3302C
Mainframe
Operation Manual

P/N:90033024 REV:G

PRODIGIT
INSTRUMENT PROFESSIONAL

Material Contents Declaration

(材料含量宣称)

(Part Name) 零件名称	Hazardous Substance (有毒有害物质或元素)					
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr6+)	多溴 联苯 (PBB)	多溴 二苯醚 (PBDE)
PCBA (印刷电路装配件)	X	O	X	O	O	O
Electrical part not on PCBA's 未在PCBA上的电子零件	X	O	X	O	O	O
Metal parts **金属零件**	O	O	O	X	O	O
Plastic parts 塑料零件	O	O	O	O	X	X
Wiring 电线	X	O	O	O	O	O
Package **封装**	X	O	O	O	O	O

对销售之日的所售产品,本表显示, PRODIGIT 供应链的电子信息产品可能包含这些物质。注意:在所售产品中可能会也可能不会含有所有所列的部件。This table shows where these substances may be found in the supply chain of Prodigit electronic information products, as of the date of sale of the enclosed product. Note that some of the component types listed above may or may not be a part of the enclosed product. ○：表示该有毒有害物质在该部件所有均质材料中的含量均在SJ/T 11363-2006 标准规定的限量要求以下。○：Indicates that the concentration of the hazardous substance in all homogeneous materials in the parts is below the relevant threshold of the SJ/T 113632006 standard. ×：表示该有毒有害物质至少在该部件的某一均质材料中的含量超出SJ/T 11363-2006 标准规定的限量要求。× : Indicates that the concentration of the hazardous substance of at least one of all homogeneous materials in the parts is above the relevant threshold of the SJ/T 11363-2006 standard.

Note(注释):

1.Prodigit has not fully transitioned to lead-free solder assembly at this moment；However, most of the components used are RoHS compliant.
(此刻，Prodigit 并非完全过渡到无铅焊料组装；但是大部份的元器件一至于RoHS的规定。)

2. The product is labeled with an environment-friendly usage period in years.

The marked period is assumed under the operating environment specified in the product specifications.
(产品标注了环境友好的使用期限制(年)。所标注的环境使用期限假定是在此产品定义的使用环境之下。)

Example of a marking for a 10 year period:
(例如此标制环境使用期限为10年)

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Chapter 1 Introduction

The 3302C Electronic load mainframe is designed to install the single channel 3250A/3310A/3310C/3330A and 3320 series plug-in load module, 3250A/3310A/3310C/3330A and 3320 series plug-in module simple specification as table 1-1. Please contact your local PRODIGIT distributor or PRODIGIT sales dept. for detail specification.

Model	Max. current	Max. voltage	Max. power
3250A	20 Arms	60 Vrms	300 W
3251A	8 Arms	150 Vrms	300 W
3252A	4 Arms	300 Vrms	300 W
3253	1Arms	300 Vrms	300 W
3310C	30A	60V	150W
3311C	60A	60V	300W
3312C	10A	250V	300W
3314C	5A	500V	200W
3315C	15A	60V	75W
3310A	30 A	60 V	150 W
3311A	60 A	60 V	300 W
3312A	10 A	250 V	300 W
3314A	5 A	500 V	200 W
3315A	15 A	60 V	75 W
3320	30A	60V	150W
3321	60A	60V	300W
3322	10A	250V	300W
3324	5A	500V	200W
3325	15A	60V	75W
3330A	50A/5A	+60V/+60V	250W/50W
3331A	50A/5A	+60V/-60V	250W/50W
3332A	5A/5A	+60V/+60V	75W/75W
3333A	5A/5A	+60V/-60V	75W/75W
3334A	5A/5A	-60V/-60V	75W/75W
3335A	100A/5A	+60V/+60V	500W/50W

Table 1-1 3250A/3310A/3310C/3330A and 3320 SERIES SIMPLE SPECIFICATION LIST

1.1 Features

3302C mainframe provides high performance easy operation and cost effective solution for power source testing, the features of the 3302C electronic load mainframe is described in the following :

1.1.1 Plug-in design, it is easy to replace different specifications load module.

1.1.2 Flexible configuration, 3302C mainframe can be installed one of 3250A, 3310A, 3310C, 3320 or 3330A series load module.

1.1.3 RS-232 connector provides RS-232 interface for remote control, it can be used to connect NOTEBOOK PC with RS-232 interface.

1.1.4 The analog programming BNC input on the rear panel can control the load module's load current with an arbitrary waveforms.

1.1.5 Built-in GPIB interface, GPIB address can control electronic load modules with set load status and read back meter capabilities.

1.2 Option

1.2.1	GPIB interface	
1.2.2	GPIB cable	1 M
1.2.3	GPIB cable	2 M
1.2.4	9931C Remote Controller	1 Set
1.2.5	D-SUB 9 Pin to D-SUB 9 Pin cable	1 M
1.2.6	IEEE-488 Interface Card	1 Pc

1.3 Specifications

The detail specification of 3302C mainframe is shown in Table 1-2.

AC INPUT	LINE	100V/115V±10%	200V/230V±10%
	FREQUENCY	50/60 HZ	
	FUSE	1A/250V (5*20mm)	0.5A/250V (5*20mm)
	MAX. POWER CONSUMPTION	40 W	
DIMENSIONS (W*H*D)		150 mm*177 mm*445 mm	
WEIGHT		NET : 5.5 Kg	

Table 1-2 SPECIFICATIONS

1.4 System block diagram

The system block diagram is shown in Fig 1-1, there are two power supplies in 3302C mainframe one for 3302C mainframe, and others are for load module.
The 3302C mainframe is optically isolated with load module.

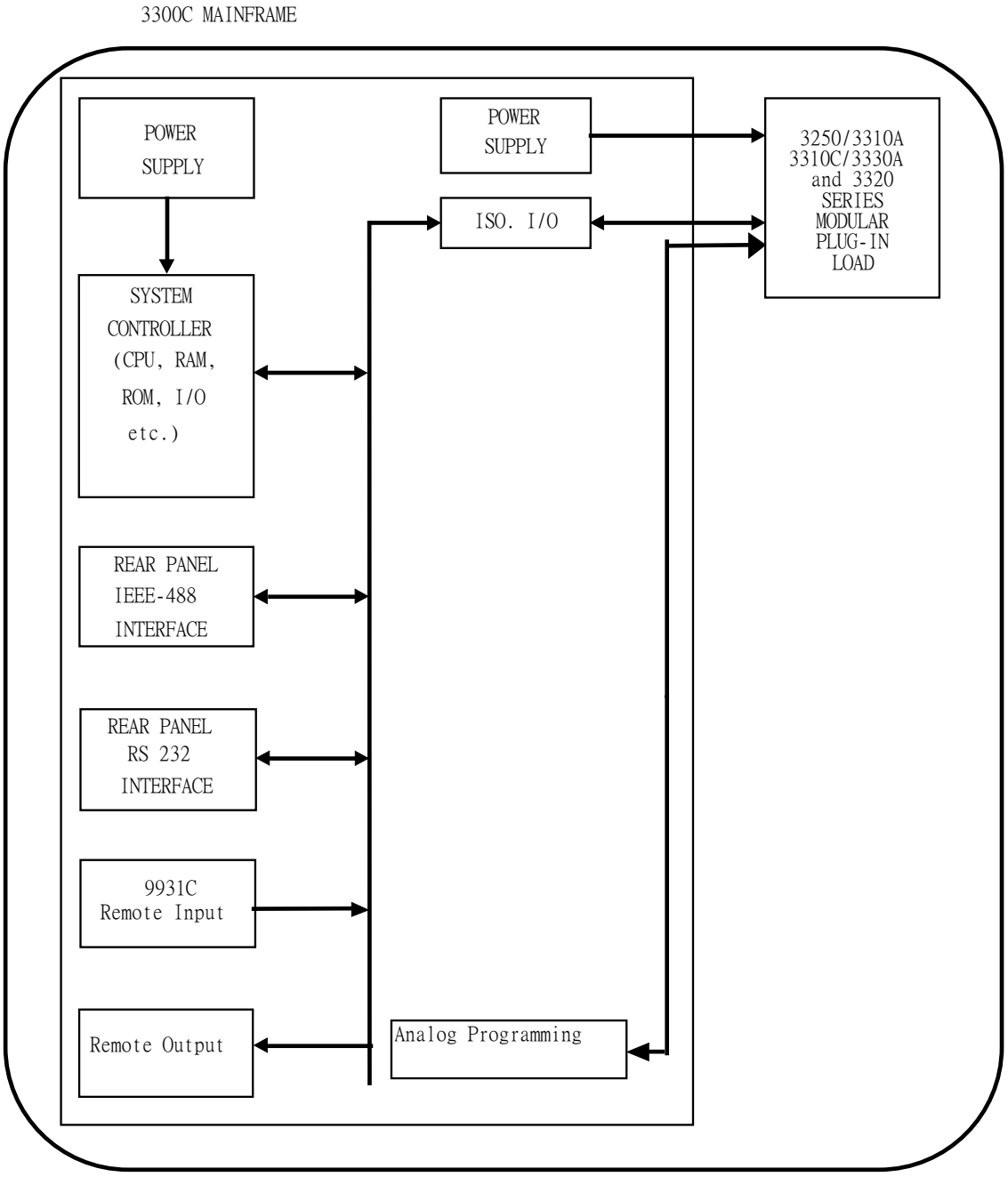


Fig 1-1 BLOCK DIAGRAM

Chapter 2 Installation

2.1 Inspection

The 3302C mainframe was carefully inspected before shipment. If instrument damage has occurred during transport, please inform Prodigit's sales and service office or representative.
Your 3302C mainframe was shipped with a power cord for the type of outlet used at your location. If the appropriated cord was not included, please contact your nearest Prodigit sales office to obtain the correct cord. Refer to " check line voltage " to check the line voltage selection and fuse type.

2.2 Check line voltage

The 3302C mainframe and 3250A/3310A/3310C/3330A/3320 series electronic load can operation with 100, 115, 200, 230Vac input as indicated on the label on the rear panel.
Make sure that the factory check marks correspond to your nominal line voltage. Skip this procedure if the label is corrected marked.

2.2.1 With the 3302C mainframe power OFF, disconnect the power cord.
2.2.2 Refer the drawing on the rear panel in Fig 2-1, set the switches to the proper voltage as describe in the following:
a. Set Switch to 100V/115V for 100Vac or 115Vac line voltage
b. Set Switch to 200V/230V for 200Vac or 230Vac
Note: 100Vac and 200Vac is used for Japan only

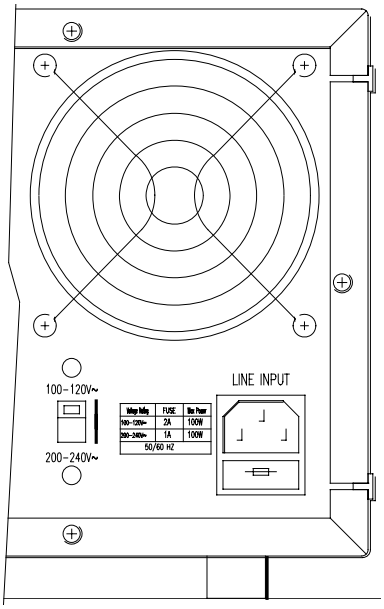


Fig 2-1 SET OF SWITCH

2.2.3 Check the rating of the line fuse and replace it with the correct fuse if necessary.
2.2.4 The AC line fuse is located below the AC line receptacle see Fig 2-2. With the power cord removed, use a small screwdriver to extract the fuse holder from under the AC socket. Replace the fuse with the appropriate type as indicated in Table 1-2. These fuses are normal-blow fuses.
2.2.5 Reinstall fuse holder and connect the power cord.

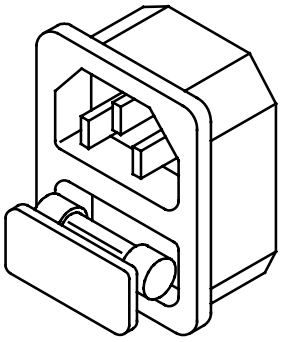


Fig 2-2 AC LINE RECEPTACLE

2.3 Grounding requirements

Model 3302C mainframe and 3250A/3310A/3310C/3330A/3320 series Plug-in load is equipped with three conductor cable which plugs in an appropriate receptacle to ground the instrument's cover.

2.4 Environmental requirements

2.4.1 Indoor use.
2.4.2 Installation Category Ⅱ.
2.4.3 Pollution Degree 2.
2.4.4 Altitude up to 2000 Meter.
2.4.5 Relative Humidity 80% Max.
2.4.6 Ambient Temperature 0 ~ 40
2.4.7 While the ideal operating temperature is 25 ± 5 degree centigrade.

2.5 Observe the International Electrical Symbol listed below.

⚠ Warning ! Risk of electric shock.

⚠ Caution ! Refer to this manual before using the meter.

2.6 Cleaning and Storage

WARNING

TO avoid electrical shock or damage to the meter,
do not get water inside the case.

Periodically wipe the case with a damp cloth and detergent; do not use abrasives or solvents.

2.7 Repairing

If the instrument is damaged, please attach a tag to the instrument to identify the owner and indicated the require service or repairing. And inform the Prodigit sales and service office or representative.

2.8 Accessories

The following parts should be include in the shipment.

2.8.1	Three conductor power cord	1pc
2.8.2	GW3302C mainframe operation manual	1pc

2.9 GPIB connection

The GPIB connector on the rear panel connects the 3302C mainframe to the controller and to other GPIB devices. An GPIB system can be connected in any configuration (star, linear, or both) as long as

2.9.1 The maximum number of devices including the controller is no more than 15.

2.9.2 The maximum length of all cable in no more than 2 meters times the number of devices connected together, up to 20 meters maximum.
Please make sure the lock screws are firmly hand - tightened, use a screw-driver only for the removal of screws. Fig 2-3 shows the rear panel of 3302C mainframe, the GPIB connector is located on the rear panel of 3302C mainframe. The GPIB address of the 3302C mainframe is set on front panel.

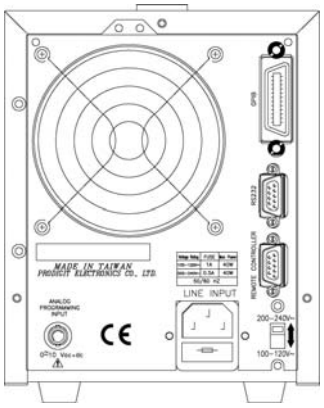


Fig 2-3 3302C REAR PANEL

2.10 RS-232C Connection

The RS-232C connector (Female) on the rear panel connects 3302C mainframe to RS-232C port of computer in one by one configuration.

2.11 Remote control Port

There are two D-sub 9 pin connector on the rear panel, the Remote Input port connects the 3302C mainframe to model 9931C remote controller and to replace the RECALL option key 1 to 5 on the front panel of 3302C mainframe, The LED will be lit if NG is occurred in any one of load module within 3302C mainframe.
The Remote output port can connect to another 3302C, 3300A or 3302 mainframe for cascade operation, this feature enable user to control up to 12 or more load module in a one memory recall operation, it is especially suitable for multiple output power supply testing applications.

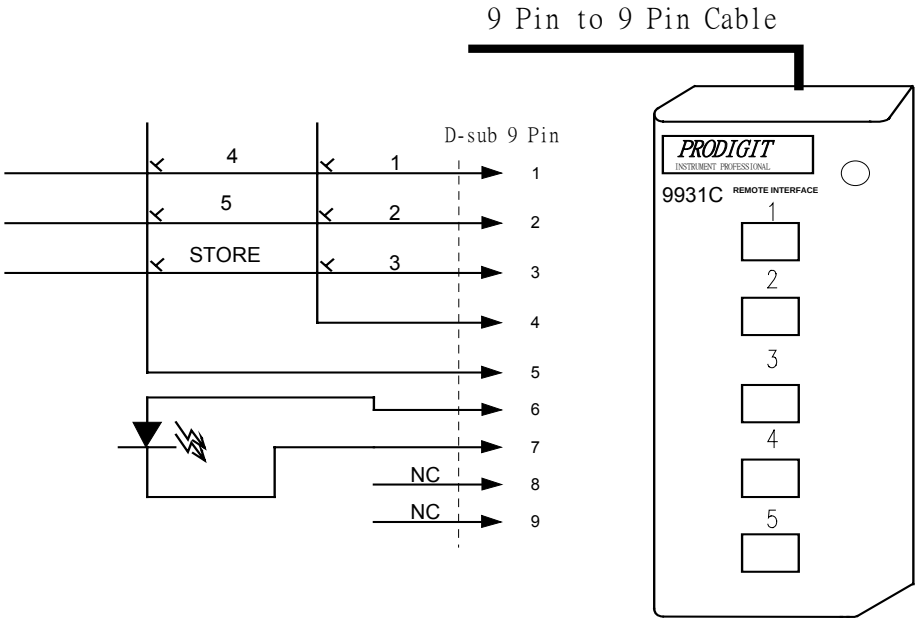


Fig 2-4 Diagram of Remote Control Port

2.12 Analog programming BNC input

The BNC connector on the rear panel connects the 3302C mainframe to the 3310A/3310C series analog programming input or to the external sync input of 3250A series load module.

Chapter 3 Mainframe operation

The front panel of 3302C mainframe is shown in Fig 3-1.

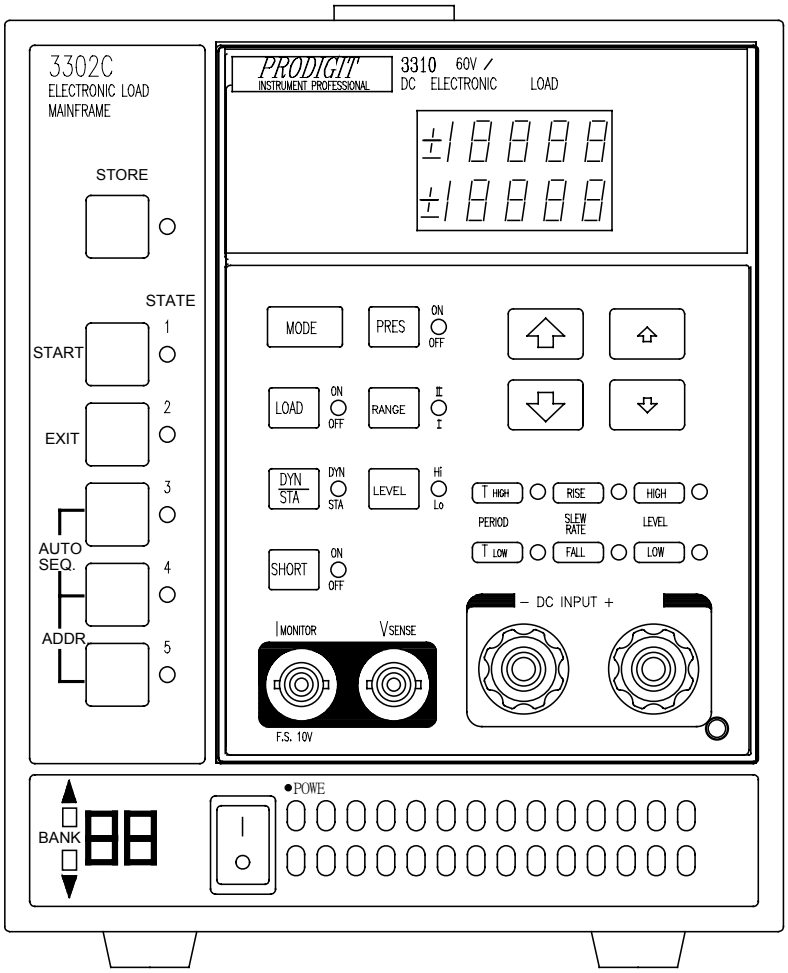


Fig 3-1 3302C FRONT PANEL

3.1 Power switch

Before connecting AC power to the 3302C mainframe, make sure the power source matches the power requirements of the 3302C Electronic load mainframe (as mark on the rear panel) Power switch turns 3302C mainframe and 3250A/3310A/3310C/3330A and 3320 series Electronic load module ON or OFF, when the 3302C mainframe is first turn ON, the 3302C mainframe is indicated with the following configuration.

3.2 Power on status

3302C:

3.2.1 Local/manual operation mode.

3.2.2 STORE/RECALL：All LED is OFF, BABK LED display shows 01; 3302C series electronic load is in power on initial state.

3.2.3 3250A/3310A/3310C/3330A and 3320 series electronic load is in power up initial state, please refer to electronic load module's operation manual.

3.2.4 GPIB address setting：

GPIB address is set by press STATE 4 + STATE 5 simultaneously, press UP or DOWN key to select 0－31 address number, press STATE 2 to exit GPIB address setting mode.

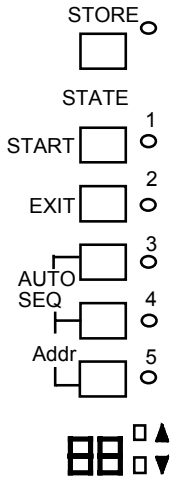


Fig 3-2 3302C FRONT PANEL KEY SWITCH

3.3 STORE / RECALL operation

The eight function keys on the front panel of 3302C mainframe are designed for high testing throughput purpose. There are 5 and 150 operation states or testing steps can be store in the EEROM memory of 3250A/3310A, and 3310C/3330A series electronic load module respectively, each state can save or recall the load status and level for four Electronic load modules simultaneously.

3.3.1 STORE procedure:

3.3.1.1 Set the load status and load level from load module within the mainframe respectively.

3.3.1.2 Skip this procedure for 3250A/3310A series load module, select the Memory Bank (01-30) to be store for 3310C and 3330A series load module.

3.3.1.3 Press the STORE key on the 3302C mainframe, the STORE LED annunciator is flashing (about two times every second) to indicate ready to store. Press Store key again or wait for about 20 sec to exit the store operation.

3.3.1.4 Press one of the state 1-5 key, the appropriate state key's LED annunciator will be lit immediately, the load level and status of 3310 series load module is stored into the EEROM memory this time. then the STORE LED annunciator turns to OFF, it means the STORE procedure is completed.

Note:
After press the STORE key, the STORE LED annunciator will flash for 20 seconds, if the STATE 1-5 key is not pressed within this 20 seconds, the STORE LED annunciator will be OFF, it indicated the STORE process is not available now, please repeat the STORE procedure for a new STORE operation.

After press the STORE key, then press the STORE key, then press the STORE LED annunciator will be blank, it indicate the STORE process is not available.

After press the STORE key, it is available and useful to operate the front panel key on the 3310 series Electronic load module. However, the STATE LED will be OFF if any key on any load module is operated, this indicates the front panel state of load module is not the same as STORE state.

3.3.2 STORE function:

Please refer chapter section on the 3250A/3310A/3310C/3330A and 3320 series electronic load module operation manual to more detail operation flow-chart for store and recall operation.

It can store up to states of 3250A/3310A/3310C/3330A and 3320 series load module setting simultaneously, if you store 2 different states in the same state key, the later state will overcome the previous state, it acts as update the new data.

3.3.3 RECALL operation:

3.3.3.1 For 3250A and 3310A series, press one of the Memory State 1 through 5 key, the appropriate LED annunciator will be lit, the store state on the 3302C mainframe is sending to the electronic load module simultaneously. Before press the states key, you press any key on the load module then the state LED annunciator is blank immediately, it indicates the STORE state has been changed on load module's front panel.

3.3.3.2 For 3310C and 3330A series, using UP and Down key to select the Memory Bank, then follow the procedure (a.) for the Memory Recall operation.

3.4 AUTO SEQUENCE testing function description

There are two modes in AUTO SEQUENCE function, EDIT MODE and TEST MODE, The AUTO SEQ mode can be entered by press S3 + S4 key simultaneously, then press STORE key again to enter the EDIT MODE, or press START key to enter the TEST MODE, Please refer to the flow chart operation below:

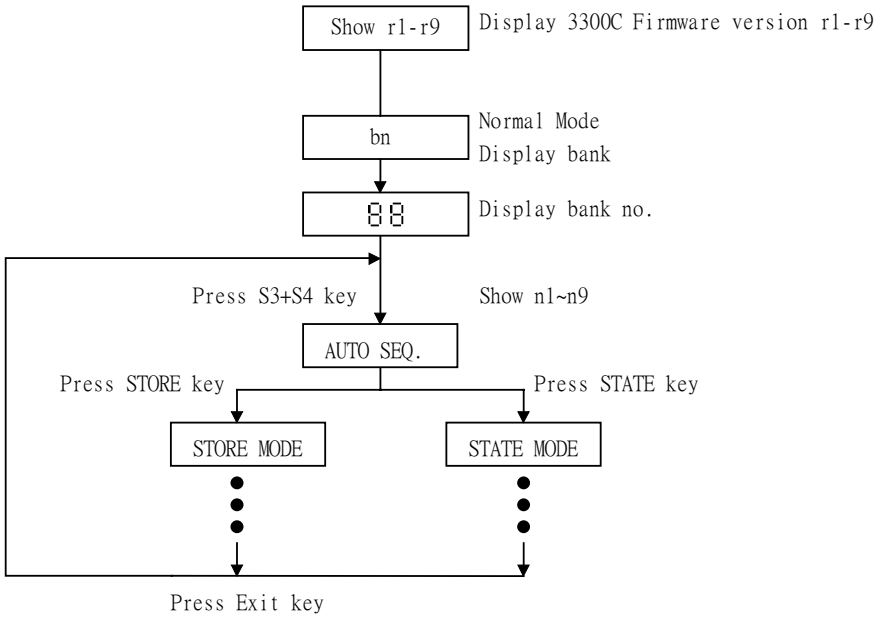


Fig 3-3 AUTO SEQUENCY FUNCTION OPERATION FLOW-CHART

3.4.1 EDIT MODE

The TEST Mode of Auto-Sequence function is entered by press S3 + S4 key simultaneously, The EDIT mode of Auto Sequence function is entered by press S3 + S4 key simultaneously, the S3 and S4 LED are ON to indicate Auto-sequence mode, then the Edit mode of Auto-sequence function is proceed by press STORE key.

The EDIT MODE flow chart is described below:

3.4.1.1 There are nine Auto Sequence (n1-n9) can be edit within 3302C

3.4.1.2 Each Auto Sequence has up to 16 Test step, where each step is any one memory of 150 sets Store memory which is 30 memory Bank with 5 memory state.

3.4.1.3 Each test step has t1 (test time) and t2 (delay time), the unit is 100mS, the range is 0.1S - 9.9S in 100mS resolution. 3302C mainframe will check each module GO/NG at the end of t1 (test time), the next step will be started after duration t2 (delay time).

3.4.1.4 The test step sequence can be up to 16 step, and can be terminated by press EXIT key if less than 16 step is required.

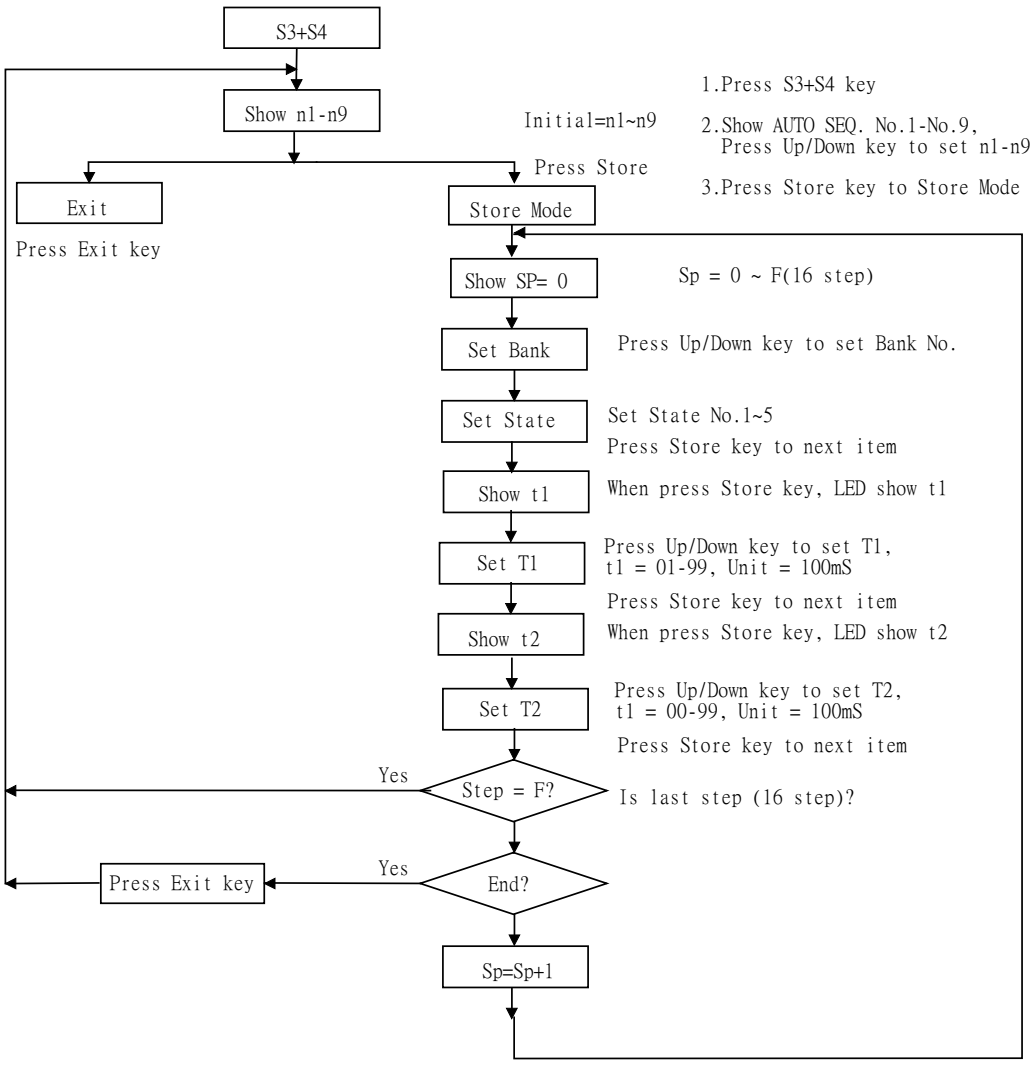


Fig 3-4 STORE (EDIT) MODE OPERATIONO FLOW-CHART

3.4.2 TEST MODE

The TEST Mode of Auto-Sequence function is entered by press S3 + S4 key simultaneously, the S3 and S4 LED are ON to indicate Auto-sequence mode, then the Test mode of Auto-sequence function is proceed by press START key.

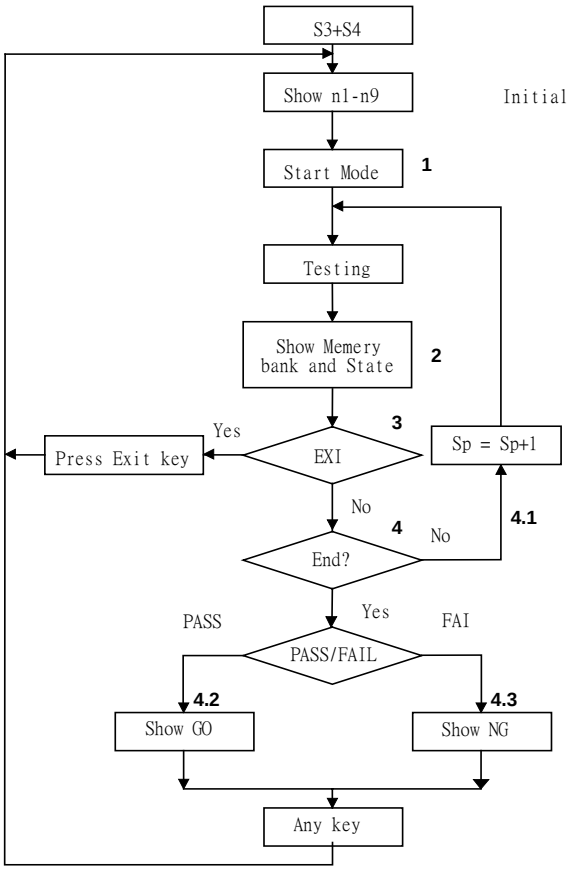
The TEST MODE flow chart is described below:

3.4.2.1 After press START key, the 3302C controls all the module within the mainframe to recall correspond memory which had been stored in Auto-sequence (n1~n9) memory.

3.4.2.2 The sequence start from (Step 0 - t1 - t2), then (step 1 - t1 - t2), and so on until last step or stop by press EXIT key.

3.4.2.3 The two digit LED display will show GO (flash) if all the test in all module is pass, and will show nG (flash) if there is at least one failure during the test.

3.4.2.4 User can press Start key to continue another test, or the 3302C can quit from Auto-Sequence mode by press EXIT key.



1.Press S3+S4 key, and S3 and S4 LED are ON

2.Show AUTO SEQ. No.1-No.9,
Press Up/Down key to set n1-n9

3.Press Start key to Start Mode

Press Start key

1.To recall correspond memory which had been stored in n1-n9 memory

2.Check the GO/NG indicator

3.Press Exit key to quit the AUTU SEQ mode

4.If test is GO, than step is last?
4.1 If no than Step + 1, continue another step.
4.2 If "Yes", than if all the test in all module is pass, Show GO.
4.3 If "Yes", than if there is at least one failure during the test, Show NG.

Fig 3-5 TEST MODE OPERATION FLOW-CHART

Chapter 4 GPIB/RS-232 programming operation

4.1 Introduction

The rear panel GPIB/RS-232 interface of 3302C mainframe is designed to connect PC (Personal Computer) or NOTEBOOK PC with GPIB/RS-232 interface, the NOTEBOOK PC acts as a remote controller of 3250A/3310A/3310C/3330A and 3320 series Electronic Load.
This feature can be used as an automatic load/cross load regulation and centering voltage testing for a switching power supply or a rechargeable battery charge/discharge characteristic testing. The function capability of rear panel GPIB/RS-232 interface not only can set the load level and.

4.2 The summary of RS-232 interface and command

The following RS-232 commands are same as GPIB commands. The RS-232 protocol in 3302C mainframe is listing below:

Baud-rate	: 9600
Parity	: none
Data bit	: 8 bits
Stop bit	: 1 bit
command delay time	: 20 mSec.

The connection of rear panel RS-232 interface is shown below, The Figure 4-1.a is connector wire diagram of rear panel RS-232 interface, User can use the general RS-232 cable as Figure 4-1.b.

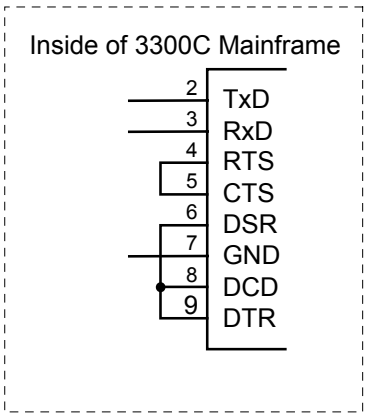


Figure 4-1.a

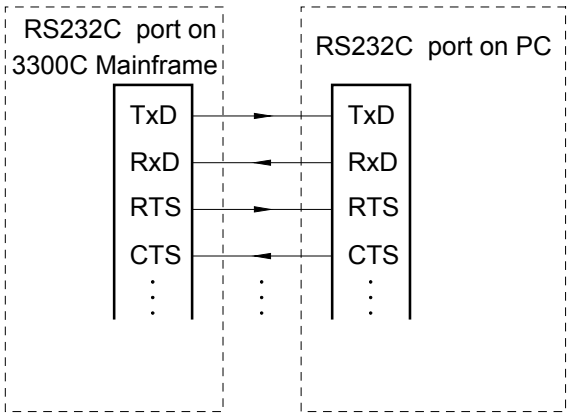


Figure 4-1.b

Fig 4-1 Rs-232 INTERFACE DIAGRAM

4.3 GPIB/RS-232C COMMAND LIST

GPIB/RS-232C setting and read back command are listed in table 4-1 and 4-2。

Setting Preset numeric command	Model					Remark
	3310A	3310C	3330A	3320	3250A	
[PRESet：] BANK{SP}{d}{；|NL}					✓	d=0~10
[PRESet：] WAVE{SP}{m}{；|NL }					✓	M=0~4
[PRESet：] FREQuency{SP}{NR2}{；|NL}					✓	40.0~70.0Hz
[PRESet：] RISE{SP}{NR2}{；|NL}	✓	✓				
[PRESet：] FALL{SP}{NR2}{；|NL}	✓	✓				
[PRESet：] SLEWrate{SP}{NR2}{；|NL}			✓			
[PRESet：] SLEWRATE{SP}{FAST|MIDD|SLOW}{；|NL}				✓		
[PRESet：] PREIod：{HIGH|LOW}{SP}{NR2}{；|NL}	✓	✓	✓			
[PRESet：] LDONv{SP}{NR2}{；|NL}		✓	✓			
[PRESet：] LDOFfv{SP}{NR2}{；|NL}		✓	✓			
[PRESet：] CC{SP}{NR2}{；|NL}			✓	✓		
[PRESet：] CC：{A|B}{SP}{NR2}{；|NL}					✓	
[PRESet：] CC：{HIGH|LOW}{SP}{NR2}{；|NL}	✓	✓	✓			
[PRESet：] CP：{HIGH|LOW}{SP}{NR2}{；|NL}		✓				
[PRESet：] CR{SP}{NR2}{；|NL}			✓			
[PRESet：] CR：{A|B}{SP}{NR2}{；|NL}					✓	
[PRESet：] LIN：{A|B}{SP}{NR2}{；|NL}					✓	
[PRESet：] CR：{HIGH|LOW}{SP}{NR2}{；|NL}	✓	✓				
[PRESet：] CV：{HIGH|LOW} {SP} {NR2}{；|NL}	✓	✓				
[PRESet：] CV{SP}{NR2}{；|NL}			✓			
[PRESet：] TCONFIG{SP} {NORMAL|OCP |OPP}{;|NL}		✓				
[PRESet：] TCONFIG{SP} {NORMAL|OCP|OVP }{;|NL}			✓			
[PRESet：] OCP:START {SP} {NR2}{;|NL}		✓	✓			
[PRESet：] OCP:STEP {SP} {NR2}{;|NL}		✓	✓			
[PRESet：] OCP:STOP {SP} {NR2}{;|NL}		✓	✓			
[PRESet：] OCP:VTH {SP} {NR2}{;|NL}		✓	✓			
[PRESet：] OPP:START {SP} {NR2}{;|NL}		✓				
[PRESet：] OPP:STEP {SP} {NR2}{;|NL}		✓				
[PRESet：] OPP:STOP {SP} {NR2}{;|NL}		✓				
[PRESet：] OPP:VTH {SP} {NR2}{;|NL}		✓				

Table 4-1 GPIB/RS-232 SETTING COMMAND SUMMARY

Note：1.OCP/OPP and TCONFIG Function is available in 3310c REV：3.06 or later
Function is available in 3311c REV：3.06 or later
Function is available in 3312c REV：3.09 or later
Function is available in 3314c REV：3.07 or later
Function is available in 3315c REV：3.06 or later
Function is available in 3302c REV：2.9 or later

Query Preset numeric command	Model					RETURN
	3310A	3310C	3330A	3320	3250A	
[PRESet：] BANK{SP}{?}{；|NL}					✓	0~10
[PRESet：] WAVE{SP}{?}{；|NL}					✓	0~4
[PRESet：] FREQuency{?}{；|NL}					✓	40.0~70.0
[PRESet：] RISE{?}{；|NL}	✓	✓				###.####
[PRESet：] FALL{?}{NR2}{；|NL}	✓	✓				###.####
[PRESet：] SLEWrate{?}{；|NL}			✓			###.####
[PRESet：] SLEWRATE{?}{；|NL}				✓		###.####
[PRESet：] PREIod：{HIGH|LOW}{?}{；|NL}	✓	✓	✓			###.####
[PRESet：] LDONv{?}{；|NL}		✓	✓			###.####
[PRESet：] LDOFfv{?}{；|NL}		✓	✓			###.####
[PRESet：] CC{?}{；|NL}			✓	✓		###.####
[PRESet：] CC：{A|B}{?}{；|NL}					✓	###.####
[PRESet：] CC：{HIGH|LOW}{?}{；|NL}	✓	✓	✓			###.####
[PRESet：] CP：{HIGH|LOW}{?}{；|NL}		✓				###.####
[PRESet：] CR{?}{；|NL}			✓			###.####
[PRESet：] CR：{A|B}{?}{；|NL}					✓	###.####
[PRESet：] LIN：{A|B}{?}{；|NL}					✓	###.####
[PRESet：] CR：{HIGH|LOW}{?}{；|NL}	✓	✓	✓			###.####
[PRESet：] CV：{HIGH|LOW}{?}{；|NL}	✓	✓				###.####
[PRESet：] CV{?}{；|NL}			✓			###.####
[PRESet：] TCONFIG {?}{;|NL}		✓				1:NORMAL 2:OCP 3:3:OPP
[PRESet：] TCONFIG {?}{;|NL}			✓			1:NORMAL 2:OCP 3:3:OVP
[PRESet：] OCP:START {?} {;|NL}		✓	✓			###.####
[PRESet：] OCP:STEP {?}{;|NL}		✓	✓			###.####
[PRESet：] OCP:STOP {?}{;|NL}		✓	✓			###.####
[PRESet：] OCP:VTH {?}{;|NL}		✓	✓			###.####
[PRESet：] OPP:START {?} {;|NL}		✓				###.####
[PRESet：] OPP:STEP {?}{;|NL}		✓				###.####
[PRESet：] OPP:STOP {?}{;|NL}		✓				###.####
[PRESet：] OPP:VTH {?}{;|NL}		✓				###.####

Table 4-2 GPIB/RS-232 QUERY COMMAND SUMMARY

LIMIT command	Model			RETURN
	3310C	3330A	3250A	
LIM：CURRent：{HIGH|LOW}{SP}{NR2}{；|NL}	✓	✓	✓	
LIM：CURRent：{HIGH|LOW}{?}{；|NL}	✓	✓	✓	###.####
LIM：POWer：{HIGH|LOW}{SP}{NR2}{；|NL}	✓		✓	
LIM：POWer：{HIGH|LOW}{?}{；|NL}	✓		✓	###.####
LIM：VA：{HIGH|LOW}{SP}{NR2}{；|NL}			✓	
LIM：VA：{HIGH|LOW}{?}{；|NL}			✓	###.####
LIM：VOLTage：{HIGH|LOW}{SP}{NR2}{；|NL}	✓	✓	✓	
LIM：VOLTage：{HIGH|LOW}{?}{；|NL}	✓	✓	✓	###.####

STAGE command	Model					RETURN
	3310A	3310C	3330A	3320	3250A	
[STATe：] LOAD{SP}{ON|OFF}{；|NL}	✓	✓	✓	✓	✓	
[STATe：] LOAD{?}{；|NL}	✓	✓	✓	✓	✓	0:OFF,1:ON
[STATe：] MODE{SP}{CC|CR|CV|CP}{；|NL}	✓	✓	✓		✓	
[STATe：] MODE{?}{；|NL}	✓	✓	✓		✓	0:CC,1:CR 2:CV,1:CP
[STATe：] SHORt{SP}{ON|OFF}{；|NL}	✓	✓	✓	✓	✓	
[STATe：] SHORt{?}{；|NL}	✓	✓	✓	✓	✓	0:OFF,1:ON
[STATe：] PRESet{SP}{ON|OFF}{；|NL}		✓	✓	✓		
[STATe：] PRESe{?}{；|NL}		✓	✓	✓	✓	0:OFF,1:ON
[STATe：] SENSe{SP}{ON|OFF}{；|NL}	✓	✓	✓		✓	
[STATe：] SENSe{?}{；|NL}	✓	✓	✓			0:OFF,1:ON
[STATe：] RANGe{SP}{I|II}{；|NL}	✓			✓		
[STATe：] RANGe{?}{；|NL}	✓			✓		0:I,1:II
[STATe：] LEVEl{SP}{HIG|LOW|AIB}{；|NL}	✓	✓			✓	
[STATe：] LEVEl{?}{；|NL}	✓	✓			✓	0:LAOW,1:HIGH
[STATe：] DYNamic{SP}{ON|OFF}{；|NL}	✓	✓	✓			
[STATe：] DYNamic{?}{；|NL}	✓	✓	✓			0:OFF,1:ON
[STATe：] SYNCronize{SP}{ON|OFF}{；|NL}					✓	
[STATe：] SYNCronize{?}{；|NL}					✓	0:OFF,1:ON
[STATe：] WATT{SP}{ON|OFF}{;|NL}		✓			✓	
[STATe：] WATT{?}{;|NL}		✓			✓	0:FF,1:ON
[STATe：] DUAL{SP}{DVM|DAM|OFF}{;|NL}			✓			
[STATe：] PARAllel{SP}{ON|OFF}{;|NL}			✓			
[STATe：] NGAB{SP}{ON|OFF}{;|NL}			✓			
[STATe：] NGAB{SP}{?}{;|NL}			✓			0:OFF,1:ON
[STATe：] NG{?}{;|NL}		✓	✓		✓	0:OK,1:NG
[STATe：] PROTect{?}{;|NL}	✓	✓	✓		✓	Ddddddddd
[STATe：] CC{SP}{AUTO|R2} Note:		✓	✓			

Note: CC AUTO/Ran2 Function is available in 3302C REV：2.8 or later
Function is available in 3310C REV：3.05 or later
Function is available in 3311C REV：3.05 or later
Function is available in 3312C REV：3.06 or later
Function is available in 3314C REV：3.05 or later
Function is available in 3315C REV：3.05 or later
Function is available in 3330A REV：3.17 or later
Function is available in 3331A REV：3.17 or later
Function is available in 3332A REV：3.17 or later
Function is available in 3333A REV：3.17 or later
Function is available in 3334A REV：3.17 or later

System command：Available for all modules

COMMAND	NOTE	RETURN
[SYStem：] RECall{SP}{m[,n]}{；|NL}	M=1~5 n=1~30	
[SYStem：] STORe{SP}{m[,n]}{；|NL}	M=1~5 n=1~30	
[SYStem：] REMOTE{；|NL}	Only RS232 cmd	
[SYStem：] LOCAL{；|NL}	Only RS232 cmd	0：OFF, 1：ON
[SYStem：] NAME{?}{；|NL}		“XXXXX”

Measure command

COMMAND	3310A	3310C	3330A	3250A	RETURN
MEASure：CURRent {?}{；|NL}	✓	✓	✓	✓	###.####
MEASure：VOLtage {?}{；|NL}	✓	✓	✓	✓	###.####
MEASure：PWR {?}{；|NL}				✓	###.####
MEASure：VA {?}{；|NL}				✓	###.####

REMARK :
1. d : 0 - 9
2. CURRENT ENGINEERING UNIT : A
3. VOLTAGE ENGINEERING UNIT : V
4. RESISTANCE ENGINEERING UNIT : Ω
5. PERIOD ENGINEERING UNIT : mS
6. SLEW-RATE ENGINEERING UNIT : A/uS

Note：The RS-232 command set is same as GPIB command set.

※ 3310C Series and 3310A series GPIB command is compatible ,but the resolution is different , The different Description as following table .

Model	CC MODE	CR MODE	CV MODE
3310C Resolution	0-3A/30A 0.8mA/8.0mA	0.1067Ω-2Ω-7.5kΩ 0.533mΩ/0.133mS	0V-60V 0.016V
3310A Resolution	0-3A/30A 0.75mA/7.5mA	0.1Ω-2Ω-8kΩ 0.5mΩ/0.125mΩ	0V-60V 0.015V
3311C Resolution	0-6A/60A 1.6mA/16mA	0.0533Ω-1Ω-3.75kΩ 0.266mΩ/0.266mS	0V-60V 0.016V
3311A Resolution	0-6A/60A 1.5mA/15mA	0.05Ω-1Ω-4kΩ 0.25mΩ/0.25mΩ	0V-60V 0.015V
3312C Resolution	0-1A/10A 0.266mA/2.66mA	1.333Ω-25Ω-18.75kΩ 6.666mΩ/0.053mS	0V-250V 0.0666V
3312A Resolution	0-1A/10A 0.25mA/2.5mA	1.25Ω-25Ω-20kΩ 0.05mS/6.25mΩ	0V-250V 0.0625V
3314C Resolution	0-0.5A/5A 0.133mA/1.33mA	5.333Ω-100Ω-18.75kΩ 26.66mΩ/13.333μS	0V-500V 0.133V
3314A Resolution	0-0.5A/5A 0.125mA/1.25mA	5Ω-100Ω-20kΩ 0.0125mS/25mΩ	0V-500V 0.125V
3315C Resolution	0-1.5A/15A 0.4mA/4.0mA	0.213Ω-4Ω-15kΩ 1.066mΩ/66.666μS	0V-60V 0.016V
3315A Resolution	0-1.5A/15A 0.375mA/3.75mA	0.2Ω-4Ω-16kΩ 1mS/0.0625mΩ	0V-60V 0.015V

Table 4-3 different description

4.4 The description of abbreviation

SP：Space, the ASCII code is 20 Hexadecimal.
; ：Semicolon, Program line terminator, the ASCII code is OA Hexadecimal.
NL：New line, Program line terminator, the ASCII code is OA Hexadecimal.
N ：Integer number from 1 to 8.
NR2：Digits with decimal point. It can be accepted in the range and format of ##.#####.

For Eexample：

30.12345, 5.0

The description of GPIB programming command syntax.

{ } :The contents of the { } symbol must be used as a part or data of the GPIB command, it can not be omitted.
[ ] :The contents of the [ ] symbol indicts the command can be used or not. It depends on the testing application.
| :This symbol means option. For example〝A|B〞means it can only use A or B as the command, it can choose only one as the setting command.
Terminator :You have to send the program line terminator character after send the GPIB command, the available command terminator characters which can be accepted in 3302C mainframe is listed in Table 4-3.

LF
LF WITH EOI
CR, LF
CR, LF WITH EOI

Table 4-4 GPIB command terminator

A terminator informs GPIB that it has reached the end of statement. Normally, this is sent automatically by your GPIB programming statements. In this manual, the terminator is assumed at the end of each example line of code. If it needs to be indicated, it is shown by symbol (nl); which stand for〝new line〞and represents ASCII code byte the OA Hexadecimal or 10 decimal.
Semicolon〝;〞： The semicolon〝;〞is a back-up command, the semicolon allows you to combine command statement on one line to create command message.

4.5 GPIB/RS-232 command description

4.5.1 Setting Command

CURRENT Level

Purpose：

The load current setting in Constant Current mode.

Command syntax：

CC：{LOW|HIGH}{SP}{NR2}{;|NL}

LIN：{A|B}{SP}{NR23}{;|NL}

CC：{A|B}{SP}{NR23}{;|NL}

CC{SP}{NR2}{;|NL}

Description：

CC：{LOW|HIGH}{SP}{NR2}{;|NL}

This command id used to set the current level of 3310 series Electronic Load module.

CC：{A|B}{SP}{NR2}{;|NL}

This command is used to set the load current level A/B of 3250A series electronic load module.

CC：{SP}{NR2}{;|NL}

This command is used to set the load current level for CC static mode of 3330A and 3320 series electronic load module.

Note:

1. The load current data must include decimal point, otherwise this command is unable to excute. The effective load current level can be programmed is the sixth digit after the decimal point.
2. The HIGH load level load current MUST be higher than LOW level load current for proper dynamic waveform definition, the load current difference between programmed HIGH and LOW level is 10 times of resolution at each range, the 3310 series Electronic Load will adjust and limit of the programmed values.
   If the programmed HIGH level is equal or less than LOW level, the 3310 series load module will adjust and limit HIGH level to be higher 10 times programming resolution of LOW level, and vice versa at the programmed LOW level is equal or more than HIGH level.
3. If the programming load current level over the maximum specification at programmed range of 3250A/3310 series load module, the full scale current will be sent to the load module.
4. Please make sure range I/II command before execute the load current setting command, otherwise the 3310 series load module will adjust to fit the load current after programming the RANGE command.
5. LOW|HIGH option is for 3310 series electronic load.
6. A|B option is for 3250A series electronic load.
7. Engineering unit for load current is Amps.
8. Please refer to Appendix C for proper programming procedure of 3310 series electronic load module.

For Example：

CC：LOW 1.8 set LOW level load current to 1.8 A.

CC：HIGH 25.123456 set HIGH level load current to 25.123456 A.

RESISTANCE Level

Purpose：

The load resistance setting in Constant Resistance mode.

Command syntax：

CR：{HIGH|LOW}{SP}{NR2}{;|NL}

CR：{A|B}{SP}{NR2}{;|NL}

CR：{SP}{NR2}{;|NL}

Description:

CR：{HIGH|LOW}{SP}{NR2}{;|NL}

This command is used to set the LOW/HIGH load resistance level of 3310 series electronic load module.

CR：{A|B}{SP}{NR2}{;|NL}

This command is used to set the load resistance for LEVEL A/B of 3250A series electronic load module.

CR：{SP}{NR2}{;|NL}

This command is used to set the load resistance level of 3330A Series load module.

Note：

1. The load resistance data must include decimal point, otherwise this command is unable to execute. The most effective load resistance level can be set is the sixth digit after the decimal point.
2. The HIGH load level load resistance MUST be higher than LOW level load resistance for proper HIGH/LOW resistance level definition, the load resistance difference between programmed HIGH and LOW level is 10 times of resolution at each range, the 3310 series Electronic Load will adjust and limit of the programmed values.
   If the programmed HIGH level is equal or less than LOW level, the 3310 series load module will adjust and limit HIGH level to be higher 10 times programming resolution of LOW level, and vice versa at the programmed LOW level is equal or more than HIGH level.
3. If the programming load resistance level over the maximum specification at programmed range of 3310 series load module, the full scale resistance will be sent to the load module.
4. Please make sure range I/II command before execute the load current setting command, otherwise the 3310 load current after programming the RANGE command.
5. LOW|HIGH option is for 3310 series electronic load module.
6. A|B option is for 3250A series electronic load module.
7. The engineering unit for load resistance is Ohms.
8. Please refer to Appendix C for proper programming procedure of 3310 series electronic load module.

For Example：

CR：LOW 0.123 set LOW level load resistance to 0.123 OHM.

CR：HIGH 3.456789 set HIGH level load resistance to 3.456789 OHM.

VOLTAGE Level

Purpose：

The load voltage setting in Constant Voltage mode.

Command Syntax :

CV:{HIGH|LOW}{SP}{NR2}{;|NL}

CV:{SP}{NR2}{;|NL}

Description：

CV:{HIGH|LOW}{SP}{MISS}{;|NL}

This command is used to set the load voltage level of 3310A/3310C series Electronic load module.

CV {SP}{NR2}{;|NL}

This command is used to used to set the load Voltage level of 3330A series electronic load module.

Note:

1. The load voltage data must include decimal point, otherwise this command is unable to execute. The most effective load voltage level can be set is the sixth digit after the decimal point.
2. The HIGH load level load voltage MUST be higher than LOW level load voltage for proper HIGH/LOW voltage level definition, the load voltage difference between programmed HIGH and LOW level is 10 times of resolution, the 3310 series Electronic Load will adjust and limit of the programmed values.
   If the programmed HIGH level is equal or less than LOW level, the 3310 series load module will adjust and limit HIGH level to be higher 10 times programming resolution of LOW level, and vice versa at the programmed LOW level is equal or more than HIGH level.
3. If the programming load voltage level over the maximum specification at programmed range of 3310 series load module, the full scale voltage will be sent to the load module.
4. The engineering unit for load voltage is Volts.
5. Please refer to Appendix C for proper programming procedure of 3310 series electronic module.

For Example：

CV:LOW 3.0 set LOW level load voltage to 3.0 V.

CV:HIGH 45.123456 set HIGH level load voltage to 45.123456 V.

POWER Level

Purpose:

The load power setting in Constant Power mode.

Command Syntax:

CP:{HIGH|LOW}{SP}{NR2}{;|NL}

Description:

This command is used to set the load Power level of 3310C series electronic load module.

Note : Mode CP is available in 3310C series only.

LOAD ON/OFF
Purpose：
Turn the Electronic load module input ON or OFF.
Command syntax：
LOAD{SP}{0FF|ON}{NL}
Description：
This command sets the Electronic load to sink current from power source.
LOAD ON the 3250A, 3310, 3330A and 3320 series Electronic load modules in the 3302C mainframe are ready to sink current from power source.

LOAD ON ; Set the load module to LOAD ON status, this load module is ready to sink current from power source.
LOAD 0 ; Set the load module LOAD OFF.

LOAD ON VOLTAGE Setting
Purpose:
The Load ON voltage setting (Initial is 1.0V) of 3310C and 3330A series electronic load module.
Command Syntax:
LDON{SP}{NR2}{;|NL}
Description:
The Load On voltage can be adjusted by the LDON command, the adjust range is 0.1～25.0 V (Res. = 0.1V), the load on voltage setting for CH A and CH B is the same setting. The load will start to sink current if power source output voltage is higher than load on voltage.

LDON 2.5; Set the load on voltage is 2.5V, The load will start to sink current when power source output voltage is higher than 2.5V.

LOAD OFF VOLTAGE Setting
Purpose:
The Load OFF voltage setting (Initial is 0.5V) of 3310C and 3330A series electronic load module.
Command Syntax:
LDOF{SP}{NR2}{;|NL}
Description:
The Load OFF voltage can be adjusted by the LDOF command, the adjust range is 0.1～load on voltage (Res. = 0.1V), the load off voltage setting for CH A and CH B is the same setting. The load will stop to sink current if power source output voltage is lower than load off voltage.

LDOF 2.0 ; Set the load off voltage is 2.0V, The load will start to sink current when power source output voltage is lower than 2.0V.

LEVEL HIGH/LOW

Purpose：

Select Low or High level in static mode of 3310 series electronic load, or LEVEL A/B of 3250A series electronic load.

Command syntax：

LEVE {SP}{HIGH|LOW|A|B}{NL}

Description：

LEVE LOW is Set LOW current level in CC mode, LOW resistance level in CR mode, or LOW voltage level in CV mode at the active load channel.

LEVE 1 is Set HIGH current level in CC mode, HIGH resistance level in CR mode, or HIGH voltage level in CV mode at the active load channel.

LEVE B is The condition and setting of 3250A series electronic load adopt the set value of LEVEL B.

PRESET ON/OFF

Purpose：

Set the upper or lower 4 1/2 digit multi-function meter to display the programming load level.

Command syntax：

PRES{SP}{0|1|OFF|ON}{NL}

Description：

PRES ON is set the load module in the 3302C mainframe to preset on status.

MODE CC/CR/CV/LIN/CP

Purpose：

Select the operating mode of Electronic load module.

Command syntax：

MODE{SP}{0|1|2|3|CC|CR|CV/LIN|CP}{NL}

Description：

MODE CC is set the presently operating mode to Constant Current mode for the load module in the 3302C mainframe.

MODE CV is set the presently operating mode to Constant Voltage mode.

MODE 1 is set the presently operating mode to Constant Resistance mode.

MODE CP is set the presently operation mode to Constant Power mode.

Note：

MODE CV is available in 3310A series only.

MODE CP is available in 3310C series only.

CLEAR status register

Purpose：

CLEar the PROT and ERR status byte registers.

Command syntax：

CLR{NL}

Description：

CLE clear the PROT and ERR status byte register, the PROT and ERR status byte register will be indicated〝0〞after execute the CLE command.

STORE

Purpose：

STORE the load level and load status into the memory of the 3250A, 3310, 3330A and 3320 series electronic LOAD.

Command syntax：

STOR{SP}{m[,n]}{;|NL}

Description：

Parameter m is 1~5 for 5 different states with 3250A and 3310A series electronic load module's load status and load current into the non-volatile memory in the 3250 and 3310A series electronic load.

Parameter m is 1~5 for 5 different states with 3320 series electronic load module's load status and load current into the EEPROM memory in 3302C mainframe.

Parameter n is 1~30 for 30 memory bank for 150 (m*n) different state with 3330A/3310C series electronic load module's load status and load current into the EEPROM memory in the 3330A and 3310C series electronic load.

For Example：

STORE 1; store the 3250A, 3310A and 3320 series electronic load module's load status and load current into the memory 1.

STORE 2,30; store the 3330A and 3310C series electronic load module's load status and load current into the memory 147.

RECALL

Purpose：

Recall the state of load level and status which is stored by GPIB/RS232 STORE command.

Command syntax：

REC{SP}{m[,n]}{;|NL}

Description：

This command is used to recall the memory state which is store into the memory by GPIB/RS232 store command, up to 5 states can be recalled for 3250A, 3310A and 3320 series electronic load module, up to 150 state can be recalled for 3330A and 3310C series electronic load module.

For Example：

REC 1; Recall the state of load level and status which is stored in memory 1 by GPIB/RS232 STOR command.

REC 147; Recall the state of load level and status which is stored in memory 147 by GPIB/RS232 STOR command.

SYNCHRONOUS ON/OFF

Purpose：
To set synchronous function ON/OFF for 3250A series electronic load module.
Command syntax：
SYNC{SP}{0|1|OFF|ON}{；|NL}
Description:
1.External synchronous signal (SYNC ON)：Using external synchronous signal as the synchronous triggering signal of the electronic load thus controlling the load current to be synchronous with the voltage.
2.Internal synchronous signal (SYNC OFF)：Using the signal at the terminal of the input connector thus generating synchronous signal through the internal zero-crossing circuit and isolated circuit.

For Example：
a.SYNC ON, to set external synchronization.
b.SYNC OFF, to set internal synchronization.

WATT Meter ON/OFF
Purpose：
To set display of power meter of 3250A series electronic load module.
Command syntax：
WATT{SP}{0|1|OFF|ON}{；|NL}
Description：
This command is to set the display of power meter. This command has to be used in conjunction with PRES：OFF. When setting to ON, the monitor on the top will change from voltmeter to Watt meter while the monitor at the bottom will change from ammeter to Volt-Amp meter (VA) and the unit is〝W〞and〝VA〞respectively. When setting to OFF, the Watt meter on the top will change back to voltmeter while the VA meter at the bottom will change back to ammeter and the unit is〝Vrms〞and〝Arms〞respectively.

For Example：
a.PRES OFF
b.WATT ON, to display WATT, VA meter.
c.WATT OFF, to display Voltage, Current meter.

WAVEFORM BANK
Purpose：
To set waveform bank for 3250A series electronic load module.
Command syntax：
BANK{SP}{d}{；|NL}　d：0～10
Description：
This command is to set the waveform bank desired to be selected.
1.waveform bank 0～2 are sine wave.
2.waveform bank 3～8 Set P.F.
3.waveform bank 3～8 are square wave.

4.waveform bank 10 is DC.

5.There are five (5) waveform information for each waveform bank, therefore, there is a total 55 waveform information for eleven (11) waveform banks. Waveform information is shown in Table 4-4.

For Example：
a.BANK 1, to set waveform bank 1.
b.BANK 10, to set waveform bank 10.

	WAVE FROM BANK	A	B	C	D	E
SINE WAVE	0	√2	2.0	2.5	3.0	3.5
	1	1.5	1.6	1.7	1.8	1.9
	2	3.0	3.1	3.2	3.3	3.4
C.F.= 2.0	3	P.F.=-0.85	P.F.=-0.80	P.F.=-0.75	P.F.=-0.70	P.F.=-0.65
C.F.= 2.5	4	P.F.=-0.70	P.F.=-0.65	P.F.=-0.60	P.F.=-0.50	P.F.=-0.40
C.F.= 3.5	5	P.F.=-0.50	P.F.=-0.45	P.F.=-0.40	P.F.=-0.35	P.F.=-0.30
C.F.= 2.0	6	P.F.= 0.85	P.F.= 0.80	P.F.= 0.75	P.F.= 0.70	P.F.= 0.65
C.F.= 2.5	7	P.F.= 0.70	P.F.= 0.65	P.F.= 0.60	P.F.= 0.50	P.F.= 0.40
C.F.= 3.5	8	P.F.= 0.50	P.F.= 0.45	P.F.= 0.40	P.F.= 0.35	P.F.= 0.30
SQUARE WAVE	9	1.0	1.1	1.2	1.3	1.4
DC	10	√2dc	2dc	2.5dc	3.0dc	3.5dc

Table 4-5 waveform information

WAVEFORM
Purpose：
To set waveform, for 3250A series electronic load module.
Command syntax：
WAVE{SP}{m}{；|NL}m：0～4
Description：
This command is to set the current C.F. at CC MODE (Peak Value Factor). This command works only at CC MODE. When BANK varies, these 5 sets of C.F. will at the same time define different C.F. as shown in Table 4-4. For details, please refer to 3250 Operation Manual.

For Example：
a.WAVE 1, to set 2nd set C.F.
b.WAVE 4, to set 5th set C.F.

FREQUENCY
Purpose：
Setting of Frequency Value for 3250 series electronic load module.
Command syntax：
FREQ{SP}{NR2}{；|NL}

This command is for setting the frequency value of electronic load. Upon directing command, attention has to be paid to the following items：

1. The frequency value designated must include the decimals, otherwise, the command will become null and void.
2. The minimum effective digit of the value is the fifth digit after the decimal point.
3. If the value designated exceeds the specification of said electronic load, the 3302 machine frame will send out the full scale current value of said electronic load specification.
4. The frequency range of 3250A series electronic load is 40.0~70.0Hz.
5. unit is Hz.

For Example：

a.FREQ 50.0, to set frequency is 50.0Hz.
b.FREQ 60.0, to set frequency is 60.0Hz.
c.FREQ 0.1, to set frequency is 0.1Hz, that is to set DC.

VOLTAGE Limit

Purpose：

To set the upper/lower limit value of threshold voltage.

Command syntax：

LIM:VOLT:{HIGH|LOW}{SP}{NR2}{；|NL}

Description：

This command is to set the upper/lower limit value of threshold voltage. When input voltage is lower than the lower limit value or higher than the upper limit value, NG indicating light will come on to indicate〝NO GOOD〞.

For Example：

LIM:VOLT:LOW 1.0, to set the lower limit value of threshold voltage is 1.0 V.
LIM:VOLT:HIGH 200.0, to set the upper Limit vale of threshold voltage is 200.0V.

CURRENT Limit

Purpose：

To set the upper/lower limit value of threshold current.

Command syntax：

LIM:CURR{HIGH/LOW}{SP}{NR2}{;|NL}

Description：

This command is to set the lower limit value of threshold current. When load sink current is lower than this lower limit value or higher than the upper limit value, NG indicating light will come on to indicate 〝NO GOOD〞.

For Example：

LIM:CURR:LOW:0.05, to set the lower limit value of threshold current is 0.05A.
LIM:CURR:HIGH:10.0, to the upper limit value of threshold current is 10.0A.

POWER Limit

Purpose：

To set the upper/lower limit value of threshold power (W).

Command syntax：

LIM:POW:{HIGH|LOW}{SP}{NR2}{;|NL}

Description：

This command is to set the upper/lower limit value of threshold power (WATT). When power (WATT) is lower than this lower limit value or higher than the upper limit value, NG indicating light will come on to indicate〝NO GOOD〞.

For Example：

LIN:POW:LOW 0.05, to set the lower limit value of threshold power (W) is 0.05 W.
LIM:POW:HIGH 250.0, to set the upper limit value of threshold power(W)is 250.0 W.

VA Limit

Purpose：

To set the upper/lower limit value of threshold power (VA).

Command syntax：

LIM:VA:{HIGH|LOW}{SP}{NR2}{;|NL}

Description：

This command is to set the upper/lower limit value of threshold power (VA). When power (VA) is lower than this lower limit value or higher than the upper limit Value, NG indicating light will come on to indicate〝NO GOOD〞.

For Example：

LIM:VA:LOW 0.05, to set the lower limit value of threshold power (VA) is 0.05 VA.
LIM:VA:HIGH 250.0, to set the upper limit value of threshold power(VA)is 250.0 VA.

PERIOD

Purpose：

Set the Tlow/Thigh duration of dynamic load in Constant Current mode.

Command Syntax：

PERI：{LOW|HIGH}{SP}{NR2}{NL}

Description：

The PERiod of dynamic waveform is composed by Tlow and Thigh. The PERIOD LOW and HIGH data must include decimal point, otherwise this command is unable to execute.

The effective PERIOD LOW and HIGH can be programmed is the sixth digit a after the decimal point. If the programming period of Tlow and Thigh setting over the maximum specification at programmed range of load module, the maximum duration of Tlow and Thigh will be sent to the load module.

Please make sure the appropriate timer range before execute the load the PERI LOW or HIGH command, otherwise the PERI load module will adjust to fit the Tlow and Thigh ranges after programming the PERD LOW or HIGH command. The engineering unit for PERI LOW and HIGH are〝ms〞.

Note:
1. There are four timer ranges in the Tlow / T high generator to produce a wide period dynamic range, these ranges are adjusted by 3310 series load module automatically which depends on the programmed Tlow / Thigh range.
2. For Example：The load CHA and CHIB USES the same T-high and T-low controller of 3330A series electronic load.

Example:
PERI：LOW 0.125;PERI：HIGH 0.8
The above GPIB command set LOW / HIGH load duration's are 0.125 ms and 0.8 ms respectively.

RISE Time
Purpose：
RISE load current slew rate setting.
Command Syntax：
RISE{SP}{NR2}{NL}
Description：
The RISE load current slew rate of load level change or dynamic load can be programmed by RISE command. The RISE slew rate of 3310 series Electronic Load module can be fully independent to the FALL slew rate.
The RISE load current slew rate data must include decimal point, otherwise this command is unable to execute.
The effective RISE load current slew rate can be programmed is the sixth digit after the decimal point. If the programming load current level over the maximum specification at programmed range of 3310 series load module, the fastest RISE slew rate will be sent to the load module.

Please make sure range I/II command before execute the load RISE slew rate setting command, otherwise the 3310 series load module will adjust to fit the RISE slew rate after programming the RISE command. The engineering unit for RISE slew rate is〝A/us〞.

For Example：
RISE 1.25 set RISE slew rate to 1.25 A/us.

FALL Time
Purpose：
FALL load current slew rate setting.
Command Syntax：
FALL{SP}{NR2}{NL}

Description：
The FALL load current slew rate of load level change or dynamic load can be programmed by FALL command. The FALL slew rate of 3310 series Electronic Load module can be fully independent to the RISE slew rate.
The FALL load current slew rate data must include decimal point, otherwise this command is unable to execute. The effective FALL load current slew rate can be programmed is the sixth digit after the decimal point. If the programming load current level over the maximum specification at programmed range of 3310 series load module, the fastest FALL slew rate will be sent to the load module.
Please make sure range I/II command before execute the load FALL slew rate setting command, otherwise the 3310 series load module will adjust to fit the FALL slew rate after programming the FALL command.
The engineering unit for FALL slew rate is〝A/us〞.

For Example：
FALL 0.124 set FALL slew rate to 0.124 A/us.

SLEW Rate
Purpose:
Set the load current slew rate of 3330A series electronic load module.
Command Syntax:
SLEW{SP}{NR2}{;|NL}
Description:
Rise and Fall slew rate is the same from SLEW command setting of 3330A electronic load module.
The Slew rate has two range, and it follows the CC mode range change automatically, when CC Dynamic mode is in Range I, the slew rate is in range I, if CC Dynamic mode is in range II, then Slew rate is in range II.

SLEWRATE
Purpose:
Set the load current slew rate of 3320 series electronic load module.
Command Syntax:
SLEWRATE{SP}{FAST|MIDD|SLOW}{;|NL}
Description:
This command selects the load current slew rate SLOW, MIDDLE and FAST.
For detail load current slew for SLOW, MIDDLE, FAST, and each model of 3320 series Electronic load module, please refer to the 3320 series Electronic load manual.

For example：
SLEWRATE FAST; selects the load current slew rate is fast.

SHORT ON/OFF

Purpose：

Short the DC input of Electronic load.

Command syntax：

SHOR{SP}{0|1|OFF|ON}{NL}

Description：

This command applies the short across the input of the Electronic load. Executing SHOR does not effect any programmed settings and the Electronic load will return to them when the short is removed.

For Example：

SHOR ON set the load module load input to short on state

SHOR OFF set the load module load input to short open state.

SENSE ON/OFF

Purpose：

Set the voltage sense ON/OFF of Electronic load.

Command syntax：

SENS{SP}{0|1|OFF|ON}{NL}

Description：

This command applies to V-sense the input of the Electronic load.

For Example：

SENS ON ; set the load module V-sense input to sense ON state. The voltage input is from V-sense input connector of front panel.

SENS OFF ; set the load module V-sense input to sense OFF state. The voltage input is from Load input connector of front panel.

DYNAMIC ON/OFF

Purpose：

Set DYNamic ON or OFF command.

Command syntax：

DYN{SP}{0|1|OFF|ON}{;|NL}

Description：

DYN OFF set the load module in the 3302C mainframe to static load mode.

DYN 1 set the load module to dynamic load mode.

NG Enable /Disable

Purpose：

Set Meter GO/NG check ON or OFF.

Command syntax：

NGAB{SP}{OFF|ON}{;|NL}

Description：
Setting NG ON or OFF indicates that the NG check is enable or disable, the NG ON or OFF can be changed by NGAB ON/OFF command. The Load GO/NG check includes voltage and current meter GO/NG check, so, user can set the current's Upper limit to max. and set the lower to min. if the current meter NG check is not required and vice versa.
Note ： When CH A nG is set to oFF,the front panel NG A LED is disable.
Note ： When CH B nG is set to oFF,the front panel NG B LED is disable.

PARAllel ON/OFF
Purpose：
A // b; Parallel Load Channel A and B for 3330A series electronic load.
Command Syntax :
PARA{SP}{ON|OFF}{;|NL}
Description:
The parallel ON/OFF command is available for Model 3330A, 3332A and 3334A. PARA command to set ON (Parallel) or OFF (Not Parallel). Dual Load parallel operation is available for same polarity load in a module, it can be two positive or two negative load.
During the parallel Loading operation, the load level and status of CH A and B is still independent, Only the current meter shows the CH A + CH B load current on Channel A's and B's current meter, user can use the DUAL command setting to display load current for CH A and B.
The 2 + or 2- load parallel operation, user should make a wire connection from each load channel input to power supply output.

RANGE I/II
Purpose：
Select the operating full scale current range.
Command syntax：
RANG{SP}{1|2|LOW|HIGH}{NL}
Description：
This command selects the full scale current range of the Electronic load. There are two full scale current range for each 3310 and 3320 series Electronic load module. Table 4-5 shows the range I/II full scale current for each 3310 and 3320 series load module.

	3310A/3320A	3311A/3321A	3312A/3322A	3314A/3324A	3315A/3325A
RANGE I	3.072	6.142	1.024	0.512	1.536
RANGE II	30.72	61.42	10.24	5.12	15.36

Table 4-6 RANGE I/II FULL SCALE CURRENT FOR 3310/3320 SERIES LOAD

When RANG command is executed, the values of the current level are adjusted as follow:

1. If the existing current setting is within the new range, then the current level does not change.
2. If the existing current level is setting in not within the new range, then the current level is set to the maximum of new range. The maximum load current level is shows in Table 4-5.
3. Please refer to Appendix C for proper programming procedure of 3310 series electronic load module.

NAME

Purpose:
Setting the specifications of the 3320 series electronic load module.
Command Syntax:
NAME{SP}{3320|3321|3322|3324|3325}{;|NL}

Note:
This command is necessary for programming the 3320 series electronic load module through 3302C mainframe.Send the NAME command before programming other GPIB command.

Description：
The configuration of 3302C mainframe is 3320.
NAME 3320

DUAL

Purpose:
Setting the Dual voltage or Dual current meter display of the 3332A series electronic load module.
Command Syntax:
DUAL{SP}{DVM|DAM|OFF}{;|NL}
Description：
The Dual V/A command is not in the control of CH A/B operation, it is an independent command operation, this command is used for dual voltage meter or current meter to be display on the two 5 digit LED display.

DUAL DVM; To set the meter is in dual voltage meter mode, the engineering unit is "V".
DUAL DAM; To set the meter is in dual current meter mode, the engineering unit is "A".
DUAL OFF; Disable the dual meter function, the upper 5 digit LED display is voltage meter, the lower 5 digit LED display is current meter.

AUTO｜R2 (suitable for 333XA/331XC series)
Command Syntax:
CC {AUTO｜R2}{；｜NL}
Description:
To set up AUTO RANGE/RANGE II function
To set up AUTO RANGE auto change RANGE I/II
To explain:
To set up RANGE II not auto change RANGE I/II TO choose in RAGNE II
Note: CC AUTO/Ran2 Function is available in 3302C REV：2.8 or later
Function is available in 3310C REV：3.05 or later
Function is available in 3311C REV：3.05 or later
Function is available in 3312C REV：3.06 or later
Function is available in 3314C REV：3.05 or later
Function is available in 3315C REV：3.05 or later
Function is available in 3330A REV：3.17 or later
Function is available in 3331A REV：3.17 or later
Function is available in 3332A REV：3.17 or later
Function is available in 3333A REV：3.17 or later
Function is available in 3334A REV：3.17 or later

OCP:START (suitable for 3330A/3310C series)
Command syntax:
OCP:START {SP}{NR2}{;|NL}
Description:
The initial current of OCP testing.

OCP:STEP (suitable for 3330A/3310C series)
Command syntax:
OCP:STEP {SP}{NR2}{;|NL}
Description:
The increment step current of each OCP test.

OCP:STOP (suitable for 3330A/3310C series)
Command syntax:
OCP:STOP {SP}{NR2}{;|NL}
Description:
The maximun current of OCP test.

OCP:VTH (suitable for 3330A/3310C series)
Command syntax:
OCP:VTH {SP}{NR2}{;|NL}
Description:
The threshold voltage when UUT output voltage is equal or lower than V-th during OCP test.

OPP:START (suitable for 3310C series)
Command syntax:
OPP:START {SP}{NR2}{;|NL}
Description:
The initial power of OPP testing.

OPP:STEP (suitable for 3310C series)
Command syntax:
OPP:STEP {SP}{NR2}{;|NL}
Description:
The increment step power of each OPP test.

OPP:STOP (suitable for 3310C series)
Command syntax:
OPP:STOP {SP}{NR2}{;|NL}
Description:
The maximun power of OPP test.

OPP:VTH (suitable for 3310C series)
Command syntax:
OPP:VTH {SP}{NR2}{;|NL}
Description:
The threshold voltage when UUT output voltage is equal or lower than V-th during OPP test.

TCONFIG NORMAL/OCP/OVP/OPP (suitable for 3310C/3330A series)
Command syntax:
TCONFIG {SP}{NORMAL/OCP/OVPO/OPP}{;|NL}
Description:
There are 3 usefue test mode con be set normal mode .OCP mode (over current protection) OVP mode.(over voltage protection) OPP mode (over power protection).
OPP mode is available in 3310c series only.
3. OVP mode is available in 3330A series only

Note：1.OCP/OPP and TCONFIG Function is available in 3310c REV：3.06 or later
Function is available in 3311c REV：3.06 or later
Function is available in 3312c REV：3.09 or later
Function is available in 3314c REV：3.07 or later
Function is available in 3315c REV：3.06 or later
Function is available in 3302c REV：2.9 or later

4.5.2 Query Command

CURRENT Level

Purpose：

The Constant Current mode's load current level query command.

Command syntax：

CC:{HIGH|LOW}{?}{;|NL}
CC:{A|B}{?}{;|NL}
LIN:{A|B}{?}{;|NL}
CC{?}{;|NL}

Description：

CURR:LOW? return the presently programmed low load current level in Constant Current mode of 3310 series electronic load module.
CURR? return the presently programmed load current level in Constant Current mode of 3330A series electronic load module.
CURR:A? return the LEVEL A load current setting of 3250A series electronic load.
The returned data format is shown in Table 4-2, the engineering unit is〝A〞.

RESISTANCE Level

Purpose：

The Constant Resistance mode's load resistance level query command.

Command syntax：

CR:{HIGH|LOW}{?}{;|NL}
CR:{A|B}{?}{;|NL}
CR{?}{;|NL}

Description：

RES:LOW? return the presently programmed low load resistance level in Constant Resistance mode of 3310 series electronic load module.
RES? return the presently programmed load resistance level in Constant Resistance mode of 3330A series electronic load module.
RES:B? return the LEVEL B load resistance setting of 3250A series electronic load.
The returned data format is shown in Table 4-2, the engineering unit is〝OHM〞.

VOLTAGE Level

Purpose：

The Constant Voltage mode's load voltage level query command.

Command syntax：

CV:{LOW|HIGH}?{NL}

Description：

CV:LOW? return the presently programmed low load voltage level in Constant Voltage mode of 3310 series electronic load module.
CV:HIGH? return the presently programmed high load voltage level in Constant Voltage mode of 3310 series electronic load module.
The returned data format is shown in Table 4-2, the engineering unit is "V".

POWER Level
Purpose：
The Constant Power mode's load power level query command.
Command syntax：
CP:{LOW|HIGH}?{NL}
Description：
CP:LOW? return the presently programmed low load power level in Constant Power mode of 3310 series electronic load module.
CP:HIGH? return the presently programmed high load power level in Constant Power mode of 3310 series electronic load module.
The returned data format is shown in Table 4-2, the engineering unit is "W".

LOAD ON/OFF
Purpose：
LOAD ON or LOAD OFF status query command.
Command syntax：
LOAD?{;|NL}
Description：
LOAD? return the presently load status, 〝0〞 indicates LOAD OFF, and 〝1〞 indicates LOAD ON.

LOAD ON Voltage
Purpose：
LOAD ON voltage level query command.
Command syntax：
LDON?{;|NL}
Description：
LDON? return the presently programming load on voltage of 3330A series electronic load module.

LOAD OFF Voltage
Purpose：
LOAD OFF voltage level query command.
Command syntax：
LDOF?{;|NL}
Description：
LDOF? return the presently programming load off voltage of 3330A series electronic load module.

LEVEL HIGH/LOW

Purpose：

Static mode's LEVEl low or high status query command or active LEVEL of 3250 series electronic load query command.

Command syntax：

LEV?{NL}

Description：

LEV? return the presently level status, 〝0〞 indicates LEVel LOW, and 〝1〞 indicates LEVEL HIGH.

PRESET ON/OFF

Purpose：

PRESet ON or OFF status query command.

Command syntax：

PRES?{NL}

Description：

PRES? return the presently preset status, 〝0〞 indicates PRESet OFF, and 〝1〞 indicates PRESet ON.

MODE

Purpose：

CC, CR, CV,LIN or CP operating mode query command.

Command syntax：

MODE?{NL}

Description：

MODE? return the presently operating mode status, ”0” indicates CC MODE, ”1” indicates CR MODE, and “2” indicates CV/LIN MODE, “3” indicates CP MODE.
CV MODE is available in 3310 series electronic load.
CP mode is available in 3310C series electronic load.

NAME

Purpose：

Electronic Load module model number query command.

Command syntax：

NAME?{NL}

Description：

NAME? return the Electronic Load module’s model number.

PROTECTION Status Register

Purpose：

OPP, OTP, OVP, and OCP protection status query command.

Command syntax：

PROT?{NL}

Description：

PROT? return the presently protection status, the status byte register summarizes all of the protection status events from all status register. Table 4-6 describes the status byte the happened on the 3250A/3310 series Electronic load. The PROT status byte register is cleared when a CLR command clear all of the PROT and ERR status registers.

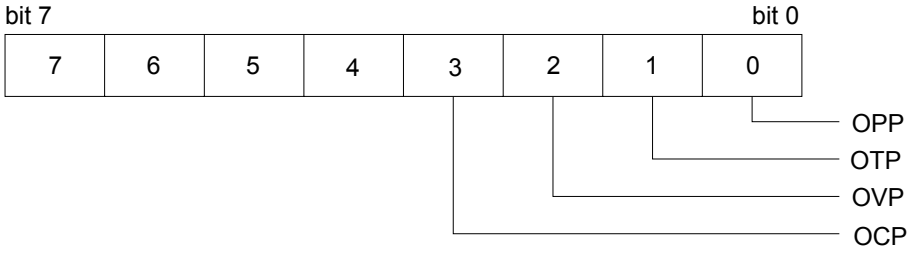


Table 4-7 PROT status byte register

VOLTAGE METER

Purpose：

The reading of 4 1/2 digit voltage meter read back query command.

Command syntax：

MEAS：VOLT?{NL}

Description：

MEAS:VOLT? return the presently 4 1/2 digital voltage meter reading. The returned data format is shown in Table 4-2, the engineering unit is〝V〞.

CURRENT METER

Purpose：

The reading of 4 1/2 digit current meter read back query command.

Command syntax：

MEAS:CURR?{NL}

Description：

MEAS:CURR? return the presently 4 1/2 digital current meter reading. The returned data format is shown in Table 4-2, the engineering unit is〝A〞.

Power Meter
Purpose：
To read the value of Watt meter.
Command syntax：
MEAS：POW?{；|NL}
Description：
MEAS：POW? Read back the value of 4 digit of the Watt meter, unit is (W).

VA METER
Purpose：
To read the value of VA meter.
Command syntax：
MEAS:VA?{；|NL}
Description：
MEAS：VA? Read back the value of 4 digit of VA meter, unit is (VA).

SYNCHRONOUS ON/OFF
Purpose：
To read the setting condition of SYNC.
Command syntax：
SYNC?{；|NL}
Description：
SYNC? Read back the condition of SYNC. 〝0〞 denotes OFF, 〝1〞 denotes ON.

SENSE ON/OFF
Purpose：
To read the setting condition of Sense ON or OFF.
Command syntax：
SENS?{；|NL}
Description：
SENS? Read back the setting condition of SENS. 〝0〞 denotes OFF, 〝1〞 denotes ON.

WATT Meter ON/OFF
Purpose：
To read the setting condition of WATT meter ON or OFF.
Command syntax：
WATT?{；|NL}
Description：
WATT? Read back the setting condition of WATT. 〝0〞 denotes Watt meter OFF, 〝1〞 denotes Watt meter ON.

WAVEFORM BANK
Purpose：
To read the set value of BANK
Command syntax：
BANK?{；|NL}
Description：
BANK? Read back the set value of BANK. 0～10 denotes waveform bank of level 0 ～level 10.

WAVEFORM
Purpose：
To read the set value of WAVE.
Command syntax：
WAVE?{；|NL}
Description：
WAVE? Read back the set value of WAVE. 0～4 denotes the C.F. setting of level 1 ～level 5.

FREQUENCY
Purpose：
To read the set frequency of FREQ.
Command syntax：
FREQ?{；|NL}
Description：
Read back the set frequency of FREQ, unit is Hz.

VOLTAGE Limit
Purpose：
To read the set value of upper/lower limit value of threshold voltage.
Command syntax:
LIM:VOLT:{HIGH/LOW}?{;|NL}
Description：
LIM:VOLT:LOW? Read back the lower limit set value of threshold voltage, unit is (V).

CURRENT Limit
Purpose：
To read the set value of upper/lower limit value of threshold current.
Command syntax：
LIM:CURR{HIGH|LOW}?{；|NL}
Description：
LIM:CURR:LOW? Read back the lower limit set value of threshold current, unit is (A).

POWER Limit
Purpose：
To read the set value of upper/lower limit value of threshold power(W).
Command syntax：
LIM:POW{HIGH|LOW}?{；|NL}
Description：
LIM:POW:LOW? Read back the lower limit set value of threshold power, unit is (W).

VA Limit
Purpose：
To read the set value of upper/lower limit value of threshold power(VA).
Command syntax：
LIM:VA{HIGH|LOW}?{；|NL}
Description：
LIM:VA:LOW? Read back the lower limit set value of threshold power, unit is (VA).

NG
Purpose：
To read the status of NG.
Command syntax：
NG?{；|NL}
Description：
NG?; Read back the condition indicating light of NG. 〝0〞 denotes that NG (NO GOOD) indicating light has been extinguished. 〝1〞 denotes that NG indicating light has been lit.

NG Enable /Disable
Purpose：
To read NG ON/OFF setting.
Command syntax：
NGAB{?}{;|NL}
Description：
NGAB? return the presently NG ON/OFF status, 〝0〞 indicates NG disable, and 〝1〞 indicates NG enable.

PERIOD

Purpose：

The dynamic mode's Tlow or Thigh duration query command

Command syntax：

PERI:{LOW|HIGH}?{NL}

Description：

PREI:LOW? return the presently programmed low duration time in dynamic load mode

PREI:HIGH? return the presently programmed high duration time in dynamic load mode

The returned data format is shown in Table 4-2, the engineering unit is〝ms〞.

RISE Time

Purpose：

The dynamic load mode's RISE slew rate query command

Command syntax：

RISE?{NL}

Description：

RISE? return the presently programmed low load current level in Constant Current mode

The returned data format is shown in Table 4-2, the engineering unit is〝A/us〞.

FALL Time

Purpose：

The dynamic load mode's FALL slew rate query command.

Command syntax：

FALL?{NL}

Description：

FALL? return the presently programmed low load current level in Constant Current mode

The returned data format is shown in Table 4-2, the engineering unit is〝A/us〞.

SHORT ON/OFF

Purpose：

SHORT ON or OFF status query command.

Command syntax：

SHOR?{NL}

Description：

SHOR? return the presently SHORt status,〝0〞indicates SHORt OFF, and〝1〞indicates SHORt ON.

DYNAMIC ON/OFF

Purpose：

DYNamic ON or OFF status query command

Command syntax：

DYN?{NL}

Description：

DYN? return the presently DYNamic ON or OFF status, 〝0〞 indicates static load mode or DYNamic OFF, and 〝1〞 indicates DYNamic load mode or DYNamic ON.

RANGE I/II

Purpose：

RANGE I or RANGE II status query command.

Command syntax：

RANG?{NL}

Description：

RANG? return the presently range I or II status, 〝1〞 indicates RANGE I, and 〝2〞 indicates range II.

Appendix A GPIB programming Example

C Example Program

```
/* Link this program with appropriate *cib*.obj. */

/* This application program is written in TURBO C 2.0 for the IBM PC-AT compatible. The
National Instruments Cooperation (NIC) Model PC-2A board provides the interface between
the PC-AT and a PRODIGIT MPAL ELECTRONIC LOAD. The appropriate *cib*.obj file is
required in each program to properly link the NIC board to C LANGUAGE. and include the
<decl.h.> HEADER FILE to C LANGUAGE. */

#include <stdio.h>
#include <dos.h>
#include <math.h>
#include "decl.h"      /* NI GPIB CARD HEADER FILE */

main()
{
    char ouster[20],rdbuf[15],spec[10];
    int i,ch,load;
/* Assign unique identifier to the device "dev5" and store in variable load. check for error.
ibfind error = negative value returned. */
    if((load = ibfind("dev5")) < 0)    /*    Device variable name is load    */
      {                                /*    GPIB address is    5    */
        printf("\r*** INTERFACE ERROR ! ***\a\n");
        printf("\r\nError routine to notify that ibfind failed.\n");
        printf("\r\nCheck software configuration.\n");
        exit(1);
      }
/*    Clear the device    */
    if((ibclr(load)) & ERR);
      {
        printf("INTERFACE ERROR ! \a");
        exit(1);
      }
    clrscr();
/* Clear load error register */
    for(i=1,ch=0;i<=4;i++,ch++)
     {
      outstr=chan[ch];
      ibwrt(load,outstr,6);
      ibwrt(load,"CLR",3);
      }
```

```
    ibwrt( load,"NAME?",5);          /*   Get the 3310 series module load specification    */
    strset(rdbuf,'\0');              /*   Clear rdbuf string buffer    */
    strset(spec,'\0');               /*   Clear spec string buffer    */
    ibrd(load,spec,20);
    if (spec[3] == '9')
        printf("\n 3302C series specification error !");
/*   Set the channel 1, preset off, current sink 1.0 amps and load on commands to the load. */
    ibwrt( load,"chan 1;pres off;cc:low 0.0;cc:high 1.0;load on ",47);
    ibwrt( load,"meas:curr?",10);
/*   Get the load actially sink current from the load    */
    ibrd( load,rdbuf,20);
/*   go to local.    */
    ibloc(load);
}
```

BASICA Example Program

LOAD DECL.BAS using BASICA MERGE command.

```
100 REM You must merge this code with DECL.BAS
105 REM
110 REM Assign a unique identifier to the device "dev5" and store it in variable load%.
125 REM
130       udname$ = "dev5"
140       CALL ibfind (udname$,load%)
145 REM
150 REM Check for error on ibfind call
155 REM
160       IF load% < 0 THEN GOTO 2000
165 REM
170 REM Clear the device
175 REM
180       CALL ibclr (load%)
185 REM
190 REM Get the 3310 series module load specification
195 REM
200       wrt$ = "NAME?" : CALL ibwrt(load%,wrt$)
210       rd$ = space$(20) : CALL ibrd(load%,rd$)
215 REM
220 REM Set the channel 1, preset off, current sink 1.0 amps and load on commands to the
load.
225 REM
230       wrt$ = "chan 1;pres off;cc:low 0.0;cc:high 1.0;load on"
240       CALL ibwrt(load%,wrt$)
245 REM
250 REM Get the load actially sink current from the load
255 REM
260       wrt$ = "meas:curr?" : CALL ibwrt(load%,wrt$)
270       rd$ = space$(20) : CALL ibrd(load%,rd$)
275 REM
280 REM Go to local
285 REM
290 CALL ibloc(load%)

2000 REM Error routine to notify that ibfind failed.
2010 REM Check software configuration.
2020 PRINT "ibfind error !" : STOP
```

Appendix B RS-232 programming Example

C Language Interface for DOS Handlers " pd_rs232.c "

```
#include <dos.h>
#include <stdio.h>
#include <conio.h>
#include <string.h>

#define COMPTR          44      /* command array pointer                */
#define QUELEN          1024    /* size of seriel input                 */
#define SUCCESS         0       /* return value variable for success    */
#define OPER_ERR        -1      /* operate error                        */
#define TIME_OUT    1           /* time_out                             */
int input_index = 0;            /* index of seriel input buffer         */
int rd_result = 0;              /* return value variable of pd_rd()     */
int timeout = 0;                /* timeout flag                         */
char queue[QUELEN];             /* seriel input buffer                  */
int ACE_DATA_REG;               /* ACIA data register                   */
int ACE_INT_ENB_REG;            /* ACIA interrupt enable register       */
int ACE_INT_IDENT_REG;          /* ACIA interrupt identification register*/
int ACE_LINE_CTL_REG;           /* ACIA line control register           */
int ACE_MODEM_CTL_REG;          /* ACIA modem control register          */
int ACE_LINE_STAT_REG;          /* ACIA line status register            */
int ACE_MODEM_STAT_REG;         /* ACIA modem status register           */
int COM_INT_NUM;                /* ACIA communication port interrupt number*/
int IRQ_MASK;                   /* IRQ mask for PC IRQ flag             */
void pd_loc(void);              /* function of disable interrupt routine */
void pd_rem(void);              /* function of enable interrupt routine  */
int pd_init(int);               /* function of initial communication port*/
int pd_wrt(char *,int);         /* function of write to device          */
int pd_rd(char *,int);          /* function of read from device         */
int read_buf(void);
int pd_meas(char *,char*, int, int);

#define PIC_CTL_REG         0x20  /* 8259A PIC control register         */
#define PIC_INT_MASK_REG    0x21  /* 8259A PIC interrupt mask register  */
#define NON_SPEC_EOI        0x20  /* non-spacific end of interrupt      */
```

```
#define CTS                0x10    /* clear to send                */
#define DSR                 0x20    /* data set ready               */
#define RI                 0x40    /* ring indicator               */
#define DCD                 0x80    /* data carrier detect          */
#define DCTS                  1    /* delta clear to send          */
#define DDSR                  2    /* delta data set ready         */
#define TERI                  4    /* trailing edge ring detect    */
#define DDCD                  8    /* delta data carrier detect    */
#define OE                    2    /* overrun error                */
#define PE                    4    /* parity error                 */
#define FE                    8    /* frame error                  */
#define BI                 0x10    /* break interrupt              */
#define THRE                0x20    /* transmit holding reg. empty  */

   /*   3302C series elec. load command sets   */
int pd_wrt(char *wrtbuf,int count)
{
      static char *combuf[COMPTR] = {"CHAN",          "CURR:HIGH",   "CURR:LOW",
                                     "RES:HIGH",   "RES:LOW",      "VOLT:HIGH",
                                     "VOLT:LOW",   "PERD:HIGH",   "PERD:LOW",
                                     "FALL",          "RISE",          "GLOB:LOAD",
                                     "GLOB:LEV",   "GLOB:PRES",   "GLOB:SHOR",
                                     "GLOB:DYN",   "GLOB:RANG",   "GLOB:MODE",
                                     "CLER",          "CHAN?",         "MEAS:VOLT?",
                                     "MEAS:CURR?","CURR:HIGH?", "CURR:LOW?",
                                     "ERR?",          "RES:HIGH?",   "RES:LOW?",
                                     "VOLT:HIGH?","VOLT:LOW?",   "NAME?",
                                     "PERD:HIGH?","PERD:LOW?",   "FALL?",
                                     "RISE?",         "LOAD?",         "LEV?",
                                     "PRES?",         "SHOR?",         "DYN?",
                                     "RANG?",         "MODE?",         "PROT?",
                                     "REMOTE",       "LOCAL" };
      int cnt,result,t;
      int comerr,err;
      char ch;
      char tempbuf[QUELEN];
      char intbuf[QUELEN];
/*      for (cnt = 0;cnt < 1024;cnt++)
      {
         intbuf[cnt] = '';
         tempbuf[cnt]='';
```

```
}     */
strset(intbuf,'');
strset(tempbuf,'');
for (cnt = 0;cnt < count+1;cnt++,wrtbuf++)
{
      intbuf[cnt] = *wrtbuf;
}
cnt = cnt--;
intbuf[cnt] = '\r';
cnt = cnt++;
count = count++;
intbuf[cnt] = '\n';
t = strcspn(intbuf," ");
if (t >count)
t = count-1;
for (cnt = 0;cnt < t;cnt++)
{
      tempbuf[cnt] = intbuf[cnt];
}
strupr(tempbuf);
strupr(intbuf);
cnt = 0;
do
{
      comerr = strncmp(tempbuf,combuf[cnt],t);
      cnt = cnt++;
}while(( cnt != COMPTR) && (comerr != 0));
if ( comerr == 0)
{
      result = SUCCESS;
   for (cnt = 0;cnt < count+1;cnt++)
   {     while(inportb(ACE_LINE_STAT_REG) & THRE == 0);
          ch = intbuf[cnt];
          delay(20);
             outportb(ACE_DATA_REG, ch);
      }
      timeout = 0;
      for (cnt = 0; cnt <= count;cnt++)
      {
            ch = intbuf[cnt];
```

```
            if(ch == '?')
            {
               do
               {
                     read_buf();
               }while((rd_result == 0)&&(timeout == 0));
               rd_result = 0;
            }
         }
         for (cnt = 0;cnt<= count;cnt++)
         {
               intbuf[cnt] = '';
               tempbuf[cnt] = '';
         }
            return(result);
      }
      return(OPER_ERR);
}
int pd_rd(char *buf,int count)
{
      char ch;
      int cnt = 0;
      do
      {
            ch = queue[cnt];
            *buf = ch;
            cnt = cnt++;
            buf = buf++;
      }while((ch != '\n') && (cnt != count));
        *buf = '\0';
      queue[0] = '\0';
      if (timeout == 1)
      {
            return(TIME_OUT);
      }
      return(SUCCESS);
}
int read_buf()
```

```
{
    char ch,ch1;
    int temp_index;
    unsigned long ticks;
    float sec1,sec2;
    rd_result = 0;
    ticks = biostime(0,0);
    sec1 = ticks/18.2;
    do
    {
        ticks = biostime(0,0);
      sec2 = ticks/18.2;
      if((sec2 - sec1) >= 20.0)                    /* delay about 1 Sec */
      {
          timeout = 1;
      }
        ch = inportb(ACE_INT_IDENT_REG);
        ch &= 0x06;
        switch(ch)
        {
            case 6:
                inportb(ACE_DATA_REG);             /* read the data register to empty it */
                break;
            case 0:
                break;
            case 2:
                break;
            case 4:                                /* read character from data register   */
                ch1 = inportb(ACE_DATA_REG);
                temp_index = input_index + 1;      /* increment index of input buffer*/
                if (ch1 != '\n')              /* check terminate bit                  */
                {
                    queue[input_index] = ch1;      /* store character to input buffer*/
                    input_index = temp_index;
                }
                else
                {
                    queue[input_index] = ch1;
                    input_index = temp_index;
                    input_index = 0;               /* if terminate bit was detected   */
                    temp_index = 0;
                    rd_result = 1;                 /* clear index and set return value */
                }
                break;
      }                                            /* finally send the non-spacific   */
```

```
    }while ((rd_result == 0) && (timeout == 0));
}

int pd_init(int pd_com)
{
    if ((pd_com != 1) && (pd_com != 2))
       return(OPER_ERR);
    if (pd_com == 2)                          /* initial communication port 2        */
    {
        ACE_DATA_REG          =    0x2f8;
        ACE_INT_ENB_REG       =    0x2f9;
        ACE_INT_IDENT_REG     =    0x2fa;
        ACE_LINE_CTL_REG      =    0x2fb;
        ACE_MODEM_CTL_REG     =    0x2fc;
        ACE_LINE_STAT_REG     =    0x2fd;
        ACE_MODEM_STAT_REG    =    0x2fe;
        COM_INT_NUM           =     11;
        IRQ_MASK              =    0xf7;          /* IRQ mask for IRQ3    (11110111)
*/
    }
    else                                      /* initial communication port 1          */
    {
        ACE_DATA_REG          =    0x3f8;
        ACE_INT_ENB_REG       =    0x3f9;
        ACE_INT_IDENT_REG     =    0x3fa;
        ACE_LINE_CTL_REG      =    0x3fb;
        ACE_MODEM_CTL_REG     =    0x3fc;
        ACE_LINE_STAT_REG     =    0x3fd;
        ACE_MODEM_STAT_REG    =    0x3fe;
        COM_INT_NUM           =     12;
        IRQ_MASK              =    0xef;          /* IRQ mask for IRQ4    (11101111)
*/
    }
    bioscom(0, 0xe3, pd_com-1);               /* boud rate : 9600, 1 start bit         */
    pd_rem();                                 /* no parity, 1 stop bit.                */
    pd_wrt("remote",6);                       /* data bit    : 8 bits                  */
    return(SUCCESS);
}

int pd_meas(char *wrtmbuf, char *rdmbuf,int wrtmcnt,int rdmcnt)
{
    static char *wrtbuf[10] = { "CURR 1",    "CURR 2",    "CURR 3",    "CURR 4",
                                "VOLT 1",    "VOLT 2",    "VOLT 3",    "VOLT 4", }
```

```
char tmpbuf[20] ={"chan "};
int cnt,result,t,cmp,measerr;
char ch;
char rdtmpbuf[20],chanbuf[20];
char measbuf[6];
for (cnt = 0; cnt < wrtmcnt; cnt++, wrtmbuf++)
{
      measbuf[cnt] = *wrtmbuf;
}
strupr(measbuf);
cnt = 0;
do
{
      measerr = strncmp(measbuf,wrtbuf[cnt],6);
      cnt = cnt++;
}while((cnt != 10) && (measerr != 0));
if(measerr == 0)
{
   result = SUCCESS;
      if (strncmp(measbuf,"CURR", 4) == 0)
      {
            ch = measbuf[5];
            switch(ch)
            {
            case '1':
                  pd_wrt("chan 1",6);
                  pd_wrt("meas:curr?",10);
                  pd_rd(rdmbuf,rdmcnt);
                  strncat(tmpbuf,chanbuf,1);
                  pd_wrt(tmpbuf,6);
                  break;
            case '2':
                  pd_wrt("chan 2",6);
                  pd_wrt("meas:curr?",10);
                  pd_rd(rdmbuf,rdmcnt);
                  strncat(tmpbuf,chanbuf,1);
                  pd_wrt(tmpbuf,6);
                  break;
            case '3':
                  pd_wrt("chan 3",6);
                  pd_wrt("meas:curr?",10);
                  pd_rd(rdmbuf,rdmcnt);
                  strncat(tmpbuf,chanbuf,1);
                  pd_wrt(tmpbuf,6);
```

```
                break;
            case '4':
                pd_wrt("chan 4",6);
                pd_wrt("meas:curr?",10);
                pd_rd(rdmbuf,rdmcnt);
                strncat(tmpbuf,chanbuf,1);
                pd_wrt(tmpbuf,6);
                break;
            }
        }
    else if(strncmp(measbuf,"VOLT",4) == 0)
        {
            ch = measbuf[5];
            switch(ch)
            {
            case '1':
                pd_wrt("chan 1",6);
                pd_wrt("meas:volt?",10);
                pd_rd(rdmbuf,rdmcnt);
                strncat(tmpbuf,chanbuf,1);
                pd_wrt(tmpbuf,6);
                break;
            case '2':
                pd_wrt("chan 2",6);
                pd_wrt("meas:volt?",10);
                pd_rd(rdmbuf,rdmcnt);
                strncat(tmpbuf,chanbuf,1);
                pd_wrt(tmpbuf,6);
                break;
            case '3':
                pd_wrt("chan 3",6);
                pd_wrt("meas:volt?",10);
                pd_rd(rdmbuf,rdmcnt);
                strncat(tmpbuf,chanbuf,1);
                pd_wrt(tmpbuf,6);
                break;
            case '4':
                pd_wrt("chan 4",6);
                pd_wrt("meas:volt?",10);
                pd_rd(rdmbuf,rdmcnt);
                strncat(tmpbuf,chanbuf,1);
                pd_wrt(tmpbuf,6);
```

```
                    break;
                }
            }
        }
    else
    {
       return(OPER_ERR);
    }
    return (result);
}

void pd_rem(void)
{
    char ch;
    outportb(ACE_INT_ENB_REG, 0xd);          /* enable ACIA interrupt register      */
    inportb(ACE_DATA_REG);                   /* empty receive data register         */
    inportb(ACE_LINE_STAT_REG);              /* clear line status register          */
    outportb(ACE_MODEM_CTL_REG, 0xb);        /* set RTS,DTR to enable modem and
*/
                                             /* turn on OUT2 to enable the
8250's   */
                                             /* IRQ interrupt to system

*/
}
void pd_loc(void)
{
    char ch;
    outportb(ACE_INT_ENB_REG, 0);            /* disable all 8250 interrupt          */
    outportb(ACE_MODEM_CTL_REG, 0);          /* clear RTS,DTR to disable modem
and */
                                             /* turn off OUT2 to disable the
8250's*/
                                              /* IRQ interrupt to system

*/
}/*     Program terminated. */
```

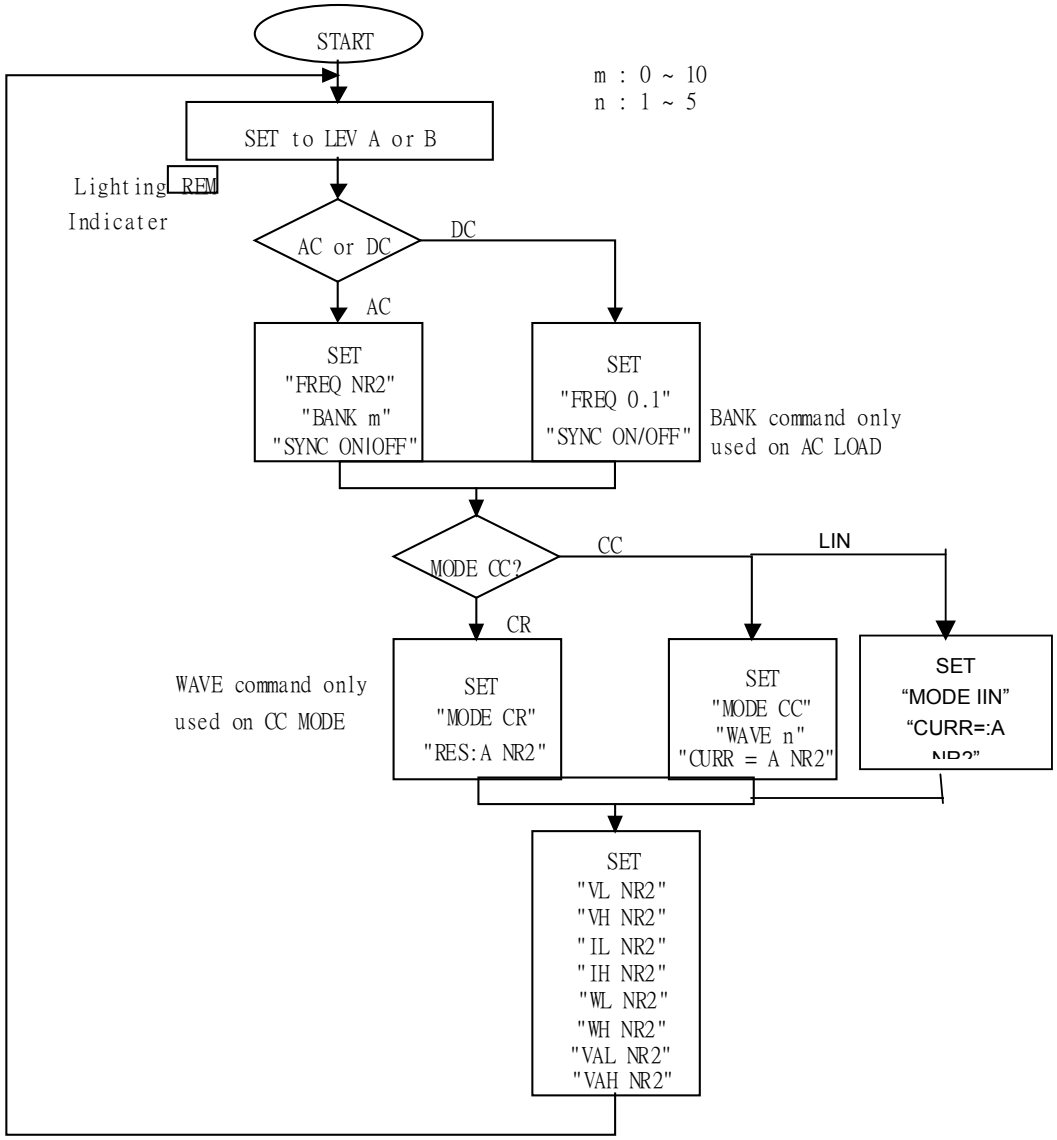
C Example Program

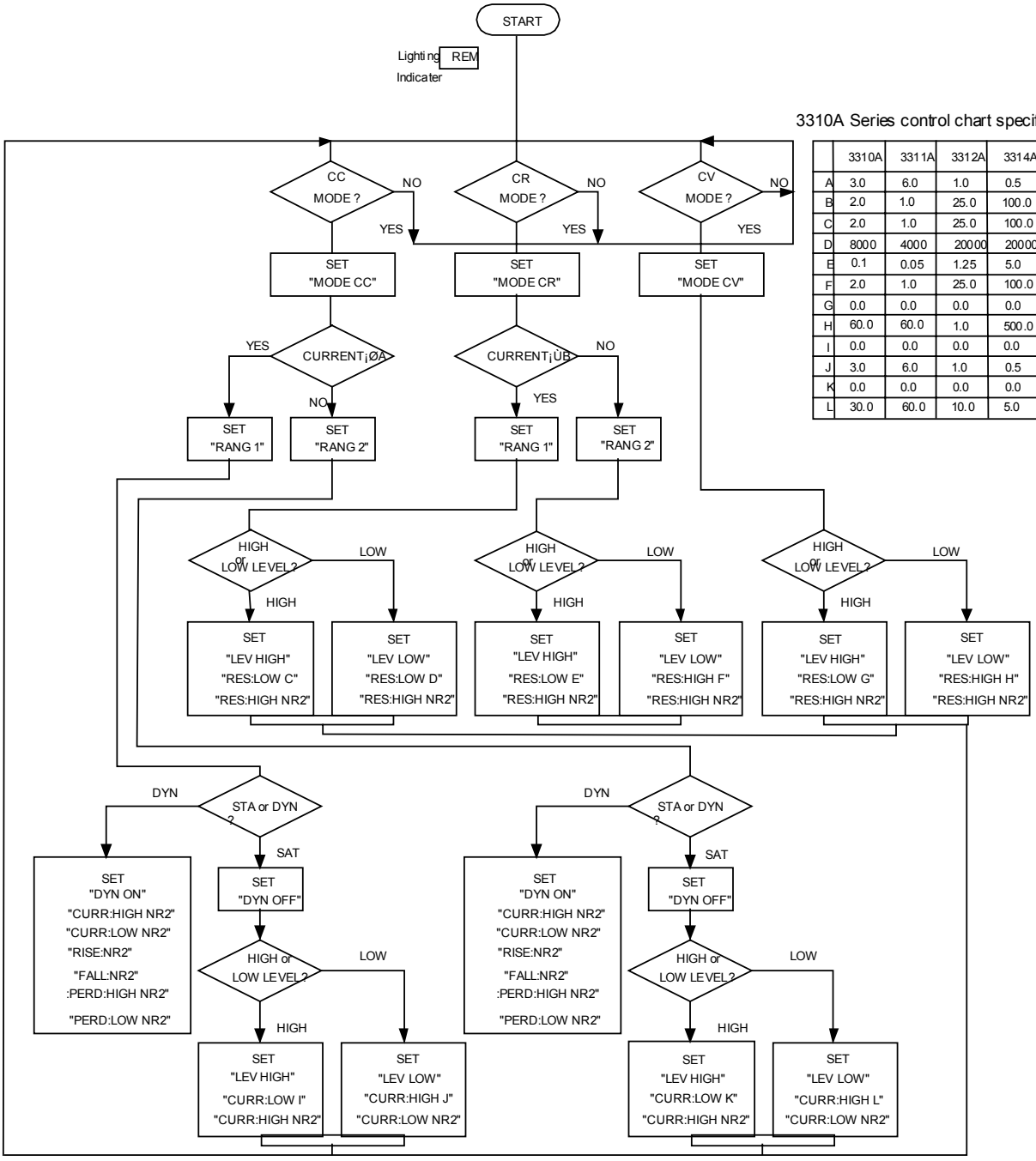
```
/* Link this program with pd_rs232.obj */

#include <dos.h>
#include <stdio.h>
#include <conio.h>
#include <string.h>

main()
```

```
{
      int com;
      int io_err= 0;
      char rdbuf[1024];
      clrscr();
      printf("Input COM1/COM2 port is : ");
      scanf("%d", &com);
      if((io_err = pd_init(com)) == 0)                  /* Initial RS-232 interface */
      {
         setstr(rdbuf,'');
         pd_wrt("chan 1",6);
         delay(200);
         pd_wrt("name?",5);
         if ((io_err = pd_rd(a,10)) == 0)
         {
               do
               {
/*    Set the channel 1, preset off, current sink 1.0 amps and load on commands to the load. */
                  pd_wrt("chan 1",6);
                  delay(200);
                  pd_wrt("pres off",8);
                  delay(200);
                  pd_wrt("curr:low 0.0",12);
                  delay(200);
                  pd_wrt("curr high 1.0",13;
                  delay(200);
                  pd_wrt("load on",7);
                  delay(200);
                  pd_wrt("meas:curr ?",11);
/*    Get the load actially sink current from the load    */
                  delay(200);
                  pd_rd(rdbuf,20);
                  io_err = 1;
               }while (io_err == 0);
         }
         else
         {
               printf("\a");
               printf("chan 1 I/O reading error !\n");
               exit(1);
         }
      pd_loc();/*    Go to local */
      }
}
```

Appendix C 3250A Series GPIB/RS-232 Operating flow chart

The following flow chart shows the typical 3302C Series mainframe remote control and load current level and status setting procedures of each 3250 series load module.





3310A Series control chart specific list

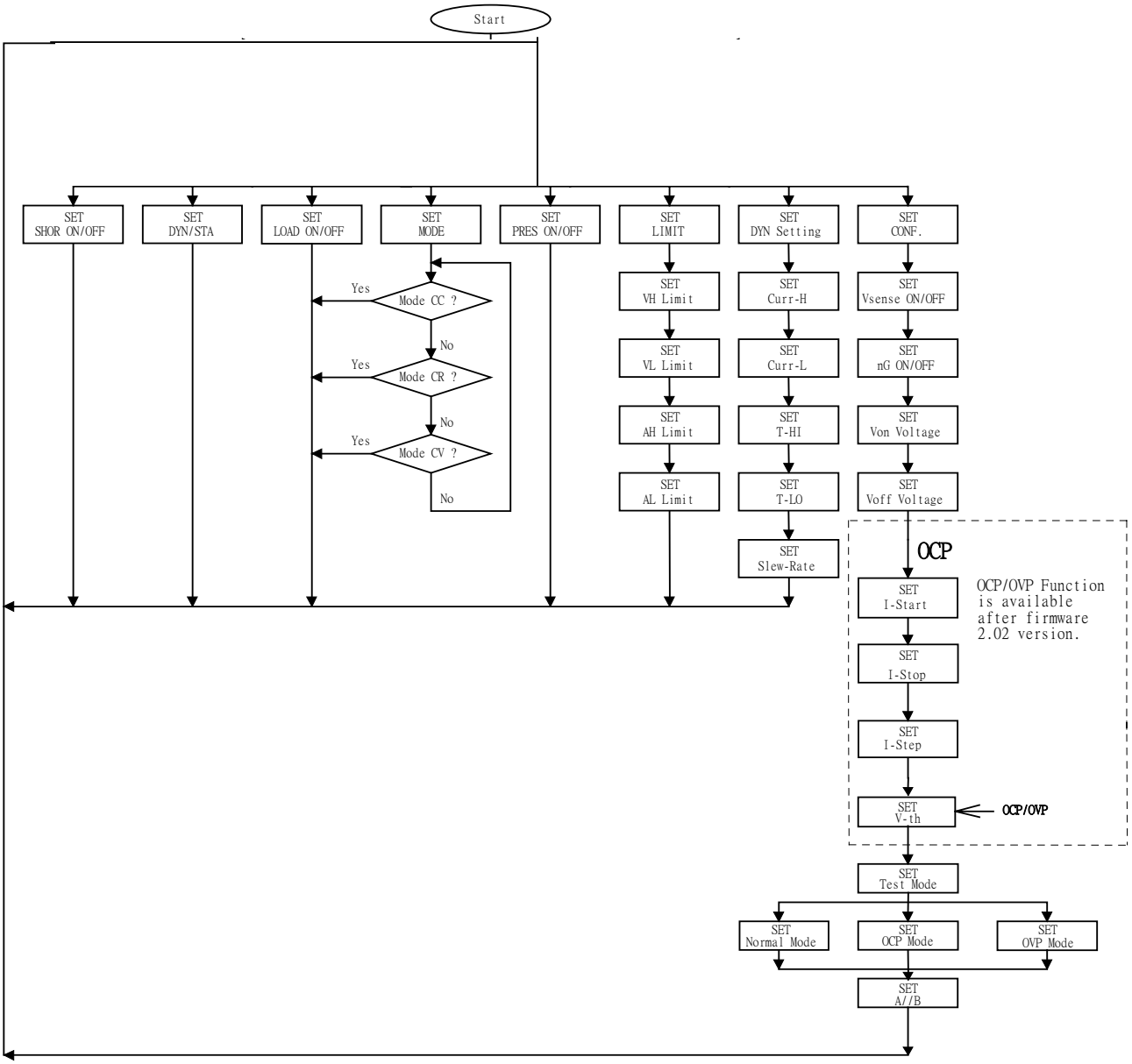
	3310A	3311A	3312A	3314A	3315A
A	3.0	6.0	1.0	0.5	1.5
B	2.0	1.0	25.0	100.0	4.0
C	2.0	1.0	25.0	100.0	4.0
D	8000	4000	20000	20000	15000
E	0.1	0.05	1.25	5.0	0.2
F	2.0	1.0	25.0	100.0	4.0
G	0.0	0.0	0.0	0.0	0.0
H	60.0	60.0	1.0	500.0	60.0
I	0.0	0.0	0.0	0.0	0.0
J	3.0	6.0	1.0	0.5	1.5
K	0.0	0.0	0.0	0.0	0.0
L	30.0	60.0	10.0	5.0	15.0

Appendix D 3310A Series GPIB/RS-232 Operating flow chart

The following flow chart shows the typical 3302C Series mainframe remote control and load current level and status setting procedures of each 3310 series load module.

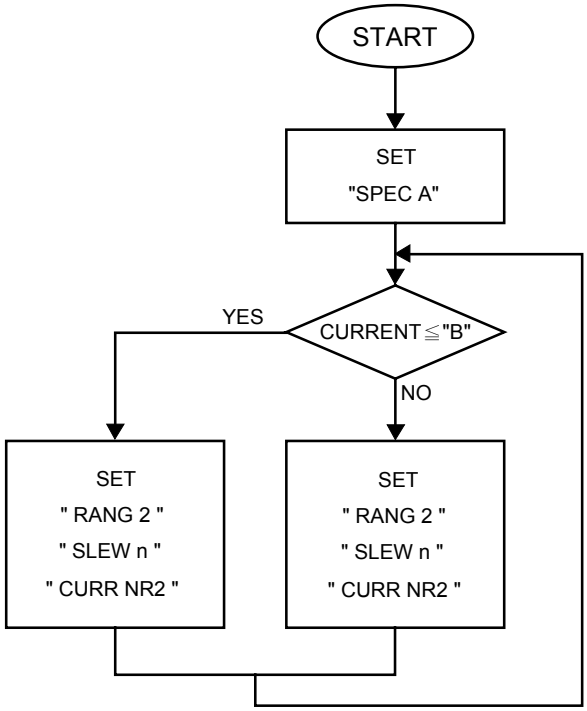
Appendix E 3330A Series GPIB/RS-232 Operating flow chart

The following flow chart shows the typical 3302C Series mainframe remote control and load current level and status setting procedures of each 3330A series load module.

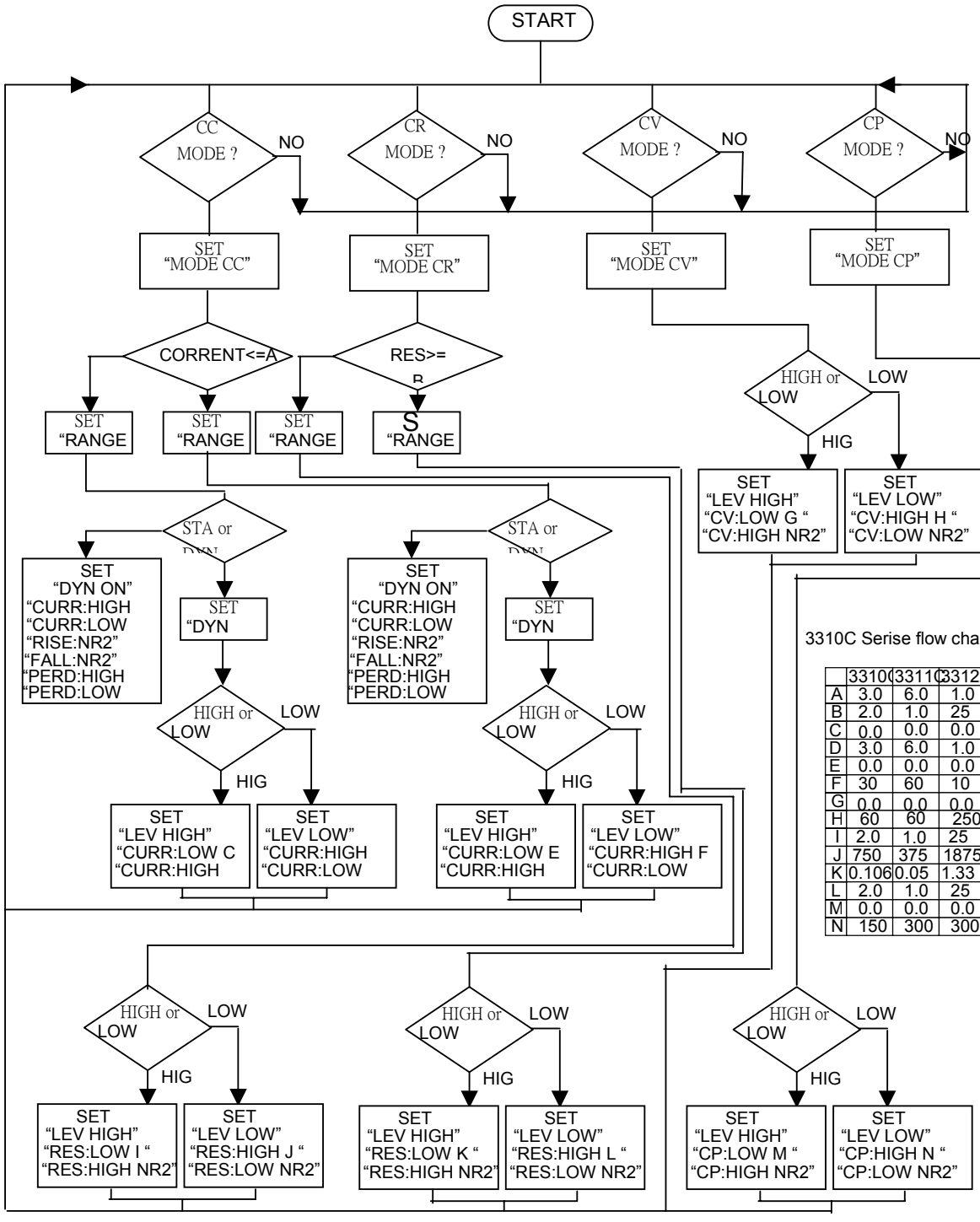


Appendix F 3320 Series GPIB/RS-232 Operating flow chart

The following flow chart shows the typical 3302C Series mainframe remote control and load current level and status setting procedures of each 3320 series load module.



Appendix G 3310C Series GPIB/RS-232 Operating flow chart



3310C Serise flow chart specific list

	3310C	3311C	3312C	3314C	3315C
A	3.0	6.0	1.0	0.5	1.5
B	2.0	1.0	25	100	4.0
C	0.0	0.0	0.0	0.0	0.0
D	3.0	6.0	1.0	0.5	1.5
E	0.0	0.0	0.0	0.0	0.0
F	30	60	10	5.0	15
G	0.0	0.0	0.0	0.0	0.0
H	60	60	250	500	60
I	2.0	1.0	25	100	4.0
J	750	375	1875	1875	150
K	0.106	0.05	1.33	5.33	0.21
L	2.0	1.0	25	100	4.0
M	0.0	0.0	0.0	0.0	0.0
N	150	300	300	200	75