Operation Manual

44M01 – Rev 1.2 P/N 160901

44M01

Modular Load Mainframe

ADAPTIVE POWER SYSTEMS™

ADAPTIVE Power Systems

Worldwide Supplier of Power Equipment

Contents

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Limited Warranty

Adaptive Power Systems, Inc. (APS) warrants each unit to be free from defects in material and workmanship. For the period of one (1) year from the date of shipment to the purchaser, APS will either repair or replace, at its sole discretion, any unit returned to the APS factory in Irvine, California or one of its designated service facilities. It does not cover damage arising from misuse of the unit or attempted field modifications or repairs. This warranty specifically excludes damage to other equipment connected to this unit.

Upon notice from the purchaser within (30) days of shipment of units found to be defective in material or workmanship, APS will pay all shipping charges for the repair or replacement. If notice is received more than thirty (30) days from shipment, all shipping charges shall be paid by the purchaser. Units returned on debit memos will not be accepted and will be returned without repair.

This warranty is exclusive of all other warranties, expressed or implied.

Service and Spare Parts Limited Warranty

APS warrants repair work to be free from defects in material and workmanship for the period of ninety (90) days from the invoice date. This Service and Spare Parts Limited Warranty applies to replacement parts or to subassemblies only. All shipping and packaging charges are the sole responsibility of the buyer. APS will not accept debit memos for returned power sources or for subassemblies. Debit memos will cause return of power sources or assemblies without repair.

This warranty is exclusive of all other warranties, expressed or implied.

1 Introduction

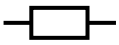
1.1 Overview

Chapter 1 contains important information you should read **BEFORE** attempting to install and power-up APS Equipment. The information in this chapter is provided for use by experienced operators. Experienced operators understand the necessity of becoming familiar with, and then observing, life-critical safety and installation issues. Topics in this chapter include:

- Safety Notices
- Warnings
- Cautions
- Preparation for Installation
- Installation Instructions

Make sure to familiarize yourself with the SAFETY SYMBOLS shown on the next page. These symbols are used throughout this manual and relate to important safety information and issues affecting the end user or operator.

SAFETY SYMBOLS

	**Direct**
	**Alternating current (AC)**
	**Both direct and**
	**Three-phase alternating**
	**Protective earth**
	On (Supply)
	**Off (Supply)**
	**Fuse**
	**Caution: Refer to this manual before using the meter.**
	**Caution, risk of electric**

1.2 Safety Notices

SAFETY SUMMARY

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

GENERAL

This product is a Safety Class 1 instrument (provided with a protective earth terminal). The protective features of this product may be impaired if it is used in a manner not specified in the operation instructions.

ENVIRONMENTAL CONDITIONS

This instrument is intended for indoor use in an installation category I, pollution degree 2 environment. It is designed to operate at a maximum relative humidity of 80% and at altitudes of up to 2000 meters. Refer to the specifications tables for the ac mains voltage requirements and ambient operating temperature range.

BEFORE APPLYING POWER

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

GROUND THE INSTRUMENT

This product is a Safety Class 1 instrument (provided with a protective earth terminal). To minimize shock hazard, the instrument chassis and cabinet must be connected to an electrical ground. The instrument must be connected to the ac power supply mains through a properly rated three-conductor power cable, with the third wire firmly connected to an electrical ground (safety ground) at the power outlet. Any interruption of the protective (grounding) conductor or disconnection of the protective earth terminal will cause a potential shock hazard that could result in personal injury.

FUSES

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

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE.

Do not operate the instrument in the presence of flammable gases or fumes.

KEEP AWAY FROM LIVE CIRCUITS.

Operating personnel must not remove instrument covers. Component replacement and internal adjustments must be made by qualified service personnel. Do not replace components with power cable connected. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries, always disconnect power, discharge circuits and remove external voltage sources before touching components.

DO NOT SERVICE OR ADJUST ALONE.

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

DO NOT EXCEED INPUT RATINGS.

This instrument may be equipped with a line filter to reduce electromagnetic interference and must be connected to a properly grounded receptacle to minimize electric shock hazard. Operation at line voltages or frequencies in excess of those stated on the data plate may cause leakage currents in excess of 5.0 mA peak.

DO NOT SUBSTITUTE PARTS OR MODIFY INSTRUMENT.

Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the instrument. Return the instrument to an Adaptive Power Systems Sales and Service Office for service and repair to ensure that safety features are maintained.

Instruments that appear damaged or defective should be made inoperative and secured against unintended operation until they can be repaired by qualified service personnel.

1.3 Introduction to the 44M01 Modular Load Mainframe

The 44M01 electronic load mainframe is required to provide the DC power conversion and optional computer communications to the 4 Series Load Modules. The 44M01 is designed to house one of the following models:

41L Series

Model	Description	Max Power (W)	Max Voltage (V)	Max Current (A)
41L0630	Single Channel DC Load Module	150	60	30
41L0660	Single Channel DC Load Module	300	60	60
41L2512	Single Channel DC Load Module	300	250	12
41L5012	Single Channel DC Load Module	300	500	12
41L0615	Single Channel DC Load Module	75	60	15

42L Series

Model	Description	Max Power (W)	Max Voltage (V)	Max Current (A)
42L0860	Dual Channel DC Load Module	250 / 50	80 / 80	60 / 6
42L0824	Dual Channel DC Load Module	120 / 120	80 / 80	24 / 24
42L0803	Dual Channel DC Load Module	40 / 40	80 / 80	3 / 3

41D & 42D Series

Model	Description	Max Power (W)	Max Voltage (V)	Max Current (A)
41D3002	LED DC Load Module	150	300	2
41D1020	LED DC Load Module	300	100	20
41D5002	LED DC Load Module	300	500	2
42D5003	Dual LED DC Load Module	240	500 / 500	0.6 / 2.4

1.3.1 Mainframe Features

The 44M01 single-slot mainframe has the following key features:

1. **Flexible Configuration:** The 44M01 can be used to house a single '4' Series load modules with different voltage and current sink ranges.
2. **Plug in Design:** It is quick and easy to take a load module out of the mainframe and to replace it with another load module.
3. **Computer Interfaces:** GPIB, RS232, USB or LAN are available options for remote control. The mechanical design of the interface cards is identical so they are easily interchangeable if needed.
4. **Front Panel Memory:** Common test settings can be stored and recalled quickly.
5. **Auto Sequencing:** Memory locations may be linked to form a time-controlled sequence of load changes.
6. **Wake Up Function:** The mainframe can be set to automatically revert to a load set up on mains power on. This feature saves energy during periods of non-operation.
7. **Intelligent Cooling:** Temperature controlled fans are used to minimize audible noise.

1.3.2 Standard Accessories

The following accessories and items are included with each 44M01 mainframe:

- BNC to BNC Cable, 1 meter/ 3 feet long.
- This Operation Manual in PDF Format on CD ROM.
- AC Line Cord.

Optional country specific line cords are available as an option.

1.3.3 Remote Control Options

Following Remote control option interfaces are available. Only one interface can be installed at a time.

Option	Description
Opt GPIB	GPIB (IEEE-488.2) Interface Option
Opt RS-232	RS-232 Interface Option
Opt USB	USB Interface Option
Opt LAN	LAN Interface Option

1.3.4 Specifications

Following specifications apply to the 44M01 mainframe.

PARAMETER	PARAMETER	SPECIFICATIONS	
SLOTS	Number of Load Modules Supported	1	
AC INPUT	Line Voltage (selectable)	100-115Vac ±10%	200-230Vac ±10%
	Frequency	50 / 60 Hz ±3Hz	
	Fuse	T1A/250V (5x20 mm)	T0.5A/250V (5x20 mm)
	Power Consumption	40 Watt Max.	
PHYSICAL	Dimensions (H x W x D)	177 x 160 x 452 mm	7.0" x 6.3" x 17.8"
	Weight:	5.5 kg	12.2 lbs
ENVIRONMENTAL	Installation Category	Cat I, Pollution Degree 2, Indoor use only	
	Temperature Range	0 – 40°C	32 – 104°F
	Relative Humidity (max.)	80 % non-condensing	
	Altitude	2000 meters	6000 feet

Table 1: Mainframe Technical Specifications

2 Installation

2.1 Inspection

The 44M01 mainframe is carefully inspected tested and calibrated before shipment. If damage to the instrument has occurred during transport, please inform Adaptive Power Systems' nearest sales and service office or representative. Your 44M01 mainframe is 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 sales office to obtain the correct cord. Refer to "check line voltage" to check the line voltage selection and fuse type.

2.2 AC Line Input Voltage Check

The 44M01 mainframe can be operated from a 100/115 or 200/230Vac input as indicated on the label on the rear panel. The input is switchable so please make sure that the switch is set correctly for your nominal mains input before turning on the mains power. The procedure below details how to change the switch position:

1. With the 44M01 mainframe power OFF, disconnect the power cord.
2. Refer the drawing on the rear panel in Fig 2-1, set the switches to the Proper voltage as described in the following:
   a. Set Switch to 100V/115V for 115Vac line voltage
   b. Set Switch to 200V/230V for 230Vac

Note: 100Vac and 200Vac is used for Japan only (Option)

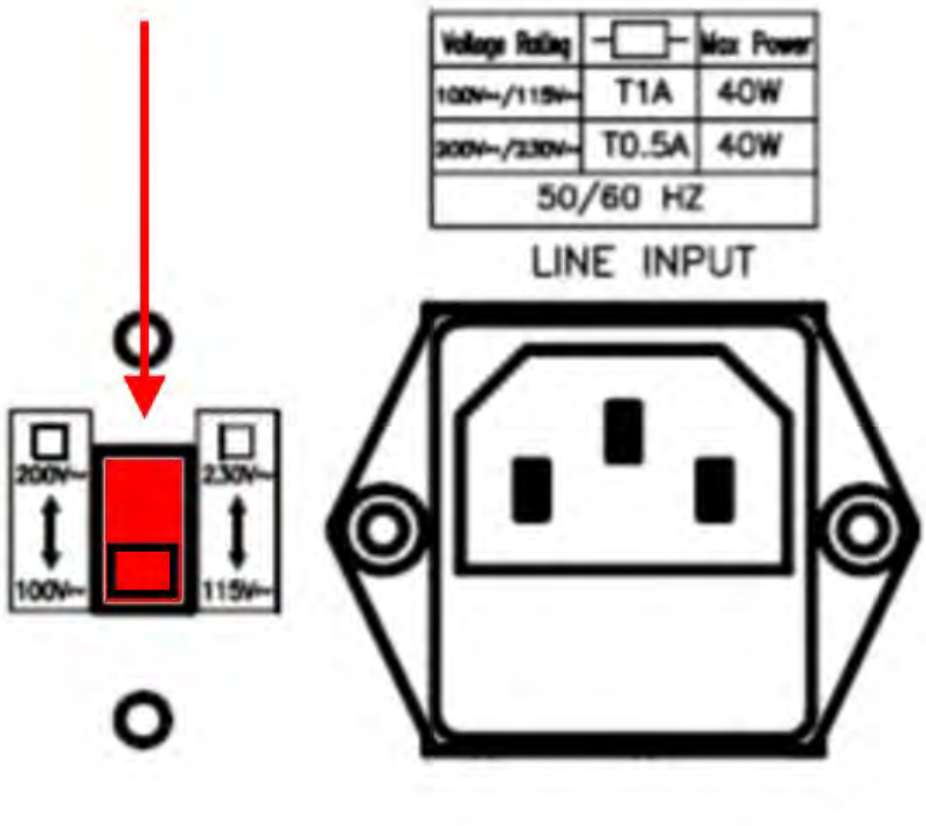


Figure 1: AC Line Selection Switch

2.3 Input Fuse

This product is fitted with a mains input fuse. If it needs to be replaced, please adhere to the following procedure.

CAUTION

BEFORE replacing the fuse you must switch off the unit and mains power outlet and disconnect the plug of the AC Power cable from the input socket of the 44M01 chassis.

WARNING

If prior to exchanging the fuse, there is any abnormal noise or odor, do not use the unit. Please inform your local sales office to organize repair of the 44M01 chassis.

To avoid the risk of fire or electronic shock the fuse must only be replaced with same type and rating as the original. Any replacement fuse used should meet local national safety standards. Any use of an improper fuse or shorting the Fuse holder is extremely dangerous and is strictly prohibited.

2.3.1 Fuse Replacement Procedure

1. Check the rating of the mains input fuse. Replace only with the correct type and rating.
   For 100V/115Vac Input use T1A/250V (5*20mm),
   For 200V/230Vac Input useT0.5A/250V (5*20mm)
2. The AC line fuse is located below the AC line socket (see Figure 2). Use a small screwdriver to remove the fuse holder. Replace the failed fuse with the appropriate type and rating according to your mains voltage. (See Table 2)
3. Refit the fuse holder and connect the power cord.

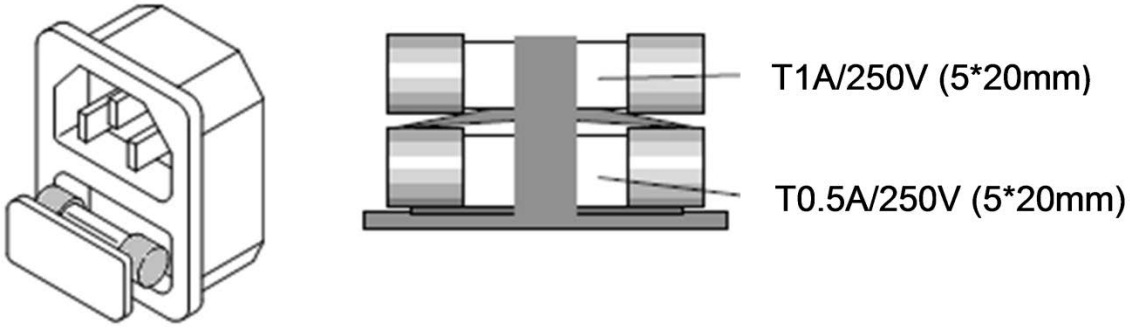


Figure 2: Fuse Holder Location

2.4 Grounding Requirements

WARNING

SHOCK HAZARD

The unit is grounded via the AC Input. A line cord with proper Earth Ground pin **must** be used at all times. Correct grounding of your electrical system infrastructure according to applicable national standards must also be observed.

2.5 Chassis Position

The 44M01 electronic load mainframe is equipped with surface protection feet installed and is ready for used as a bench instrument. The feet provide a good viewing angle for bench-top use.

2.6 Cleaning

To clean this product uses a soft or slightly damp cloth.

CAUTION

BEFORE you clean the unit, switch the mains power off and disconnect the input line cord.

・Please do NOT use any organic solvent capable of changing the nature of the plastic such as benzene or acetone.

・Please ensure that no liquid is allowed to penetrate this product.

2.7 Powering Up

The following procedure should be followed before applying mains power:

1. Check that the POWER switch is in the off (O) position.
2. Verify that the rear panel voltage selector of the 44M01 mainframe is correctly set.
3. Check that nothing is connected to any of the DC INPUT (load input terminals) on the front and/or rear panels.
4. Connect the correct AC mains line cord to the 44M01 AC input terminal.
5. Plug the line cord plug into a suitable AC outlet socket.
6. Turn on (I) the POWER switch.

2.8 Interface Options

The 44M01 support one of four different remote control interface options. The interface specified at the time of order is installed at the factory prior to shipment. It is possible to retrofit interface options in the field. Contact Adaptive Power Systems Customer Service for instructions.

2.8.1 RS232 Serial Interface

Figure 3 shows the RS232 connector (Female) on the rear panel. This connects the 44M01 mainframe to RS232 port of computer. The RS232 BAUD-RATE can be set on the front panel of the 44M01. Press the "SYSTEM" button twice to enter the desired BAUD RATE adjustment.

Figure 3:44M01 RS232 Connection

2.8.2 GPIB Interface

The GPIB connector is located on the rear panel. This socket allows the 44M01 to be connected to the controller and other GPIB devices. A GPIB system can be connected in any configuration (star, linear, or both) as long as the following conditions are met:

- The maximum number of devices including the controller is equal or less than 15.
- The maximum length of the GPIB cable is no more than 2 meters.
- The total lead length of all devices connected together totals less than 20 meters.
- Please make sure the lock screws are firmly hand-tightened, use a screwdriver only for the removal of screws. Figure 4 shows the rear panel of 44M01 mainframe. The GPIB address of the 44M01 mainframe is set on the front panel.

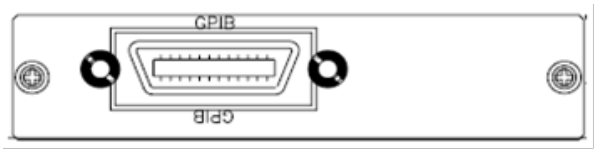


Figure 4: 44M01 GPIB Connection

2.8.3 USB Interface

The 44M01 is a USB Device and uses a USB Type B connector on the rear panel when equipped with the USB interface option. Figure 5 shows the USB connector in the rear panel of 44M01 mainframe. Please refer Appendix B for information on USB communications.

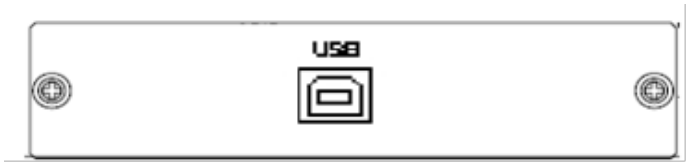


Figure 5: 44M01 USB Connection

2.8.4 LAN Interface

The LAN option uses a 100BaseT Ethernet interface. Figure 6 shows the LAN connector on the rear panel of the 44M01 mainframe. Please refer Appendix C for information on LAN communications.

Figure 6: 44M01 LAN Connection

2.9 Remote Controller Option

A wired remote controller can be connected to the mainframe. Figure 1 shows the DB15 remote controller connector, which is located on the rear panel.

Figure 3: 44M01 Remote Controller Connector

Figure 2 shows pin assignments for the DSUB-15 connector when the remote controller option is fitted to the 44M01 mainframe. The remote controller allows the first 10 memory locations to be recalled. Set ups saved at these memory locations can include dynamic waveforms and the load ON state.

Note 1: O/P as a set of NG TTL High level signal output.

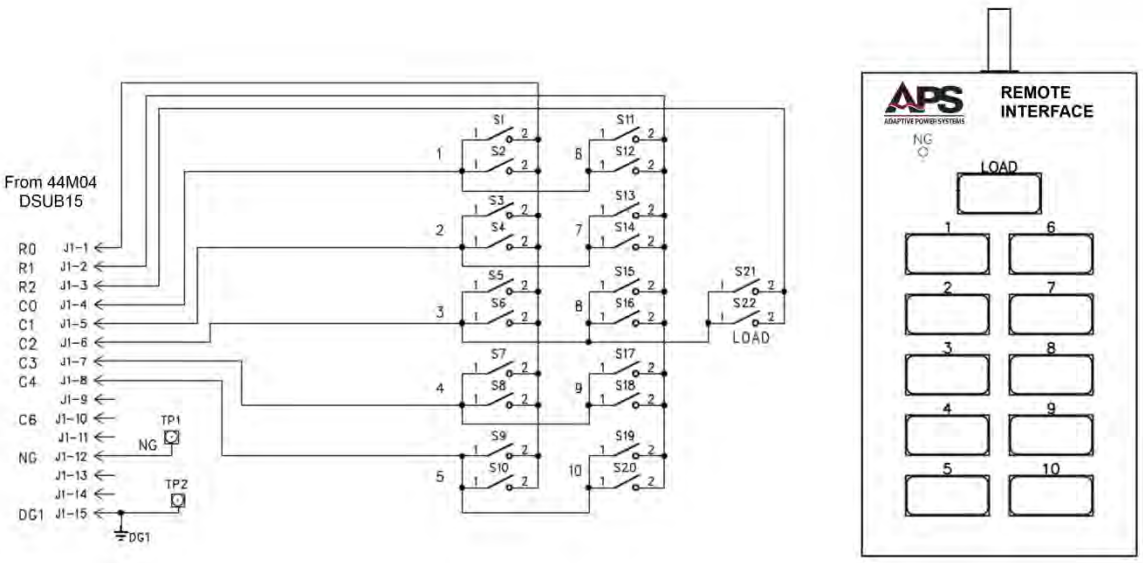


Figure 4: Remote Controller Connection

2.10 Analog Programming Input

The 44M01 mainframe has an analog programming input. This feature allows an external waveform to be tracked as long as it is within the load's dynamic capabilities. The analog programming input is available through a BNC connector on the rear panel of the 44M01 mainframe. This input will accept a 0-10V signal. This signal is proportional to the load module's maximum current range.

Note: The analog programming input will only operate with single channel load modules. It can **NOT** be used for dual channel load modules from the 42L series or the 42D5003.

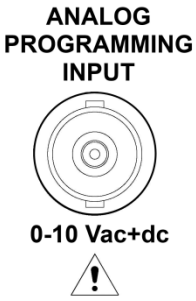


Figure 5: Pin-out of Analog Pogramming Input Connector

The analog programming input operates in CC or CP modes only. The load module will attempt to load proportionally according to the signal and the load module's maximum current or power range.

For example: 41L0660: Imax = 60A and Pmax = 300W

- In CC mode, if the analog programming input is 5V = 30A load setting.
- In CP mode, if the analog programming input is 1V = 30W load setting.

The analog programming signal can act alone or it can be summed with the programmed value set via the front panel or the optional computer interface (GPIB, RS232, USB, or LAN) or the front panel.

Figure 4 shows the result of an analog programming signal at 4Vac, 500Hz when it is summed with a 24A programmed setting in CC mode of 41L0660 Load module.

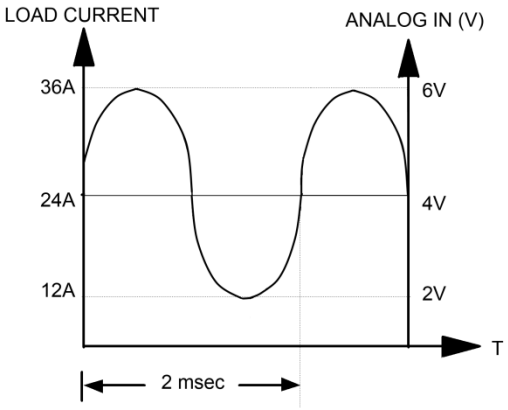


Figure 6: Analog Porgramming Example

3 Mainframe Operation

3.1 Overview

Chapter 3 provides an overview of front panel operation for the 44M01 when configured with a load module. The 44M01 Provides DC bias supplies to the installed load module as well as cooling based on load demand. It also allows sequences of load settings to be programmed using a time sequence.

3.2 Front Panel

The front panel layout is shown in Figure 5 below. Each load module has its own front panel controls and readouts of settings and measurements. Controls and readouts specific to the mainframe are all located along the bottom edge of the mainframe front panel. Rack handles shown may be removed unless the unit is to be rack mounted.

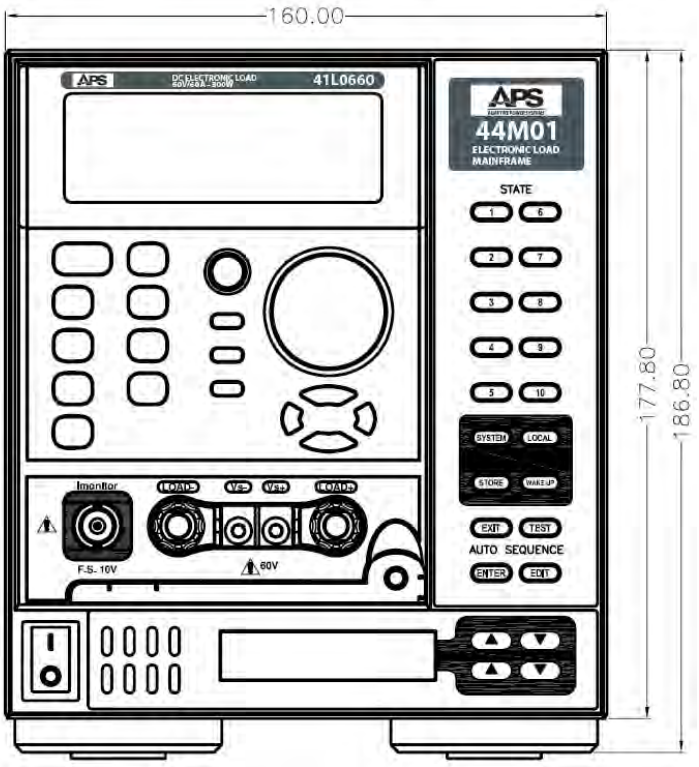


Figure 7: 44M01 Mainframe Front View

3.3 Side Panels

The side view shown below shows the air intake vents on either side of the mainframe chassis. Care should be taken not to block these vents when installing the load mainframe in an instrument cabinet.

Figure 8: 44M01 Mainframe Side View

3.4 Rear Panel

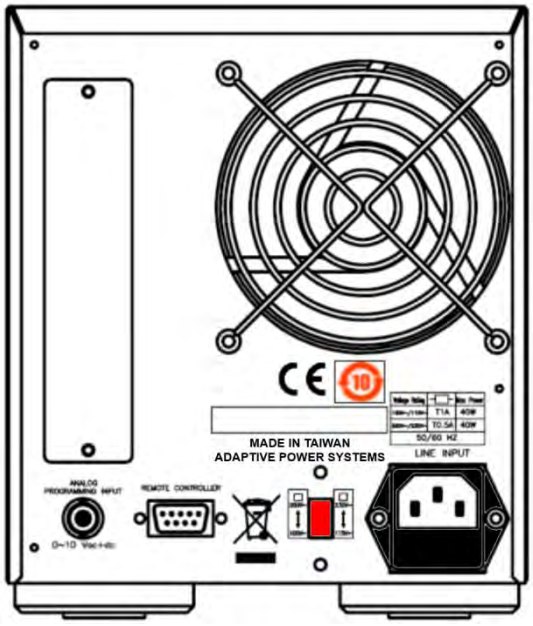


Figure 9: 44M01 Mainframe Rear Panel View

3.5 Mainframe Controls and Indicators

3.5.1 Power On Switch

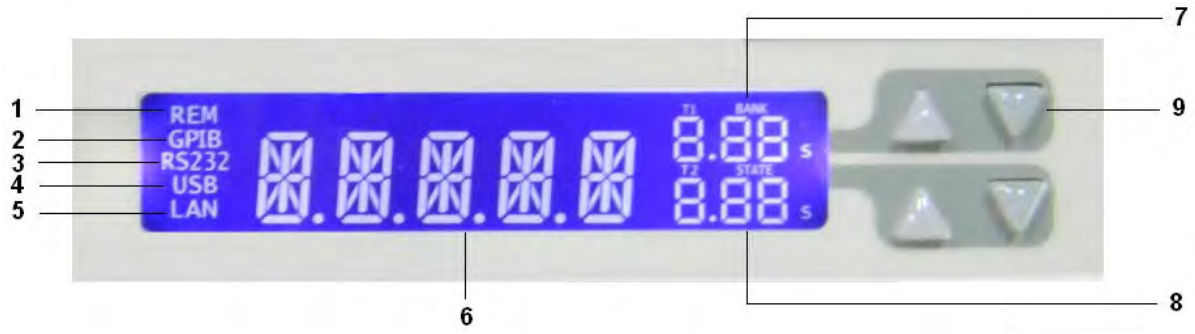
Before switching on the unit, please ensure that the mains voltage applied matches the mainframe AC input settings. See Section Check AC Line Voltage, page 2.

At mains power ON, the following should be apparent:

- The mainframe and firmware version is displayed on its screen at the bottom right.
- If a load module is fitted, its LCD will become lit and display its firmware version.
- If no load module is fitted the fan associated with that position (slot) will not operate. If a load module has been installed, the fan will turn slowly. The fan will speed up under load.

3.5.2 LCD Display

The mainframe's LCD Display will illuminate fully when power is applied. Please refer to the relevant section number below for a brief description of the information displayed.



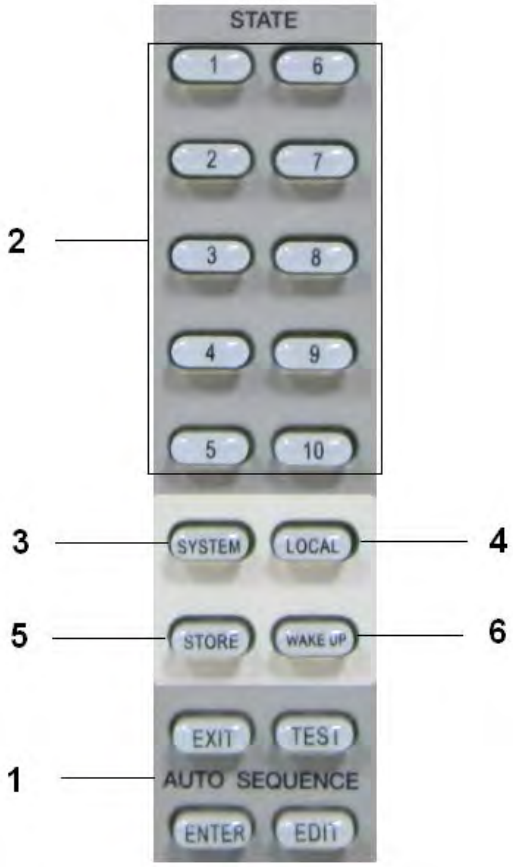
#	Displays	Description
1	Remote State	The REM annunciator will be lit when 44M01 is being controlled via the GPIB/RS232/USB or LAN -Interface. To bring back the unit to front panel control, the **LOCAL** button on the Right hand side of the mainframe can be pressed
2	GPIB Installed	The GPIB annunciator will be permanently lit if the GPIB Interface option is detected.
3	RS232 Installed	The RS232 annunciator will be permanently lit if the Rs232 Interface option is detected.
4	USB Installed	The USB annunciator will be permanently lit if the USB Interface option is detected.
5	LAN Installed	The LAN annunciator will be permanently lit if the LAN Interface option is detected.

#	Displays	Description
6	Status Display	At power up, the LCD will display "Nor" which indicates NORMAL operation. The message displayed will change if a setting such as WAKE-UP or AUTO-SEQUENCE is selected. 
7	BANK T1 / Display	The upper digits on the right hand side of the screen relate to the memory BANK in normal mode. There are 15 BANKS which can be selected in turn by pressing the upper pair of arrow keys. Each BANK has 10 separate memory STATES (locations) which are selected with the lower pair of arrow keys. When in auto-sequence mode, T1 is displayed. T1 is the test time. The test time can be adjusted using the upper arrow keys between 0.1sec and 9.9sec in 100ms steps. Please note that during the T1 test time, the mainframe LCD will not flag "NG". The T2 setting is used for checking the no-go (NG) function according to the voltage, current or power limits set in the LIMIT menu.
8	STATE / T2 Display	The lower digits relate to the memory STATE (location) in normal mode. There are 10 memory STATES (locations) which can be selected in turn by pressing the Lower arrow keys. These memory STATES are supplemented by the 15 memory BANKS, giving the user a total of 150 memory locations. When in auto-sequence mode the T2 function is displayed. T2 is the time that NG/GO is checked according to the LIMITS that have been set for that test step. So if the NG flag has been enabled and the load measures values outside the preset LIMIT values, then the test will stop during T2. The mainframe's LCD will flash "NG" and the test will stop at that step in the auto-sequence. At this point, the user can either press the ENTER key to carry on to the next step or the EXIT key to abort the auto-sequence.
9	Arrow Buttons	The ARROW keys are used to increase or decrease setting values.

Table 3: 44M01 Mainframe LCD Call-outs

3.5.3 Keypad Description

This paragraph covers the keypad located on the right hand-side of the mainframe front panel. Please refer to the relevant section number below for a brief description of the purpose for each key.



#	Key	Description
1	EXIT, TEST, ENTER and EDIT	The 4 buttons marked EXIT, TEST, ENTER and EDIT are used to set and execute an auto-sequence.
2	1 - 10	The numbered buttons 1~10 are the memory states (locations) for storing or recalling a load set up. They are also used to select a previously saved Auto-sequence when in test mode.
3	SYSTEM	Pressing the system button once allows the GPIB address to be changed by using the arrow keys. Pressing the system button again allows the RS232 baud rate to be adjusted. With the third press of the system button the buzzer can be switched On/Off. Another press puts the LCD back to the Normal state as shown below.

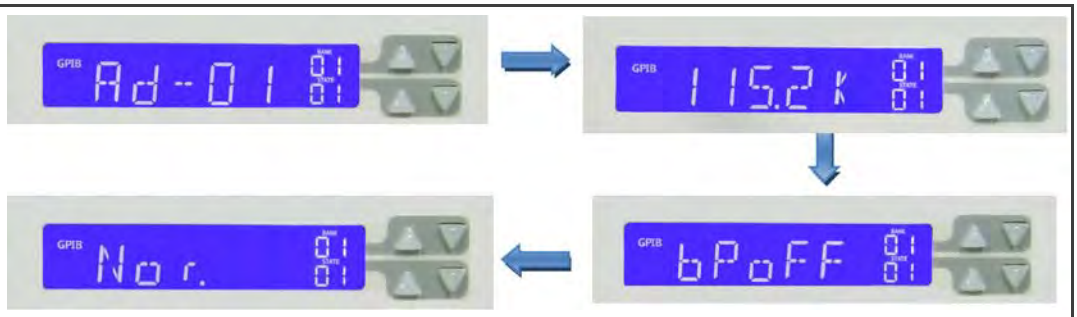
		
4	LOCAL	The local button is used to exit the remote mode and bring the unit back to front panel control
5	STORE	The store button is used to save the load configuration.
6	WAKE UP	The wake up button is used to recall the load configuration at mains power on.

Table 4: 44M01 Mainframe Keypad Call-outs

3.6 Operating Instructions

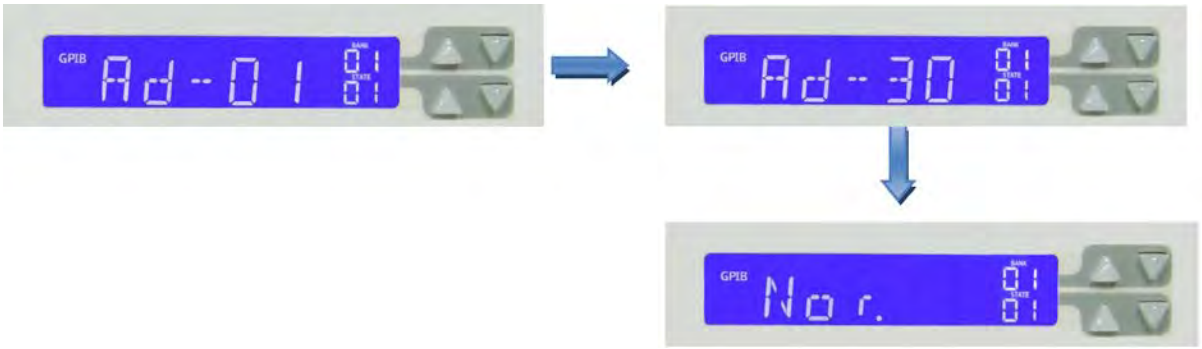
This section of the manual covers mainframe operation from the front panel.

3.6.1 Setting System Parameters

The SYSTEM button allows the setting for GPIB address, RS232 baud rate and Buzzer mode.

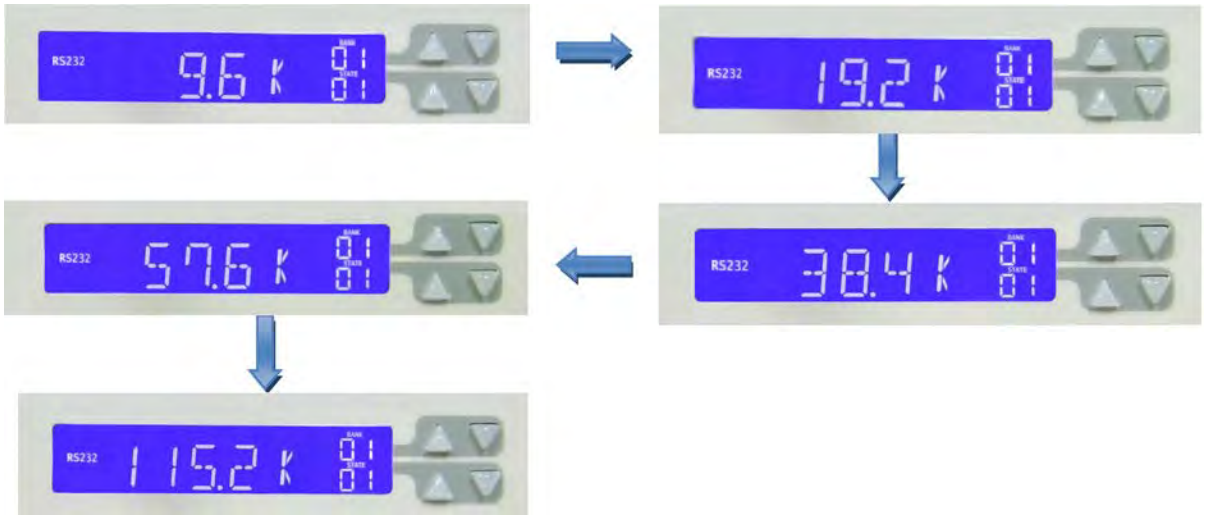
GPIB Settings

To set the GPIB address, you must press the SYSTEM key once. The LCD will display the current address. The arrow keys are used to change the address. Once the required address is reached, press the ENTER or STORE button to save the new address. The exit key can be pressed to return to the normal screen.



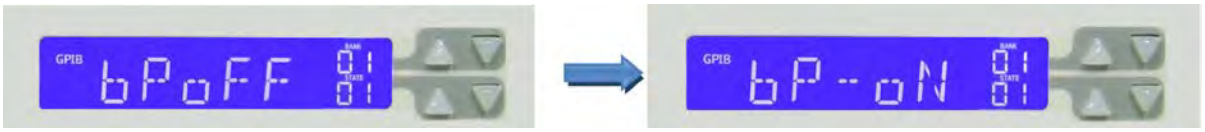
RS232 Settings

To set the RS232 baud rate you must press the SYSTEM key twice. The LCD will display the current baud rate. The upper arrow keys are used to change the baud rate. Once the required value is reached press ENTERE or STORE button to save the new setting. The EXIT key can be pressed to return to the normal screen.



Buzzer Settings

To set the buzzer on/off you need to press the SYSTEM key 3 times. The arrow key is used to change the buzzer state. The buzzer is used to signal that an automatic sequence has ended or failed. To save the setting press ENTER or STORE.



3.6.2 Settings STORE/RECALL Operation

The function keys on the front panel of 44M01 mainframe can be used to STORE or RECALL up to 10 Electronic Load STATES for 41L / 41L / 42L series electronic load modules. Each state can contain up to 15 BANKS for setup data for a total of 150 electronic load settings. Each setting can store a variety of electronic lead status and settings.

	41Lxx	42Lxx	41Dxx	42Dxx
BANK (n)	15	15	15	15
STATE (m)	10	10	10	10
Total States / Mem. Locations	150	150	150	150

Storing a Load Setup

To store a new load setting from the front panel, proceed as follows:

1- Adjust the desired electronic load module to desired status and settings.
2- With the UP and DOWN keys on the mainframe, select the bank (1 to 15) in which you want to store the set up.
3- Press the store key on the mainframe. The store key starts flashing. (If you no longer wish to store a setting, you can press the EXIT button or wait about 20 seconds for the unit to automatically exit the store operation).
4- While the STORE light is flashing, press one of the number keys (1 to10) where the set-up is to be saved. The STORE light will go out and the numbered key pressed will stay illuminated. This indicates the set-up has been saved to that location.

Recalling a Load Setup

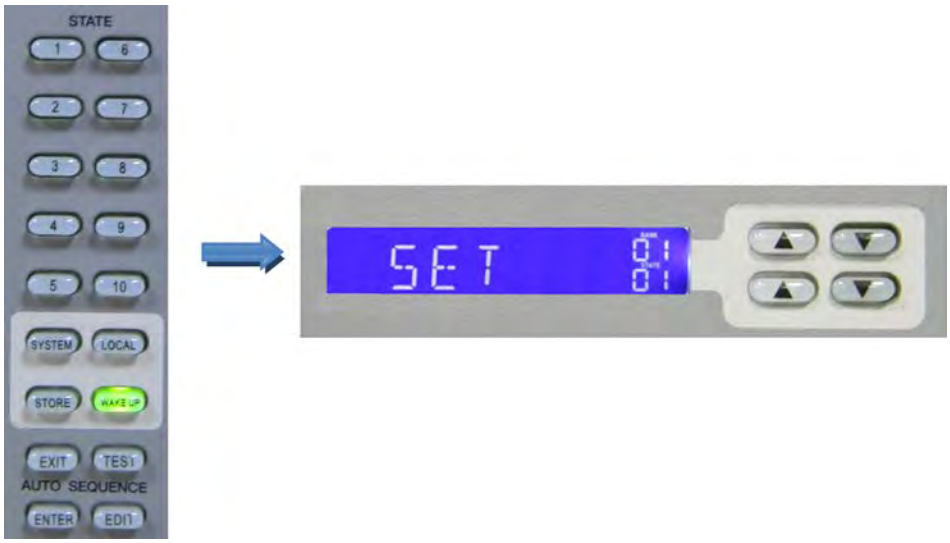
To recall a load setting from the front panel, proceed as follows:

1- First select the memory bank by using the UP and DOWN arrow buttons.
2- Pressing one of the numbered STATE buttons will recall the previously saved load configuration.
3- The electronic load will immediately switch to the previously saved set-up changing the load values, operation mode and limits accordingly.

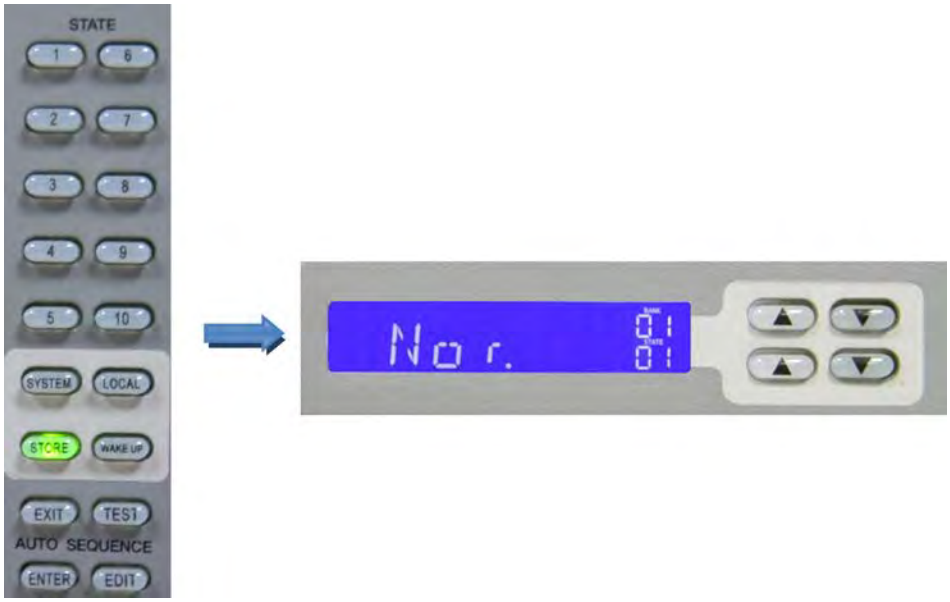
3.6.3 WAKE UP Function

The wake up function automatically recalls a setting at mains power on. To use this feature, proceed as follows:

1- Press WAKE UP once or twice so that message SET is displayed on the 44M01 mainframe LCD.



2- Select the memory location (BANK and STATE) that is to be used at power on. Once the correct location has been selected, press the STORE key. The example below shows BANK 01 STATE 01. After pressing the STORE key, the LCD will revert to the normal (Nor) message.



3- Use the mains switch on the front panel to power down the unit.

4- At mains power on the unit will automatically recall the previously saved set-up from the selected memory location.
5- To clear the settings, press the WAKE UP key once or twice so that the LCD shows clear. Now press the STORE key to cancel the previously set WAKE UP function.

3.6.4 AUTO-SEQUENCING

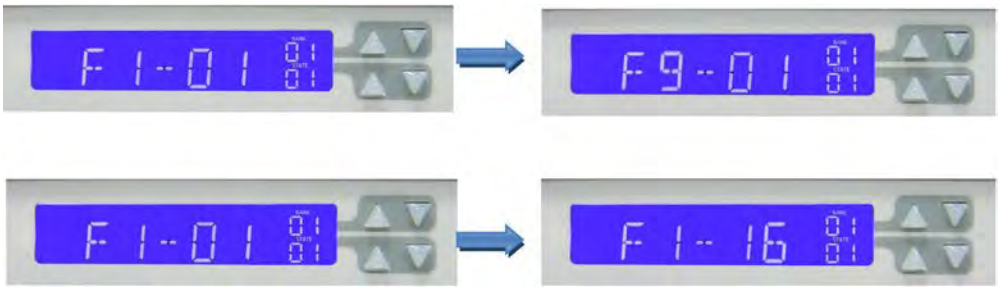
An auto-sequence allows the user to step through previously saved set-ups stored in the mainframe's memory. Up to 9 auto-sequences can be saved. Each auto-sequence can consist of up to 16 steps. There are two modes in the auto-sequence function:

- EDIT mode
- TEST mode

3.6.5 AUTO-SEQUENCE – EDIT MODE

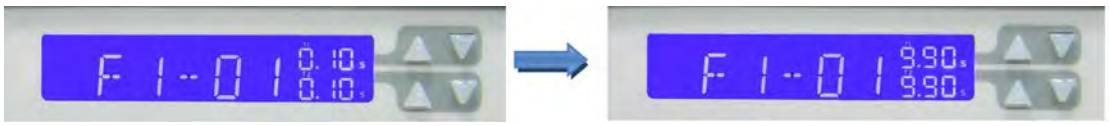
To create a new auto-sequence or edit an existing one, proceed as follows:

1- Press the EDIT key.
2- The EDIT button will become lit and the LCD will display "FX-XX". This is field is made up as follows:
   a. The "FX" part indicates the auto-sequence number (F1 to F9 are possible). The numbered STATE keys are used to select the auto-sequence number.
   b. The "XX" part is the test step. (1 through 16)

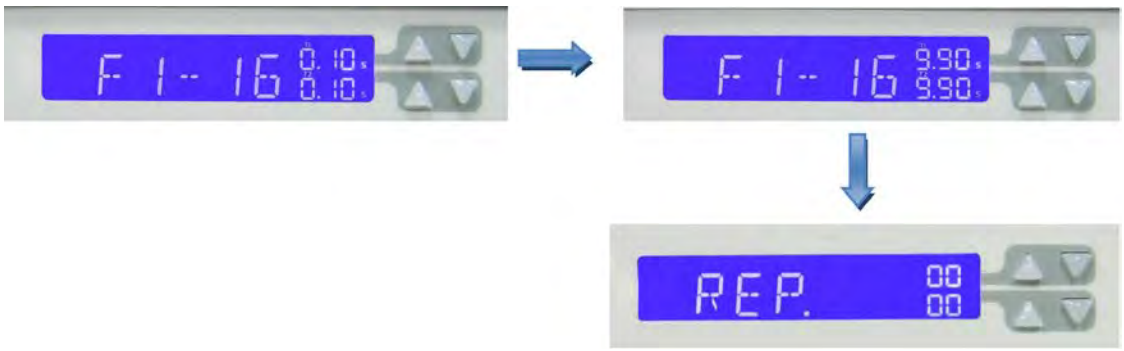


3- Once the auto-sequence number is selected, the memory location of the first test step can be selected. The arrow keys next to the 44M01 LCD are used to select the memory BANK and STATE. Once the desired location is selected, press ENTER.

4- Next the total test time for that step (T1+T2) can be entered. T1 is the test time without checking the NG/LIMIT settings. T2 is the test time where if NG is ON the LIMIT settings will be checked. The upper arrow keys are used to set T1 and the lower arrow keys are used to set T2. The time setting can be adjusted in the range of 0.1s to 9.9s in 100ms increments. Please refer to Table 4 for a definition of T1 and T2.



5- Press ENTER to set the next setting step. Repeat the same process for each setting steps. Up to 16 steps can be entered. Once the T1 and T2 settings have been entered for the final step press the STORE button. The LCD will now show REP.



6- The REP function allows the auto-sequence to be repeated a number of times. Both sets of arrow keys are used to set the number of repeats between 0 and 9999 times. Once the number of repeats has been set, press the STORE button to save the auto-sequence.

Example:

The following screen shot shows the number of repetitions has been set to 2023.

The above Auto-Sequence Edit procedure is illustrated in the flow chart shown below.

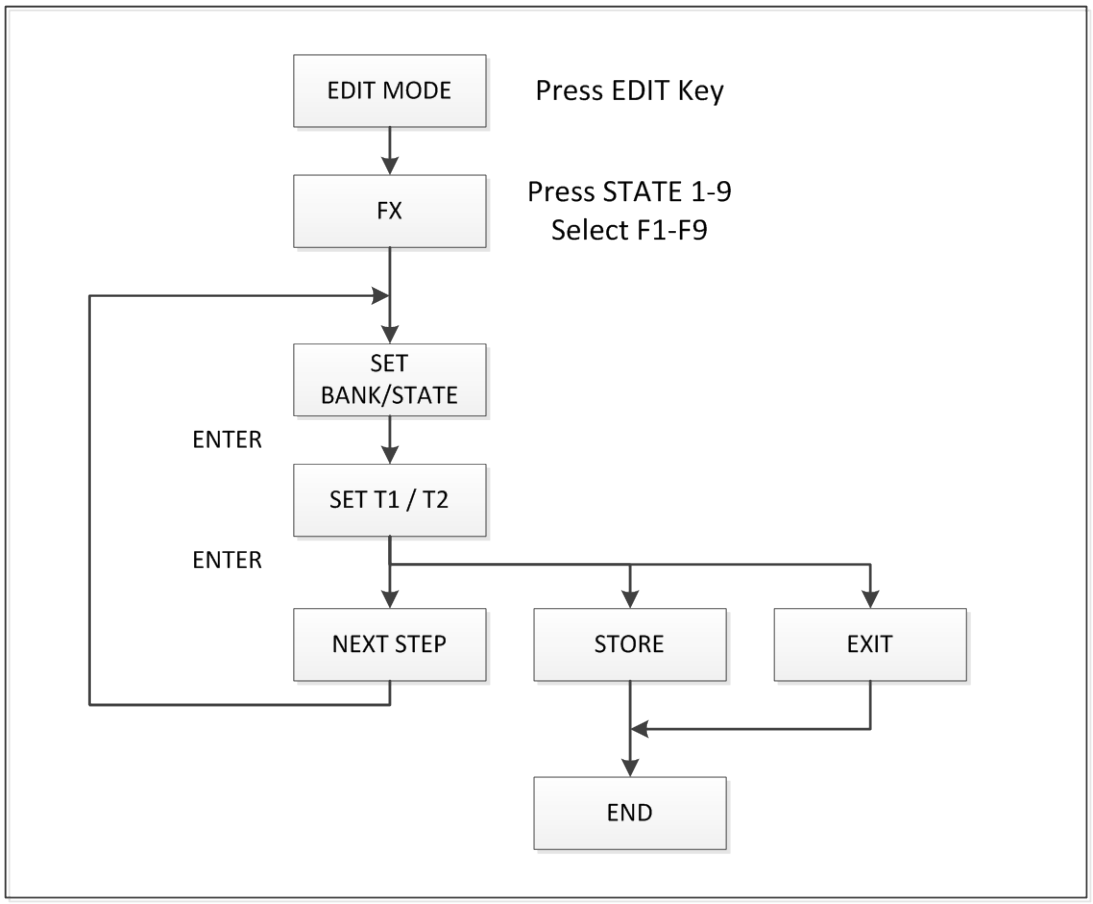
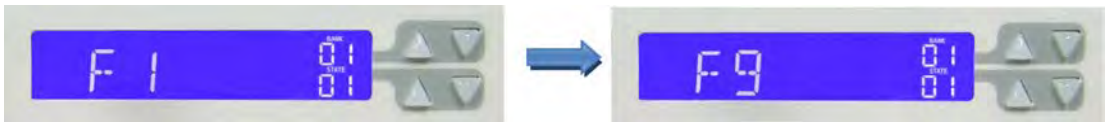


Figure 14: Auto Sequence Edit Mode Procedure Flow Chart

3.6.6 AUTO-SEQUENCE – TEST MODE

To execute an existing auto-sequence, proceed as follows:

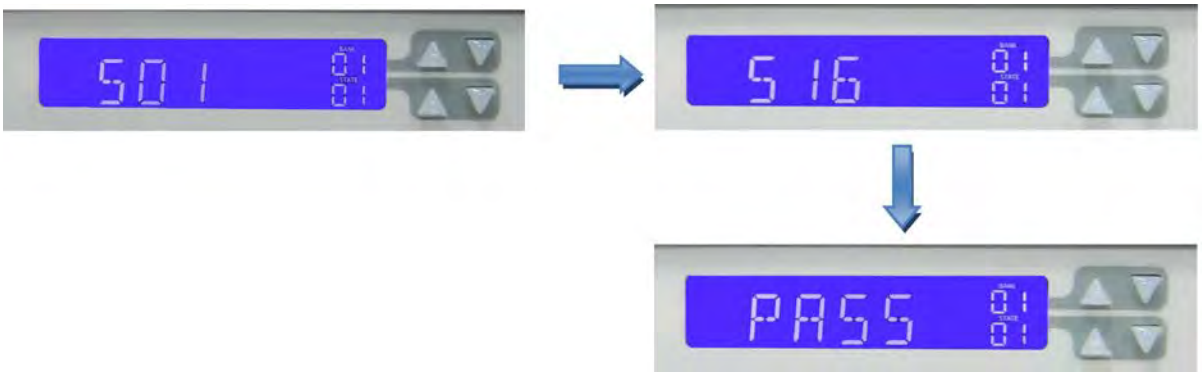
1- Pressing the TEST button will cause the TEST switch to illuminate and the LCD to show the last selected Auto-sequence number (F1 to F9).The numbered STATE buttons (1-9) are used to change the Auto-sequence number (F1 ~ F9). Once the desired auto-sequence has been selected press ENTER to start the test.



2- The LCD will display "SXX", where "XX" is the actual STEP being presently tested. If during a given test step the values measured are outside the preset limits (and the NG Function has been enabled) then the LCD will flash "NG" and the test is suspended.
3- The user can press the ENTER button to continue the remaining test steps. Alternatively, the EXIT button may be used to leave the test mode.
4- If all the test steps are OK, the LCD displays "PASS". If the unit under test fails any of the test steps the mainframe's LCD will show "FAIL".
5- If the buzzer is set to ON, the PASS result is also accompanied by a single buzzer call out. If the test shows FAIL the buzzer will sound twice.
6- When the test is completed, the user can press the ENTER key again to start the test again. Alternatively, the EXIT button may be used to leave the test mode.

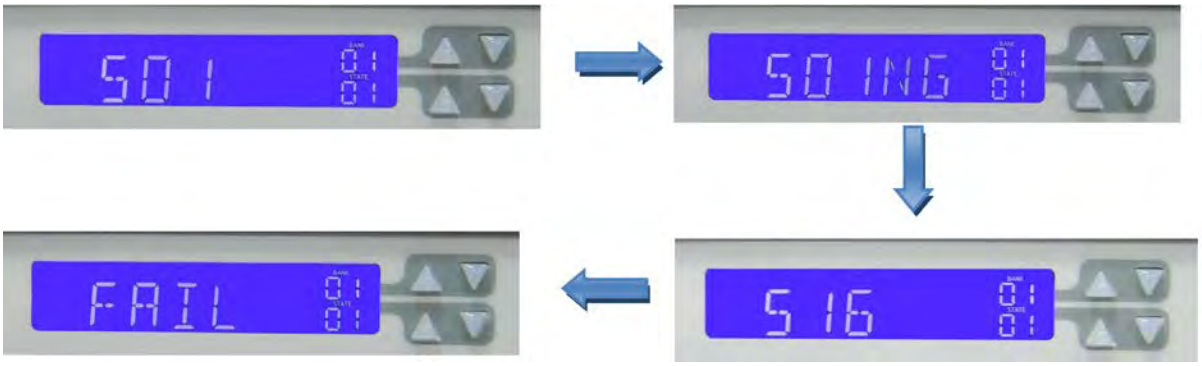
Example 1:

Once editing of the 16-step test is completed, press the TEST key. The unit will then automatically run through the test steps S01 to S16 in order. If all tests steps have been completed then the LCD will show PASS.

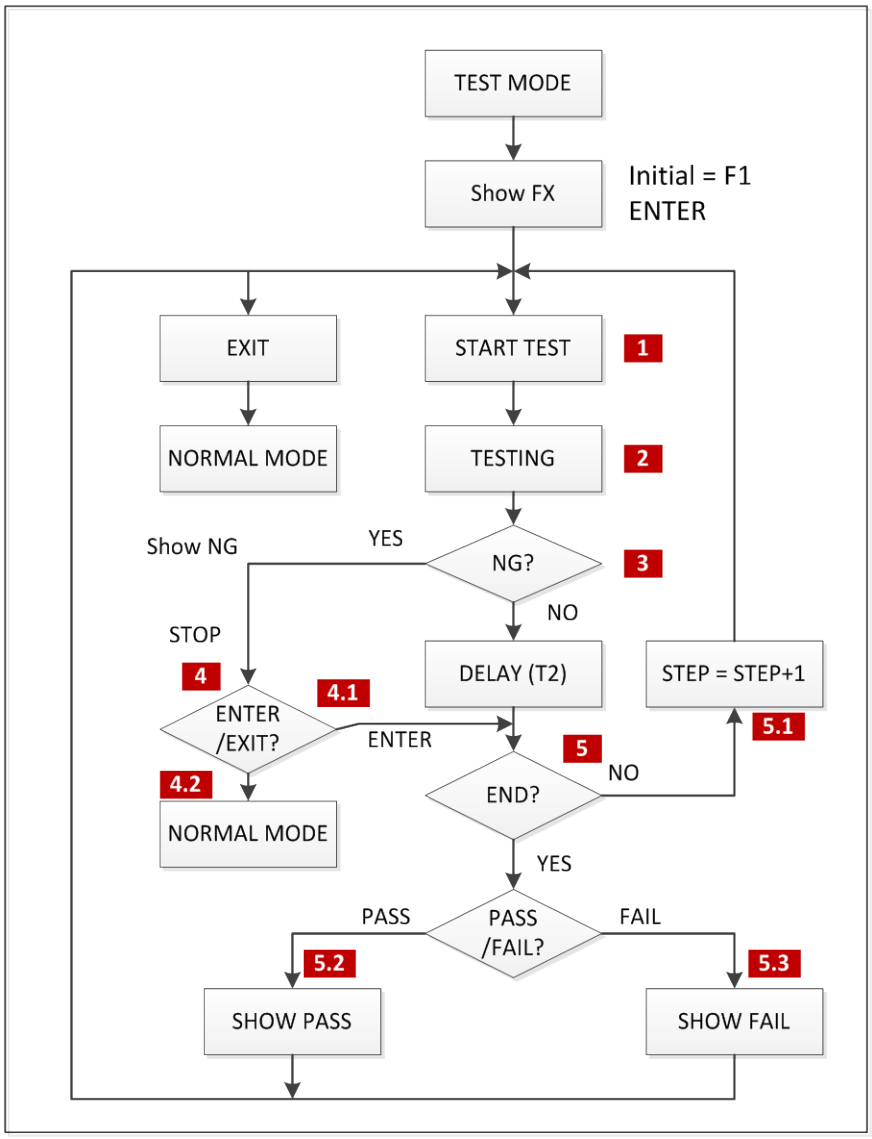


Example 2:

Once the edit mode has been used to set the 16-step auto-sequence, the user can press the TEST key. If the test fails at one of the test steps the LCD will flash "NG" and the test will stop. The user can then press ENTER key to continue the test or press the EXIT button to leave the test mode.



The Auto-sequence Test Process is illustrated in the flow chart shown below.



Process Steps:

1- Recall selected setup from F1-F9 memory
2- Check results against GO/NG criteria
3- Suspend Testing if results is NG
4- Wait for Operator Input
   4.1 If Operator pressed ENTER, continue test sequence
   4.2 If Operator pressed EXIT, abort test sequence and return to Normal Mode
5- If test is GO, is this the last step in the sequence?
   5.1 If no, then increment to next step and continue
   5.2 If yes, then if all test steps passed, show PASS
   5.3 If yes but at least one test step failed, show FAIL

4 Remote Control Programming

4.1 Overview

If your unit is fitted with a computer interface option then a GPIB, RS232, USB or LAN connector will be present on the rear panel based on the order configuration. The interface allows the load settings to be configured remotely and measurement data to be retrieved for analysis and test report generation.

There are two sets of programming commands for the 44M01. One is referred to as the SHORT FORM commands and the other set as the LONG FORM commands.

For Example

To enable the load the GPIB programming command syntax is：
“LOAD ON”

To turn the load off, send command “LOAD OFF”.

NOTE: When either the USB or LAN interface options is used to control the 44M01, it is important to send the "REMOTE" command to make sure the 44M01 is in REMOTE state.

4.2 RS232 Set-up

The RS232 interface of the 44M01 mainframe is configured up as follows:

Baud-rate:	9600~115200bps (selectable using the SYSTEM key)
Parity:	None
Data bit:	8 bits
Stop bit:	1 bit
Handshaking:	Hardware (RTS/CTS).

The RS232 Interface connector DB9 pin-out of the 44M01 is shown in Figure 15.

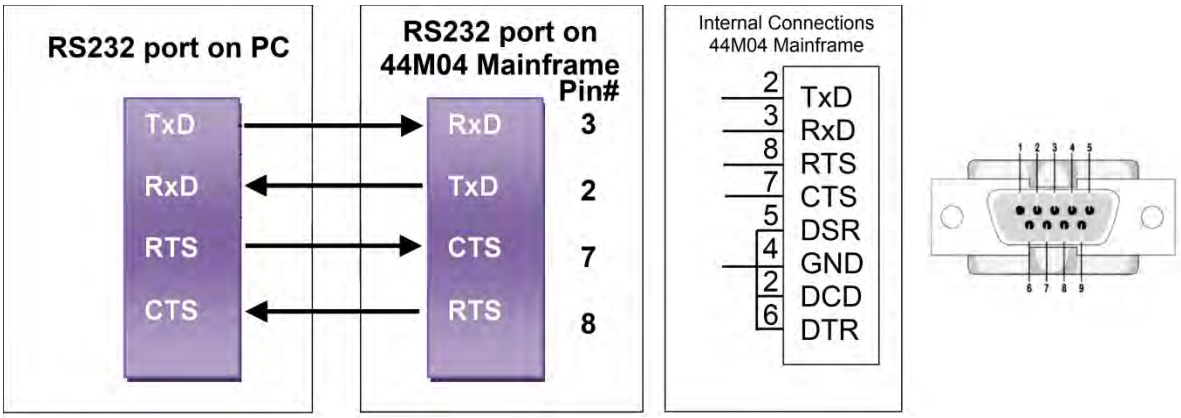


Figure 15: RS232 Connection to PC and DB9 Pin out

PIN	Abbreviation	Description
Pin1	CD	Carrier Detect
Pin2	RXD	Receive
Pin3	TXD	Transmit
Pin4	DTR	Data Terminal Ready
Pin5	GND	Ground
Pin6	DSR	Data Set Ready
Pin7	RTS	Request To Send
Pin8	CTS	Clear To Send
Pin9	RI	Ring Indicator

4.3 Programming Syntax

A variety of syntax notations are used in the description of the remote control commands and in the summary tables. The syntax used is defined as follows:

- SP Space, the ASCII code is 20 Hexadecimal.
- ; Semicolon, Program line terminator, the ASCII code is 0A Hexadecimal.
- NL New line, Program line terminator, the ASCII code is 0A Hexadecimal.
- NR2 Numeric value with decimal point. Values can be accepted in the range and format of ###.#####. For example: 30.12345. In this instance, the load will read up to five significant digits after the decimal point. The decimal point can be omitted if not required.

4.3.1 Parenthesis

The following parenthesis are used in the command descriptions to indicate whether a command is necessary or optional and whether a choice has to be made. The symbols { },[ ], | or ? are not actually used in the programming commands. The symbols { }, [ ] and | are merely used to illustrate the command syntax.

{ } - Required: The contents of the { } symbol must be used as part of the command, it cannot be omitted.

[ ] - Optional: The contents of the [ ] symbol indicates that the command is optional. The use of the contents depends on the test application.

| - Required Choice: This symbol means a choice must be made between the stated command key words. For example, “LOW|HIGH” Means a LOW or HIGH choice needs to be made as part of the command.

? - Required Choice: Where a question mark is present, it indicates that a choice needs to be made. This may be entering a numerical value that needs to be set.

4.3.2 Terminators

All remote control commands sent to the 44M01 interface must be terminated with a command terminator. The command terminator characters accepted by the 44M01 mainframe are listed in Table 5.

Terminator	Hex Code	Decimal	C Code	Notes
LF	0x0A	10	\n	
LF+ EOI	0x0A	10	\n	GPIB only
CR+LF	0x0D + 0x0A	13 + 10	\r\n	
CR+LF+EOI	0x0D + 0x0A	13 + 10	\r\n	GPIB only

Table 5: Supported Command Terminators

Semicolon ";" The semicolon character allows you to combine multiple commands in one message string to create a command sequence. The commands will be parsed in the order in which they are received.

4.4 Short Form Command Syntax

The setting and query commands for the 4xL and 4xD Series of load modules when operated within the 44M01 mainframe are listed in the summary tables below. Short form commands use an abbreviated syntax, which reduces the amount of characters required for each command and thus increases throughput.

SETTING PRESET NUMERIC COMMANDS	MODEL				REMARK
	41Lxx	42Lxx	41Dxx	42Dxx	
RISE{SP} {NR2} {;| NL}	V	V	V		A/us (41L0630,41L0660,41L2512)
					mA/us (41L5012,41L0615,42L,41D)
FALL{SP}{;| NL}	V	V	V		A/us (41L0630,41L0660,41L2512)
					mA/us (41L5012,41L0615,42L,41D)
PERD:{HIGH|LOW} {SP} {NR2} {;| NL}	V	V	V		
LDONV{SP} {NR2} {;| NL}	V	V	V	V	
LDOFFV{SP} {NR2} {;| NL}	V	V	V	V	
CC|CURR:{HIGH|LOW} {SP} {NR2}{;| NL}	V	V	V		
CC|CURR{SP} {NR2}{;| NL}				V	
CP:{HIGH|LOW} {SP} {NR2}{;| NL}	V	V	V		
CR|RES:{HIGH|LOW} {SP} {NR2}{;| NL}	V	V	V		
CR|RES{SP} {NR2}{;| NL}				V	
CV|VOLT:{HIGH|LOW} {SP} {NR2}{;| NL}	V	V	V		
CV|VOLT{SP} {NR2}{;| NL}				V	
TCONFIG {SP} {NORMAL|OCP | OPP | SHORT }{;|NL}	V	V	V	V	42D5003 NOT OPP
OCP:START {SP} {NR2}{;|NL}	V	V	V	V	
OCP:STEP {SP} {NR2}{;|NL}	V	V	V	V	
OCP:STOP {SP} {NR2}{;|NL}	V	V	V	V	
VTH {SP} {NR2}{;|NL}	V	V	V	V	
OPP:START {SP} {NR2}{;|NL}	V	V	V	-	
OPP:STEP {SP} {NR2}{;|NL}	V	V	V	-	
OPP:STOP {SP} {NR2}{;|NL}	V	V	V	-	
STIME {SP} {NR2}{;|NL}	V	V	V	V-	
MPPT {SP}{ON|OFF}{;| NL}	V				ON: Starts MPP Recording
MPPTIME {SP} n{;| NL}	V				SET MPP recording interval, n=1000~60000 msec
VO{SP} {NR2} {;| NL}			V	V	
VD{SP} {NR2} {;| NL}			V	V	
RD{SP} {NR2} {;| NL}			V	V	
RR{SP} {OFF| NR2} {;| NL}			V	-	
FREQ {NR1} ; {;| NL}			V	V	10-1000=10-1000Hz
					0=DC
DIM:LEV {NR2}{;| NL}			V	V	DIM LEVEL,0-10V

SETTING PRESET NUMERIC COMMANDS	MODEL				REMARK
	41Lxx	42Lxx	41Dxx	42Dxx	
DUTY {NR1}{;|NL}			V	V	0.01-0.99=1-99% DUTY CYCLE
DIM {OFF|ON}{;|NL}			V	V	0：OFF 1：ON

Table 6: Short Form – Setting Commands

QUERY PRESET NUMERIC COMMANDS	MODEL				RETURN FORMAT
	41Lxx	42Lxx	41Dxx	42Dxx	
RISE{?} {;|NL}	V	V	V		###.####
FALL{?} {;|NL}	V	V	V		###.####
PERD:{HIGH|LOW}{?} {;|NL}	V	V	V		###.####
LDONV {?}{;|NL}	V	V	V	V	###.####
LDOFFV {?}{;|NL}	V	V	V	V	###.####
CC|CURR:{HIGH|LOW} {?} {;|NL}	V	V	V		###.####
CC|CURR: {?} {;|NL}				V	###.####
CP:{HIGH|LOW} {?} {;|NL}	V	V	V		###.####
CR|RES:{HIGH|LOW} {?} {;|NL}	V	V	V		###.####
CR|RES: {?} {;|NL}				V	###.####
CV|VOLT:{HIGH|LOW} {?} {;|NL}	V	V	V		###.####
CV|VOLT:{?} {;|NL}				V	###.####
TCONFIG {?}{;|NL}	V	V	V		1:NORMAL
					2:OCP
				V	3:OPP
					4:SHORT, 42D5003 NOT OPP
OCP: START {?} {;|NL}	V	V	V	V	###.####
OCP: STEP {?}{;|NL}	V	V	V	V	###.####
OCP: STOP {?}{;|NL}	V	V	V	V	###.####
VTH {?}{;|NL}	V	V	V	V	###.####
OPP: START {?} {;|NL}	V	V	V		###.####
OPP: STEP {?}{;|NL}	V	V	V		###.####
OPP: STOP {?}{;|NL}	V	V	V		###.####
STIME {?}{;|NL}	V	V	V		###.####
OCP {?}{;|NL}	V	V	V	V	###.####
OPP {?}{;|NL}	V	V	V		###.####
MPP {?}{;|NL}	V				READ MPP DATA "V/I/P" OR "END"(*9)
MPPTIME? {;|NL}	V				(*9)
VO {?}{;|NL}			V	V	###.####

QUERY PRESET NUMERIC COMMANDS	MODEL 41Lxx	42Lxx	41Dxx	42Dxx	RETURN FORMAT
VD {?}{;|NL}			V	V	###.####
RD {?}{;|NL}			V	V	###.####
RR {?}{;|NL}			V		OFF or ###.####
FREQ {?}{;|NL}			V	V	
DIM: LEV {?}{;|NL}			V	V	##.##
DUTY {?}{;|NL}			V	V	##
DIM {?}{;|NL}			V	V	0：OFF 1：ON
BW {?} {;|NL}			V	V	0:LO 1:HI
AVG {?} {;|NL}			V	V	
LEDNO {?} {;|NL}			V	V	

Table 7: Short Form – Query Commands

LIMIT COMMANDS	MODEL 41Lxx	42Lxx	41Dxx	42Dxx	RETURN
IH|IL{SP}{NR2}{;|NL}	V	V	V	V	
IH|IL {?}{;|NL}	V	V	V	V	
WH|WL{SP}{NR2}{;|NL}	V	V	V	V	
WH|WL {?}{;|NL}	V	V	V	V	###.####
VH|VL{SP}{NR2}{;|NL}	V	V	V	V	
VH|VL {?}{;|NL}	V	V	V	V	###.####
SVH|SVL{SP}{NR2}{;|NL}	V	V	V	V	
SVH|SVL {?}{;|NL}	V	V	V	V	###.####

Table 8: Short Form – Limit Commands

TEST COMMANDS	MODEL 41Lxx	42Lxx	41Dxx	42Dxx	REMARK
LOAD {SP}{ON|OFF|1|0} {; | NL}	V	V	V	V	
LOAD {?} {; | NL}	V	V	V	V	0：OFF 1：ON
MODE {SP} {CC|CR|CV|CP} {; | NL}	V	V	V		
MODE {SP} {CC|CR|CV} {; | NL}	V	V	V	V	
MODE {SP} { LED} {; | NL}			V	V	
MODE {?} {; | NL}	V	V	V	V	0：CC 1：CR
					2：CV 3：CP
					4 : LED
					NOTE:41L & 42L
					NOT LED MODE

TEST COMMANDS	MODEL 41Lxx	42Lxx	41Dxx	42Dxx	REMARK
					NOTE:42D5003 NOT CP MODE
SHOR {SP} {ON|OFF|1|0} ; | NL}	V	V	V	V	
SHOR {?} {; | NL}	V	V	V	V	0：OFF 1：ON
PRES {SP} {ON|OFF|1|0} ; | NL}	V	V	V	V	
PRES {?} {; | NL}	V	V	V	V	0：OFF 1：ON
SENS {SP} {ON|AUTO|1|0} {; | NL}	V	V			
SENS {SP} {ON|OFF } {; | NL}			V	V	
SENS {?} {; | NL}	V	V	V	V	0：OFF/AUTO 1：ON 41D/42D Not AUTO
LEV {SP} { LOW|HIGH|0|1} {; | NL}	V	V			
LEV {?} {; | NL}	V	V	V		0：LOW
					1：HIGH
DYN{SP} {ON|OFF|1|0} {; | NL}	V	V	V		
DYN{?} {; | NL}	V	V	V		0：OFF 1：ON
CLR{; | NL}	V	V	V	V	
ERR {?}{; | NL}	V	V	V	V	
NG {?}{; | NL}	V	V	V	V	0：GO 1：NG
PROT {?}{; | NL}	V	V	V	V	
CCR{SP}{AUTO|R2}{; | NL}	V	V	V	V	
NGENABLE{SP}{ON|OFF}{; | NL}	V	V	V	V	
POLAR{SP}{POS|NEG}{; | NL}	V	V	V	V	
START{; | NL}	V	V	V	V	
STOP{; | NL}	V	V	V	V	
TESTING {?} {; | NL}	V	V	V	V	0：TEST END, 1：TESTING

Table 9: Short Form – Test Commands

SYSTEM COMMANDS	NOTES	RETURN FORMAT
CHAN {SP} {1|2|3|4}[A | B] {; | NL}	"A | B " for 42L and 42D	
CHAN {?}{ : | NL}	"A | B "for 42L and 42D	{1|2|3|4} [A | B]
RECALL {SP} {m [,n] }{; | NL}	m=1~10 n=1~15	
	m:STATE , n:BANK	
STORE {SP} {m [,n] }{; | NL}	m=1~10 n=1~15	
	m:STATE , n:BANK	
REMOTE {; | NL}	RS232/USB/LAN only command	

SYSTEM COMMANDS	NOTES	RETURN FORMAT
LOCAL{; | NL}	RS232/USB/LAN only command	
NAME {?} {; | NL}		"XXXXX"
*RST {; | NL}		
SYNC：LOAD {SP} {ON|OFF} {; | NL}		

Table 10: Short Form – System Commands, All Modules

MEASUREMENT QUERY COMMANDS	MODEL				RETURN
	41Lxx	42Lxx	41Dxx	42Dxx	
MEAS:CURR {?}{; | NL}	V	V	V	V	###.####
MEAS:VOLT {?}{; | NL}	V	V	V	V	###.####
MEAS:POW {?}{; | NL}	V	V	V	V	###.####
MEAS:VC {?}{; | NL}	V	V	V	V	###.####,###.####

Table 11: Short Form – Measurement Query Commands

GLOBAL COMMANDS	MODEL				RETURN
	41Lxx	42Lxx	41Dxx	42Dxx	
GLOB:PRES{SP}{ON | OFF | 1 | 0}{; | NL}	V		V		
GLOB:LOAD{SP}{ON | OFF | 1 | 0}{; | NL}	V	V	V	V	
GLOB:MODE{SP}{CC | CR | CV | CP}{; | NL}	V	V	V		(*9)
GLOB:MODE{SP}{CC | CR | CV | CP | LED}{; | NL}			V		(*9)
GLOB:MODE{SP}{CC | CR | CV | LED}{; | NL}			V	V	(*9)
GLOB:SHOR{SP}{ ON | OFF | 1 | 0}{; | NL}	V		V	V	(*9)
GLOB:DYN{SP}{ON | OFF | 1 | 0}{; | NL}	V	V	V		(*9)
GLOB:LEV{SP}{HIGH | LOW | 1 | 0}{; | NL}	V	V	V		(*9)
GLOB:ANG{SP}{ LOW | HIGH | 1 | 2}{; | NL}	V	V	V	V	(*9)
GLOB:MEAS：CURR{?}{; | NL}	V	V	V	V	###.##
GLOB:MEAS：VOLT{?}{; | NL}	V	V	V	V	###.##

Table 12: Short Form – Global Commands

AUTO SEQUENCE COMMANDS	NOTES	RETURN
FILE {SP} {n}{; | NL}	n=1~9	1~9
STEP {SP} {n} {; | NL}	n=1~16	1~16
TOTSTEP {SP} {n}{; | NL}	Total step n=1~16	1~16
SB {SP} {m,n} {; | NL}	m=1~10 n=1~15 m:STATE , n:BANK	
T1 {SP} {NR2} {; | NL}	0.1~9.9(s)	0.1~9.9(sec)

AUTO SEQUENCE COMMANDS	NOTES	RETURN
T2 {SP} {NR2} {; | NL}	0.1~9.9(s)	0.1~9.9(sec)
SAVE {; | NL}	Save "File n" data	
REPEAT {SP} {n} {; | NL}	n=0~9999	0~9999
RUN {SP} {F} {n} {; | NL}	n=1~9	AUTO REPLY
		"PASS" or "FAIL:XX"
		(XX=NG STEP)

Table 13: Short Form – Auto Sequence Commands

4.4.1 Notations and Conventions Used in programming commands:

1. Frequency engineering unit: Hz
2. GLOB: GLOBAL (all channels active at the same time).
3. Current engineering unit: A
4. Voltage engineering unit: V
5. Resistance engineering unit: Ω
6. Time Period engineering unit: ms
7. Slew-rate engineering unit: A/us or mA/us
8. Power engineering unit: W
9. *9 MPPT and CR DYN function supported from FW version as follows:
    a) 44M01 at r2.15 version and higher enabled.
    b) 41L0630 at r1.11 version and higher enabled.
    c) 41L0660 at r1.11 version and higher enabled.
    d) 41L2512 at r1.11 version and higher enabled.
    e) 41L5012 at r1.11 version and higher enabled.
    f) 41L0615 at r1.11 version and higher enabled.

4.5 Long Form Command Syntax

The setting and query commands for the 4xL and 4xD Series of load modules when operated within the 44M01 mainframe are listed in the tables below. Long form commands use extended command key words for easier code readability.

SETTING COMMAND SUMMARY	MODEL				REMARK
	41Lxx	42Lxx	41Dxx	42Dxx	
[PRESet:] RISE{SP} {NR2} {; | NL}	V	V	V		A/us (41L0630,41L0660,41L2512)
					mA/us (41L5012,41L0615,42L,41D)
[PRESet:] FALL{SP}{; | NL}	V	V	V		A/us (41L0630,41L0660,41L2512)
					mA/us (41L5012,41L0615,42L,41D)
[PRESet:] PERI|PERD:HIGH|LOW {SP} {NR2} {; | NL}	V	V	V	V	
[PRESet:] LDONv{SP} {NR2} {; | NL}	V	V	V	V	
[PRESet:] LDOFfv{SP} {NR2} {; | NL}	V	V	V	V	
[PRESet:] CC|CURR: {HIGH|LOW} {SP} {NR2}{; | NL}	V	V	V		
[PRESet:] CC|CURR{SP} {NR2}{; | NL}				V	
[PRESet:] CP:{HIGH|LOW} {SP} {NR2}{; | NL}	V	V	V		
[PRESet:] CR|RES: {HIGH|LOW} {SP} {NR2}{; | NL}	V	V	V		
[PRESet:] CR|RES{SP} {NR2}{; | NL}				V	
[PRESet:] CV|VOLT：{HIGH|LOW} {SP} {NR2}{; | NL}	V	V	V		
[PRESet:] CV|VOLT{SP} {NR2}{; | NL}				V	
[PRESet:]TCONFIG {SP} {NORMAL|OCP | OPP|SHORT}{;| NL}	V	V	V	V	42D5003 NOT OPP
[PRESet:] OCP:START {SP} {NR2}{;| NL}	V	V	V	V	
[PRESet:] OCP:STEP {SP} {NR2}{;| NL}	V	V	V	V	
[PRESet:] OCP:STOP {SP} {NR2}{;| NL}	V	V	V	V	
[PRESet:] VTH {SP} {NR2}{;|NL}	V	V	V	V	
[PRESet:] OPP:START {SP} {NR2}{;| NL}	V	V	V		
[PRESet:] OPP:STEP {SP} {NR2}{;| NL}	V	V	V		
[PRESet:] OPP:STOP {SP} {NR2}{;| NL}	V	V	V		
[PRESet:] STIME {SP} {NR2}{;| NL}	V	V	V	V	
[PRESet:] MPPT{SP}{ON|OFF} {; | NL}	V				ON: Starts MPP Recording

SETTING COMMAND SUMMARY	MODEL				REMARK
	41Lxx	42Lxx	41Dxx	42Dxx	
[PRESet:] MPPTIME{SP}n{; | NL}	V				SET MPP recording interval, n=1000~60000 msec
[PRESet:] VO{SP} {NR2} {; | NL}			V	V	
[PRESet:] VD{SP} {NR2} {; | NL}			V	V	
[PRESet:] RD{SP} {NR2} {; | NL}			V	V	
[PRESet:] RR{SP} {OFF|NR2} {; | NL}			V		
[PRESet:]FREQ {NR1} {; | NL}			V	V	10-1000=10-1000Hz
					0=DC
[PRESet:]DIM:LEV {NR2}			V	V	DIM LEVEL,0-10V
[PRESet:]DUTY {NR1}{; | NL}			V	V	0.01~0.99=1~99% DUTY CYCLE
[PRESet:]BW{SP} {LO|HI} {; | NL}			V	V	
[PRESet:]AVG{SP}{n}{; | NL}			V	V	n=1/2/4/8/16/32/64
[PRESet:]LEDNO{SP}{n}{; | NL}			V	V	n=1-99 ,SET LED NUMBER

Table 14: Long Form – Setting Commands

QUERY COMMAND SUMMARY	MODEL				RETURN FORMAT
	41Lxx	42Lxx	41Dxx	42Dxx	
[PRESet:] RISE{?} {; | NL}	V	V	V		###.####
[PRESet:] FALL{?}{; | NL}	V	V	V		###.####
[PRESet:] PERI| PERD：{HIGH|LOW}{?} {; | NL}	V	V	V		###.####
[PRESet:] LDONv {?}{; | NL}	V	V	V	V	###.####
[PRESet:] LDOFfv {?}{; | NL}	V	V	V	V	###.####
[PRESet:] CC|CURR：{HIGH|LOW} {?} {; | NL}	V	V	V		###.####
[PRESet:] CC|CURR {?} {; | NL}				V	###.####
[PRESet:] CP：{HIGH|LOW} {?} {; | NL}	V	V	V		###.####
[PRESet:] CR|RES：{HIGH|LOW} {?} {; | NL}	V	V	V		###.####
[PRESet:] CR|RES{?} {; | NL}				V	
[PRESet:] CV|VOLT：{HIGH|LOW} {?} {; | NL}	V	V	V		###.####
[PRESet:] CV|VOLT{?} {; | NL}				V	
[PRESet:] TCONFIG {?}{; | NL}	V	V	V	V	1:NORMAL
					2:OCP
					3:OPP

QUERY COMMAND SUMMARY	MODEL 41Lxx	42Lxx	41Dxx	42Dxx	RETURN FORMAT
					4:SHORT 42D5003 Not OPP
[PRESet:] OCP: START {?} {;|NL}	V	V	V	V	###.####
[PRESet:] OCP: STEP {?}{;|NL}	V	V	V	V	###.####
[PRESet:] OCP: STOP {?}{;|NL}	V	V	V	V	###.####
[PRESet:] VTH {?}{;|NL}	V	V	V	V	###.####
[PRESet:] OPP: START {?} {;|NL}	V	V	V		###.####
[PRESet:] OPP: STEP {?}{;|NL}	V	V	V		###.####
[PRESet:] OPP: STOP {?}{;|NL}	V	V	V		###.####
[PRESet:] STIME {?}{;|NL}	V	V	V	V	###.####
[PRESet:] MPP {?}{ ; | NL}	V				READ MPP DATA "V/I/P" OR "END"(*9)
[PRESet:] MPPTIME? { ; | NL}	V				(*9)
[PRESet:] VO {?}{;|NL}			V	V	###.####
[PRESet:] VD {?}{;|NL}			V	V	###.####
[PRESet:] RD {?}{;|NL}			V	V	###.####
[PRESet:] RR {?}{;|NL}			V		OFF or ###.####
[PRESet:] FREQ {?}{;|NL}			V	V	
[PRESet:] DIM: LEV {?}{;|NL}					##.##
[PRESet:] DUTY {?}{;|NL}					##
[PRESet:] DIM {?}{;|NL}					0 : OFF 1 : ON
[PRESet:] BW {?} {; | NL}					0:LO 1:HI
[PRESet:] AVG {?} {; | NL}					
[PRESet:] LEDNO {?} {; | NL}					

Table 15: Long Form – Query Commands

LIMIT COMMAND	MODEL				RETURN
	41Lxx	42Lxx	41Dxx	42Dxx	
LIMit:CURRent：{HIGH|LOW}{SP}{NR2}{; | NL}	V	V	V	V	
LIMit:CURRent：{HIGH|LOW }{?}{; | NL}	V	V	V	V	###.####
IH|IL{SP}{NR2}{; | NL}	V	V	V	V	
IH|IL {?}{; | NL}	V	V	V	V	
LIMit:POWer：{HIGH|LOW}{SP}{NR2}{; | NL}	V	V	V	V	
LIMit:POWer：{HIGH|LOW }{?}{; | NL}	V	V	V	V	###.####
WH|WL{SP}{NR2}{; | NL}	V	V	V	V	
WH|WL {?}{; | NL}	V	V	V	V	###.####
LIMit:VOLTage：{HIGH|LOW}{SP}{NR2}{; | NL}	V	V	V	V	
LIMit:VOLTage：{HIGH|LOW }{?}{; | NL}	V	V	V	V	###.####
VH|VL{SP}{NR2}{; | NL}	V	V	V	V	
VH|VL {?}{; | NL}	V	V	V	V	###.####
SVH|SVL{SP}{NR2}{; | NL}	V	V	V	V	
SVH|SVL {?}{; | NL}	V	V	V	V	###.####

Table 16: Long Form – Limit Commands

TEST COMMAND	MODEL				REMARK
	41Lxx	42Lxx	41Dxx	42Dxx	
[STATe:] LOAD {SP}{ON|OFF} {; | NL}	V	V	V	V	
[STATe:] LOAD {?} {; | NL}	V	V	V	V	0：OFF 1：ON
[STATe:] MODE {SP} {CC|CR|CV|CP} {; | NL}	V	V	V		
[STATe:] MODE {SP} {CC | CR | CV | } {; | NL}	V	V	V	V	
[STATe:] MODE {LED} {; | NL}			V	V	
[STATe:] MODE {?} {; | NL}	V	V	V	V	0 | 1 | 2 | 3 | 4 CC | CR | CV | CP | LED 42D5003 not CP Mode
[STATe:] SHORt {SP} {ON|OFF} {; | NL}	V	V	V	V	
[STATe:] SHORt {?} {; | NL}	V	V	V	V	0：OFF 1：ON
[STATe:] PRESet {SP} {ON|OFF} {; | NL}	V	V	V	V	
[STATe:] PRESet {?} {; | NL}	V	V	V	V	0：OFF 1：ON

TEST COMMAND	MODEL 41Lxx	42Lxx	41Dxx	42Dxx	REMARK
[STATe:] SENSe {SP} {ON|AUTO } {; | NL}	V	V			
[STATe:] SENSe {SP} {ON|OFF } {; | NL}			V	V	
[STATe:] SENSe {?} {; | NL}	V	V	V	V	0：OFF/AUTO 1：ON 41D/42D Not AUTO
[STATe:] LEVEl {SP} { LOW|HIGH} {; | NL}	V	V	V		
[STATe:] LEVEl {?} {; | NL}	V	V	V		0：LOW 1：HIGH
[STATe:] LEV{SP} {LOW |HIGH} {; | NL}	V	V	V		
[STATe:] LEV {?} {; | NL}	V	V	V		0：LOW 1：HIGH
[STATe:] DYNamic {SP} {ON|OFF} {; | NL}	V	V	V		
[STATe:] DYNamic {?} {; | NL}	V	V	V		0：OFF 1：ON
[STATe:] CLR{; | NL}	V	V	V		
[STATe:] ERRor {?}{; | NL}	V	V	V	V	
[STATe:] NO {SP} GOOD {?}{; | NL}	V	V	V	V	0：GO 1：NG
[STATe:] NG {?}{; | NL}	V	V	V	V	0：GO 1：NG
[STATe:] PROTect {?}{; | NL}	V	V	V	V	
[STATe:] CCR{SP}{AUTO|R2}{; | NL}（NOTE 1）	V	V	V	V	
[STATe:] NGENABLE{SP}{ON|OFF}{; | NL}	V	V	V	V	
[STATe:]POLAR{SP}{POS|NEG}{; | NL}	V	V	V	V	
[STATe:]START{; | NL}	V	V	V	V	
[STATe:]STOP{; | NL}	V	V	V	V	
[STATe:] TESTING {?}{; | NL}	V	V	V	V	0: TEST END, 1: TESTING

Table 17: Long Form – Test Commands

COMMAND	NOTE	RETURNS
[SYStem:] CHANnel {SP} {1 | 2 | 3 | 4}[A | B] {; | NL}	A | B " for 42L and 42D5003	
[SYStem:] CHANnel {?}{; | NL}	A | B " for 42L and 42D5003	{1 | 2 | 3 | 4} [A | B]
[SYStem:] RECall {SP} {m [,n] }{; | NL}	m=1~10 n=1~15	
[SYStem:] STORe {SP} {m [,n] }{; | NL}	m=1~10 n=1~15	
[SYStem:] REMOTE {; | NL}	RS232/USB/LAN command	
[SYStem:] LOCAL{; | NL}	RS232/USB/LAN command	
[SYStem:] NAME {?} {; | NL}		"XXXXX"
[SYStem:]*RST {; | NL}		
[SYStem:]SYNC:LOAD {SP} {ON|OFF} {; | NL}		

Table 18: Long Form – System Commands

MEASUREMENT QUERY COMMANDS	MODEL				RETURN
	41Lxx	42Lxx	41Dxx	42Dxx	
MEASure:CURRent {?}{; | NL}	V	V	V	V	###.####
MEASure:VOLTage {?}{; | NL}	V	V	V	V	###.####
MEASure:POWer {?}{; | NL}	V	V	V	V	###.####
MEASure:VC {?}{; | NL}	V	V	V	V	###.####,###.####

Table 19: Long Form– Measurement Query Commands

GLOBAL COMMANDS	MODEL				RETURN
	41Lxx	42Lxx	41Dxx	42Dxx	
GLOBe:[STATe:] PRESet {SP} {ON | OFF | 1 | 0} {; | NL}	V		V		
GLOBe:[STATe:] LOAD {SP} {ON | OFF | 1 | 0} {; | NL}	V	V	V	V	
GLOBe:[STATe:] MODE {SP} {CC | CR | CV | CP} {; | NL}	V	V	V		(*9)
GLOBe:[STATe:] MODE {SP}{CC | CR | CV | CP | LED} {; | NL}			V		(*9)
GLOBe:[STATe:] MODE {SP}{CC | CR | CV | LED} {; | NL}			V	V	(*9)
GLOBe:[STATe:] SHORt {SP} { ON | OFF | 1 | 0} {; | NL}	V		V	V	(*9)
GLOBe:[STATe:] DYNamic {SP} {ON | OFF | 1 | 0} {; | NL}	V	V	V		(*9)
GLOBe:[STATe:] LEVel {SP} {HIGH | LOW | 1 | 0} {; | NL}	V	V	V		(*9)
GLOBe:[STATe:] RANGe {SP} { LOW | HIGH | 1 | 2} {; | NL}	V	V	V	V	(*9)
GLOBe:MEASure：CURRent {?} ; | NL}	V	V	V	V	###.##
GLOBe:MEASure：VOLTage {?} {; | NL}	V	V	V	V	###.##

Table 20: Long Form – Global Commands.

AUTO SEQUENCE COMMANDS	NOTES	RETURN
FILE {SP} {n}{; | NL}	n=1~9	1~9
STEP {SP} {n} {; | NL}	n=1~16	1~16
TOTSTEP {SP} {n}{; | NL}	Total step n=1~16	1~16
SB {SP} {m,n} {; | NL}	m=1~10 n=1~15	
	m:STATE , n:BANK	
T1 {SP} {NR2} {; | NL}	0.1~9.9(s)	0.1~9.9(sec)
T2 {SP} {NR2} {; | NL}	0.1~9.9(s)	0.1~9.9(sec)
SAVE {; | NL}	Save "File n" data	
REPEAT {SP} {n} {; | NL}	n=0~9999	0~9999
RUN {SP} {F} {n} {; | NL}	n=1~9	AUTO REPLY
		"PASS" or "FAIL:XX"
		(XX=NG STEP)

Table 21: Long Form – Auto Sequence Commands

4.5.1 Notations and Conventions Used in programming commands:

10. Frequency engineering unit: Hz
11. GLOB: GLOBAL (all channels active at the same time).
12. Current engineering unit: A
13. Voltage engineering unit: V
14. Resistance engineering unit: Ω
15. Time Period engineering unit: ms
16. Slew-rate engineering unit: A/us or mA/us
17. Power engineering unit: W
18. *9 MPPT and CR DYN function supported from FW version as follows:
    g) 44M01 at r2.15 version and higher enabled.
    h) 41L0630 at r1.11 version and higher enabled.
    i) 41L0660 at r1.11 version and higher enabled.
    j) 41L2512 at r1.11 version and higher enabled.
    k) 41L5012 at r1.11 version and higher enabled.
    l) 41L0615 at r1.11 version and higher enabled.

4.6 Remote Control Command Descriptions

The remote control syntax of all available commands is described in the following sections. Supported commands are grouped in the following categories:

Command Category	Description
SETTING	Setting commands are used to program operating modes, sink values and built in test modes like SHORT, OPP and OCP. This category also contains specific commands that apply to the 41D/42D LED Load modules.
LIMIT	Limit commands may be used to set expected upper and lower operating limits as they apply to a unit under test. These limit settings are used in conjunction with Go/No-go testing to indicate the load is sinking outside expected parameters.
STATE	State commands are used to query or clear status information from a load module to determine its operating condition.
SYSTEM	System commands enable querying of load module model number and configuration data, RS232 control on/off. They also support storing and saving load set-ups in non-volatile memory of the 44M01 mainframe. (15 Banks / 10 States)
MEASUREMENTS	Allows querying load measurement data.

4.6.1 SETTING Commands

RISE

Command Syntax:
[PRESet:] RISE {SP} {NR2} {;|NL}
[PRESet:] RISE ? {;|NL}
Purpose:
Set and read the RISE SLEW-RATE
Description:
1. The definition of the RISE SLEW-RATE is the rate of current change from a LOW level to a HIGH level when operating in dynamic mode. The settings of RISE and FALL are completely independent.
2. The RISE command must include a number value otherwise, the command will not be valid.
3. The least significant number is the fourth digit after the decimal point.
4. Should a value be entered that is higher than what is possible then the 44M01 will automatically set its maximum value according the load module fitted.
5. The engineering unit is A/us for load modules 41L0630, 41L0660& 41L2512. The engineering unit is mA/us for load modules 41L5012, 41L0615, 41D & 42D.

FALL

Command Syntax:
[PRESet:] FALL {SP} {; | NL}
[PRESet:] FALL? {;|NL}
Purpose:
Set and read the FALL SLEW-RATE
Description:
1. The definition of the FALL SLEW-RATE is the rate of current change from a HIGH level to a LOW level when operating in dynamic mode. The settings of RISE and FALL are completely independent.
2. Should a value be entered that is higher than what is possible then the 44M01 will automatically set its maximum value according the load module fitted.
3. The engineering unit is A/us for load modules 41L0630, 41L0660& 41L2512. The engineering unit is mA/us for load modules 41L5012, 41L0615, 41D & 42D.

PERI or PERD

Command Syntax:
[PRESet:] PERI|PERD: HIGH|LOW {SP} {NR2} {;|NL}
[PRESet:] PERI|PERD: HIGH|LOW ? {; |NL}
Purpose:
Set and read the combined TLOW and THIGH of a DYNAMIC waveform
Description:

1. The time period combines TLOW (time low) and THIGH (time high) sections of a DYNAMIC waveform.
2. The value of TLOW and THIGH has to be included the number of the decimal point; otherwise the command will not be available.
3. The least significant number is the fifth after the decimal point.
4. Should a value be entered that is higher than what is possible then the 44M01 will automatically set its maximum value according the load module fitted.
5. The engineering unit is ms.

LDONv

Command Syntax:
[PRESet:] LDONv {SP} {NR2}{; | NL}
[PRESet:] LDONv?{; | NL}
Purpose:
Set and Read the voltage level at which the LOAD will switch ON.
Description:
This command is used to set or query the voltage value at which the LOAD will automatically switch ON. The engineering unit is V.

LDOFfv

Command Syntax:
[PRESet:] LDOFfv {SP} {NR2} {; | NL}
[PRESet:] LDOFfv?{; | NL}
Purpose:
Set and Read the voltage level at which the LOAD will switch OFF.
Description:
This command is used to set or query the voltage value at which the LOAD will automatically switch OFF. The engineering unit is V.

CURR : HIGH | LOW

Command Syntax:
[PRESet:] CC | CURR : HIGH | LOW{SP} { NR2}{; | NL}
[PRESet:] CC | CURR : HIGH | LOW? {; | NL}
Purpose:
Set or read the HIGH or LOW current levels in Amps.
Description:
This command is used to set or query the HIGH and LOW levels of load current allowed. These 2 current levels need to be used if a dynamic load waveform is used. It also allows the user to switch between two preset current levels.

1. The least significant number is the fifth digit after the decimal point.
2. The LOW level current value cannot be higher than the HIGH level.
3. Should a value be entered that is higher than what is possible then the 44M01 will automatically set the maximum value according the load module installed.
4. The engineering unit is A.

CURR

Command Syntax:
[PRESet:] CC | CURR {SP} {NR2}{: | NL}
[PRESet:] CC | CURR?{; | NL}
Purpose:
Set or read the load current.
Description:
This command is used to set or query the load current.
1. The least significant number is the fifth digit after the decimal point.
2. Should a value be entered that is higher than what is possible then the 44M01 will automatically set the maximum value according the load module installed.
3. The engineering unit is A.

CP: {HIGH | LOW}

Command Syntax:
[PRESet:] CP:{ HIGH | LOW} {SP} { NR2} {; | NL}
[PRESet:] CP:{ HIGH | LOW}? {; | NL}
Purpose:
Set and read the operating power value in Watts
Description:
This command is used to set or query the HIGH or LOW setting levels of load power. These 2 power levels need to be used should a dynamic load waveform be desired. It also allows the user to switch between two preset power levels.
1. The least significant number is the fifth digit after the decimal point.
2. The LOW level power value cannot be higher than the HIGH level.
3. Should a value be entered that is higher than what is possible then the 44M01 will automatically set its maximum value according the load module installed.
4. The engineering unit is W.

CR | RES:{HIGH | LOW}

Command Syntax:
[PRESet:] CR | RES:{HIGH | LOW} {SP} {NR2} {; | NL}
[PRESet:] CR | RES:{HIGH | LOW}? {; | NL}

Purpose:
Set and read the HIGH or LOW resistance levels.
Description:
This command is used to set or query the HIGH and LOW levels of load resistance. It allows the user to switch between two resistance levels.
1. The least significant number is the fifth digit after the decimal point.
2. The LOW level resistance value cannot be higher than the HIGH level.
3. Should a value be entered that is higher than what is possible then the 44M01 will automatically set its maximum value according the load module installed.
4. The engineering unit is Ω.

CR | RES

Command Syntax:
[PRESet:] CR | RES {SP} {NR2}{; | NL}
[PRESet:] CR | RES? {; | NL}
Purpose:
Set and read the resistance.
Description:
This command is used to set or query the load resistance.
1. The least significant number is the fifth digit after the decimal point.
2. Should a value be entered that is higher than what is possible then the 44M01 will automatically set its maximum value according the load module installed.
3. The engineering unit is Ω.

CV: {HIGH | LOW}

Command Syntax:
[PRESet:] CV: {HIGH | LOW} {SP} {NR2}{; | NL}
[PRESet:] CV: {HIGH | LOW}? {; | NL}
Purpose:
Set and Read the value of DC Load Voltage
Description:
This command is used to set or query the HIGH and LOW levels of load voltage. It allows the user to switch between two voltage levels.
1. The least significant number is the fifth digit after the decimal point.
2. The LOW level voltage value cannot be below the HIGH level.
3. Should a value be entered that is higher than what is possible then the 44M01 will automatically set its maximum value according the load module installed.
4. The engineering unit is V.

CV

Command Syntax:
[PRESet:] CV {SP} {NR2}{; | NL}
[PRESet:] CV? {; | NL}
Purpose:
Set and Read the value of DC Load Voltage
Description:
This command is used to set or query the load voltage.
1. The least significant number is the fifth digit after the decimal point.
2. Should a value be entered that is higher than what is possible then the 44M01 will automatically set its maximum value according the load module installed.
3. The engineering unit is V.

OCP: START

Command Syntax:
[PRESet:] OCP:START {SP} {NR2}{; | NL}
[PRESet:] OCP:START? {; | NL}
Purpose:
Set and read the initial value of OCP test
Description:
This command is used to set or query the required initial value (I-START) of the OCP test.

OCP: STEP

Command Syntax:
[PRESet:] OCP:STEP {SP} {NR2}{; | NL}
[PRESet:] OCP:STEP? {; | NL}
Purpose:
Set and read the increasing value of OCP test
Description:
This command is used to set or query the increment value (I-STEP) for the OCP test.

OCP:STOP

Command Syntax:
[PRESet:] OCP:STOP {SP} {NR2} {; | NL}
[PRESet:] OCP: STOP? {; | NL}
Purpose:
Set and read the maximum value of OCP Test
Description:

This command is used to set or query the maximum or end value (I-STOP) for the OCP test.

VTH

Command Syntax:
[PRESet:] VTH {SP}{NR2}{; | NL}
[PRESet:] VTH ? {; | NL}
Purpose:
Set and read the value of the Threshold Voltage
Description:
This command is used to set or query the minimum threshold voltage for the OCP/OPP tests. If the measured voltage is below the threshold voltage and the OCP/OPP test started, the test will not run and an error will be flagged.

OPP:START

Command Syntax:
[PRESet:] OPP:START {SP} {NR2} {; | NL}
[PRESet:] OPP:START? {; | NL}
Purpose:
Set and read the initial value of OPP Test
Description:
This command is used to set or query setting the initial value (P-START) of the OPP test.

OPP:STEP

Command Syntax:
[PRESet:] OPP:STEP {SP} {NR2} {; | NL}
[PRESet:] OPP:STEP? {; | NL}
Purpose:
Set and read the increasing value of OPP Test
Description:
This command is used to set or query the power increments, which the OPP test will follow between the P-START and P-STOP values.

OPP:STOP

Command Syntax:
[PRESet:] OPP:STOP {SP} {NR2} {; | NL}
[PRESet:] OPP:STOP ? {; | NL}
Purpose:

Set and read the maximum value of OPP Test

Description:

This command is used to set or query the maximum power value (P-STOP) of the OPP test.

TCONFIG

Command Syntax:

[PRESet:] TONFIG {NORMAL | OCP | OVP | OPP | SHORT} {; | NL}

[PRESet:] TONFIG ? {; | NL}

Purpose:

Set or query the function mode of Dynamic Test

Description:

There are five options for this command. Those are NORMAL mode, OCP Test, OVP Test, OPP Test and SHORT Mode Test.

STIME

Command Syntax:

[PRESet:] STIME {SP} {NR2}{; | NL}

[PRESet:] STIME? {; | NL}

Purpose:

Set and read time of the short-circuit test

Description:

This command is used to set the short-circuit test time. If the time is set to zero, there is no time limit. In other words, a continuous short circuit test will be implemented. If a non-zero value is entered, this is the short circuit duration test time in milliseconds (ms).

OCP

Command Syntax:

OCP? {; | NL}

Purpose:

Query the OCP test current.

Description:

This command is used to query the OCP current measured in the OCP test.

OPP

Command Syntax:

OPP? {; | NL}

Purpose:

Query the OPP test power level in watt.

Description:
This command is used to query the OPP power for the OPP test.

MPPT

Command Syntax:
[PRESet:] MPPT {SP} ON | OFF {; | NL}
Purpose:
MPPT (maximum power point tracking) test ON/OFF
Description:
This command sets the MPPT test mode to ON of OFF.

MPP

Command Syntax:
[PRESet :] MPP? {; | NL}
Purpose:
Query the MPP (maximum power point) data from: Voltmeter / Ammeter/ Power Meter.
Description:
MPP readback: Voltmeter / Ammeter/ Power Meter.

MPPTIME

Command Syntax:
[PRESet:] MPPTIME {SP} {n} {; | NL}
[PRESet:] MPPTIME? {; | NL}
Purpose:
Set or query the MPPTIME (maximum power point reading interval time).
Description:
This command sets or queries the MPPTIME (maximum power point reading interval time) Allowable range for n = 1000 to 60000 (ms).

Example:
Step 1: setting MPPTIME 5000ms (maximum power point, read once every 5 seconds).
Step 2: setting MPPT ON command.
Step 3: setting MPP? Command, Read: Voltmeter/Ammeter/ Power Meter.
Step 4: setting MPPT OFF command.

BW

Command Syntax:
[PRESet:] BW {SP} {LO | HI} {; | NL}

[PRESet:] BW {?} {; | NL}
Purpose:
Set and read the BW level to LO or HI.
Description:
The BW command allows the user to change the bandwidth of the 41D/42D series load when operating in LED mode. The BW Function can be used when in CC Mode, CV Mode or CR Mode Range I. The initial Value of the bandwidth is HI.
Please note that when operating in CR Mode Range II there is only one bandwidth.

AVG

Command Syntax:
[PRESet:] AVG {SP} {n} {; | NL}
[PRESet:] AVG {?} {; | NL}
Purpose:
Set or query the VI Measurement Averaging.
Description:
A number of voltage and current measurements can be averaged. This provides more stable readings in the presence of noise. The average function can be set in the range from 1 to 64. The default value is one.

LEDNO

Command Syntax:
[PRESet:] LEDNO {SP} {n} {; | NL}
[PRESet:] LEDNO {?} {; | NL}
Purpose:
Set or query the quantity of LEDs to simulate.
Description:
This command allows the user to enter or query the total number of LEDs the 41D/42D series is to simulate.

- For models 41D3002 and 41D5002 the LEDNO setting range is 1 to 90.
- For the 41D1020 model the LEDNO setting range is 1 to 30.
- For the 42D5003 model the LEDNO setting range is 1 to 90.

VO

Command Syntax:
[PRESet:]VO {SP} NR2 {; | NL}
[PRESet:]VO {?}{; | NL}
Purpose:
Set and read Vo Voltage in LED mode.

Description:
This command is used to set or query the output voltage VO for the 41D/42D series of LED simulators. The engineering unit is V.

VD

Command Syntax:
[PRESet:] VD {SP} NR2 {; | NL}
[PRESet:] VD {?} {; | NL}
Purpose:
Set or query the Vd Voltage in LED mode.
Description:
This command is used to set or query back the forward bias voltage (Vd) of the 41D/42D units when operating in LED mode. The engineering unit is V.

RD

Command Syntax:
[PRESet:] RD {SP} NR2 {; | NL}
[PRESet:] RD {?} {; | NL}
Purpose:
Set or query the Rd Impedance in LED mode.
Description:
This command is used to set and read the Impedance (Rd) value when the 41D/42D units are operated in LED mode. The engineering unit is Ω.

RR

Command Syntax:
[PRESet :] RR {SP} {OFF | NR2} {; | NL}
[PRESet :] RR {?} {; | NL}
Purpose:
Set or query the Rr Impedance in LED mode.
Description:
This command is used to set or query the Rr Impedance of 41D/42D when used to simulate LEDs. The Rr is used to simulate the high frequency impedance and high frequency ripple of an LED string. The engineering unit is Ω.

DIM LEV

Command Syntax:
[PRESet:] DIM:LEV {NR2} {; | NL}

[PRESet:] DIM:LEV {?} {; | NL}

Purpose:

Set or query the dimming control level.

Description:

This command is used to set or query the dimming control level for the 41D/42D series when used to simulate LEDs. The dimming range is 0-10V. The engineering unit is V.

FREQ

Command Syntax:

[PRESet :]FREQ {NR2} {; | NL}

[PRESet :] FREQ {?} {; | NL}

Purpose:

Set or query dimming frequency FREQ.

Description:

This command is used to set or query the frequency rate of the dimming control. A range of 10Hz to 1000Hz is possible. The engineering unit is Hz.

DIM

Command Syntax:

[PRESet:] DIM {OFF | ON} {; | NL}

[PRESet:] DIM {?} {; | NL}

Purpose:

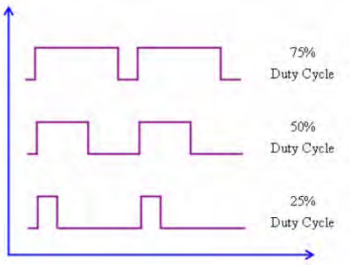
This command is set or query the dimming control state as ON or OFF.

Description:

This command is used to turn the dimming control function ON or OFF.

0 = OFF and 1 = ON.

DUTY



Command Syntax:

[PRESet:] DUTY {NR2} {; | NL}

[PRESet:] DUTY {?} {; | NL}}

Purpose:

Set or query the dimming DUTY cycle.

Description:

This command is for setting the duty cycle when the 41D/42D Series is used in LED mode. If the FREQ is set to DC then a duty cycle command will not be valid. The setting range for the duty cycle is 0.01 through 0.99. This corresponds to a duty cycle of 1% to 99% as illustrated in the diagram.

4.6.2 LIMIT Commands

LIMIT commands are used to set high and low operating limits that can be used in conjunction with the GO/NOGO (NG) function to signal that the load is sinking outside the expected parameters.

[LIMit:]CURRent:{HIGH | LOW} or IH | IL

Command Syntax:
[LIMit:]CURRent:{HIGH | LOW} {SP} { NR2 } {; | NL}
[LIMit:]CURRent:{HIGH | LOW}? {; | NL}
[IH | IL]{SP}{ NR2 } {; | NL}
[IH | IL]? {; | NL}
Purpose:
Set or query the HIGH / LOW load current limits when operating in CC or CR modes.
Description:
This command is used to set or query two current LIMIT values. Operation outside these LIMIT values will cause a No Good (NG) signal to be generated.
1. The LOW level cannot be higher than the HIGH level.
2. If the current taken by the load falls below the LOW limit then a No Good (NG) signal is available.
3. If the current rises above the HIGH limit then the NG signal is available.
4. If the current stays between HIGH and LOW LIMIT levels the NG signal will not be sent.

[LIMit:]POWer:{HIGH | LOW} or WH | WL

Command Syntax:
[LIMit:]POWer:{HIGH | LOW}{SP}{ NR2 }{; | NL}
[LIMit:]POWer:{HIGH | LOW}? {; | NL}
[WH | WL]{SP}{ NR2 } {; | NL}
[WH | WL]? {; | NL}
Purpose:
Set or query the HIGH / LOW load power limits when operating in CP or CR modes.
Description:
This command is used to set two power LIMIT values. Operation outside these LIMIT values will cause a NG signal to be generated.
1. The LOW level cannot be higher than the HIGH level.
2. If the power taken by the load falls below the LOW limit then a No Good (NG) signal is available.
3. If the power rises above the HIGH limit then the NG signal is available.
4. If the power stays between HIGH and LOW LIMIT levels the NG signal will not be sent.

[LIMit:]VOLtage:{HIGH | LOW} or VH | VL

Command Syntax:
[LIMit:]VOLtage:{HIGH | LOW} {SP} { NR2 }{; | NL}
[LIMit:]VOLtage:{ HIGH [illegible]}?
[VH | VL] {SP} { NR2 }{; | NL}
[VH | VL]? {; | NL}
Purpose:
Set or query the HIGH / LOW limits of voltage present at the load terminals.
Description:
This command is used to set two voltage LIMIT values. Operation outside these LIMIT values will cause a NG signal to be generated.
1. The LOW level cannot be higher than the HIGH level.
2. If the voltage at the load input falls below the LOW limit then a No Good (NG) signal is available.
3. If the voltage rises above the HIGH limit then the NG signal is available.
4. If the current stays between HIGH and LOW LIMIT levels, the NG signal will not be sent.

[LIMit :] SVH [illegible]SVL

Command Syntax:
[LIMit:] {SVH | SVL} {SP} {NR2}{; | NL}
[LIMit:] {SVH | SVL}? {; | NL}
Purpose:
Set or query the upper and lower voltage levels during for short test.
Description:
This command is used to set two voltage LIMIT values. If during the short test the voltage is outside these LIMIT values, a NG signal will be generated.
1. The LOW level cannot be higher than the HIGH level.
2. If the voltage at the load input falls below the LOW limit then a No Good (NG) signal is available.
3. If the voltage rises above the HIGH limit then the NG signal is given.
4. If the current stays between HIGH and LOW LIMIT levels, the NG signal will not be sent.

4.6.3 STATE Commands

STATE commands can be used to set or query the actual operating status of the electronic load at any time.

[STATe:] LOAD {SP} {ON | OFF}

Command Syntax:
[STATe:] LOAD {SP} {ON | OFF} {; | NL}
[STATe:] LOAD? {; | NL}
Purpose:
Read LOAD ON or OFF status.
Description:
This command is used to see if the Load is ON or OFF. 0 = Load OFF1, = Load ON.

[STATe:] MODE {SP} {CC | CR | CV | CP | LED}

Command Syntax:
[STATe:] MODE {SP} {CC | CR | CV | CP | LED} {; | NL}
[STATe:] MODE? {; | NL}
Purpose:
Set and read the operating mode of LOAD
Description:
The return value is 0 | 1 | 2 | 3 | 4 which corresponds to the operating mode that the load is in. i.e. CC | CR | CV | CP | LED.

Mode:	CC	CR	CV	CP	LED
Value:	(0)	(1)	(2)	(3)	(4)
41Lxxxx	V	V	V	V	
42Lxxx	V	V	V	V	
41Dxxx	V	V	V	V	V
42D5003	V	V	V		V

[STATe:] SHORt {SP} {ON | OFF}

Command Syntax:
[STATe:] SHORt {SP} {ON | OFF} {; | NL}
[STATe:] SHORt? {; | NL}
Purpose:
Reads back whether the short circuit test is active or not
Description:
0 = short circuit test active, 1 = short circuit test inactive

[STATe:] PRESet {SP} {ON |OFF}

Command Syntax:
[STATe:] PRESet {SP} {ON | OFF} {; | NL}
[STATe:] PRESet? {; | NL}
Purpose:
Reads back whether load is in preset mode.
Description:
This command is used to check if the load is in preset mode.
0 = Preset mode OFF, 1 = Preset mode ON

[STATe:] SENSe{SP} {ON | OFF | AUTO}

Command Syntax:
[STATe:] SENSe {SP}{ON | OFF | AUTO } {; | NL}
[STATe:] SENSe? {; | NL}
Purpose:
Reads back whether the sense function is ON or OFF.
Description:
0 = Sense OFF or Sense AUTO
1 = Sense ON

[STATe:] LEVel {SP} {HIGH | LOW} or LEV {SP} {HIGH | LOW}

Command Syntax:
[STATe:] LEVel {SP} {HIGH | LOW } {; | NL}
[STATe:] LEVel? {; | NL}
[STATe:] LEV {SP} {HIGH | LOW} {; | NL}
[STATe:] LEV? {; | NL}
Purpose:
Reads back whether the load is operating at its LOW or HIGH LEVEL.
Description:
In CC, CR, CV or CP operating modes the user can set two LEVELS of load current, resistance, voltage or power. The load will read back which level it is at:
0 = Load operating at low level
1 = Load operating at high level

[STATe:] DYNamic {SP} {ON | OFF}

Command Syntax:
[STATe:] DYNamic {SP} {ON | OFF} {; | NL}
[STATe:] DYNamic? {; | NL}
Purpose:

Reads back whether the load is operating in STATIC or DYNAMIC mode.

Description:

0 = Dynamic operation

1 = Static Operation

[STATe:] CLR

Command Syntax:

[STATe:] CLR {; | NL}

Purpose:

Clears the error flag.

Description:

This command is used for clearing the contents of the PROT and ERR registers. After execution, the contents of these two registers will be "0".

[STATe:] ERRor

Command Syntax:

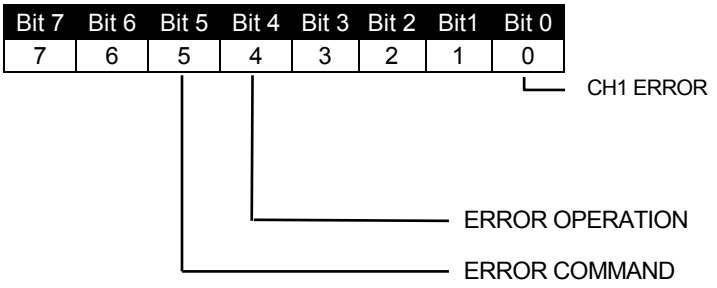
[STATe:] ERRor? {; | NL}

Purpose:

Query if there are any errors flagged in the module.

Description:

1. ERR? : Read the register of ERR status. Table 22 shows the corresponding number of ERR status.
2. Use command CLR to clear the register of ERR status to be"0"



BIT ID	BIT VALUE	REMARK
bit 0-3	0 = Off, 1 = Triggered	CH1 error
bit 4	0 = Off, 1 = Triggered	Operation error
bit 5	0 = Off, 1 = Triggered	Command error (e.g. syntax error)

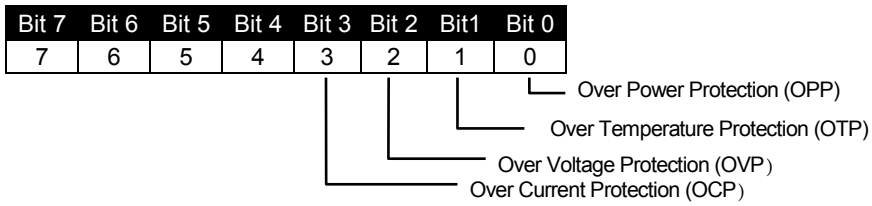
Table 22: Error Register

[STATe:] NG? {;|NL}

Command Syntax:
[STATe:] NG? {;|NL}
Purpose:
Query if the NG flag is displayed on this module.
Description:
This command queries the NG status. If the response is "0", the LED of NG (NO GOOD) will be off. If the response is "1", the LED will be lit, showing that the NG flag is present.

[STATe:] PROTect? {;|NL}

Command Syntax:
[STATe:] PROTect? {;|NL}
Purpose:
Query the state of the protection register on this module.
Description:
1. PROT? requests the status of the units protection register.
2. Use the command "CLR" to clear the register of PROT status to "0".



BIT ID	BIT VALUE	REMARK
bit 0	0 = Off, 1 = Triggered	Over Power Protection (OPP)
bit 1	0 = Off, 1 = Triggered	Over Temperature Protection (OTP)
bit 2	0 = Off, 1 = Triggered	Over Voltage Protection (OVP)
bit 3	0 = Off, 1 = Triggered	Over Current Protection (OCP)

Table 23: Protection Status Register

[STATe:] CCR {AUTO | R2}

Command Syntax:
[STATe:] CCR {AUTO | R2} {; | NL}
Purpose:
This command sets the CC MODE RANGE, forcing RANGE II operation if required.
Description:
Switches the unit between AUTO RANGE and RANGE II. AUTO RANGE will allow the unit to move to a more precise range at low currents, while forcing the unit to remain in RANGE II keeps the range consistent regardless of the current level.

[STATe:] POLAR {POS | NEG}

Command Syntax:
[STATe:] POLAR {POS | NEG} {; | NL}
Purpose:
Sets the polarity displayed by the voltage meter.
Description:
The voltage read-out can be set to POS for positive, and NEG for negative polarity display.

[STATe:] START

Command Syntax:
[STATe:]START {; | NL}
Purpose:
Set for Load to begin the test.
Description:
Begins the test, according to the TEST CONFIG (TCONFIG). The load module will start to test based on the items and parameters stored.

[STATe:] STOP

Command Syntax:
[STATe:]STOP {; | NL}
Purpose:
Stops a test, if one is in progress.

4.6.4 SYSTEM Commands

SYSTEM commands allow the user to read the part number of the load modules and turn RS232 control ON and OFF. Commands are also available for storing and retrieving load set-ups saved in the memory of the mainframe. The mainframe has 150 separate memory locations. This is comprised of 15 memory BANKS with each bank having 10 STATES.

	41Lxx	42Lxx	41Dxx	42Dxx
BANK (n)	15	15	15	15
STATE (m)	10	10	10	10
Total States / Mem. Locations	150	150	150	150

[SYStem:] RECall {SP} { m} [, n]

Command Syntax:
[SYStem:] RECall {SP} {m} [, n] {; | NL}
Purpose:
Recalls the load set-up, which has been previously saved in memory.
Description:
This command is for recalling the procedure stored in a specified memory location where:
m = STATE, 1 through 10
n = BANK, 1 through 15
If the memory STATE to be used is from the currently selected BANK as shown on the mainframe's display, then the BANK [n] can be omitted.
For example:
RECALL 2,15 Recalls the load set up saved in the 2nd STATE and 15th BANK of the memory.
REC 3 Recalls the load set up from the 3rd memory STATE from the current BANK as shown on the units front panel display.

[SYStem:] STORe {SP} {m}[, n]

Command Syntax:
[SYStem:] STORe {SP} {m} [, n] {; | NL}
Purpose:
Saves the Load's status to the unit's memory.
Description:
This command is for saving the current set up to a specified memory location where:
m = STATE, 1 through 10
n = BANK, 1 through 15
If the memory STATE to be saved to the currently selected BANK then the BANK [n] part of the command can be omitted.

For example:
STORE 2, 15 Saves the status of the load to the 2nd STATE of the 15th memory BANK.
STOR 3 Saves the load setup to the 3rd memory STATE of the current BANK as shown on the units front panel display.

[SYStem:] CHANnel {SP} {1 | 2 | 3 | 4} [A | B]

Command Syntax:
[SYStem:] CHANnel {SP} {1 | 2 | 3 | 4} [A | B] {; | NL}
[SYStem:] CHANnel? {: | NL}
Purpose:
Select the required load module or query what 44M01 module is selected.
Description:
Select the required load module.
For Example:
CHAN 3 Choose the 3rd load module.
CHAN 2B Choose the 2rd CHB load module (For 42Lxxxx).
CHAN 4A Choose the 4rd CHA load module (For 42Lxxxx).

[SYStem:] NAME?

Command Syntax:
[SYStem:] NAME? {; | NL}
Purpose:
Return the model number of selected load module.
Description:
This command is for reading the model number of the load. If no module is operating, the display will display "NULL". The model number length is limited to 5 characters. The model number will be returned as per Table 24.

APS-Model	Return Value	APS-Model	Return Value	APS-Model	Return Value
41L0630	L0630	**42L0860**	L0860	**41D3002**	D3002
41L0660	L0660	**42L0824**	L0824	**41D1020**	D1020
41L2512	L2512	**42L0803**	L0803	**41D5002**	D5002
41L5012	L5012			**41D5003**	D5003
41L0615	L0615				

Table 24: Load Module Name Return Values

[SYSTem:] *RST

Command Syntax:
[SYStem:] *RST {; | NL}
Purpose:
44M01 mainframe reset.
Description:
This command resets the 44M01 mainframe to its default state.

[SYStem:] REMOTE

Command Syntax:
[SYStem:] REMOTE {: | NL}
Purpose:
Command to enter REMOTE status (only for RS232, USB or LAN).
Description:
This command is for enabling control of the unit via RS232, USB or LAN.

[SYStem:] LOCAL

Command Syntax:
[SYStem:] LOCAL {; | NL}
Purpose:
Command to exit the REMOTE status (only for RS232)
Description:
This command closes the RS232 control interface.

SYNC:LOAD {SP} {ON | OFF}

Command Syntax:
SYNC:LOAD {SP} {ON | OFF} {; | NL}
Purpose:
Command to enable or disable all electronics loads in the mainframe at the same time.
Example: SYNC:LOAD ON
SYNC:LOAD OFF

4.6.5 MEASUREMENT Commands

Measurement commands allow measurement data for each module to be retrieved.

MEASure:CURRent?

Command Syntax:
MEASure:CURRent? {; | NL}
Purpose:
Measures the load current.
Description:
Reads the current meter data. The engineering unit is Ampere (A).

MEASure:VOLtage?

Command Syntax:
MEASure:VOLtage? {; | NL}
Purpose:
Measures the load voltage.
Description:
Reads the voltmeter data. The engineering unit is Voltage (V).

MEASure:POWer?

Command Syntax:
MEASure:POWer? {; | NL}
Purpose:
Reads the power being absorbed by the load.
Description:
Reads the power meter data. The engineering unit is Watt (W).

MEASure:VC?

Command Syntax:
MEASure:VC? {; | NL}
Purpose:
Reads the voltage and current being taken by the load.
Description:
Reads the voltage and current meter. Return data format:"###.####,###.####". The first value is the Voltage (V), the second value is the Current (A).

4.6.6 GLOBAL Commands

GLOBAL commands can be used to set control multiple load modules at the same time. This provides for synchronized operation between modules.

GLOBe:[STATe:] PRESet {SP} {ON|OFF|1|0} {; | NL}

Command Syntax:
GLOBe:[STATe:] PRESet {SP} {ON|OFF|1|0} {; | NL}

Purpose:
Turn all load modules preset mode on or off.
Description:
Turns PRESet mode on or off.

GLOBe:[STATe:] LOAD {SP} {ON|OFF|1|0} {; | NL}

GLOBe:[STATe:] MODE {SP}{CC|CR|CV|CP|LED} {; | NL}

Command Syntax:
GLOBe:[STATe:] MODE {SP}{CC|CR|CV|CP|LED} {; | NL}

Purpose:
Sets all load modules to selected mode.
Description:
Sets all load modules to CC, CR, CV, or LED mode.

GLOBe:[STATe:] DYNamic {SP} {ON|OFF|1|0} {; | NL}

Command Syntax:
GLOBe:[STATe:] DYNamic {SP} {ON|OFF|1|0} {; | NL}

Purpose:
Sets all load modules to dynamic current mode.
Description:
Enable or disable dynamic current mode on all load modules.

GLOBe:[STATe:] LEVel {SP} {HIGH|LOW|1|0} {; | NL}

Command Syntax:
GLOBe:[STATe:] LEVel {SP} {HIGH|LOW|1|0} {; | NL}

Purpose:
Sets all load modules to high or low level.
Description:
Set high or low level on all load modules.

GLOBe:[STATe:] RANGe {SP} { LOW|HIGH|1|2} {; | NL}

Command Syntax:
GLOBe:[STATe:] RANGe {SP} { LOW|HIGH|1|2} {; | NL}

Purpose:
Sets all load modules to high or low range.
Description:
Set high or low range on all load modules.

GLOBe:MEASure:CURRent {?} ; | NL}

Command Syntax:
GLOBe:MEASure:CURRent {?} ; | NL}

Purpose:
Query total current.

GLOBe:MEASure:VOLTage {?} {; | NL}

Command Syntax:
GLOBe:MEASure:VOLTage {?} {; | NL}

Purpose:
Query total voltage.

1.1.1 TBD - AUTO SEQUENCE Commands

GLOBAL commands can be used to set control multiple load modules at the same time. This provides for synchronized operation between modules.

4.7 IEEE488.2 Common Commands

The following IEEE488.2 common commands (a.k.a. star commands) are supported by the load.

4.7.1 *IDN?

Command Syntax:
*IDN? {; | NL}
Purpose: Returns the load Identity string.
Description: This command is similar to the MODEL command but returns the response in a SCPI format. The response contains several four fields separated by a comma.
Query response: Manufacturer, mainframe model, load module model number, mainframe firmware revision, load controller firmware revision.
Example: APS,44M01:41L0630,1.0,1.0

4.7.2 *RST

Command Syntax:
*RST {; | NL}
Purpose: The *RST command (reset) has the same effect as an IEEE-488 Device Clear bus command but can be used over the RS232C interface as well. This command resets the load to its power on default state.

5 System Calibration

5.1 Overview

Calibration requirements apply to individual load modules only, not the 44M01 mainframe. Refer to the relevant Load Module Operation Manual for specific calibration information.

6 Appendix A - USB Driver Installation

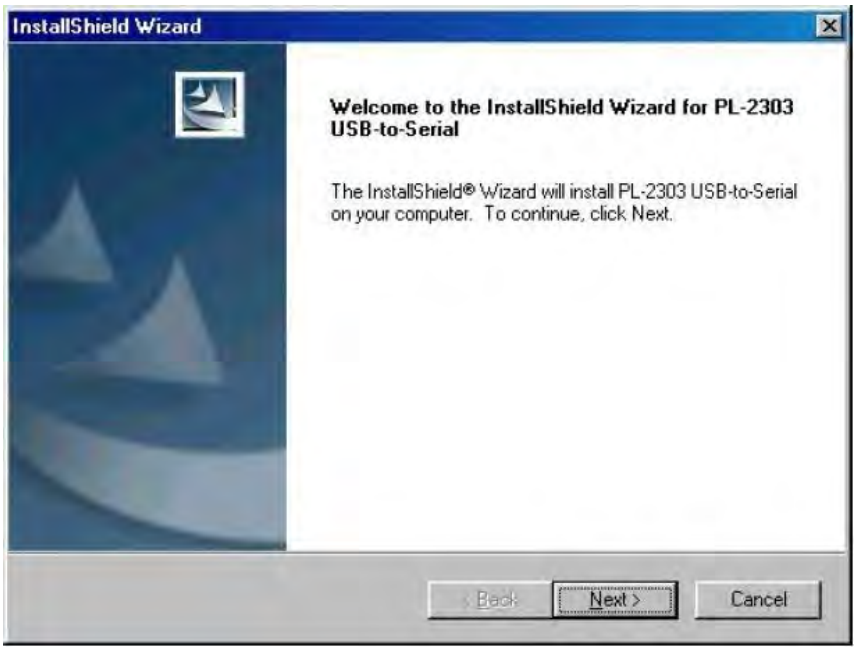
6.1 Overview

The 44M01 may be equipped with a USB interface. To communicate with this interface, a USB device driver is required on a Windows PC. This appendix describes the driver installation process for the PL-2303 USB to Serial Driver. Once installed, the USB port will appear as a COM port to the Windows Operating System.

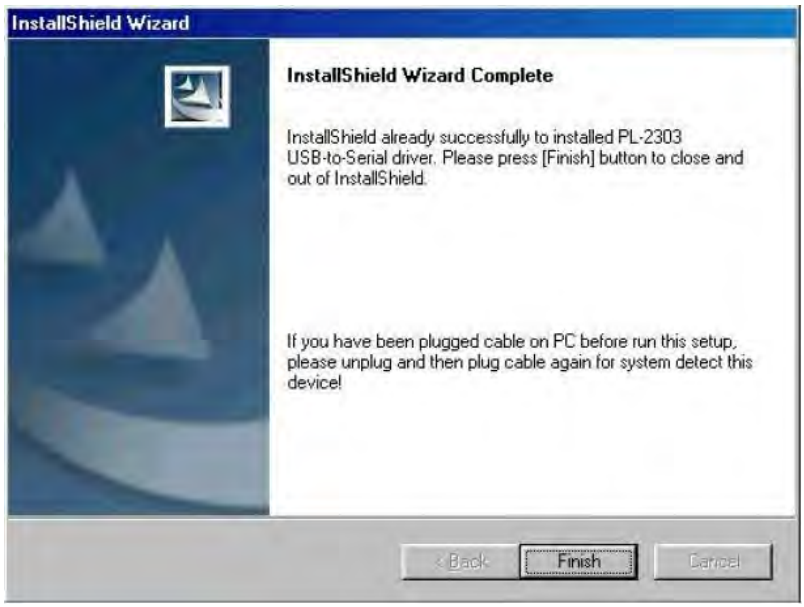
6.2 USB Driver Installation

To install the USB device driver, proceed as follows:

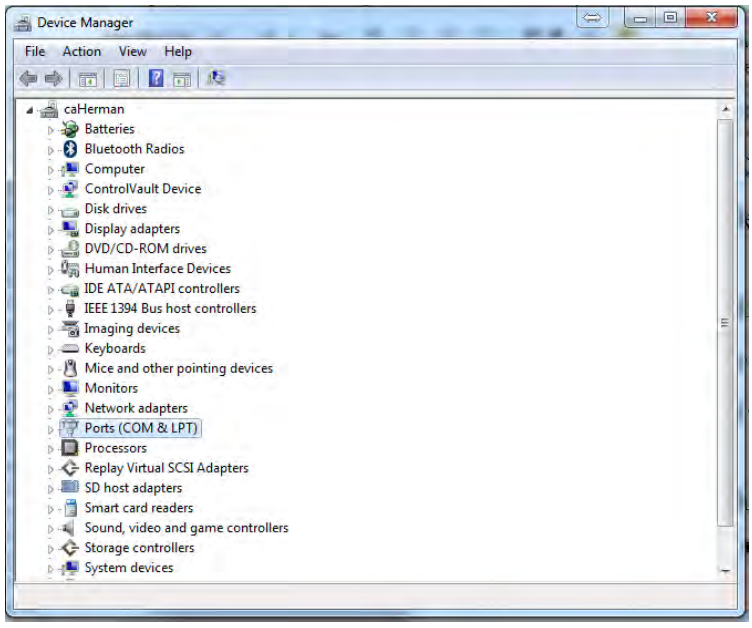
1. Insert the supplied CD ROM into a CD Rom drive.
2. If configured for auto-start, the driver installation program will launch. If not, run "USB\SETUP\PL-2303 Driver Installer.exe" from the CD Rom drive.
3. This will open the first installation wizard screen.



4. Follow the on-screen prompts.

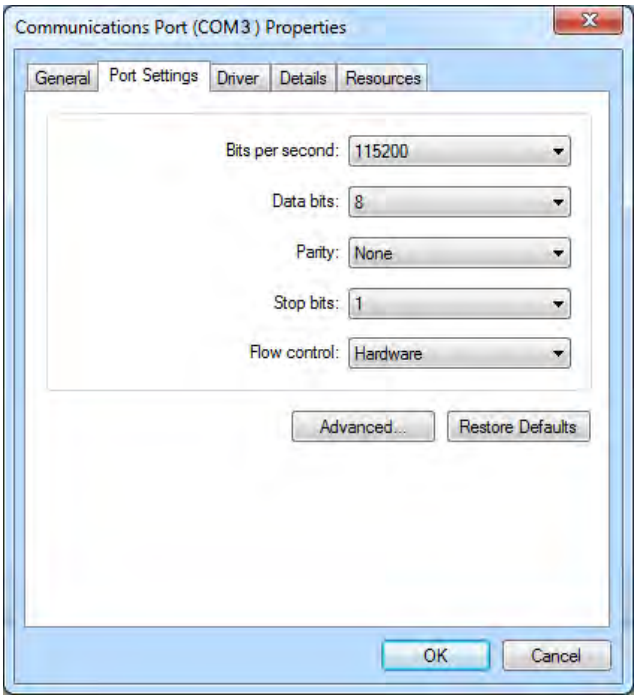


5. After the installation completes, open the Windows Control Panel from the Start menu and select "Device Manager".
6. In the Device Manger Listing, locate the "Ports (COM & LPT)" entry



7. One of the entries should show "USB to Serial Port (COMx) with x any value higher than 2.
8. Note the Com port number at which the USB device is located. Right click on this Com port and select "Properties".

9. In the Properties dialog box, select “Port Settings”.
10. Select the relevant COM port and set Bit per second (baud rate) to “115200” and Flow control “Hardware”



11. Connect the 44M01 mainframe to the PC using a suitable USB cable. (not supplied with the load).
12. You should now be able to communicate with the 44M01 mainframe through COMn.

.

7 Appendix B - LAN Driver Installation

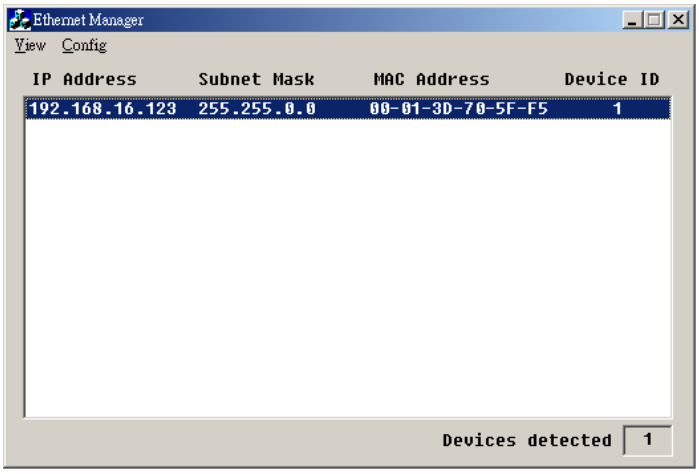
7.1 Overview

The 44M01 may be equipped with a LAN (Ethernet) interface. To communicate with this interface, an Ethernet Manager Utility program is supplied with the LAN interface. This appendix describes the use of this utility to establish a network connection with the 44M01 mainframe under Windows.

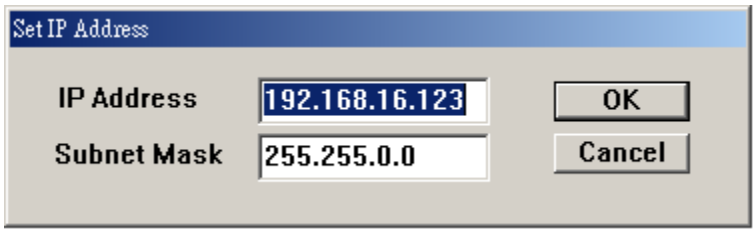
7.2 Introduction

To establish an Ethernet connection between a PC on your network and the 44M01 mainframe, proceed as follows:

1. Connect AC power and the network (LAN) CAT5 cable to the 44M01 mainframe.
2. Connect the other side of the network cable to an existing Ethernet network.
3. After inserting the driver CD-ROM, run LAN\ETM.EXE from the CD.
4. The Ethernet Manager screen will be displayed as shown below. If the Ethernet Manager window does not appear, press F5 to search again (refresh), and check the LAN connections if necessary.



5. The connected unit will appear on the list, click it to set the IP Address and Subnet Mask as shown in the figure below.



6. At this point, the Controller Setup page should be accessible, once everything is set correctly. This allows greater control over the communications interface.

Controller Setup	
IP Address	192.186.16.128
Subnet mask	255.255.255.0
Gateway address	0.0.0.0
Network link speed	Auto
DHCP client	Enable
Socket port of HTTP setup	80
Socket port of serial I/O	4001 TCP Server
Socket port of digital I/O	5001 TCP Server
Destination IP address / socket port (TCP client and UDP) Connection	0.0.0.0 0 Auto
TCP socket inactive timeout (minutes)	0
Serial I/O settings (baud rate, parity, data bits, stop bits)	115200 N 8 1
Interface of serial I/O	RS 232 (RTS/CTS)
Packet mode of serial input	Disable
Device ID	1
Report device ID when connected	Disable
Setup password	
UPDATE	

7. Insert the following into the controller set up screen:

IP Address: **as recommended according to your network**
Subnet Mask: **as recommended according to your network**
Gateway Address: **as recommended according to your network**
Network link speed: **Auto**
DHCP client: **Enable**
Socket port of HTTP setup: **80**
Socket port of serial I/O: **4001，TCP Server**
Socket port of digital I/O: **5001，TCP Server**
Destination IP address / socket port (TCP client and UDP) Connection: **Auto**
TCP socket inactive timeout(minutes)：**Set the network disconnection after N minutes, set 0 minutes will work forever.**
Serial I/O settings (baud rate, parity, data, bits, stop bits): **115200, N, 8, 1**

Interface of serial I/O: **RS 232 (RTS/CTS)**
Packet mode of serial input: **Disable**
Device ID : 5
Report device ID when connected：**Auto**
Setup password: Not required

8. If you experience difficulties establishing a connection, contact your network administrator for assistance. Network security setting may prevent you from connecting properly.

8 Appendix C - Auto Sequence Programming Examples

8.1 Overview

An auto-sequence allows the user to step through previously saved set-ups stored in the mainframe's memory. Up to nine auto-sequences can be saved. Each auto-sequence can consist of up to sixteen steps. There are two modes available for the auto-sequence function. These are **edit mode -** to set up an auto-sequence and **test mode -** to recall and start an auto-sequence execution.

8.2 Edit Mode

To set up a new auto-sequence using the Edit mode, proceed as follows:

1. Set-up all load parameters such as the operating mode, along with sink values and the LOAD ON/OFF status. Configuration and limit settings can also be set and the NG ON function may be selected as part of the setup.
2. Press the STORE key and one of the numbered STATE keys to store the set up in one of the memory locations. The BANK number can also be changed to provide additional memory locations.
3. Repeat the previous steps as needed to create additional load set-ups and saved them to separate memory locations using the STORE, BANK and STATE keys.
4. Once the required number of load setups has been saved enter the EDIT mode by pressing the EDIT key. The EDIT key will light up indicating the EDIT mode is active.
5. With the EDIT button lit, the auto-sequence identity (F1 to F9) can be selected using the numbered STATE keys.
6. Now select the first memory location by pressing the up/down arrow keys to select the BANK and STATE. This will become the first step of the AUTO-SEQUENCE.
7. Press ENTER to set the chosen BANK and STATE memory location.
8. Using the arrow keys set the test time (T1) and NG/LIMIT checking time (T2) for that step of the auto-sequence.
9. Press ENTER to save the time setting and move onto the next step of the auto-sequence.

10. Repeat steps 6 to 9 to as needed to enter up to 16 steps to form the auto-sequence
11. Once the desired number of steps have been set, press the STORE button.
12. The LCD will show REP (repetitions).
13. Use the arrow keys to set the number of auto-sequence repetitions.
14. Press STORE to confirm the sequence edit.

This completes the programming sequence.

8.3 Test Mode

To execute a previously stored auto-test sequence, proceed as follows:

1. Press the TEST key on the mainframe to enter the TEST mode.
2. Use the numbered STATE keys (1 to 9) to select the previously saved auto-sequence.
3. Press ENTER to start the auto-sequence.
4. The LCD shows “PASS” or “FAIL” after testing.
   If limits and the NG functions have been set and a test step fails, the mainframe LCD display will flash “NG”. The user must then press ENTER to continue the auto-sequence execution or EXIT to abort the auto-sequence.
5. Press Auto-sequence or EXIT at any time to abort an auto-test sequence.

8.4 AUTO TEST SEQUENCE Example

In this example, we will create a program based on following illustration of a varying current over time. A total of eight sequence steps will be needed to implement this sequence. The program executes steps 1 to 8 in sequence.

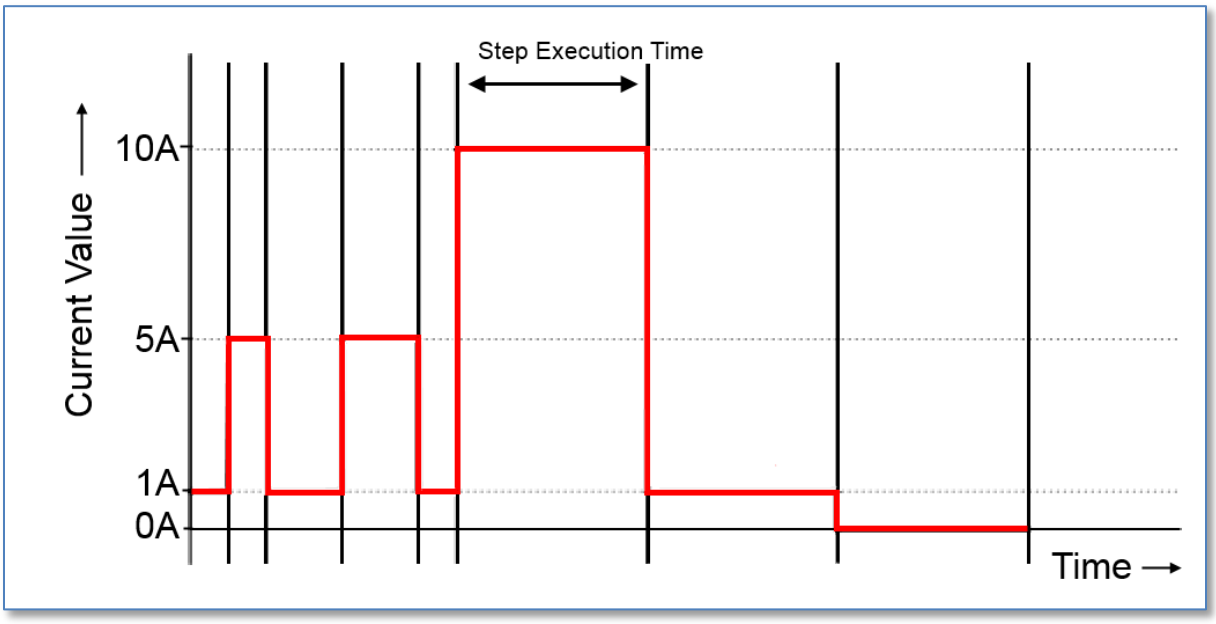


Figure 16: Auto-Test Sequence Example Illustration

The desired current levels and durations are shown in the table below.

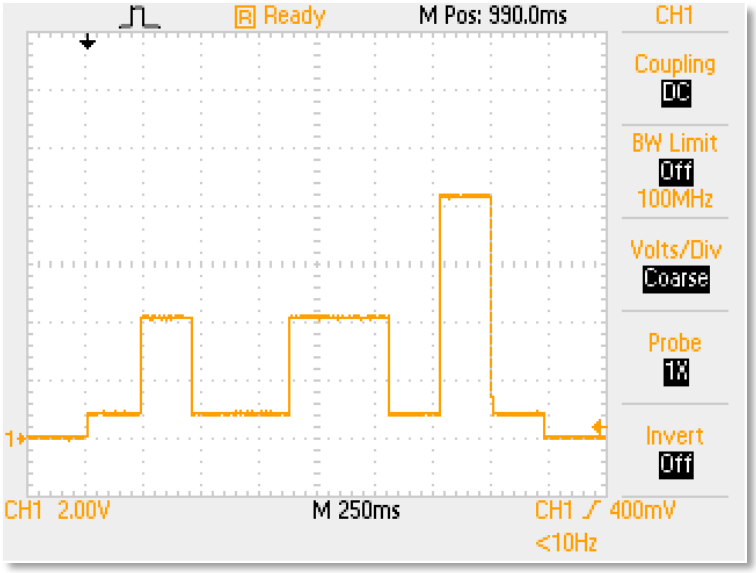
Auto-sequence Step number	Memory BANK	Memory STATE	Current Value	Execution Time (T1+T2)
1	3	1	1.0 Adc	200 ms
2	3	2	5.0 Adc	200 ms
3	3	3	1.0 Adc	400 ms
4	3	4	5.0 Adc	400 ms
5	3	5	1.0 Adc	200 ms
6	3	6	10.0 Adc	1000 ms
7	3	7	1.0 Adc	1000 ms
8	3	8	0.0 Adc	1000 ms

Table 25: Auto-Test Sequence Example Values

To program this sample sequence, proceed as follows:

1. Set the operation mode: Press the mode key to CC mode.
2. Set the range: Press RANGE key to force range 2.
3. Set LOAD ON/OFF Status: Press Load ON.
4. Set the current values steps 1-8 and store to memory BANK 3 STATES 1-8.
5. Press EDIT key of 3300F mainframe.
6. Press the number 2 key to select F2 as the auto sequence location.
7. Press up/down key to memory bank 3 and state 1.
8. Press ENTER key to confirm the sequence memory.
9. Press up/down key to set the test time for that step (T1+ T2).
10. Press ENTER key to confirm the sequence step.
11. Repeat steps 7 to 10 to set auto-sequence steps 1-8.
12. After setting final step press the STORE key.
13. Press up/down key to 1 to repeat the auto-sequence one time.
14. Press STORE key to confirm the number of repetitions.
15. Press TEST key to enter TEST mode.
16. Press number 2 to select auto-sequence F2.
17. Press ENTER to confirm selection and start TEST.
18. The load will now step through the auto-sequence.

The current test waveform can be checked on an oscilloscope as shown below - assuming that the DC Source can supply the programmed load currents.



9 Appendix D - Short Circuit, OPP and OCP Test Examples

9.1 Overview

This appendix provides examples on how to program the built-in test modes of the 4 Series loads. These tests allow commonly used functional testing of power supplies with minimal programming effort.

The parameters for the Short, Over Power Protection and Over Current Protection tests can all be programmed over the optional computer interfaces. The following examples may prove useful.

9.2 SHORT Test

To invoke short circuit testing of a unit under test, send the following sequence of commands to the load:

SHORT Test

This example sets a short test for 500ms until the STOP command is received.

REMOTE	Set Remote
TCONFIG SHORT	Set SHORT test function
STIME 500	Sets short time to 500ms time*
START	Start SHORT testing
TESTING?	Ask Testing? 1:Testing, 0:Testing End
STOP	Stop SHORT testing
	* if 500 is replaced with 0 the short test is continuous until STOP command

9.3 OPP Test

To invoke over power protection circuit testing of a unit under test, send the following sequence of commands to the load:

OPP Test

In this example, threshold limits are set and the NG signal is enabled.

REMOTE	Set Remote	
TCONFIG OPP	Set OCP test	
OPP:START 3	Set start load watt 3W	
OPP:STEP 1	Set step load watt 1W	
OPP:STOP 5	Set stop load watt 5W	
VTH 0.6	Set OPP VTH 0.6V	
WL 0	Set watt low limit 0W	
WH 5	Set watt high limit 5W	
NGENABLE ON	Set NG Enable ON	
START	Start OPP testing	
TESTING?	Ask Testing?	1:Testing, 0:Testing End
NG?	Ask PASS/FAIL? 0:PASS,1:FAIL	
OPP?	Ask OPP watt value	
STOP	Stop OPP testing	

9.4 OCP Test

To invoke over current protection circuit testing of a unit under test, send the following sequence of commands to the load:

OCP Test

This test will start sinking current at 3A and increase to 5A in 1A steps.

REMOTE	Set Remote
TCONFIG OCP	Set OCP test
OCP:START 3	Set start load current 3A
OCP:STEP 1	Set step load current 1A
OCP:STOP 5	Set stop load current 5A
VTH 0.6	Set OCP VTH 0.6V
IL 0	Set current low limit 0A
IH 5	Set current high limit 5A
NGENABLE ON	Set NG Enable ON
START	Start OCP testing
TESTING?	Ask Testing? 1:Testing, 0:Testing End
NG?	Ask PASS/FAIL?,0:PASS,1:FAIL
OCP?	Ask OCP current value
STOP	Stop OCP testing.

10 CE MARK Declaration of Conformity

Directive: 2004/108/EC

Product Name 4 Series DC Electronic Load Modules
Models 44M01 Mainframe, 44M02 Mainframe, 44M04 Mainframe
41L0630, 41L0660, 41L2512, 41L5012, 41L0615, 42L0860
42L0824, 42L0803, 41D3002, 41D1020, 41D5002, 42D5003

The manufacturer hereby declares that the products are in conformity with the following standards or other normative documents:

SAFETY:
Standard applied IEC 61010-1:2001

EMC:
Standard applied EN 61326-1:2006

Reference Basic Standards:
EMISSIONS: CISPR11: 2003+A1: 2004+A2: 2006
EN 61000-3-2: 2006
EN 61000-3-3: 2008

IMMUNITY: IEC 61000-4-2: 2008
IEC 61000-4-3: 2008
IEC 61000-4-4: 2004 +Corr.1: 2006 +Corr.2: 2007
IEC 61000-4-5: 2005
IEC 61000-4-6: 2003+A1: 2004+A2: 2006
IEC 61000-4-8: 2001
IEC 61000-4-11: 2004

Supplemental Information:

When and Where Issued: March 28, 2014
Irvine, California, USA

Authorized Signatory: Loc Tran
Quality Assurance Inspector
Adaptive Power Systems

Responsible Person: Joe Abranko
Adaptive Power Systems
17711 Fitch
Irvine, California, 92649, USA

CE **Mark of Compliance**

11 RoHS Material Content Declaration

The table below shows where these substances may be found in the supply chain of APS's products, as of the date of sale of the relevant product. Note that some of the component types listed above may or may not be a part of the enclosed product.

Part Name	Hazardous Substance					
	Pb	*Hg*	*Cd*	*Cr6+*	*PBB*	*PBDE*
PCB Assy's	**x**	**0**	**x**	**0**	**0**	**0**
Electrical Parts not on PCB Assy's	**x**	**0**	**x**	**0**	**0**	**0**
Metal Parts	**0**	**0**	**0**	**x**	**0**	**0**
Plastic Parts	**0**	**0**	**0**	**0**	**x**	**x**
Wiring	**x**	**0**	**0**	**0**	**0**	**0**
Packaging	**x**	**0**	**0**	**0**	**0**	**0**

Table 26: Material Declaration

Legend:

0 : Indicates that the concentration of the hazardous substance in all homogeneous materials in the parts is below the relevant RoHS threshold.

x : Indicates that the concentration of the hazardous substance of at least one of all homogeneous materials in the parts is above the relevant RoHS threshold.

Notes:

1. APS has not fully transitioned to lead-free solder assembly at this point in time. However, the vast majority of components used in production are RoHS compliant.
2. These APS products are labeled with an environmental-friendly usage period in years. The marked period is assumed under the operating environment specified in the product specifications.

Example of marking for a 10 year period: