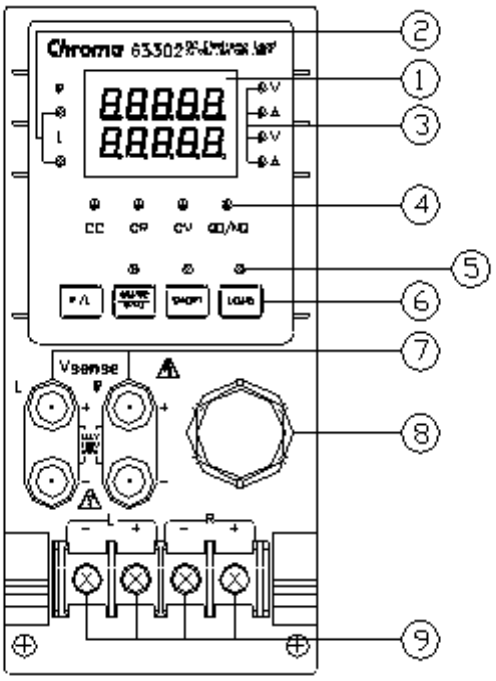


Figure 4-8 Double Channels/Module (Panel B)

The double channels/module means there are two channels in one module. Each channel is isolated from the other. The module display/keypad can control both channels. The left channel is called channel L while the right one is channel R. The 7-segment LED displays one or two channel status. The keypad and rotary knob can control both channels through **R/L** key.

1. 7-segment LED Display
   The 7-segment LED displays measurement V/I for single or double channels. Each display has five digits.

2. The Channel LED Indicators
   There are two LEDs indicating the active right and/or left channel(s) of Load module. When the LED of channel R is on, the 7-segment display, mode, GO/NG indicators, and keypad are active for channel R. Channel L has the same function as channel R when its LED indicator is on.

   When the indicators of channel R and L are on, the 7-segment display selectively shows both channels' V or I. The indicators and keys, **STATIC/DYNA**, **SHORT**, **LOAD** in operation mode will be disabled when both channels are selected.

3. 7-segment Display Unit Indicators
   They indicate the 7-segment display measurement unit V and/or I.

4. Operation Mode and GO/NG Indicators
   When the LED of channel R or L is on, the operation and GO/NG LED has the same

function as single channel/module. When the LEDs of channel R and L are on, the LED of operation mode indicators will be disabled (off). The GO/NG LED turns to red when the channel SPEC checking fails. It will turn to green when the SPEC checking of both channels is all right.

5. Keypad Indicators
   There are three LEDs to indicate the keypad status. Each LED shows the key status. It has the same function as single channel/module. The LED of LOAD will be active when either input of channel L or R is on.

6. Keypad
   There are four keys for you to select /control the operation of Load module. The **R/L** key is used to select the display of 7-segment LED, and the indicators of channel R and/or L. The **R/L** key can be used to select fix mode for rotary knob setting too. Please refer to section 4.3.3.

7. Vsense Connectors
   These four connectors are for Vsense measurement input. The two connectors on the right are for right channel while those on the left is for left channel. Refer to section 2.5.2 for remote sensing connections.

8. Rotary Knob
   The knob has the same function as single channel/module when channel R or L is selected. If the indicators of channel R and L are on, the knob will be disabled.

9. Load Terminals
   They are input connectors for the Load to connect with the UUT. The two Terminals on the left are for input of left channel while those on the right are for the right channel. The PLUS (+) sign of each channel input must connect to the high potential. Refer to section 2.5.1 for load input connections.

Examples

Following examples illustrate how to select the double channels module in CC mode.

You have to select right or left channel for display & keypad for the double channels module. When channel R and L is selected; only **R/L** key is enabled. Other keys are disabled. During power-on, the pre-selected channel is channel L. It means the 7-segment display, indicators and keypad are active for channel L. The double channels module has the same function as single channel module, except it cannot select level 2 (B).

The display sequence of **R/L** key is channel L -> channel R -> channels L+R display V -> channels L+R, then back to channel L.

1. Select Dynamic Function
   The static and dynamic function can be selected through the **STATIC/DYNA** key. Press this key to select Dynamic function, and press it again to select static function. When Dynamic function is selected, the LED of DYNAmic will be active.

2. Short the Load Input
   The Load can simulate a short circuit across the input. The short circuit can be enabled when **SHORT** is pressed, and Load input is active. When the input is shorted, the LED of short will be active. The **SHORT** key can be set in configuration for toggle on/off mode, or active by pressing.

3. Load Input On/Off
   The input can be toggled on or off by pressing **LOAD**. When the input is turned on, the LED of LOAD will be active.

4.3.3 Online Change Level

Load module provides you two ways to change level online. They are convenient for you to change load directly with the rotary knob in LOADON. These two operation modes are described below.

Ratio Mode: In LOADON change load with the rotary knob.
When the rotary knob turns clockwise, it means the following.
CC mode: raise the current value.
CR mode: raise the resistance value.
CV mode: raise the voltage value.

When the rotary knob turns counterclockwise, it means the following.
CC mode: lower the current value.
CR mode: lower the resistance value.
CV mode: lower the voltage value.

The modulation is dependent on the turning speed of the rotary knob.

Fixed Mode: In LOADON press **A/B** key (single channel module) or **R/L** key (double channels module) for over 2.5 seconds to enter this operation mode. Now V and I will be displayed in fixed positions in this mode. Press **A/B** / **R/L** or **STATIC/DYNA** key to shift a digit left or right. The resolution nearest to that digit will begin to change. The changed digit will be displayed glisteningly, and modulated by the rotary knob. To exit from this mode, press **A/B** or **R/L** key for more than 2.5 seconds.

ⓘ NOTICE
The value of mainframe setting will not be changed if the setting is changed by the rotary knob. Therefore, when you change the setting value with rotary knob, the value of load module setting and that of mainframe setting will not be the same.