User Manual

N38300 Series Wide Range High Power Programmable DC Power Supply

Version: V20231216

Copyright Statement

Hunan Next Generation Instrumental T&C Tech. Co., Ltd.

Contents

1 Preface

Dear Customers,

First of all, we greatly appreciate your choice of N38300 series DC power supply (N38300 for short). We are also honored to introduce our company, Hunan Next Generation Instrumental T&C Tech. Co., Ltd.

About Company

TOYOTECH is a professional manufacturer of intelligent equipment and test & control instruments, committed to developing, manufacturing battery simulators, power supplies, electronic loads, and many more instruments. The products can be widely used in the industries of battery, power supply, fuel cell, consumer electronics, new energy vehicle, semiconductor, etc.

TOYOTECH maintains close cooperation with many universities and scientific research institutions, and maintains close ties with many industry leaders. We strive to develop high- quality, technology- leading products, provide high- end technologies, and continue to explore new industry measurement and control solutions.

About User Manual

This manual is applied to N38300 series DC power supply, including installation, operation, specifications and other detailed information. Due to the upgrade of instrument, this manual may be revised without notice in future versions.

This manual has been reviewed carefully by TOYOTECH for the technical accuracy. The manufacturer declines all responsibility for possible errors in this operation manual, if due to misprints or errors in copying. The manufacturer is not liable for malfunctioning if the product has not correctly been operated.

To ensure the safety and correct use of N38300, please read this manual carefully, especially the safety instructions.

Please keep this manual for future use.

Thanks for your trust and support.

2 Safety Instructions

2.1 Safety Notes

This instrument is intended for use by specific personnel. Such personnel need to be able to recognize shock hazards and be familiar with necessary safety precautions to avoid potential injury. Please read and follow all installation, operation, and maintenance information carefully before using this instrument. For complete product specifications, please refer to this manual.

If the instrument is used in a manner not specified, the protective functions provided by the instrument could be impaired.

Instrument user type:

The body of safety responsibility can be an individual or a department, who is responsible for the use and maintenance of the instrument, ensures that the instrument is used within the regulation scope and operating limit, and ensures that the operator has received sufficient training.

The operator uses the instrument for its intended function. Operators need to be trained in electrical safety measures and the correct use of this instrument. Operators should be protected from electric shock and from contact with hazardous live circuits.

Maintenance personnel perform routine maintenance on the instrument to ensure proper operation, for example, setting the line voltage. Maintenance procedures are described in this manual. These steps are clearly described whether the operator can perform them.

Service personnel are trained to work on live circuits, perform safe installations, and repair this instrument. Installation and servicing procedures should only be performed by properly trained service personnel.

Before operating the instrument, please make sure the power cord is connected to a properly grounded electrical socket. Before each use, please inspect connecting cables, test leads, and jumpers for frayed or broken wires.

Please be careful when there is a risk of electric shock during use. Hazardous voltages may be present in the cable connector jacks or test fixtures. There is a danger of electric shock when the voltage level exceeds 30Vrms, 42.4Vpeak or 60V DC, please take precautions.

During the operation and use of this instrument, please strictly observe the following safety precautions. Failure to observe the following safety precautions or specific warnings indicated elsewhere in this manual may impair the protection provided by the instrument.

The user shall be responsible for the consequences caused by the user's failure to comply with the safety precautions.

Safety Precautions
- ➢ **Confirm the AC input voltage before supplying power**.
- ➢ **Reliable grounding**: Before operation, the instrument must be reliably grounded to avoid the electric shock.
- ➢ **Confirm the fuse**: Ensure to have installed the fuse correctly.
- ➢ **Do not open the chassis**: The operator cannot open the instrument chassis. Non-professional operators are not allowed to maintain or adjust it.
- ➢ **Do not operate under hazardous conditions**: Do not operate the instrument under flammable or explosive conditions.
- ➢ **Confirm the working range**: Make sure the DUT is within N38300's rated range.

2.2 Safety Symbols

The following terms or symbols may appear in this manual or on the instrument.

⚠**Remarks/Notes**

Remarks/Notes indicate reminders. It requires an attention before performing an operational step, and provides the operator with tips or supplementary information.

⚠**Warnings**

Warnings indicates danger. It requires an attention before performing an operational step, and indicates conditions and actions that may endanger the life of the operator. Be sure to read the relevant information carefully before performing the specified procedure.

Table 1 Safety Symbols

Symbol	Definition	Symbol	Definition
⎓	DC (direct current)	N	Null line or neutral line
∼	AC (alternating current)	L	Live line
≂	AC and DC	I	Power-on
3∼	Three-phase current	O	Power-off
⏚	Ground	⏻	Back-up power
⏚	Protective ground	▭	Power-on state
⏚	Chassis ground	▯	Power-off state
⏛	Signal ground	⚡	Risk of electric shock
WARNING	Hazardous sign	🔥	High temperature warning
Caution	Be careful	⚠	Warning

3 Inspection and Installation

3.1 Inspection

After receiving N38300, please check the instrument according to the following steps:

1. Check whether the instrument is damaged during transportation.

2. Check accessories.

3. Make sure the following accessories are attached.

📖 **Note**

1: If any severe damage to the package, please contact our authorized distributor or TOYOTECH. Send it back after getting a positive response.

2: If no problem, please keep it carefully. Compliance with packing requirements when returning for service.

3.2 Connection

Before connecting the power cord, observe the following precautions to prevent electric shock and damage to the instrument:

1. Make sure that the power supply voltage matches the rated power supply voltage of the instrument;

2. Make sure the power switch is off.

3.3 Installation

3.3.1 AC Input Connection

3.3.1.1 Single Unit AC Input Connection
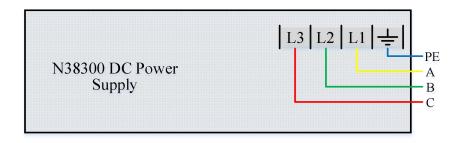
Figure 1   Single Unit AC Input Connection

3.3.1.2 Multiple Units AC Input Connection

When multiple 5kW, 6kW, 10kW, and 12kW units are connected to the grid simultaneously, it is recommended to distribute the access points in a balanced manner. As shown in the figure below, L1, L2 and L3 terminals of the three power supplies are respectively connected to ABC, BCA and ACB. When multiple 15kW and above units are connected to the three-phase power grid, there is no need to consider the imbalance to the power grid.
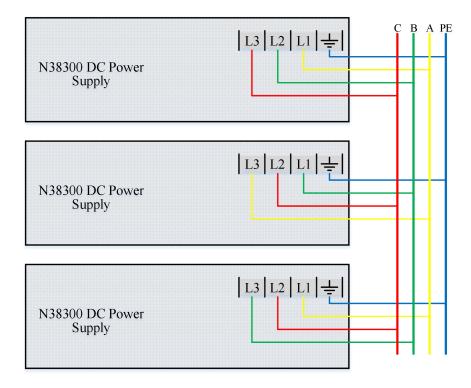
Figure 2   Multiple 5kW/6kW/10kW/12kW Units AC Input Connection

3.3.2 Voltage Remote Sense Connection

When N38300 is working, due to the parasitic resistance of the wire, the voltage at the load input terminal will be lower than the voltage at N38300 output terminal after the current flows through the wire, which will affect the output accuracy of N38300. N38300 series supports remote sense to compensate the voltage drop.

When using remote sense, please connect S+ to load input+ and connect S- to load input-. After remote sense terminal is connected, SENS symbol will be displayed on the screen. If the sense wire falls off, only the compensation voltage will be lost, the power output will not be affected.
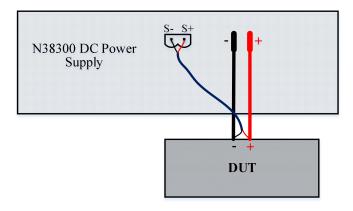
Figure 3   Voltage Remote Sense Connection

⚠**Note**

1. **The sense wires can be red and black wires with a cross-sectional area of 0.5mm² to 1mm². It is recommended the sense wire should be twisted.**

2. **Voltage compensation for models @ 80V is less than 1.5V. Voltage compensation for models above 80V is less than 5V.**

3.4 Power-on Test

After N38300 is powered on, please check the device according to the following steps.

- Power-on test includes two parts: system self-test and output inspection.

1. System self-test

After the power cable is connected and power switch is pressed, N38300 will start self-inspection process. The following interface will be displayed.

Figure 4   System Self-test Interface

The following items will be checked.

①Check if the converter module works normally.

②Check if the calibration data are complete.

③Check if the file parameters are missing.

After all items passed, it will automatically enter application interface. If not passed,

it will stay in the above interface. Please contact TOYOTECH for solution. Without affecting the use, users can press [**Enter**] to enter the application interface.

2. Output Inspection

● Output Voltage Inspection

Steps to verify N38300's basic voltage function without connecting to a load:

1. Press the power switch.

2. Make sure the output is in off state.

3. Make sure the output positive and negative polarities are open-circuited.

4. Set voltage to 1V.

5. Set current to higher than 1A.

6. Turn on output.

7. Check if the readback voltage is close to 1V.

8. Change voltage setting and check if the voltage can be set from 0V to full range.

● Output Current Inspection

Steps to verify N38300's basic current function during output short-circuited:

1. Press the power switch.

2. Make sure the output is in off state.

3. Connect an insulated wire to short circuit the positive and negative polarities at the output of N38300. The wire used should be able to bear the maximum output current of N38300.

4. Set current to 1A.

5. Set voltage to higher than 1V.

6. Turn on output.

7. Check if the readback current is close to 1A.

8. Change current setting and check if the current can be set from 0A to full range.

3.5 Remote Operation

N38300 is equipped with two communication interfaces as standard: RS232 and LAN. It supports connecting to a computer through either a serial port cable or an Ethernet cable, and also supports multiple N38300s to be connected to one or more computers simultaneously through a network switch or router. Before communication, please make sure the cable connection is correct and the IP addresses of all N38300s are not duplicated.
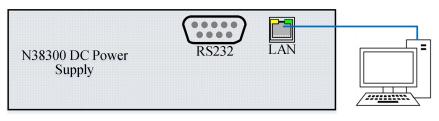
Figure 5   Single Device Connection Diagram
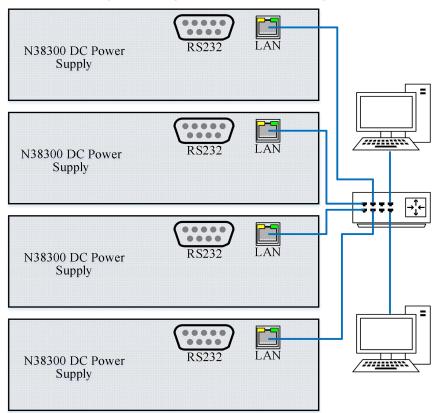
Figure 6   Multiple Devices Connection Diagram

Under remote control, the screen will be as below picture. To return to local

operation, please press [**Enter**] button.

Figure 7　　Remote Control Interface

4 Product

4.1 Brief Introduction

N38300 series is a wide range, high power density, programmable high power DC power supply. N38300 standalone 19-inch 3U chassis is up to 18kW. Power efficiency is as high as 93%. Power range is up to 180kW. Current range is up to 5100A and voltage range is up to 2250V. N38300 series DC power supply has comprehensive functions and supports multiple control methods, making it an ideal choice for laboratory applications and automated test systems.

Main Features

- Voltage up to 2250V, current up to 5100A, power up to 180kW

- Supporting master/slave parallel, extended power up to 1.8MW

- Voltage accuracy 0.05%F.S., current accuracy 0.1%F.S.

- Voltage and current sampling rate 500kHz, resolution 16 bits

- Power factor 0.99, efficiency up to 93%

- CC&CV priority function

- LAN port and RS232 interface as standard, GPIB, CAN, RS485 and USB as

optional

- Editable rise and fall slew rate for voltage and current

- CC, CV and CP mode

- Internal resistance simulation, SEQ function, voltage RAMP function

- Multiple protections: OCP, OVP, LVP, OTP, OPP

- Equipped with LCD screen, numeric buttons and knob to support local operation

- Standard 19-inch 3U chassis

- Equipped with high-voltage isolation digital & analog, and monitoring interfaces

4.2 Appearance & Dimension
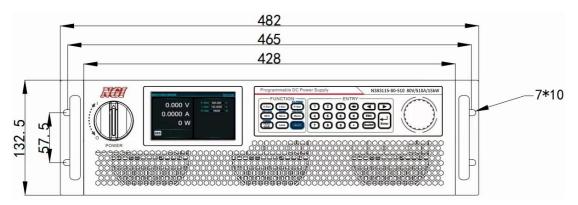
Figure 8   3U Chassis Front Panel Dimension(mm)
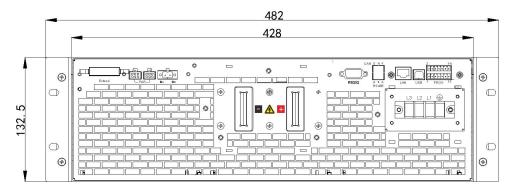
Figure 9   3U Chassis Rear Panel Dimension(mm)
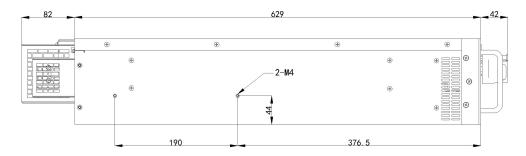
Figure 10   3U Chassis Side Dimension(mm)

4.3 Front Panel Introduction

Figure 11   Front Panel

Table 2

Number	Name	Function
1	Handle	For installation and handling
2	Power switch	Power control
3	Screen	Displaying data
4	Buttons	Operation mode and parameter setting
5	Device model	Displaying model number
6	Knob	Operation mode and parameter setting
7	Air outlet	Exhaust outlet, cooling

4.3.1 Button & Knob

Users can control N38300 via button and knob.
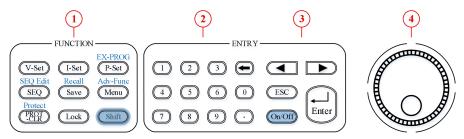
Figure 12   Button & Knob

Table 3

Number	Name
1	Function buttons
2	Numeric buttons
3	Left/right button, ESC button, On/Off button, Enter button
4	Knob

4.3.2 Function Button
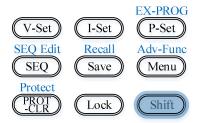
Figure 13   Function Button

Table 4

Button	Function
[V-Set]	To set output voltage
[I-Set]	To set output current
[P-Set]	To set output power
[SEQ]	To enter SEQ test interface
[Save]	To enter save interface
[Menu]	To enter the main menu
[PROT-CLR]	To clear the protection
[Lock]	To lock/unlock
[Shift]	Compound button
EX-PROG（[Shift]+[P-Set]）	To enter external programming
SEQ Edit（[Shift]+[SEQ]）	To enter SEQ Edit
Recall（[Shift]+[Save])	To enter recall interface
Adv-Func（[Shift]+[Menu]）	To enter advanced function interface
Protect（[Shift]+[PROT-CLR]）	To enter protection interface

4.3.3 Numeric Button
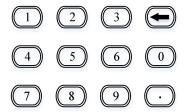
Figure 14   Numeric Button

Table 5

Button	Function
[0~9], [.]	To input digits
[⬅]	To delete

4.3.4 Left/Right Button, ESC Button, On/Off Button, Enter Button
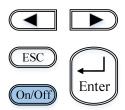
Figure 15   Left/Right Button, ESC Button, On/Off Button, Enter Button

Table 6

Button	Function
[←], [→]	1. To shift or select the required parameter 2. To control the cursor scrolling when setting parameter
[ESC]	To return to previous page
[Enter]	To enter the required parameter, confirm the input, exit from setting
[On/Off]	To turn on/off the output

4.3.5 Knob
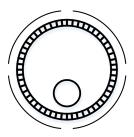
Figure 16   Knob

Table 7

Knob	Function
	By rotating: to select the required item, adjust the parameter By pressing: to enter the edit interface, confirm the input

4.4 Rear Panel Introduction
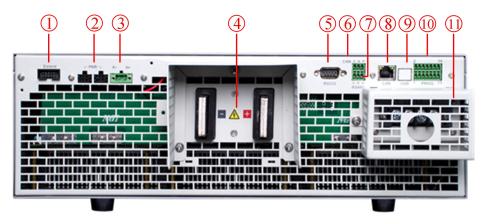
Figure 17   3U Rear Panel

Table 8

Number	Name	Icon	Definition
1	Extension interface	Extend	For power extension
2	Parallel interface	PAR	Master/slave parallel interface
3	Voltage sense interface	S- , S+	For voltage remote sense
4	Output interface	**-** **+**	DC power supply output
5	RS232 interface	RS232	Serial port, for remote control
6	CAN interface	CAN	Optional, for remote control
7	RS485 interface	RS485	Optional, for remote control

8	LAN port	LAN	For remote control
9	USB port	USB	Optional, USB serial port, for remote control
10	External programming interface	PROG	Voltage/current/power/status monitoring, trigger, emergency stop, etc.
11	AC power interface	L3 L2 L1 ⊕	Three phase, L1/L2/L3/grounding terminal

4.4.1 DC Output Connection

The DC output connection is to connect the + and - copper bars on the rear panel of N38300 to the DUT, as shown in the figure below. When connecting, please pay attention to the wire diameter, length and polarity of the output wire, and avoid reverse polarity connection, which can burn out the DUT. Do not use wires with smaller diameter, which will affect measurement accuracy and cause overheating and danger. Please refer to the Recommended Wire Gauge Selection Table.
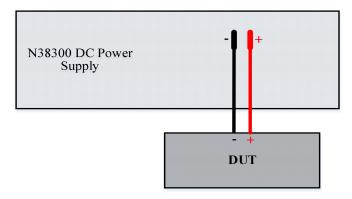
Figure 18   DC Output Connection

Table 9   Recommended Wire Gauge Selection Table

Model	Sectional Area	Temperature Conditions			
		60℃	75℃	85℃	90℃
AWG	mm²	Wire model: RUW, T , UF	Wire model: RHW, RH	Wire model: V, MI	Wire model: TA, TBS, SA, AV
		Rated Current (A)			
14	2.08	20	20	20	20
12	3.31	25	25	30	30
10	5.26	30	35	40	40
8	8.36	40	50	55	55
6	13.3	55	65	70	75
4	21.1	70	85	95	95
3	26.7	85	100	110	110
2	33.6	95	115	125	130
1	42.4	110	130	145	150
0	53.5	125	150	165	170
00	67.4	145	175	190	195
000	85	165	200	215	225
0000	107	195	230	250	260

4.4.2 LAN Port

LAN port is a default communication port for N38300. The Ethernet cable is a standard accessory.

Steps for remote control via LAN port:

1. Check if N38300 is switched on properly.
2. Make sure the PC is switched on and its LAN port is working properly.
3. Connect one end of Ethernet cable to PC LAN port.
4. Connect another end of Ethernet cable to N38300 LAN port.
5. Check if the indicator light at LAN port on N38300: green light always on, orange light flashing.

⚠️Note

If the green light is always on and the orange light is flashing, it means the hardware network connection has been established. Otherwise, please check whether the computer LAN port works properly, and make sure the computer is turned on properly.

4.4.3 RS232 Interface

On the rear panel, there is a male DB-9 interface with 9 pins.

Table 10   RS232 Pin Definition

Pin	Definition
1	NC
2	RXD, receive data
3	TXD, transmit data
4	NC
5	GND, ground
6	NC
7	NC
8	NC
9	NC
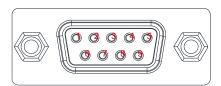
Figure 19   RS232 Interface

4.4.4 CAN/RS485 Interface

On the rear panel, there is a shared interface for CAN and RS485. RS485 is on the top. CAN is in the bottom.
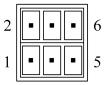
Figure 20   CAN/RS485 Interface

Table 11   CAN/RS485 Pin Definition

Pin	Name	Definition
1,2	GND	Reference ground
3	RS485-B	RS485 bus B terminal
4	CAN-N	CAN bus L terminal
5	RS485-A	RS485 bus A terminal
6	CAN-P	CAN bus H terminal

4.4.5 Programming Interface
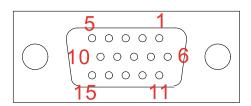
Figure 21   Programming Interface

Table 12   Pin Definition

Name	Description	Pin
I-Set	CC analog input, input range: default 0~10V, optional 0~5V	2
IMON	Output current monitoring terminal, output range: default 0~10V, optional 0~5V	3
Fault	Fault indication output signal terminal, 5V TTL level. H: failure, L: normal	5
P-Set	CP analog input, input range: default 0~10V, optional 0~5V	7
GND	Reference ground	8，13
Stop	Emergency stop signal input terminal, supporting empty node and 5V TTL level	10
V-Set	CV analog input, input range: default 0~10V, optional 0~5V	11
VMON	Output voltage monitoring terminal, output range: default 0~10V, optional 0~5V	12
On/Off	External control input terminal, supporting empty node and 5V TTL level. Active on falling edge or low level.	14

Mode	Operation mode output terminal, 5V TTL level. H:CC mode or CP mode, L:CV mode	15
Reserve	reserve	1，4，6，9

The external programming interface is electrically isolated from the positive and negative output terminals of N38300. When using the external programming interface, pin 8 and 13 are the reference ground for the external programming interface.

5 Operation

After the device is switched on, it will enter Normal mode directly. Users can enter Menu by pressing "Menu". There are ten options on the menu: SEQ, SEQ Edit, master-slave parallelism, APG, Advanced function, Protection Config, Function Config, System Config, Factory Reset and About TOYOTECH. Users can enter the desired option by pressing the corresponding button. Parameter settings can be completed easily

Figure 22   Menu

5.1 Test Interface

Figure 23   Test Interface

Table 13

Name	Number	Function
Device specification	①	Displaying specification of voltage, current and power
Readback area	②	Readback of voltage, current and power Users can press Shift +▶ or Shift + ◀ to switch parameters: power, loading time, Ah, kWh, resistance and temperature.

Status information area	③④⑤⑥	③ Output mode: Off/CV/CC/CP ④Parallel status: Under parallel mode, Σ-P symbol will be displayed. There is no parallel symbol if the device is not under parallel mode. ⑤Remote sense: Under remote sense, SENS symbol will be displayed. There is no sense symbol if the device is not under remote sense. ⑥External programming: Symbol APG-VI stands for voltage & current programming. Symbol APG-VIP stands for voltage & current & power programming. There is no external programming symbol if the external programming is not activated.
Warning area	⑦⑧	⑦Protection warning: There will be corresponding symbol if protection happens, for example OTP (over temperature protection). ⑧Emergency stop warning: The emergency stop symbol ❗ will be displayed when emergency stop signal is triggered. The emergency stop symbol will disappear after the signal disappers and button PORT-CLR is pressed.
Operation information area	⑨⑩	⑨Control mode: TG stands for Toggle. HD stands for Hold. ⑩Symbol 🔒 will be displayed after button Lock is pressed. At this time, the buttons are invalid. Symbol 🔒 will disappear after button Lock is pressed again. At this time, the buttons are valid.
Parameter setting area	⑪	Users can press ◄ or► or knob to set the parameters.

Alarm

N38300 has multiple protection and alarm functions, including over voltage, over current, overpower, under voltage, over temperature, external communication timeout, and emergency stop. Partial protection parameters can be set under [**Protection**].

After a protection alarm occurs, N38300 will immediately turn off the output and display the protection in the alarm area of the screen. At the same time, the buzzer sounds three consecutive alarms. By pressing [**PROT-CLR**] button, the protection state and protection alarm can be cleared. N38300 can restart output.

Over Voltage Protection

Over voltage protection includes hardware protection and software protection. The hardware over voltage protection threshold is fixed at 105% of rated voltage. The corresponding alarm is OV.

The threshold of software over voltage protection can be set. Threshold 0 is considered to close protection. When the threshold is not 0 and the output voltage exceeds the set threshold, the software over voltage protection will be triggered, and the screen will prompt OVP.

Over Current Protection

Over current protection includes hardware protection and software protection. The hardware over current protection threshold is fixed at 105% of rated current. The corresponding alarm is OC.

The threshold of software over current protection can be set. Threshold 0 is considered to close protection. When the threshold is not 0 and the output current exceeds the set threshold, the software over current protection will be triggered, and the screen will prompt OCP.

Over Power Protection

Overpower protection includes hardware protection and software protection. The hardware overpower protection threshold is fixed at 105% of rated power. The corresponding alarm is OP.

The threshold of software overpower protection can be set. Threshold 0 is considered to close protection. When the threshold is not 0 and the output power exceeds the set threshold, the software overpower protection will be triggered, and the screen will prompt OPP.

Under Voltage Protection

N38300 has software under voltage protection. The threshold of under voltage protection can be set. Threshold 0 is considered to close protection. When the threshold is not 0 and the output voltage is below the set threshold, the software under voltage protection will be triggered, and the screen will prompt LVP.

Over Temperature Protection

When the ambient temperature of N38300 is too high or the ventilation is not good, the over-temperature protection will be triggered. The screen will prompt OTP. The over-temperature protection threshold has been solidified in the device. No manual setup is required.

External Communication Timeout

The external communication timeout protection is used to monitor the message interaction between N38300 and the host computer. When the protection is enabled, if the host computer does not send a communication command to N38300 within the timeout period, the external communication timeout protection will be triggered. The corresponding alarm is CMF. The timeout period can be set under [**Protection**]. The settable range is 0.0～60.0s.

Emergency Stop

N38300 provides an input terminal for emergency stop. This terminal can be connected to a passive physical switch or a 0~5V signal source, and the low level is

active. Closed or 0V is low level. Open or 5V is high level. After the emergency stop occurs, N38300 immediately turns off the output. The interface displays alarm synchronously. When the emergency stop signal disappears and [**PROT-CLR**] button is pressed, the emergency stop alarm can be cleared. At this time, N38300 can restart output.

Module Failure

When N38300 power module fails or the electricity is cut off, N38300 will stop output and display MF in the alarm area.

5.2 Normal Mode

N38300 can output stably within the full power range. After the device is turned on, it enters **Normal** mode by default. Users can also enter **Normal** mode by pressing [**V-Set**], [**I-Set**], [**P-Set**] buttons on the front panel.

Figure 24   Normal Interface

5.3 SEQ Mode

SEQ mode includes SEQ Test function and SEQ Edit interface.

5.3.1 SEQ Test

SEQ Test allows users to select the sequence file to be run. SEQ test (sequence test

function) supports simulation of complex voltage & current waveform, which is frequently used for automotive electronics test, engine start-up test, etc. When the sequence file runs, the highest voltage and current slew rates are used by default. Please press [**SEQ**] button to enter [**SEQ Test**].

Figure 25   SEQ Test

Under [**SEQ Test**], **SEQ File No.** is used to select the running file. N38300 provides 10 sequence files, supports cycle running of the same sequence file, and supports linking to the next file. Each sequence file supports up to 100 running steps. **Volt(V)**, **Curr(A)**, **Pow(W)** and **Delay(s)** display the setting of present step. **File** displays the running file number. **Link** displays the file number to be linked. The values of **Cycle** and **Step** are separated by /. The left and right values of **Cycle** represent the cycles already operated and the total cycles respectively. The left and right values of **Step** represent the current running step number and the total steps of the running file respectively. **Voltage Slope(V/S)** indicates the voltage slope of the current running step, and **Current Slope(A/S)** indicates the current slope of the current running step.

After selecting the sequence file, please press [**On/Off**] button to start sequence test. When the running cycles of all test steps in the sequence file reach the preset cycles, N38300 will automatically turn off the output and stop the sequence test.
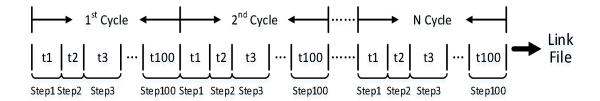
Figure 26   Sequence Operation Principle

5.3.2 SEQ Edit

Please press [**Shift**] first and then[**SEQ**] to enter **SEQ Edit**.

Figure 27   SEQ Edit

The table on left side of the interface displays the currently edited file. A single page can display ten steps. Users can switch pages by pressing [**Shift**] first, and then

pressing [◄] or [►]. When [**Save**] button is pressed or **File No.** on the right side is modified, the table on the left side will be updated accordingly.

The right side of the interface is the sequence file editing area. N38300 provides 10 sequence files. Each file supports up to 100 running steps.

Table 14

Parameter	Function
File No.	To set the sequence file number, range 1~10. When it is modified, number 2 to 9 and data in table on left side will be updated accordingly.
Total Steps	To set the total test steps for the SEQ file, range 1~100
Cycle Times	To set the number of cycles for the file under edit, range 0～60000. Zero means continuous cycle.
Link to File	Link to the required file after the present file is completed, range 0～10. Zero means no link.
Step No.	To set the test step number, range 1～100. When it is modified, number 6 to 9 and data in table on left side will be updated accordingly.
V-Out	To set the output voltage for the present step
I-Out	To set the output current for the present step
P-Out	To set the output power for the present step
Dwell	To set single step delay time, range 0.001～86400s
V-Slew	To set the voltage slew for the present step
I-Slew	To set the current slew for the present step

5.4 Advanced Function

SEQ mode includes RES and RAMP.

5.4.1 RES

The simulated internal resistance test function of N38300 can be used to simulate a battery offering power to test object. Please select **Adv-Func** in the menu, and then

select **RES** to enter internal resistance simulation test.

Figure 28   RES Interface

Due to the existence of internal resistance in real batteries, the voltage will decrease with the increase of current when offering power to test object. The output of battery meets the following formula.

Vo= Vs − Io × Ri

Vo is the actual output voltage. Vs is the open circuit voltage. Io is the actual output current. Ri is internal resistance.

Right side of [**RES**] interface provides four settable parameters: **V-Max**, **I-Max**, **P-Max** and **R-Set**. **V-Max** is the open circuit voltage of battery, corresponding to Vs in the above formula. **I-Max** and **P-Max** are the allowable maximum output current and maximum output power respectively, and the actual value depends on the load condition. **R-Set** is the simulated internal resistance of battery, which corresponds to Ri in the above formula.

5.4.2 RAMP

N38300 provides **RAMP** test function. Please select **Adv-Func** in the menu, and then

select **RAMP** to enter RAMP test.

Figure 29   RAMP

In the diagram below, the starting point A, midpoint B, and end point C are connected to form two straight lines, and the voltage values of each point are determined by **V-Set A**, **V-Set B** and **V-Set C** respectively. The slew rate of straight lines AB is determined by **A Hold Time**, **V-Slew AB** and **B Hold Time**. The slew rate of straight lines BC is determined by **B Hold Time**, **V-Slew BC** and **C Hold Time**.
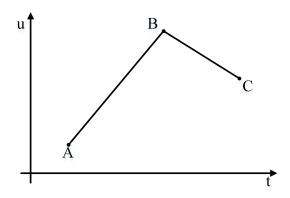

Figure 30   RAMP

When using RAMP function, it is recommended to set the current and power to the maximum value to avoid entering CC or CP mode, which will cause the voltage to fail to output according to the set value and set slew rate.

5.5 Function

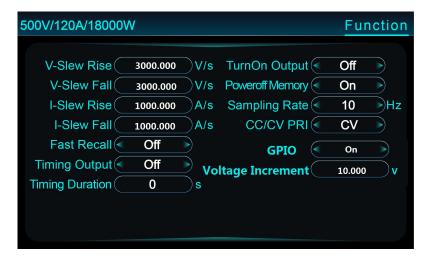The [**Function**] is as shown in the figure below.

Figure 31　Function

5.5.1 Output Mode

N38300 has three output modes, constant voltage (CV), constant current (CC), and constant power (CP). When N38300 output is turned on, the status display area will display the present output mode.

CV: When the actual output current is less than the current setting value and the actual output power is less than the power setting value, the power supply operates in CV mode, and the voltage outputs according to the setting value.

CC: When the actual output current reaches the current setting value, the power supply operates in CC mode. At this time, the output current outputs according to the current setting value, and the voltage is determined by the product of the output current and the internal resistance of the load.

CP: When the actual output power reaches the power setting value, the power supply operates in CP mode. At this time, the output power outputs according to the power setting value.

5.5.2 Save/Recall

N38300 supports saving and recalling test parameters in normal mode. It can save 20 groups of test parameters for users to recall quickly. Each group includes five parameters: voltage setting, current setting, power setting, voltage slew rate, and current slew rate. This function helps to improve the test efficiency. This function is only valid for normal mode. Before using, please enable the fast recall function under [**Function**].

To save the present parameters, please press [**Save**] button in [**Normal**] mode to enter the save interface. As shown in the figure below, it prompts "Please select". After inputting the storage location, it prompts "Please press Save". At this time, please press [**Save**] again to save the present parameters to the selected location, and the interface will simultaneously display "Saved successfully" and automatically jump back to [**Normal**] interface.

Figure 32   Save Interface

To recall a certain group of parameters, please press [**Shift**] first and then press [**Save**] to enter the recall interface. As shown in the figure below, it prompts "Please select". After inputting the recall location, it prompts "Please press Recall". At this time, please press [**Shift**] first and then press [**Save**]. It will update the parameters of the

selected position to the set value, and the interface will simultaneously display "Recalled successfully" and automatically jump back to [**Normal**] interface.
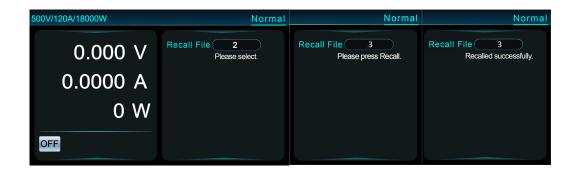
Figure 33   Fast Recall

5.5.3 Timing Output

N38300 supports timing output function. The timing duration can be set up to a maximum of 2678400s (equivalent to 31 days). This function can be set under [**Function**]. After the function is enabled, the countdown time will be displayed on top of [**Normal**] interface. The time format is DD HH:MM:SS, which respectively represent day, hour, minute, and second. If the output is turned off, the countdown will be aborted.

Figure 34   Countdown Interface

5.5.4 CC/CV Priority

If the test object is a capacitive or inductive load, there may be a current or voltage spike at the moment the test starts. To solve this problem, N38300 is developed with CC priority and CV priority selection function, which can force the power supply to run in CC mode or CV mode when the output is turned on. The output performance of CC priority and CV priority are shown in the following two figures respectively.
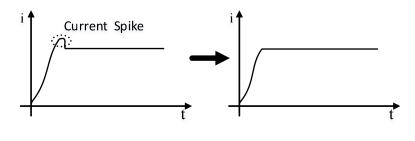
Figure 38   CC Priority
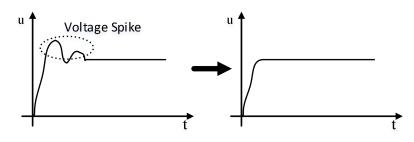
Figure 35   CV Priority

5.5.5 GPIO

The setting voltage of the dissipator must be an increment higher than the setting voltage of N38300. When the setting voltage of the dissipator is higher than the setting voltage of N38300, the dissipator will not work. If the voltage returned by the motor is exceeding the setting voltage of the dissopator, the dissipator starts to work to protect N38300 and the motor controller.

Voltage increment can be set by "Function"; GPIO can be set by "On/Off"; The

voltage increment of the dissipator can be set by voltage increment, and the value will be changed accordingly.

Note: Dissipator set voltage = power supply set voltage + voltage increment.

For example, if the N38300 and the dissipator are connected correctly and the communication is completed, the voltage increment is set to 1V, and if the output voltage of the N38300 is set to 10V, the voltage of the dissipator will be set to 11V automatically.

5.5.6 Voltage/Current Slew Rate

N38300 supports voltage slew rate and current slew rate settings. Users can set the required slew rate to meet the test requirement of DUT.

The default voltage slew rate of N38300 series is 3000V/s, and the default current slew rate is 1000A/s. The highest settable slew rate is related to the specification and model.

5.5.7 Power-off Memory

N38300 provides power-off memory function. After this function is enabled, when N38300 is powered on, the parameters at the last shutdown will be restored. Otherwise it will be initialized to default parameters.

The power-off memory function can be turned on or off under [**Function**]. It is enabled by default.

5.6 External Programming

5.6.1 Analog Programming

N38300 supports external analog programming function of voltage, current and power. The output of N38300 can be controlled by simulating the set value through an external 0~5V DC voltage signal. The output changes with the change of the external input volume. The two are directly proportional. When external programming is turned on, the voltage, current and power settings on the LCD screen are invalid. The sampling rate of voltage, current and power programming is 1000 points/s. The relationship between input and output is shown in the figure below.
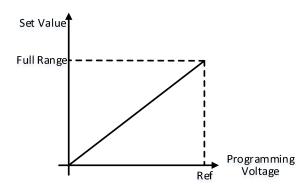
Figure 36   Input & Output Relationship of External Analog Programming

Voltage, current and power programming can be set under [**EX-Prog**] interface, as shown in the figure below. After the external programming is turned on, the interface will display information APG-XXX. If the voltage programming is enabled, the interface will display APG-V. If the voltage and power programming is enabled, the interface will display APG-VP. If all three are enabled, the interface will display APG-VIP. In parallel mode, the programming function of the master is valid for the whole machine.

Figure 37   External Programming

5.6.2 Output Monitoring

N38300 provides analog monitoring function of output voltage and output current. This function is always valid after N38300 is turned on. The rate can reach up to 1000 points/s. Power output 0~rated value corresponds to monitoring output port 0~10V or 0~5V.

5.6.3 Output Mode Monitoring

N38300 has an output mode signal terminal. This terminal outputs 5V TTL level signal. Low level indicates N38300 is working in CV mode. High level indicates N38300 is working in CC or CP mode.

5.6.4 Fault Indication Monitoring

N38300 has a fault indication signal terminal. This terminal outputs 5V TTL level signal. Low level indicates N38300 is working normally. High level indicates N38300 is abnormal or has been protected and the protection has not been cleared.

5.6.5 On/Off External Control

N38300 provides an input terminal for trigger signal. This terminal can be connected to a physical switch or a 0~5V signal source, and the low level is active. Closed or 0V is low level. Open or 5V is high level. The response time is about 20ms. After the input terminal receives valid input, N38300 will respond according to the external control mode. The external control mode can be set under [**EX-Prog**]. There are three options: Off, Toggle and Hold.

Off: It ignores the input signal and does not respond.

Toggle: As an output control signal, the input terminal detects a valid low-level pulse, and then switches the ON and OFF states once. The operation information prompt is TG.

Hold: As an output switch control signal, when the input terminal is low level, N38300 output is turned on. When it is high level, N38300 output is turned off. The operation information prompt is HD.

5.7 Limit Parameter

N38300 provides settable upper(Max) and lower(Min) limits for voltage, current and power. The setting value can only be set within the allowable upper and lower limits. Normally, the setting value range is 0~full scale. Reducing the upper and lower limits is equivalent to reducing the settable range of setting value. This function has the advantage of protecting test objects. If the limit parameter is set to 0, the limit will be canceled.

If the setting value is less than the lower limit, the setting value will be automatically adjusted to the lower limit and take effect immediately. Conversely, if the setting value is greater than the upper limit, the setting value will be automatically adjusted

to the upper limit and take effect immediately. The limit parameters can be set under [**Protection**]. Users can press [**Shift**] first and then press [**PROT-CLR**] or enter [**Protection**] from the menu.

Figure 38   Protection

Under [**Protection**], after the upper and lower limit of voltage or current or power is changed, N38300 will automatically check whether the setting value is within the allowable range. If it is not within the allowable range, it will be automatically changed to upper or lower limit. Users can observe the changed setting value by returning to the test page.

5.8 Parallel

N38300 supports parallel connection of 10 devices of the same specification, which can be controlled and read back simultaneously through the shared bus PAR.

5.8.1 Parallel Connection

The master-slave parallel function only supports connection of devices of the same specification. Wiring is shown in the figure below. Corresponding settings should be made for each power supply to realize master-slave parallel function. If voltage

remote sense is required, it is necessary to connect the voltage remote sense terminals S+ and S- of the master to the compensation point.
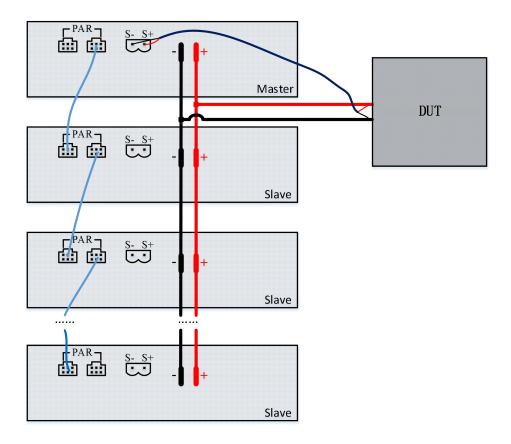

Figure 39   Parallel Connection Diagram

5.8.2 Parallel Setting

Users can enter [**Parallel**] interface from the menu. In parallel application, the slave should be configured first and then the master to avoid communication failure of the master. Options of [**Master/Slave**] are Master, Slave1 or Slave2, etc. There can only be one master. There can be multiple slaves. However, the role of the slave cannot be repeated, and must be set in ascending order. If there is only one slave, the slave number must be set to Slave1. When there are two slaves, one of them must be set as Slave1, the other must be set as Slave2, and so on, otherwise it will cause communication failure.

[**Slave Number**] is used to set the number of slaves, which must be consistent with the actual situation, otherwise the power and current readback of the master will be inaccurate. [**Control**] is used to enable or disable the parallel function. [**Slave Number**] and [**Control**] are only displayed when [**Master/Slave**] is set to master. If set to slave, the two options will be hidden automatically, as shown in the figure below.

Figure 40　　Parallel Interface　　　　　　　　Figure 41　　Parallel Interface(Slave)

⚠ **Note**

When multiple devices are set as master and the control function is turned on, the parallel operation will fail.

5.8.3 Parallel Operation

After the master and slave are paralleled, the operation is like a single machine. Users only need to operate the master to control the entire unit. The master test

interface displays the setting parameters and readback values of the entire unit. The slave displays the readback value of itself, as shown in the figure below.

Figure 42   Slave Interface

When any device is protected, the system will automatically turn off the output of all devices. The slave displays the error information. The master displays the master error information and the faulty slave number. If only the master is protected, it is necessary to press [**PROT-CLR**] button on the master. But if the slave is protected, it is necessary to press [**PROT-CLR**] button on both the corresponding slave and the master to clear the fault. The following table lists the protection and fault conditions that may occur in parallel.

Table 15

No.	Error Information	Description
1	Red ∑-P showed on the master	Parallel communication is abnormal.
2	SP01-SP09	Indicating the faulty slave number

⚠Warning

When the device is set as a slave, the original protection parameters will be canceled.

⚠ **Warning**

It will take effect only by restarting the device after completing factory reset.

5.9 System Mode

N38300 provides multiple communication interfaces. CAN interface supports CANOpen protocol. Other interfaces support standard Modbus and SCPI protocols. The default is Modbus. Users can set communication parameters under [**System**] interface, as shown in the figure below.

<p align="center">Figure 43   System</p>

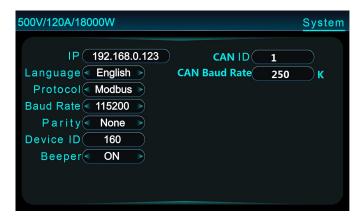The default IP address is 192.168.0.123. The IP of computer must be in the same network segment as the IP of N38300, otherwise the connection will fail. When using LAN communication, the corresponding relationship between protocol and port number is shown in the table below.

Table 16

Application Layer Protocol	Transport Layer Protocol	Port
SCPI	TCP	7001
	UDP	7000

Modbus	TCP	502
	UDP	7000

Communication Protocol

N38300 supports SCPI, Modbus and CANopen communication protocols. CAN interface only supports CANopen protocol. Other interfaces support SCPI and Modbus protocols.

Baud Rate

The baud rate setting is valid for RS232, RS485, and USB serial ports. Baud rate options are 4800, 9600, 19200, 38400, 115200. The default rate is 9600. The unit is bps. CAN interface baud rate is fixed at 500kbps. No settings are required by the user.

Parity

Parity setting is valid for serial communication. Options are None, Even, and Odd. The default value is None.

Device ID

The device ID is used to set address of communication connection. The settable range is 0~254. Default address is 160. When using CANopen communication, the communication address takes the lower 7 bits of device address, such as setting address to 160 (0xA0), and the CANopen address to 32 (0x20).

Language

N38300 supports English and Chinese, which can be switched under [**System**].

5.10 Factory Reset

Users can enter **Factory Reset** from the menu.

Figure 44   Factory Reset

In this interface, by pressing [**Enter**] button or the knob to select **Yes**, N38300

parameters will be restored to factory state. At the same time, the top of interface

⚠Warning

It will take effect only by restarting the device after modifying the parameters.

shows Reset successfully. Please restart the device.

6 Maintenance and Self-inspection

6.1 Regular Maintenance

Clean the Device

Please wipe lightly the device with a dry or slightly wet cloth, and do not wipe the inside of it. Make sure the power is disconnected before cleaning.

⚠ **Warning: Disconnect power before cleaning.**

6.2 Fault Self-inspection

Device Fault Self-inspection

Due to system upgrade or hardware problem, the device may break down. Please do the following necessary inspection to eliminate the troubles, which can save your maintenance and time cost. If the troubles cannot be recovered, please contact TOYOTECH.

The inspection steps are as below.
◆ Check whether the device is powered.
◆ Check whether the device can be turned on normally.
◆ Check whether the fuse has no damage.
◆ Check whether other connectors are correct, including wire cables, plug, etc.
◆ Check whether the system configuration is correct.
◆ Check whether all the specifications and performances are within the device
   working range.
◆ Check whether the device displays error information.
◆ Operate on a replacement device.

Calibration Intervals

It is suggested that N38300 series should be calibrated once a year.

7 Main Technical Data

⚠️Warning

1. The measurement accuracy is identified by the following three conditions: within one year after calibration, operation temperature between 18℃ and 28℃, and the relative humidity up to 80%.
2. Please warm up the device for half hour to ensure the measurement accuracy.
3. Ripple measurement conditions: voltage measurement bandwidth 20Hz~20MHz, test probe port connected to 10μF+0.1μF capacitor.

Table 17

Model	N38318-1000-40
Voltage	0~1000V
Current	0~40A
Power	0~18kW
CV Mode	
Range	0~1000V
Setting Resolution	10mV
Setting Accuracy	0.05%+0.05%F.S.
CC Mode	
Range	0~40A
Setting Resolution	0.1mA
Setting Accuracy	0.1%+0.1%F.S.
CP Mode	
Range	0~18kW
Setting Accuracy	1%F.S.
Voltage Measurement	
Range	0~1000V
Readback	10mV
Readback Accuracy	0.05%+0.05%F.S.
Current Measurement	
Range	0~40A
Readback	0.1mA
Readback Accuracy	0.1%+0.1%F.S.
Line Regulation	
Voltage	≤0.01%F.S.

Current	≤0.05% F.S.
Load Regulation	
Voltage	≤0.02% F.S.
Current	≤0.05% F.S.
Dynamic Characteristics	
Voltage Slew Rate	40V/ms(max)
Voltage Fall Time(no load)[1]	≤3.5s（Voltage drops below 50V）
Transient Recovery	The recovery time of load varying 10%~90% and voltage recovering
Voltage Ripple	≤850mV
Voltage Ripple	≤150mV
Others	
Parallelism	Supporting parallel connection of 10 devices of the same specification
Interface	Standard: RS232/LAN, optional: RS485/CAN/GPIB/USB
Protocol	SCPI/MODBUS-RTU/CAN-Open
Communication Response Time	≤5ms
Input Feature	
AC Input	Three phase 340VAC ~ 460VAC, frequency 47Hz ~ 63Hz
Efficiency	93%（Typical）
Power Factor	0.99（Typical）
Operating Environment	
Temperature	Operating temperature: 0℃-40℃, storage temperature: -20℃~60℃
Operating Environment	Altitude <2000m, relative humidity: 5%-90%RH(non-condensing), atmospheric pressure: 80-110kPa
Dimension（mm）	132.5(H)*482.0(W)*711.0(D), with output shield
Net Weight	Approx. 32kg