Operation Manual

34M01 Mainframe – Rev 1.1 P/N 160921-10

34M01 Mainframe Programmable AC&DC Load

ADAPTIVE Power Systems

Worldwide Supplier of Power Equipment

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2 Front Matter

2.1 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.

2.2 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.

2.3 Safety Information

This chapter 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.

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SAFETY SYMBOLS

Direct current (DC)

Alternating current (AC)

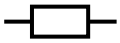
Both direct and alternating current

Three-phase alternating current

Protective Earth (ground) terminal

On (Supply)

Off (Supply)



Fuse

Caution: Refer to this manual before this Product.

Caution, risk of electric shock

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2.4 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 environments. 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.

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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.

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3 Product Overview

This chapter provides an overview of the APS 34M01 AC & DC load mainframe. It introduces the reader to general operating characteristics of the chassis that holds a single AC & DC load module.

3.1 General Description

The 34M01 electronic load mainframe is required to provide the AC/DC power conversion and optional computer communications to a single 3A Series load module. The 34M01 is designed to house one of the following models:

APS Model	Description	Max Power (VA)	Max Voltage (V)	Max Current (A)
3A060-20	AC&DC Electronic Load Module	300	60	20
3A150-08	AC&DC Electronic Load Module	300	150	8
3A300-04	AC&DC Electronic Load Module	300	300	4

Table 3-1: Supported AC & DC Load Module Part Numbers

3.2 Mainframe Features

The 34M01 mainframe provides a high performance, easy to operate and cost effective solution for AC or DC power source testing. The main features of the 34M01 electronic load mainframe are:

1. **Plug-in design:** Easy swapping of different model load modules.
2. **RS-232 Interface:** Provides an RS-232 interface for remote control.
3. **Analog Inputs:** BNC input on the rear panel is provided to allow external synchronization of load module to an external reference.
4. **GPIB interface:** GPIB control with set load status and read back meter capabilities. (34M01-01) mainframes only.

3.3 Accessories Included

The following accessories are included with each 34M01 mainframe DC Load. If one or more of these is missing upon incoming inspection of the product, please contact Adaptive Power Systems customer service.

Item	Quantity
Operation Manual in hardcopy or PDF Format on CD ROM	1
AC Line Cord	1

Table 3-2: Included Accessories

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3.4 Remote Control Interface Models

Following 34M01 mainframe versions can be ordered at time of original purchase.

Model	Interfaces
34M01	RS-232 Interface Option
34M01-01	RS-232 and GPIB Interface Options

Table 3-3: Available Remote Control Interfaces

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3.5 System Block Diagram

The figure below shows a functional block diagram of the 34M01 mainframe. The load module connects to a DC power bus and a fully isolated communication bus located on the chassis backplane.

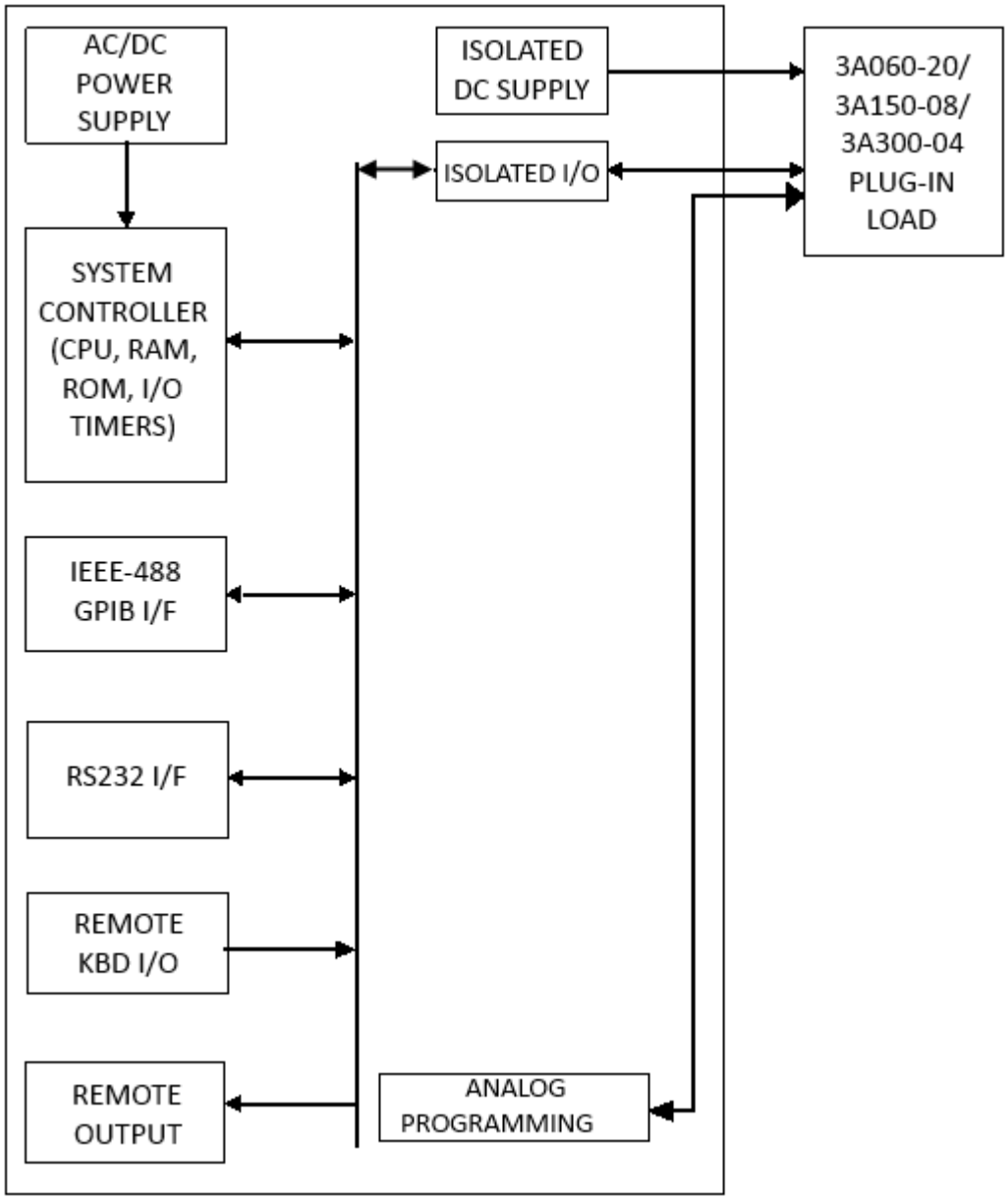

Figure 3-1: Functional Block Diagram

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4 Technical Specifications

Technical specifications shown here apply at an ambient temperature of 25° C ± 5°.

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 150 x 445 mm	7.0” x 5.9” x 17.5”
	Weight:	5.5 kg	12.2 lbs.
ENVIRONMENTAL	Installation Category	Cat I, Pollution Degree 2, Indoor use only	
	Cooling	Fan Cooled	
	Temperature Range	0 – 40°C	32 – 104°F
	Relative Humidity (max.)	80 % non-condensing	
	Altitude	2000 meters	6000 feet

Table 4-1: Mainframe Specifications

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5 Unpacking and Installation

5.1 Inspection

The 34M01 mainframe is carefully inspected before shipment. If instrument damage has occurred during transport, please inform Adaptive Power Systems' nearest sales and service office or representative.

Your mainframe was shipped with a power cord for the type of outlet used at your location. If the appropriated cord was not included, please contact your nearest sales office to obtain the correct cord. Refer to "check line voltage" to check the line voltage selection and fuse type.

5.2 Check Line Voltage

The 34M01 mainframe load can be operated with a 100Vac, 115Vac, 200Vac or 230Vac input as indicated on the label on the rear panel. Make sure that the factory check mark corresponds to your nominal line voltage. Skip this procedure if the label is correctly marked.

1. With the 34M01 mainframe powered OFF, disconnect the AC power cord.
2. Refer the drawing on the rear panel of 34M01 mainframe load in Figure 5-1, set the switches to the proper voltage as indicated below.

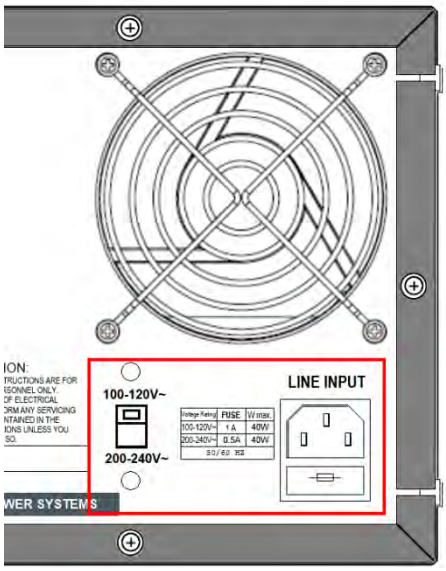

Figure 5-1: AC Input Voltage Selection

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5.3 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 load 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 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.

5.3.1 Fuse Replacement Procedure

To replace the AC line input fuse, proceed as follows:

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 5-2). Use a small screwdriver to remove the fuse holder. Replace the failed fuse with the appropriate type and rating according to your mains voltage.
3. Refit the fuse holder and connect the power cord.

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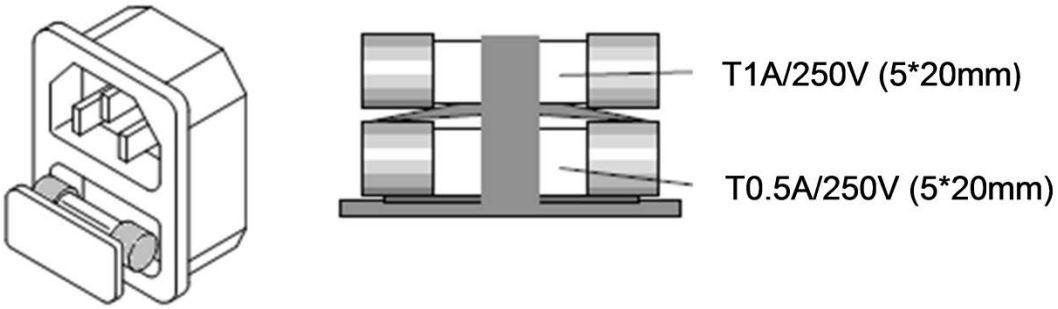

Figure 5-2: AC Line Fuse Holder Location

5.4 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.

5.5 Chassis Position

The 34M01 mainframe load chassis is equipped with surface protection feet and is ready for use as a bench instrument.

5.6 Rack Mounting

The 34M01 mainframe chassis is **NOT** designed to be rack mounted in a standard 19 inch rack. Please refer to the 34M04 four slot mainframe for system or ATE applications.

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5.7 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.

5.8 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 chassis 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 34M01 mainframe load AC input terminal.
5. Plug the line cord plug into a suitable AC outlet socket.
6. Turn on (I) the POWER switch.
7. If the instrument does not turn on for some reason, turn OFF the POWER switch and verify the presence of the correct AC line input voltage using appropriate safety measures.

5.9 In Case of Malfunction

In the unlikely event of an instrument malfunction or if the instrument does not turn on despite the presence of the correct AC line voltage, please attach a warning tag to the instrument to identify the owner and indicate that service or repair is required. Contact Adaptive Power Systems or its authorized representative to arrange for service.

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5.10 Remote Control Interface

The 34M01-01 mainframe supports both RS232 and GPIB interface. The 34M01 mainframe supports only a RS232 serial interface. The interfaces are installed at the factory prior to shipment and cannot be retrofitted in the field.

5.10.1 GPIB Interface

The GPIB connector is located on the rear panel of the 34M010-1 only. This connector allows the load mainframe to be connected to a PC with GPIB 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 5-3 shows the rear panel of the 34M01. The GPIB address of the load is set from the front panel.

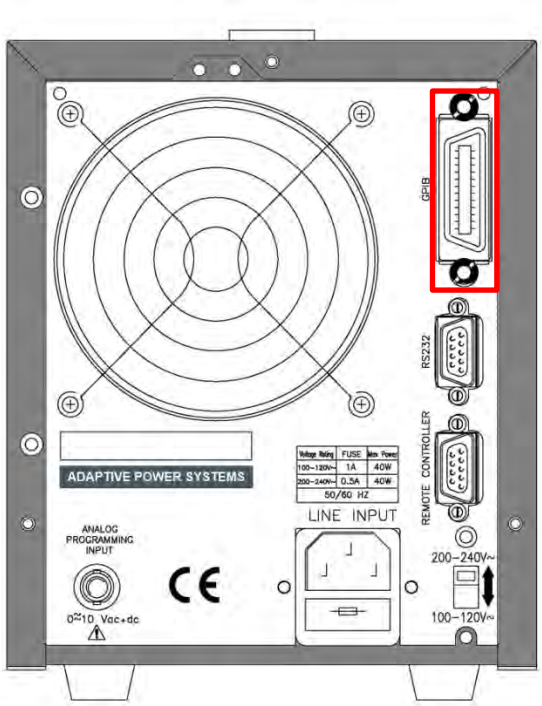
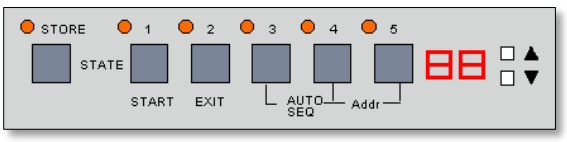


Figure 5-3: 34M01 Mainframe Rear Panel – GPIB Location

To set the GPIB address, press the “4” and “5” buttons (Addr) at the same time and use the Bank up/down keys to the right of the “5” key to increment or decrement the GPIB address. Available setting range is 0 to 31. Once set, press the “2” (EXIT) key to exit.



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5.10.2 RS232 Serial Interface

Figure 5-4 shows the RS232 connector (Female) on the rear panel. This connects the load unit to an RS232 port of a computer.

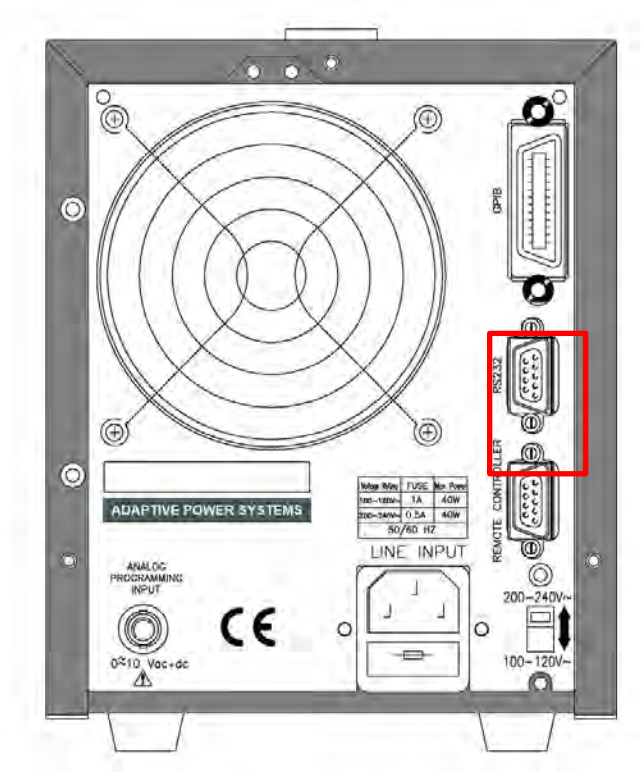

Figure 5-4: 34M01 Mainframe Rear Panel – RS232 Location

The RS-232 communication settings are fixed as follows:

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

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5.11 Remote Controller Option Ports

There are two additional D-sub 9 pin connectors on the rear panel. The Remote **Input** port connects the 34M01 mainframe to optional remote controller which replaces the five RECALL option keys on the front panel of the mainframe. The LED will be lit if a NoGo (NG) condition occurs in any one of the load modules within the mainframe.

The Remote **Output** port can connect to another 34M01 mainframe for cascade operation. This capability enables the user to control twelve or more load modules with a single memory recall operation. This is especially useful for multiple output power source testing applications.

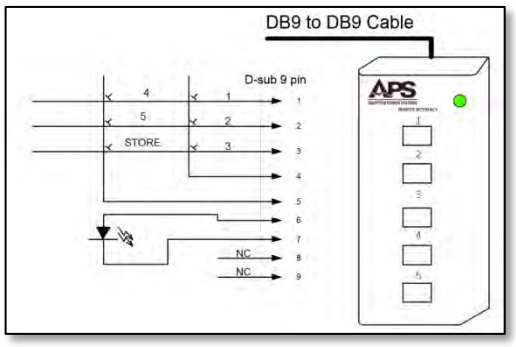

Figure 5-5: Remote Control Panel

5.12 External Sync Input BNC

The 34M01 mainframe has an analog programming input BNC connecter located on the rear panel but this feature **is not available** on 3A Series AC load modules. Instead, these inputs are used to sync up the 3A AC load module to an external sync signal.

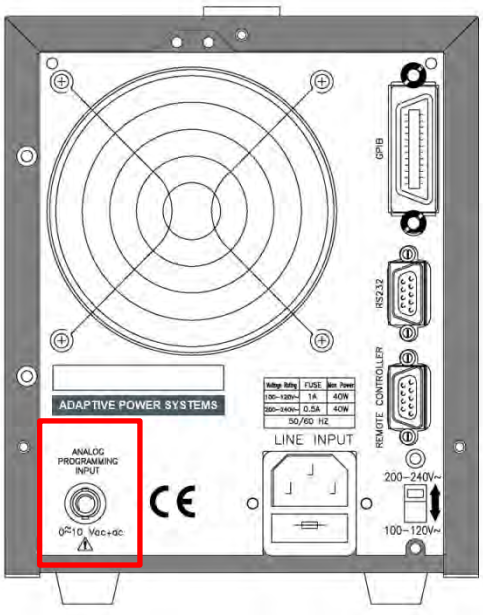

Figure 5-6: 34M01 Mainframe Rear Panel – External Sync Input BNC Connector Location

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6 Front Panel Operation

This Chapter provides an overview of front panel operation of the 34M01 mainframe itself. Note that only mainframe controls and indicators located along the left hand side of the 34M01 chassis' front are covered by this manual. Operation of an individual 3A load module is covered by the 3A Series Operation Manual (P/N 160922-10).

For remote control operation, refer to Section 8, "Remote Control Programming" of this manual for an overview of available programming commands.

6.1 Front Panel Layout

The front panel layout is shown in Figure 6-1 below..

Figure 6-1: 34M01 Mainframe DC Load Front Panel View

Mainframe controls are located along the bottom edge. These controls include the power ON/OFF switch on the left and a set of Setup Memory Store and Recall Buttons that double as Auto Sequence controls. The memory bank selected and selection control buttons are on the right.

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6.2 User Controls and Readouts

The following user controls, indicator and displays are available on the mainframe itself.

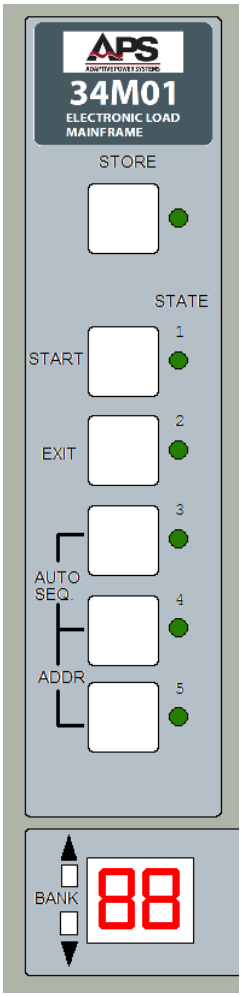

Figure 6-2: Chassis Controls and Indicators

6.3 Power On Status

STORE/RECALL: All LEDs are OFF, BANK LED display shows 01. The 3A Series load is in initial power on state.

6.4 GPIB address setting

GPIB address is set by pressing the STATE 4 and STATE 5 keys simultaneously. Press UP or DOWN BANK keys to select address 0 through 31. Press the STATE 2 key to exit GPIB address setting mode.

6.5 Settings STORE/RECALL Operation

The eight function keys on the front panel of the 34M01 mainframe are used to support high speed test throughput. There are 5 banks with 150 operating states or testing steps each that can be store in the non-volatile memory of the 3A Series load modules. Each state can save or recall the load status for one electronic load module.

The 34M01 mainframe can store up several 3A Series load module settings simultaneously. If you store two different states under the same state key, the last state will replace the previous state. In effect, it acts as an update with the new data.

Please refer to the relevant section in the 3A Series electronic load module operation manual for details on using the store and recall functions.

6.5.1 Recalling a Load Setup

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

1. Press one of the Memory STATE 1 through 5 keys. The corresponding LED annunciator will now be lit.
2. The stored state on the 34M01 mainframe is sent to each electronic load module simultaneously.

Note: If you press any key on the load module **before** pressing a STATE key, then the state LED annunciator will turn off immediately. This indicates the STORE state has been changed on load module's front panel.

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6.6 AUTO-SEQUENCING

There are two modes in AUTO SEQUENCE function:

- EDIT mode
- TEST mode

6.6.1 AUTO-SEQUENCE – EDIT MODE

The AUTO SEQ mode can be entered by pressing keys 3 and 4 simultaneously, then press STORE key again to enter the EDIT MODE. Or press the START key to enter the TEST MODE. Please refer to the flow chart operation below.

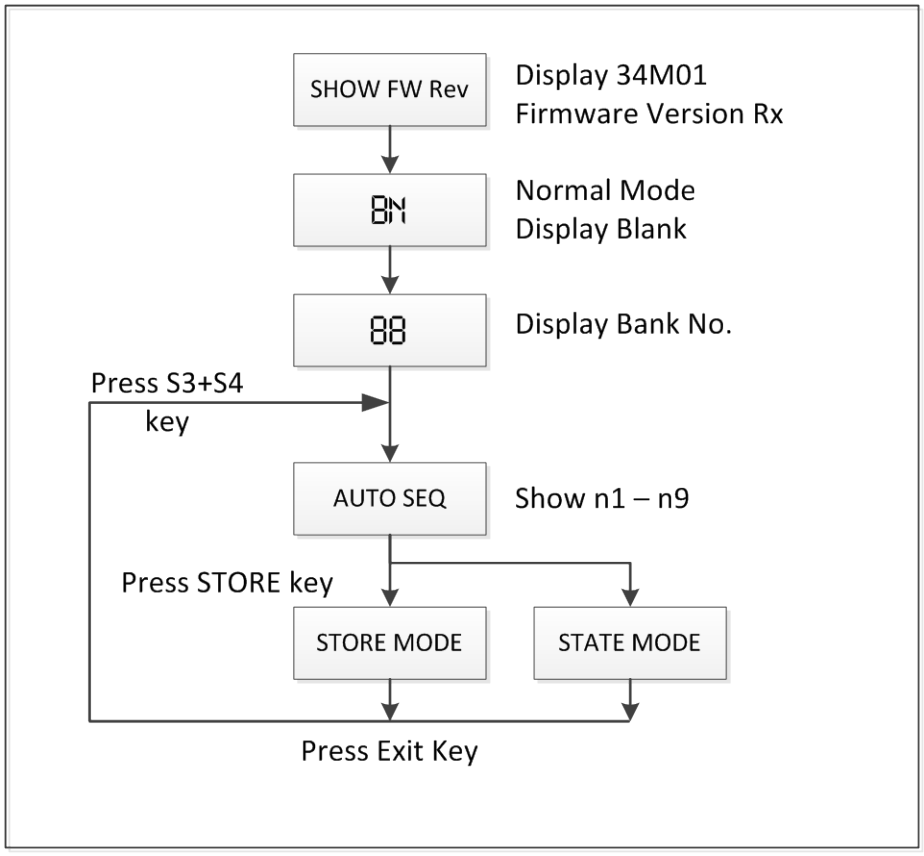

Figure 6-3: AUTO SEQUENCE Edit Mode Flow diagram

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The EDIT mode of the Auto Sequence function is engaged by press keys 3 and 4 simultaneously. LEDs for keys 3 and 4 will be ON to indicate Auto-sequence mode.

The EDIT MODE flow chart is shown in Figure 6-4 and described in more detail below:

1. There are nine Auto Sequences (n1-n9) that can be edited within the 34M01.
2. Each Auto Sequence has up to 16 Test steps. Each step has memory for 150 sets of settings, divided into 30 memory Banks with 5 memory states each.
3. Each test step has the following parameters:
   t1 (test time)
   t2 (delay time)
   The unit is 100 msec, the range is 0.1 sec to 9.9 sec in 100ms resolution.
4. The mainframe will check each module's GO/NG state at the end of t1 (test time).
5. The next step will be started after duration t2 (delay time).

Note: The test step sequence can be up to 16 steps and can be terminated by press the EXIT key if less than 16 steps are required.

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

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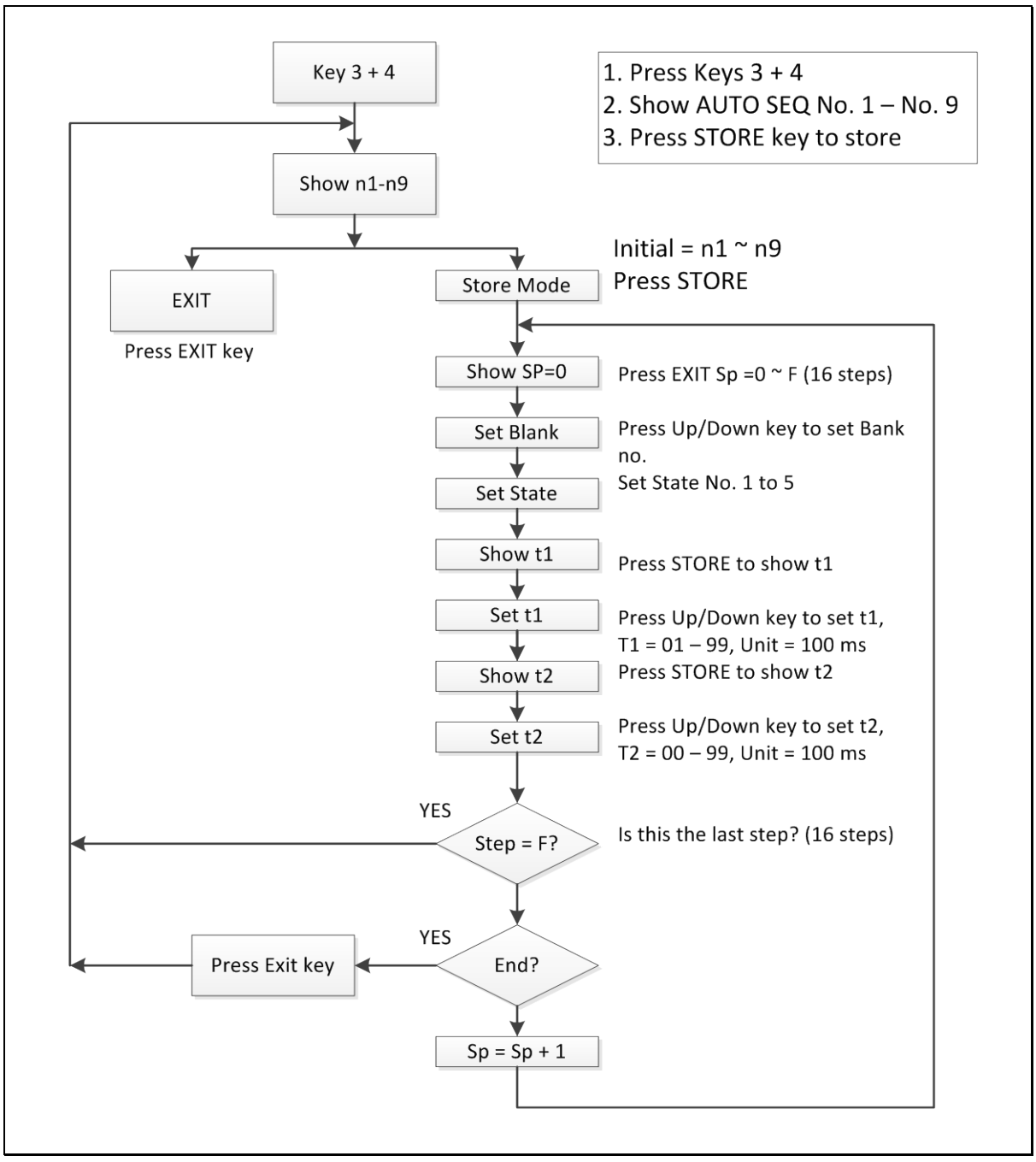

Figure 6-4: Auto Sequence Edit Mode Procedure Flow Chart

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6.6.2 AUTO-SEQUENCE – TEST MODE

The Auto-Sequence TEST Mode is entered by pressing keys 3 and 4 key simultaneously. The number 3 and 4 LEDs will be ON to indicate Auto-Sequence mode is engaged. The Auto-Sequence test is started by press START key.

The TEST MODE flow chart is shown in Figure 6-5 and described below:

1. After pressing the START key, the mainframe controls all the modules installed to recall corresponding memory settings which had been stored in auto-sequence memory (n1 – n9).
2. The test sequence starts from (Step 0 – t1 – t2), then (step 1 – t1 – t2), and so on until the last step is reached or is aborted by pressing EXIT key.
3. The two digit LED display will show GO (flash) if all the test in all module is pass, and will show nG (flash) if there is at least one failure during the test.

Note: The user can press the START key to continue with another test run, or exit the auto-sequence mode by pressing the EXIT key.

Flow Chart States:

Press the START key to start Auto-sequence execution.

1. Recall relevant memory location 1 through 9 to run.
2. Check Go/NG Indicator.
3. Press EXIT key to abort test sequence execution.
4. If test is GO, then is this the last step?

   4.1 If no, then step number is incremented and next step is executed.

   4.2 If yes, then if all steps passed, display GO result

   4.3 If yes and one or more steps failed since start of sequence execution, then display NoGo result.

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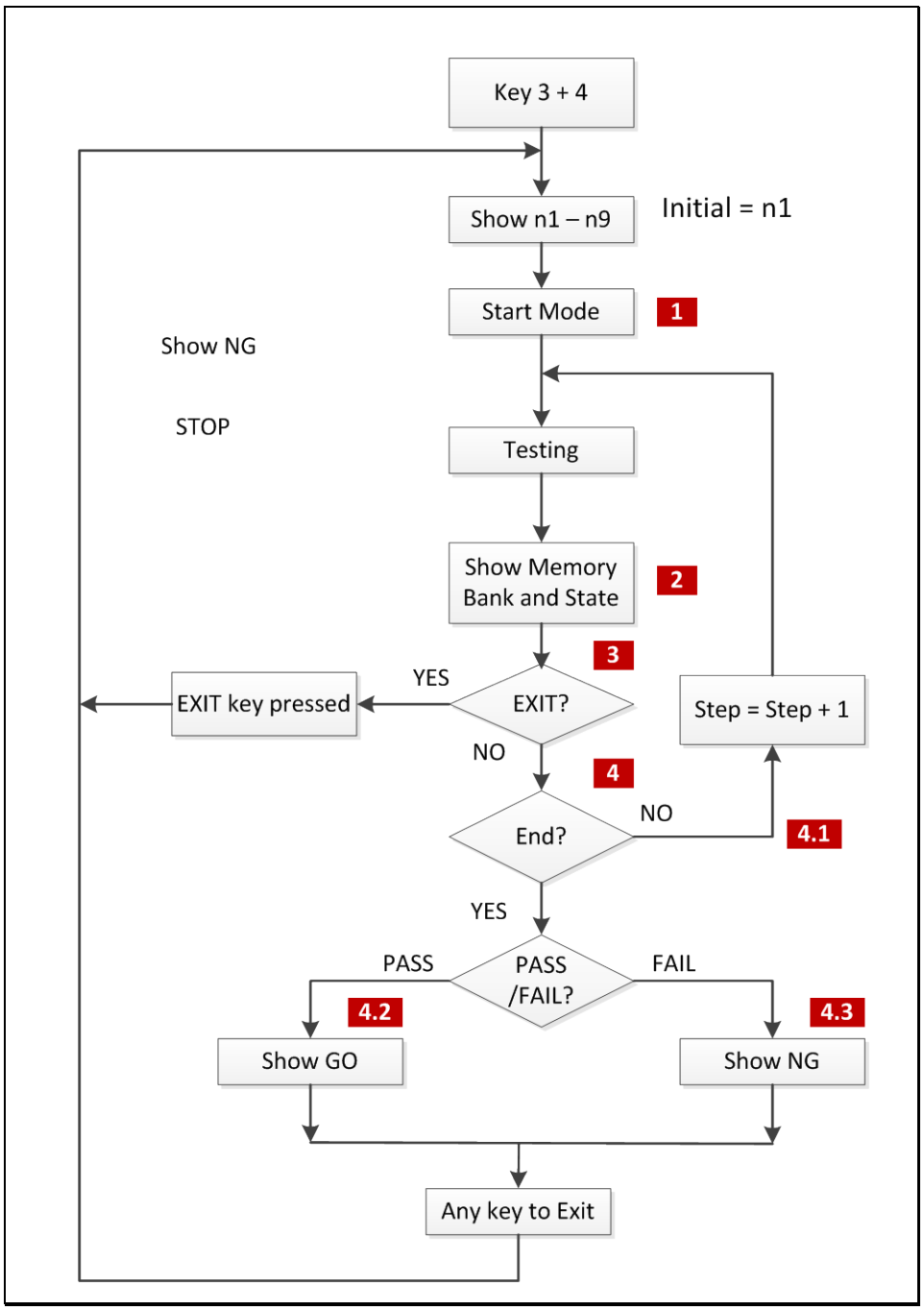

Figure 6-5: Auto-Sequence Test Execution Flow chart

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7 Rear Panel Overview and Connectors

This section describes the rear panel layout of the 34M01 mainframe.

7.1 Rear Panel Layout

Connector Locations for AC input, RS232, GPIB and External Sync are indicated on the drawing below.

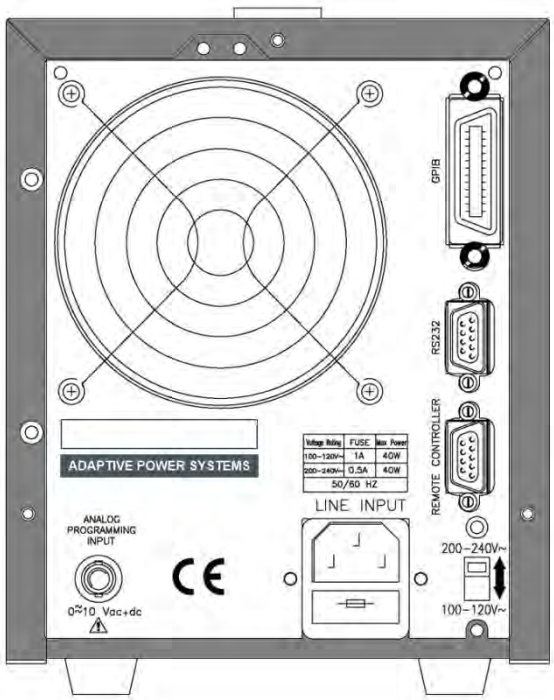

Figure 7-1: 34M01 Rear Panel Connector Layout and Connector Locations

7.2 Air Flow

When positioning the 34M01 mainframe, make sure the fan exhausts on the rear panel are not obstructed in any way. Leave at least 30 cm/1 ft of clearance behind the rear panel to any wall or other obstruction to ensure sufficient cooling of the load modules.

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8 Remote Control Programming

8.1 Overview

If your unit is fitted with a computer interface option then a GPIB and/or RS232 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 APS Loads. One is referred to as the SHORT FORM commands and the other set as the LONG FORM commands.

For Example

To query the actual voltage present at the load form the load's measurement system, the long form command is:

MEASURE:VOLTAGE?

The same command in its short form is:

MEAS:VOLT?

NOTE: When the RS232 interface is used to control the load, it is important to send the "REMOTE" command first to make sure the load is in REMOTE state. To return the load to local operation, the "LOCAL" command is used. These two commands do not apply to the GPIB interface as remote and local state of an instrument is handled through the GPIB ATN hardware signal per theIEEE488 standard.

8.2 Module / Channel Addressing

All remote control commands are generally channel specific. That means they apply to an individual load module. The selected load module is set by using the "CHAN" command "[CHANnel]". Once selected, the module remains selected and all commands issued apply to that module until a CHAN command is issued to select a different modules. Modules are numbered 1 through 4 from left to right.

The only non-channel specific command is the GLOBal command "[GLOB:]" which applies to all installed modules.

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8.3 RS232 Set-up

The RS232 interface of the APS 34M01 mainframe is configured as follows:

Baud-rate:	9600 bps
Parity:	None
Data bit:	8 bits
Stop bit:	1 bit
Command delay:	20 ms between successive commands is required to allow command parsing and processing.

Make sure the settings used on the controller's COM port match those of the load.

The RS232 Interface connector DB9 pin-out of the load is shown in Table 8-1.

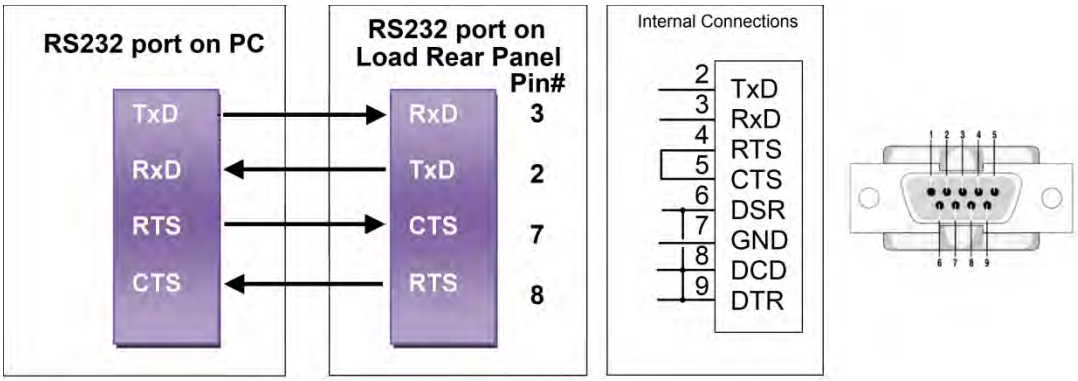

Figure 8-1: RS232 Connection to PC and DB9 Pin out

RS232 DB9 Signal Pin Assignments:

PIN	Abbreviation	Description
Pin1	DCD	Direct Carrier Detect
Pin2	TXD	Transmit Data
Pin3	RXD	Receive Data
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

Table 8-1: RS232 DB9 Pin Assignments

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8.4 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.

8.4.1 Parenthesis

The following parentheses 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 { }, [ ], and | 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: The question mark implies the query format of the command.

8.4.2 Terminators

All remote control commands sent to the load must be terminated with a command terminator. The command terminator characters accepted by the APS loads are listed in Table 8-2.

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 8-2: 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.

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8.5 Command Syntax Tables

The setting and query commands for the 34M01 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. They short form syntax is shown in upper case. The long from syntax is shown as lower case.

SETTING PRESET COMMANDS	REMARK
[PRESet:] BANK{SP}{d}{;|NL}	d = 0 through 10
[PRESet:] BANK{SP}{?}{;|NL}	d = 0 through 10
[PRESet:] WAVE{SP}{m}{;|NL }	m = 0 through 4
[PRESet:] WAVE{SP}{?}{;|NL}	m = 0 through 4
[PRESet:] FREQuency{SP}{NR2}{;|NL}	40.0 through 70.0Hz
[PRESet:] FREQuency{?}{;|NL}	40.0 through 70.0Hz
[PRESet:] CC: | CURRent:{A|B}{SP}{NR2}{;|NL}	
(PRESet:] CC: | CURRent: {A|B}{?}{;|NL}	###.####
[PRESet:] CR: | RES: {A|B}{SP}{NR2}{;|NL}	
[PRESet:] CR: | RES: {A|B}{?}{;|NL}	###.####
[PRESet:] LIN:{A|B}{SP}{NR2}{;|NL}	
[PRESet:] LIN:{A|B}{?}{;|NL}	###.####

Table 8-3: Setting Commands - Short Form

LIMIT COMMANDS	REMARK
LIMit:CURRent:{HIGH|LOW}{SP}{NR2}{;|NL}	
LIMit:CURRent:{HIGH|LOW}{?}{;|NL}	###.####
LIMit:POWer:{HIGH|LOW}{SP}{NR2}{;|NL}	
LIMit:POWer:{HIGH|LOW}{?}{;|NL}	###.####
LIMit:VA:{HIGH|LOW}{SP}{NR2}{;|NL}	
LIMit:VA:{HIGH|LOW}{?}{;|NL}	###.####
LIMit:VOLTage:{HIGH|LOW}{SP}{NR2}{;|NL}	
LIMit:VOLTage:{HIGH|LOW}{?}{;|NL}	###.####

Table 8-4: Limit Commands - Short Form

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STATE COMMANDS	REMARK
[STATe:] ERRor? {;|NL}	ERROR CODE
[STATe:] LOAD{SP}{ON|OFF}{;|NL}	
[STATe:] LOAD{?}{;|NL}	0:OFF, 1:ON
[STATe:] MODE{SP}{CC|CR|LIN}{;|NL}	
[STATe:] MODE{?}{;|NL}	0:CC, 1:CR, 2: LIN
[STATe:] SHORt{SP}{ON|OFF}{;|NL}	
[STATe:] SHORt{?}{;|NL}	0:OFF, 1:ON
[STATe:] PRESet{?}{;|NL}	0:OFF, 1:ON
[STATe:] SENSe{SP}{ON|OFF}{;|NL}	
[STATe:] LEVel{SP}{HIGH|LOW|A|B} {;|NL}	
[STATe:] LEVel{?}{;|NL}	0:LOW, 1:HIGH
[STATe:] SYNCronize{SP}{ON|OFF}{;|NL}	
[STATe:] SYNCronize{?}{;|NL}	0:OFF, 1:ON
[STATe:] WATT{SP}{ON|OFF}{;|NL}	
[STATe:] WATT{?}{;|NL}	0:OFF, 1:ON
[STATe:] NG{?}{;|NL}	0:OK, 1:NG
[STATe:] PROTect{?}{;|NL}	DDDDDDDD

Table 8-5: State Commands - Short Form

SYSTEM COMMANDS	NOTES	REMARKS
[SYSTem:] CHANnel{SP}{1|2|3|4}[A|B]{;|NL}		
[SYSTem:] CHANnel{SP}{?}{;|NL}		{1|2|3|4}[A|B]
[SYSTem:] RECall{SP}{M[,N]}{;|NL}	M=1~5 N=1~30	
[SYSTem:] STORe{SP}{M[,N]}{;|NL}	M=1~5 N=1~30	
[SYSTem:] REMote{;|NL}	RS232 only	
[SYSTem:] LOCal{;|NL}	RS232 only	0:OFF, 1:ON
[SYSTem:] NAME{?}{;|NL}		“XXXXX”

Table 8-6: System Commands - Short Form

MEASUREMENT QUERY COMMANDS	REMARKS
MEASure:CURRent {?}{;|NL}	###.####
MEASure:VOLTage {?}{;|NL}	###.####
MEASure:PWR {?}{;|NL}	###.####
MEASure:VA {?}{;|NL}	###.####

Table 8-7: Measurement Query Commands - Short Form

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GLOBAL COMMANDS	REMARK
GLOBal:[STATe:] PRESet {SP}{ON|OFF}{;|NL}	
GLOBal:[STATe:] LOAD{SP}{ON|OFF}{;|NL}	
GLOBal:[STATe:] MODe {SP}{ON|OFF}{;|NL}	
GLOBal:[STATe:] LEVel {SP}{A|B}{;|NL}	
GLOBal:MEASure:CURRent{?}{;|NL}	###.##
GLOBal:MEASure:VOLTage{?}{;|NL}	###.##

Table 8-8: Global Commands - Short Form

8.5.1 Notations and Conventions Used in programming commands:

1. GLOB | GLOBAL — All channels active
2. Current engineering unit: — A
3. Voltage engineering unit: — V
4. Resistance engineering unit: — Ω
5. Frequency engineering unit: — Hz
6. Time Period engineering unit: — ms
7. Slew-rate engineering unit: — A/us
8. Power engineering unit: — W

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8.6 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 (PRESET)	Setting commands are used to program operating modes, sink values and built in test modes like SHORT, OPP and OCP.
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/NG 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. (15 Banks / 10 States)
MEASUREMENTS	Allows querying load measurement data.
GLOBAL	Commands that affect all modules simultaneously.
IEEE488.2 COMMANDS	Supported IEEE488.2 Commands (a.k.a. star commands)

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8.6.1 SETTING Commands

BANK

Command Syntax:

[PRESet:] BANK{SP}{d}{;|NL}

[PRESet:] BANK{SP}{?}{;|NL}Purpose:

Purpose: Set or read the waveform bank number. Bank number 'd' ranges from 0 through 10. Refer to Table 8-10 for bank and waveform locations.

Description: This command is used to set or query the waveform bank number.

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 load will automatically set the maximum value according the load module installed.

WAVEform

Command Syntax:

[PRESet:] WAVE {SP} {m} {;|NL }

[PRESet:] WAVE {SP} {?} {;|NL }

Purpose: Set or read the waveform number for the desired current crest factor in the selected bank. Waveform number 'm' ranges from 0 through 4. Refer to Table 8-10 for bank and waveform locations.

Description: This command is used to set or query the waveform number.

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 load will automatically set the maximum value according the load module installed.

Waveform	BANK	WAVE = 0	WAVE = 1	WAVE = 2	WAVE = 3	WAVE = 4	Phase Shift
Sine wave	0	√2	2.0	2.5	3.0	3.5	
	1	1.5	1.6	1.7	1.8	1.9	
	2	3.0	3.1	3.2	3.3	3.4	
C.F. = 2	3	P.F. = -0.85	P.F. = -0.80	P.F. = -0.75	P.F. = -0.70	P.F. = -0.65	
C.F. = 2.5	4	P.F. = -0.75	P.F. = -0.70	P.F. = -0.65	P.F. = -0.50	P.F. = -0.40	Lagging PF
C.F. = 3.5	5	P.F. = -0.50	P.F. = -0.45	P.F. = -0.40	P.F. = -0.35	P.F. = -0.30	
C.F. = 2	6	P.F. = +0.85	P.F. = +0.80	P.F. = +0.75	P.F. = +0.70	P.F. = +0.65	
C.F. = 2.5	7	P.F. = +0.75	P.F. = +0.70	P.F. = +0.65	P.F. = +0.50	P.F. = +0.40	Leading PF
C.F. = 3.5	8	P.F. = +0.50	P.F. = +0.45	P.F. = +0.40	P.F. = +0.35	P.F. = +0.30	
Square	9	1.0	1.1	1.2	1.3	1.4	
DC	10	√2 dc	2 dc	2.5 dc	3.0 dc	3.5 dc	

Table 8-9: AC CC Mode BANK and WAVE Table

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

Command Syntax:

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

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

Purpose: Set or read the expected AC frequency at the load input.

Description: This command is used to set or query the frequency setting.

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 load will automatically set the maximum value according the load module installed.
3. Valid frequency range for 3A series load modules is 40.0 Hz through 70.0 Hz
4. The engineering unit is Hz.

CURRent

Command Syntax:

[PRESet:] CC | CURR {A | B} {NR2} {: | NL}

[PRESet:] CC | CURR {A | B} {?} {; | NL}

Purpose: Set or read the load current for level A or B.

Description: This command is used to set or query the load current. There are two set points, A and B. This allows the user to switch between two current levels.

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 load will automatically set the maximum value according the load module installed.
3. The engineering unit is A.

CR | RES: {A | B}

Command Syntax:

[PRESet:] CR | RES:{A | B} {SP} {NR2} {; | NL}

[PRESet:] CR | RES:{A | B} {?} {; | NL}

Purpose: Set and read the A or B resistance levels.

Description: This command is used to set or query the A and B levels of load resistance. There are two set points, A and B. This allows the user to switch between two resistance levels.

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

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LINear

Command Syntax:

[PRESet:] LIN: {A | B} {SP} {NR2} {;|NL}

[PRESet:] LIN: {A | B} {?} {;|NL}

Purpose:

Set and read the A or B current levels.

Description:

This command is used to set or query the A and B levels of current in linear mode. There are two set points, A and B. This allows the user to switch between two current levels.

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

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8.6.2 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}

Command Syntax:

[LIMit:]CURRent:{HIGH | LOW} {SP} { NR2 } {;|NL}

[LIMit:]CURRent:{HIGH | LOW}? {;|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 set.

[LIMit:]POWer:{HIGH | LOW}

Command Syntax:

[LIMit:]POWer:{HIGH | LOW}{SP}{ NR2 }{;|NL}

[LIMit:]POWer:{HIGH | LOW}? {;|NL}

Purpose: Set or query the HIGH / LOW load power limits when operating in CC 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 set.

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[LIMit:]VA:{HIGH | LOW}

Command Syntax:

[LIMit:]VA:{HIGH | LOW}{SP}{ NR2 }{;|NL}

[LIMit:]VA:{HIGH | LOW}? {;|NL}

Purpose: Set or query the HIGH / LOW load apparent power limits when operating in CC or CR modes.

Description: This command is used to set two apparent 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 apparent power taken by the load falls below the LOW limit then a No Good (NG) signal is available.
3. If the apparent power rises above the HIGH limit then the NG signal is available.
4. If the apparent power stays between HIGH and LOW LIMIT levels the NG signal will not be set.

[LIMit:]VOLtage:{HIGH | LOW}

Command Syntax:

[LIMit:]VOLtage:{HIGH | LOW} {SP} { NR2 }{;|NL}

[LIMit:]VOLtage:{ HIGH | LOW}? {;|NL}

Purpose: Set or query the HIGH / LOW limits for the 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 set.

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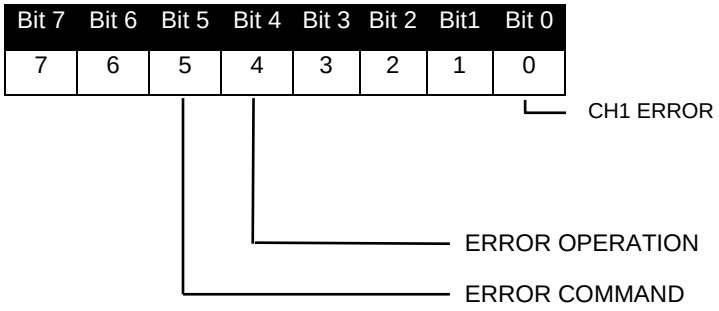
8.6.3 STATE Commands

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

[STATe:] ERRor

Command Syntax:
[STATe:] ERRor? {; | NL}
Purpose:
Query if there are any errors flagged set. Also clears error register.
NOTE: Comparable to IEEEE488.2 *ESR? Command but return values used different bit assignments.
Description:

1. ERR? : Read the register of ERR status. Table below shows the corresponding number of ERR status bits returned.
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 8-10: Error Register

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

Command Syntax:

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

[STATe:] LOAD? {; | NL}

Purpose: Turns load on or off. Query format returns LOAD ON or OFF status.

Description: This command is used to turn the load on or off.

Query response: 0 = OFF, 1 = ON.

[STATe:] MODE {SP} {CC | CR | LIN}

Command Syntax:

[STATe:] MODE {SP} {CC | CR | LIN} {; | 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 | LIN.

Query response: See table below

Mode:	CC	CR	LIN
Value:	(0)	(1)	(2)
Supported	√	√	√

[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

Query response: 0 = OFF, 1 = ON.

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

Command Syntax:

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

[STATe:] PRESet? {; | NL}

Purpose: Turns load on or off. Query format returns preset mode state

Description: This command is used to check if the load is in preset mode.
0 = Preset mode OFF, 1 = Preset mode ON

Query response: 0 = OFF, 1 = ON.

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

Command Syntax:

[STATe:] SENSe {SP}{ON | OFF}{; | NL}

[STATe:] SENSe? {; | NL}

Purpose: Sets or reads back whether the voltage sense function is ON or OFF.

Description:

Query response: 0 = OFF, 1 = ON

[STATe:] LEVel {SP} {HIGH | LOW | A | B}

Command Syntax:

[STATe:] LEVel {SP} {HIGH | LOW | A | B} {; | NL}

[STATe:] LEVel? {; | NL}

Purpose: Sets or reads back whether the load is operating at its LOW or HIGH LEVEL.

Description: In CC, CR or LIN operating modes the user can set two LEVELS of load current, or resistance. The query format will return the active level.

Query response: 0 = LOW | A, 1 = HIGH | B

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[STATe:] SYNCronize {SP} {ON|OFF}{;|NL}

Command Syntax:

[STATe:] SYNCronize {SP} {ON|OFF}{;|NL}

[STATe:] SYNCronize {?} {;|NL}

Purpose: Sets the internal or external sync mode. Query format return sync setting.

Description: This state determines if the load current is synchronized to:

1. The sensed voltage through the internal zero-crossing circuit and isolated circuit
2. To the external sync input

Query response: 0 = Internal Sync, 1 = External Sync

[STATe:] WATT{SP} {ON|OFF} {;|NL}

Command Syntax:

[STATe:] WATT{SP} {ON|OFF} {;|NL}

[STATe:] WATT{?} {;|NL}

Purpose: This command sets the display of the power meter. This command has to be used in conjunction with the PRES：OFF command.

Description: The front panel display read outs can be toggled between voltage and current readout or Power and Apparent readout using this command:

1. When set to OFF, the monitor on top of the display will display voltage while the bottom monitor will display current. Units are “Vrms” and ”Arms” respectively.
2. When set to ON, the monitor on top of the display will change from voltmeter to Watt meter, while the monitor at the bottom of the display will change from ammeter to Volt-Ameter (VA). Units are “W” and ”VA” respectively.

Query response: 0 = V and I displayed, 1 = W and VA displayed

[STATe:] NG? {; | NL}

Command Syntax:

[STATe:] NG? {; | NL}

Purpose: Query if the NG annunciator is lit on the selected module.

Description: This command queries the NG status. If the response is “0”, the NG (NO GOOD) annunciator on the selected load module (CHAN) is off. If the response is ”1”, the NG annunciator on the selected load module(CHAN) is lit, indicating that the NG flag is set.

Query response: 0 = OFF, 1 = ON

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[STATe:] PROTect? {; | NL}

Command Syntax:

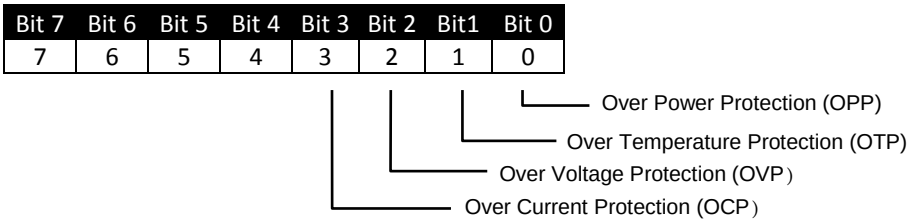
[STATe:] PROTect? {; | NL}

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”.

Query response: 0 - 255



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)

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8.6.4 SYSTEM Commands

SYSTEM commands allow the user to read the model number of the load modules and turn RS232 remote control state ON and OFF. Commands are also available for storing and retrieving load set-ups saved in the memory of the load.

[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 a load module and if applicable, setting A or B. Available range is 1 through 4.

Description: Selects a specific load module. Setting A or B may be added if applicable.

For Example:

CHAN 3 Select load module. #3.

CHAN 1B Select load module #1, setting B

Query response: {1 | 2 | 3 | 4} [A | B]

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

Command Syntax:

[SYStem:] RECall {SP} {m} [, n] {; | NL}

Purpose: Recalls a previously stored load set-up from memory. The load has 150 separate memory locations. This is comprised of 30 memory BANKS with each bank having 5 STATES.

	All 3A Series Load Modules
BANK (n)	30
STATE (m)	5
Total States / Mem. Locations	150

Description: This command is for recalling the procedure stored in a specified memory location where:

m = STATE, 1 through 5

n = BANK, 1 through 30

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.

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.

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[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 used to save the current set-up to a specified memory location where:

m = STATE, 1 through 5

n = BANK, 1 through 30

If the memory STATE to be saved to the currently selected BANK then the BANK [n] part of the command can be omitted.

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:] REMOTE

Command Syntax:

[SYStem:] REMOTE {: | NL}

Purpose: Command to enter REMOTE status (only for RS232).

Description: This command is for enabling control of the unit via RS232.

[SYStem:] LOCAL

Command Syntax:

[SYStem:] LOCAL {; | NL}

[SYStem:] LOCAL? {; | NL}

Purpose: Command to exit the REMOTE status (only for RS232). The query format will return remote or local status of the mainframe.

Description: This command closes the RS232 control interface.

Query response: 0 = LOCAL, 1 = REMOTE

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[SYStem:] NAME?

Command Syntax:

[SYStem:] NAME? {; | NL}

Purpose: Returns the APS model number of the selected (CHAN) load module.

Description: This command is for reading the model number of the selected load module. If no module is present at the selected position, the query will return “NULL”. The model number length is limited to 5 characters. The model number will be returned as per Table 8-13.

Query response:

APS-Model	Return Value
34M01	34M01
34M01-01	34M01

Table 8-11: 34M01 Mainframe Load Module Name Return Values

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8.6.5 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).

Query response: ###.#### (floating point, 4 decimal places)

MEASure:VOLtage?

Command Syntax:

MEASure:VOLtage? {; | NL}

Purpose: Measures the load voltage.

Description: Reads the voltmeter data. The engineering unit is Voltage (V).

Query response: ###.#### (floating point, 4 decimal places)

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).

Query response: ###.#### (floating point, 4 decimal places)

MEASure:VA?

Command Syntax:

MEASure:VA? {; | NL}

Purpose: Reads the apparent power being absorbed by the load.

Description: Reads the apparent power meter data. The engineering unit is VoltAmperes (VA).

Query response: ###.#### (floating point, 4 decimal places)

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8.6.1 GLOBAL Commands

Global commands are used to control all installed load modules simultaneously. This allows synchronous operation of multiple load modules.

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

Command Syntax:

GLOBal:[STATe:] PRESet {SP} {ON|OFF} {;|NL}

Purpose: Turns on or off PRESet state on all load modules.

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

Command Syntax:

GLOBal:[STATe:] LOAD{SP} {ON|OFF} {;|NL}

Purpose: Turns all load modules ON or OFF

GLOBal:[STATe:] MODE {SP} {CC|CR|LIN}

Command Syntax:

GLOBal:[STATe:] MODE {SP} {CC|CR|LIN}{;|NL}

Purpose: Sets operation mode on all load modules to selected mode.

GLOBal:[STATe:] LEVel {SP} {A|B}

Command Syntax:

GLOBal:[STATe:] LEVel {SP} {A|B} {;|NL}

Purpose: Sets selected level on all load modules to A or B.

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GLOBal:MEASure:CURRent{?}

Command Syntax:

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

Purpose: Queries total current on all load modules.

Query response: ###.##

GLOBal:MEASure:VOLTage{?}

Query response: 0 = OFF, 1 = ON.

Command Syntax:

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

Purpose: Queries total voltage on all load modules.

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8.7 IEEE488.2 Common Commands

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

8.7.1 *ESE

Command Syntax:

*ESE{?} {; | NL}

Purpose: Sets the Event Status Event Enable register value. Setting a bit indicates the corresponding event will trigger a service request. The bit configuration for the ESE register is shown below.

Query Format: Returns the Event Status Event Enable register value. Reading the register clears it.

Query response: {NR2}

See also: STATe:ERRor?, *ESR? And *STB?

ESE Register - Bit Configuration

Position	bit 7	bit 6	bit 5	bit 4	bit 3	Bit 2	bit 1	bit 0
Name	PON	unused	CME	EXE	DDE	QYE	unused	OPC
Value	128	-	32	16	8	4	2	1

Bit Definitions:

BIT ID	BIT VALUE	REMARK
bit 0	0 = disabled, 1 = enabled	Operation Complete
bit 1	n/a	Not used
bit 2	0 = disabled, 1 = enabled	Query Error
bit 3	0 = disabled, 1 = enabled	Device Dependent Error
bit 4	0 = disabled, 1 = enabled	Execution Error
bit 5	0 = disabled, 1 = enabled	Command Error
bit 6	n/a	Not used
bit 7	0 = disabled, 1 = enabled	Power On

Table 8-12: Event Status Enable Register

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8.7.2 *ESR?

Command Syntax:

*ESR? {; | NL}

Purpose: Returns the Event Status Event register. Reading the register clears it. The bit configuration for the ESR register is identical to that of the ESE register. Refer to the tables shown under the *ESE? Command description above.

Query Format: Only the query format of this command exists. Reading the register clears it.

Query response: {NR2}

See also: STATe:ERRor?, *ESE And *STB?

8.7.3 *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 four fields separated by a comma.

Query response: Manufacturer, model number, mainframe firmware revision, load controller firmware revision.

Example: APS,3B018-18,1.0,1.00

8.7.4 *OPC

Command Syntax:

*OPC {?} {; | NL}

Purpose: This command sets the OPC bit (bit 0) of the Standard Event Status register when the load has completed all pending operations. (See *ESE for the bit configuration of the Standard Event Status registers.)

Description: Pending operations are complete when all commands sent before *OPC have been executed. This includes overlapped commands. Most commands are sequential and are completed before the next command is executed. The *OPC 1 command must be part of the same message with the command for which the OPC status is requested.

Query format: The query causes the interface to place an ASCII "1" in the Output Queue when all pending operations are completed.

Query response: {NR2}

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8.7.5 *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.

8.7.6 *SRE

Command Syntax:

*SRE {?} {; | NL}

Purpose: This command sets the condition of the Service Request Enable Register.

Description: This register determines which bits from the Status Byte Register (see *STB for its bit configuration) are allowed to set the Master Status Summary (MSS) bit and the Request for Service (RQS) summary bit. A 1 in any Service Request Enable Register bit position enables the corresponding Status Byte Register bit and all such enabled bits then are logically ORed to cause Bit 6 of the Status Byte Register to be set.

When the IEEE-488 BUS controller conducts a serial poll in response to SRQ, the RQS bit is cleared, but the MSS bit is not. When *SRE is cleared (by programming it with 0), the load cannot generate an SRQ to the controller.

Query format: The query format returns the Service Request Enable Register value.

Query response: {NR2}

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8.7.7 *STB?

Command Syntax:

*STB? {; | NL}

Purpose: Returns the Status Byte register. Reading the Status Byte register **DOES NOT CLEAR IT**. The bit configuration for the Status Byte register is shown in the table below.

Description: This query reads the Status Byte register, which contains the status summary bits and the Output Queue MAV bit. Reading the Status Byte register does not clear it. The input summary bits are cleared when the appropriate event registers are read. A serial poll also returns the value of the Status Byte register, except that bit 6 returns Request for Service (RQS) instead of Master Status Summary (MSS). A serial poll clears RQS, but not MSS. When MSS is set, it indicates that the load has one or more reasons for requesting service.

Query Format: Only the query format of this command exists.

Query response: {NR2}

See also: STATe:ERRor?, *ESE and *ESR?

STB Register - Bit Configuration

Position	bit 7	bit 6	bit 5	bit 4	bit 3	Bit 2	bit 1	bit 0
Name	OPER	MSS RQS	ESB	MAV	QUES	unused	unused	unused
Value	128	-	32	16	8	4	2	1

Bit Definitions:

BIT ID	REMARK
bit 0 - 2	Not used
bit 3	Questionable Status Summary Bit
bit 4	Message Available Bit
bit 5	Event Status Summary Bit
bit 6	Master Status Summary, Request for Service
bit 7	Operation Status Summary Bit

Table 8-13: Status Byte Register

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9 Remote Programming Flowchart 3A Series Loads

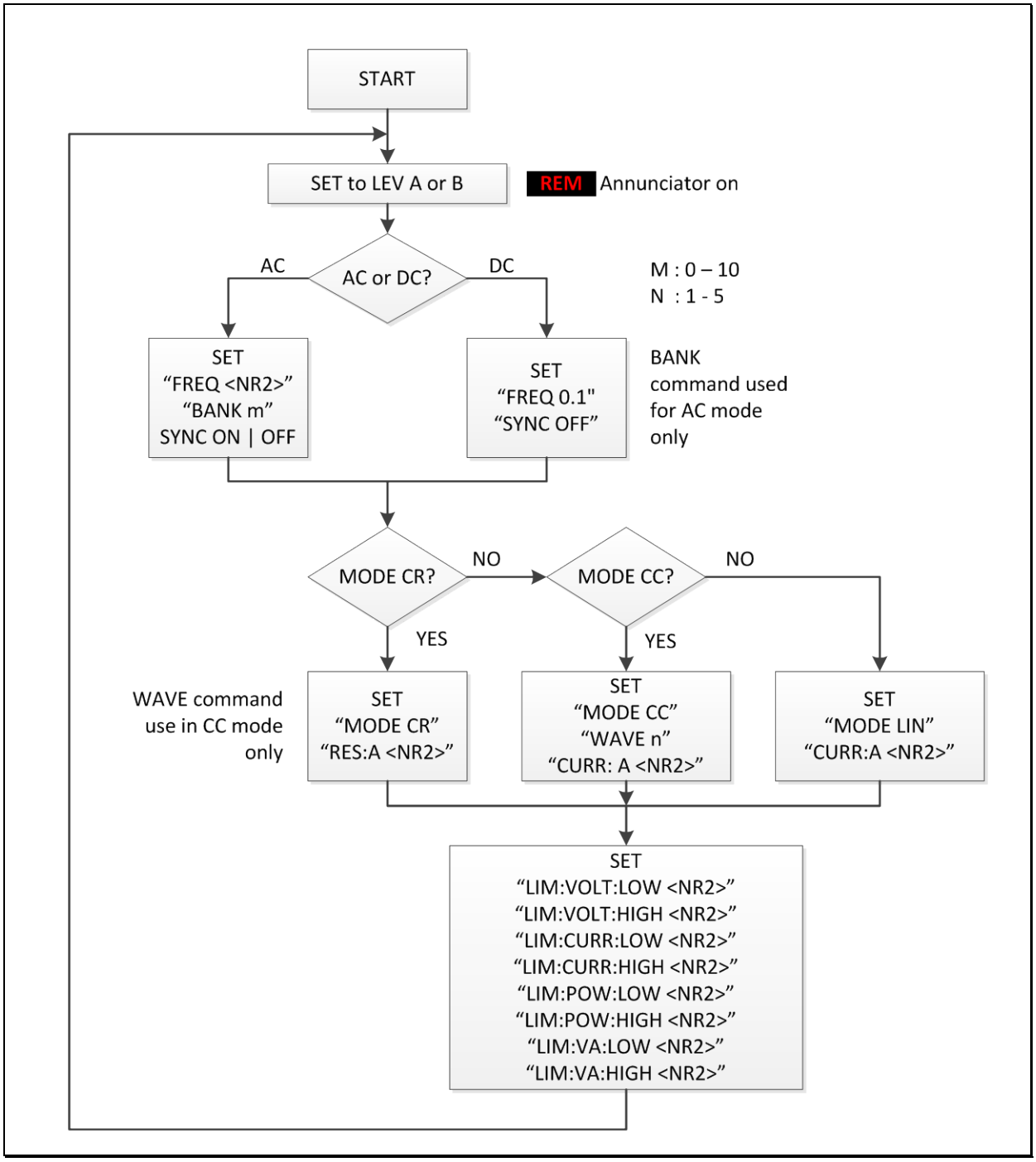

Figure 9-1: Typical Program Flow Chart

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10 Calibration

10.1 Overview

All APS products ship with factory calibration. No additional calibration is required when first received.

10.2 Calibration Interval

The recommended calibration interval for these loads is one year (12 months). Routine annual calibration can be performed by most calibration labs that have Low Frequency measurement and power calibration capabilities. Alternative, the load can be returned to the manufacturer to obtain a factory calibration.

10.3 Calibration Coefficients

The 34M01 mainframe itself requires no calibration but the 3A load modules do. All calibration is performed through software. No manual internal adjustments have to be made as part of routine calibration.

Calibration coefficients for the following parameters and functions are stored in non-volatile memory:

Parameters	Coefficients Stored
Load Current	All modes, AC & DC, Offset and Gain, High Range & Low Range
Resistance	All modes, AC & DC, Offset and Gain, High Range & Low Range
Voltage Measurement	AC&DC, Offset and Gain
Current Measurement	AC&DC, Offset and Gain
Power Measurement	AC&DC, Offset and Gain

10.4 Calibration Procedures

Certified calibration labs may request a copy of the calibration manual for the relevant load model by contacting the nearest Adaptive Power Systems company location. Refer to Section 1, “Contact Information”.

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11 CE MARK Declaration of Conformity

Directive: **2004/108/EC**

Product Name 34M01 & 34M04 Series AC & DC Electronic Loads

Serial Number _____

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
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Irvine, California, 92649, USA

CE **Mark of Compliance**

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12 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**

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.

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