



Programmable DC Power Supply 42000 Series Operating & Programming Manual

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Material Contents Declaration

A regulatory requirement of The United States of America defined by specification SJ/T 11364-2006 mandates that manufacturers provide a material contents declaration of electronic products. QuadTech's materials are listed below.

| Part Name | Hazardous Substances | | | | | |
|-----------|----------------------|---------|---------|---------------------|--------------------------|--------------------------|
| | Lead | Mercury | Cadmium | Hexavalent Chromium | Polybrominated Biphenyls | Polybromodiphenyl Ethers |
| | Pb | Hg | Cd | Cr ⁶⁺ | PBB | PBDE |
| PCBA | × | ○ | ○ | ○ | ○ | ○ |
| CHASSIS | × | ○ | ○ | ○ | ○ | ○ |
| ACCESSORY | × | ○ | ○ | ○ | ○ | ○ |
| PACKAGE | ○ | ○ | ○ | ○ | ○ | ○ |

“O” indicates that the level of the specified chemical substance is less than the threshold level specified in the standards.

“X” indicates that the level of the specified chemical substance exceeds the threshold level specified in the standards.

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

Disposal

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



SAFETY SUMMARY

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

BEFORE APPLYING POWER

Verify that the power is set to match the rated input of this power supply.

PROTECTIVE GROUND

Make sure to connect the protective ground to prevent an electric shock before turning on the power.

NECESSITY OF PROTECTIVE GROUNDING

Never cut off the internal or external protective ground wire, or disconnect the wiring of the protective grounding terminal. Cutting the protective ground could cause a potential shock hazard that may bring injury to a person.

FUSES

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

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

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




DO NOT REMOVE THE COVER OF THE INSTRUMENT

Operating personnel must not remove the cover of this instrument. Component replacements and internal adjustments can be done only by qualified service personnel

WARNING

Touching the connected circuit or output terminal on the front or rear panel when power is on may result in serious injury or death.

SAFETY SYMBOLS

| | |
|---|---|
|  | <p>DANGER – High voltage.</p> |
|  | <p>Explanation: To avoid injury, death of personnel, or damage to the instrument, the operator must refer to an explanation in the instruction manual.</p> |
|  | <p>Protective grounding terminal: Protects against electrical shock in case of a fault. This symbol indicates the terminal must be connected to the ground wire before operating the equipment.</p> |
| <p>WARNING</p> | <p>The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or followed, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.</p> |
| <p>CAUTION</p> | <p>The CAUTION sign denotes a hazard. It may result in personal injury or death if not proceeded upon with caution. It calls attention to procedures, practices and conditions.</p> |

Revision History

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

| Date | Version | Revised Sections |
|-------------|----------------|-------------------------------------|
| Jan. 2009 | A1 | Initial Release |
| Feb. 2009 | A2 | Update figures 1-1 to 1-5 and 3.29b |
| Oct. 2009 | A3 | Update Move |

Table of Contents

| | | |
|-----------|--|-----------|
| 1. | Overview | 13 |
| 1.1 | Introduction | 13 |
| 1.2 | System Functions | 13 |
| 1.2.1 | Operation Mode | 13 |
| 1.2.2 | Protection | 13 |
| 1.2.3 | Output/Indication | 13 |
| 1.2.4 | Input Control Signals | 14 |
| 1.2.5 | Measuring & Editing | 14 |
| 1.3 | Specifications | 14 |
| 1.3.1 | Other Specifications | 17 |
| 1.4 | Function Keys | 19 |
| 1.4.1 | Front Panel | 19 |
| 1.4.2 | Rear Panel | 21 |
| 2. | Installation | 25 |
| 2.1 | Checking the Package | 25 |
| 2.1.1 | Maintenance & Cleaning | 25 |
| 2.2 | Preparation for Use | 26 |
| 2.2.1 | Normal Environment Conditions | 26 |
| 2.3 | Requirements of Input Power | 26 |
| 2.3.1 | Ratings | 26 |
| 2.3.2 | Input Connection | 27 |
| 2.4 | Output Connection | 29 |
| 2.4.1 | Rear Panel Output | 30 |
| 2.4.2 | Front Panel Output | 30 |
| 2.4.3 | Specification of Connecting Wire | 31 |
| 2.4.4 | Specification of Parallel Capacitance | 32 |
| 2.5 | Remote Sensing | 32 |
| 2.5.1 | Correct Connection | 32 |
| 2.5.2 | Disconnecting Remote Sensing Wire | 33 |
| 2.5.3 | Reverse Connection of Remote Sensing Wire Polarity | 34 |
| 2.5.4 | Rack Mounting Kit & Handle Installation | 35 |
| 2.6 | Power-On Procedure | 35 |
| 2.7 | I/O Connector (Option) | 37 |
| 3. | Manual Operation | 38 |
| 3.1 | Introduction | 38 |
| 3.2 | Setting Voltage & Current | 38 |
| 3.3 | Setting Configuration | 39 |
| 3.3.1 | SYSTEM SETUP | 41 |
| 3.3.1.1 | GPIB ADDRESS | 42 |
| 3.3.1.2 | RS-232 BAUDRATE | 42 |
| 3.3.1.3 | APG | 43 |
| 3.3.1.4 | BACKLIGHT | 45 |
| 3.3.1.5 | BUZZER | 46 |
| 3.3.1.6 | POWER-ON STATUS | 47 |
| 3.3.2 | OUTPUT SETUP | 49 |
| 3.3.2.1 | VOLTAGE LIMIT SETTING | 49 |

| | | |
|-----------|--|------------|
| 3.3.2.2 | CURRENT LIMIT SETTING | 50 |
| 3.3.2.3 | VOLTAGE SLEW RATE | 51 |
| 3.3.2.4 | CURRENT SLEW RATE SETTING | 52 |
| 3.3.2.5 | TTL Option | 53 |
| 3.3.2.6 | Setting DC_ON | 54 |
| 3.3.3 | SERIES/PARALLEL | 55 |
| 3.3.3.1 | Connecting Series/Parallel Output Cable | 56 |
| 3.3.3.2 | Assembling Series/Parallel Communication Interface | 57 |
| 3.3.3.3 | Setting Series/Parallel Operation Mode..... | 59 |
| 3.3.3.4 | Setting Series Parameters..... | 64 |
| 3.3.3.5 | Setting Parallel Parameters | 67 |
| 3.3.3.6 | Setting Procedure for APG in Series or Parallel | 70 |
| 3.3.4 | DISPLAY | 75 |
| 3.3.4.1 | DISPLAY SELECTION..... | 76 |
| 3.3.4.2 | READING AVERAGE TIMES..... | 78 |
| 3.3.5 | PROTECTION..... | 79 |
| 3.3.5.1 | OVP Protection | 80 |
| 3.3.5.2 | OCP Protection..... | 81 |
| 3.3.5.3 | OPP Protection | 82 |
| 3.3.5.4 | REMOTE INHIBIT..... | 83 |
| 3.3.5.5 | SAFETY INT.LOCK..... | 85 |
| 3.3.5.6 | FOLDBACK..... | 86 |
| 3.3.5.7 | OTP..... | 88 |
| 3.3.5.8 | AC FAULT | 89 |
| 3.3.5.9 | SENSE FAULT Protection | 89 |
| 3.3.5.10 | FANLOCK Protection | 90 |
| 3.3.5.11 | BUSOVP Protection | 91 |
| 3.3.5.12 | SERIES FAULT Protection | 92 |
| 3.3.6 | FACTORY SETTING..... | 93 |
| 3.3.7 | CALIBRATION..... | 93 |
| 3.3.7.1 | Voltage Output & Measurement Calibration..... | 95 |
| 3.3.7.2 | Current Measurement Calibration..... | 97 |
| 3.3.7.3 | Current Output (PROG.) Calibration | 101 |
| 3.3.7.4 | APG Voltage Calibration..... | 105 |
| 3.3.7.5 | APG Current Calibration | 108 |
| 4. | Program Sequence..... | 112 |
| 4.1 | LIST MODE..... | 112 |
| 4.1.1 | Description of PROGRAM Settings | 113 |
| 4.1.1.1 | Setting PROG NO. | 113 |
| 4.1.1.2 | Setting RUN COUNT..... | 114 |
| 4.1.1.3 | Setting PROG CHAIN..... | 115 |
| 4.1.1.4 | Setting CLEAR PROGRAM | 118 |
| 4.1.2 | Setting Sequence | 119 |
| 4.1.2.1 | Setting Sequence Number..... | 120 |
| 4.1.2.2 | Setting Sequence Type | 120 |
| 4.1.2.3 | Setting Voltage..... | 125 |
| 4.1.2.4 | Setting Current | 125 |
| 4.1.2.5 | Setting Voltage Slew Rate | 125 |
| 4.1.2.6 | Setting Current Slew Rate..... | 126 |

| | | |
|-----------|--|------------|
| 4.1.2.7 | Setting TTL OUT | 126 |
| 4.1.2.8 | Setting Time..... | 126 |
| 4.1.3 | Execution in LIST MODE..... | 127 |
| 4.1.3.1 | Running LIST MODE | 127 |
| 4.1.3.2 | Program List Mode Description..... | 128 |
| 4.2 | V_STEP MODE | 128 |
| 4.2.1 | Setting V_STEP MODE..... | 129 |
| 4.2.1.1 | Setting START_VOLTAGE..... | 129 |
| 4.2.1.2 | Setting END_VOLTAGE..... | 129 |
| 4.2.1.3 | Setting RUN_TIME..... | 130 |
| 4.2.2 | Execution of V_STEP MODE | 131 |
| 4.2.2.1 | Running V_STEP MODE..... | 131 |
| 4.2.2.2 | Description of Program V_Step Mode | 132 |
| 5. | Remote Operation | 133 |
| 5.1 | Overview | 133 |
| 5.1.1 | USB Interface..... | 133 |
| 5.1.2 | Setting GPIB Address & RS-232C Parameters | 133 |
| 5.1.3 | Connecting RS-232C..... | 133 |
| 5.2 | GPIB Function of 42000 Series..... | 134 |
| 5.3 | Introduction to Programming | 135 |
| 5.3.1 | Conventions | 135 |
| 5.3.2 | Numerical Data Formats..... | 135 |
| 5.3.3 | Boolean Data Format..... | 136 |
| 5.3.4 | Character Data Format | 136 |
| 5.3.5 | Basic Definition | 136 |
| 5.3.5.1 | Command Tree Structure..... | 136 |
| 5.3.5.2 | Program Headers | 136 |
| 5.3.5.3 | Common Command and Query Headers..... | 137 |
| 5.3.5.4 | Instrument-Controlled Headers..... | 137 |
| 5.3.5.5 | Program Header Separator (:): | 137 |
| 5.3.5.6 | Program Message | 137 |
| 5.3.5.7 | Program Message Unit | 137 |
| 5.4 | Command Tree | 138 |
| 5.5 | Execution Order..... | 138 |
| 5.6 | Commands of DC Power Supply..... | 138 |
| 5.6.1 | Common Command Syntax..... | 138 |
| 5.6.2 | Specific RS-232 and GPIB Commands for 42000 Series | 143 |
| 5.6.2.1 | ABORT Subsystem | 143 |
| 5.6.2.2 | CONFIGURE Subsystem | 143 |
| 5.6.2.3 | SOURCE Subsystem | 147 |
| 5.6.2.4 | FETCH Subsystem | 151 |
| 5.6.2.5 | MEASURE Subsystem..... | 153 |
| 5.6.2.6 | PROGRAM Subsystem | 153 |
| 5.6.2.7 | SYSTEM Subsystem | 158 |
| 6. | Theory of Operation..... | 159 |
| 6.1 | Overview | 159 |
| 6.2 | Function Description..... | 161 |
| 6.2.1 | I/P (PFC) Stage | 161 |

| | | |
|-------------------|--|------------|
| 6.2.2 | Auxiliary Power | 162 |
| 6.2.3 | Output Stage..... | 162 |
| 6.2.4 | Digital Circuit | 162 |
| 7. | Self Test & Troubleshooting | 163 |
| 7.1 | Overview | 163 |
| 7.2 | Troubleshooting..... | 163 |
| Appendix A | APG & System Status Pin Assignment..... | 165 |
| Appendix B | List of Protection | 167 |

1. Overview

1.1 Introduction

The QuadTech, Inc. 42000 Series are constant DC Power Supplies that can provide stable DC output and accurate measurement of voltage and current.

The 42000 Series DC Power Supply features:

- (1) Voltage mode with two loops control: Provides stable and quick output and sets the slew rate of output voltage and current.
- (2) Constant power output: Users are able to get rated power output within the maximum output voltage range (42012-80-60: 80V-60A).
- (3) 16-bit ADC/16-bit DAC: Provides excellent resolution.
- (4) Lower transient spike and transient response time: Makes certain the unit under examination gets the most stable output and the best protection under the circumstance of load variation.
- (5) Editing mode (Programming Mode) for output waveform: Provides multiple output voltage and current combinations in time for long period test.
- (6) Rotary knob and keyboard control on the front panel: Sets the output voltage and current.
- (7) Large LCD panel: Gives users a complete operation state.
- (8) Via GPIB, RS-232C, USB or APG (analog programmable interface) interface: Controllable via remote control.

1.2 System Functions

1.2.1 Operation Mode

- (1) Local operation is performed by the keyboard and rotary knob on the front panel.
- (2) Remote control is done via GPIB, RS-232C or USB interface.
- (3) Control output via analog signal through the APG input.

1.2.2 Protection

- (1) Protection for abnormal input voltage, over output voltage, over current, over power, over temperature, fan fail, CV/CC fold back and etc. are available.
- (2) Temperature control for the fan speed.

1.2.3 Output/Indication

- (1) The output terminals are on the front and rear panels.
- (2) Auxiliary power output (12Vdc/10mA).

- (3) Analog monitors (V/I Monitor) the output signal instantaneously. This allows signals to be easily monitored by external instruments (DMM, Oscilloscope, etc). This makes it possible to set the output level indication (DC ON) signal.
- (4) Protection state indication (OVP/OCP/OPP/OTP/FAN LOCK/AC FAULT, etc).
- (5) CV/CC status indicators.
- (6) 8-bit TTL output signal.
- (7) Output status indicators.

1.2.4 Input Control Signals

- (1) Remote sense input for voltage drop compensation.
- (2) Analog reference voltage (APG) input, 0-10VDC or 0-5VDC, for voltage and current.
- (3) Remote inhibit control signal (TTL)

1.2.5 Measuring & Editing

- (1) Measurement for voltage, current and power.
- (2) Ten programs and 100 sequences to edit voltage/current waveform output.
- (3) A run time voltage program that can be set for a full hour.

1.3 Specifications

The operating specifications of the 42000 Series DC Power Supply are listed below. Besides the noted, all specifications are tested following the standard test procedure of QuadTech, Inc. (test condition: $25 \pm 5^{\circ}\text{C}$ and under resistive load).

| Model | 42006-30-80 | 42006-100-25 | 42006-300-8 | 42012-40-120 | 42012-80-60 |
|---|-------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| Output Ratings | | | | | |
| Output Voltage | 0-30V | 0-100V | 0-300V | 0-40V | 0-80V |
| Output Current | 0-80A | 0-25A | 0-8A | 0-120A | 0-60A |
| Output Power | 600W | 600W | 600W | 1200W | 1200W |
| Line Regulation | | | | | |
| Voltage | 0.01%+2mV | 0.01%+6mV | 0.01%+18mV | 0.01%+2mV | 0.01%+8mV |
| Current | 0.01%+25mA | 0.01%+5mA | 0.03%+20mA | 0.01%+25mA | 0.01%+10mA |
| Load Regulation | | | | | |
| Voltage | 0.01%+3mV | 0.01%+10mV | 0.01%+50mV | 0.01%+3mV | 0.01%+12mV |
| Current | 0.01%+10mA | 0.01%+5mA | 0.03%+40mA | 0.01%+10mA | 0.01%+20mA |
| Voltage Measurement | | | | | |
| Rnage | 6V / 30V | 20V / 100V | 60V / 300V | 8V / 40V | 16V / 80V |
| Accuracy | 0.05% + 0.05%F.S. | | | | |
| Current Measurement | | | | | |
| Range | 16A / 80A | 5A / 25A | 1.6A / 8A | 24A / 120A | 12A / 60A |
| Accuracy | 0.1% + 0.2%F.S. | 0.1% + 0.2%F.S. | 0.1% + 0.1%F.S. | 0.1% + 0.1%F.S. | 0.1% + 0.1%F.S. |
| Output Noise (0-20MHz) | | | | | |
| Voltage (P-P) | 90 mV | 85 mV | 180 mV | 90 mV | 100 mV |
| Output Ripple (rms) | 10 mV | 10 mV | 90 mV | 10 mV | 10 mV |
| Output Ripple (rms) | 120 mA | 10 mA | 60 mA | 120 mA | 30 mA |
| OVP Adjustment Range | 110% of Vset to 110% of Vmax | | | | |
| Slew Rate Range | | | | | |
| Voltage (with USB) | 0.001V - 5V/ms | 0.001V - 10V/ms | 0.01V - 10V/ms | 0.001V - 5V/ms | 0.001V - 10V/ms |
| Current (with USB) | 0.001A - 1A/ms | 0.001A - 1A/ms | 0.001A - 1A/ms | 0.001A - 1A/ms | 0.001A - 1A/ms |
| Programing Response Time (Typical) | | | | | |
| Rise Time (Full & No Load) | 6 ms | 10 ms | 30 ms | 8 ms | 8 ms |
| Fall Time | 360 ms(max) | 300 ms(max) | 2.5 s(max) | 460 ms(max) | 240 ms(max) |
| Efficiency | 0.75 | 0.75 | 0.75 | 0.8 | 0.8 |
| Drift (8 hours) | | | | | |
| Voltage | 0.02% of Vmax | | | | |
| Current | 0.04% of Imax | | | | |
| Temperature Coefficient | | | | | |
| Voltage | 0.02% of Vmax/ ^o C | | | | |
| Current | 0.04% of Imax/ ^o C | | | | |
| Transient response time | 3 mS | 3 mS | 3 mS | 3 mS | 3 mS |
| 10 % step change | 150 mV | 180 mV | 600mV | 150 mV | 250 mV |
| Voltage limit @ Series Mode | 150V | 500V | 800V | 200V | 400V |
| AC Line Input Voltage Ranges | 95 to 250Vac | 95 to 250Vac | 95 to 250Vac | 95 to 250Vac | 95 to 250Vac |
| Weight | 13kg | 13kg | 13kg | 13kg | 13kg |
| Operating Temperature | 0 - 40 ^o C | 0 - 40 ^o C | 0 - 40 ^o C | 0 - 40 ^o C | 0 - 40 ^o C |
| Dimensions (HxWxD) mm | 88 x 428 x 425 | 88 x 428 x 425 | 88 x 428 x 425 | 88 x 428 x 425 | 88 x 428 x 425 |

| Model | 42012-100-50 | 42012-600-8 | 42024-80-60 | 42024-100-50 | 42050-100-100 |
|--|-------------------------------|-----------------------|---------------------------------|---------------------------------|--|
| Output Ratings | | | | | |
| Output Voltage | 0-100V | 0-600V | 0-80V | 0-100V | 0-100V |
| Output Current | 0-50A | 0-8A | 0-60A | 0-50A | 0-100A |
| Output Power | 1200W | 1200W | 2400W | 2400W | 5000W |
| Line Regulation | | | | | |
| Voltage | 0.01%+10mV | 0.01%+18mV | 0.01%+8mV | 0.01%+10mV | 0.01%+8mV |
| Current | 0.01%+12mA | 0.03%+20mA | 0.01%+10mA | 0.01%+12mA | 0.01%+24mA |
| Load Regulation | | | | | |
| Voltage | 0.01%+18mV | 0.01%+50mV | 0.01%+12mV | 0.01%+18mV | 0.01%+12mV |
| Current | 0.01%+28mA | 0.03%+40mA | 0.01%+20mA | 0.01%+28mA | 0.01%+56mA |
| Voltage Measurement | | | | | |
| Range | 20V / 100V | 120V / 600V | 16V / 80V | 20V / 100V | 20V / 100V |
| Accuracy | 0.05% + 0.05%F.S. | | | | |
| Current Measurement | | | | | |
| Range | 10A / 50A | 1.6A / 8A | 12A / 60A | 10A / 50A | 20A / 100A |
| Accuracy | 0.1% + 0.1%F.S. | 0.1% + 0.1%F.S. | 0.1% + 0.1%F.S. | 0.1% + 0.1%F.S. | 0.1% + 0.1%F.S. |
| Output Noise (0-20MHz) | | | | | |
| Voltage (P-P) | 100 mV | 180 mV | 100 mV | 100 mV | 50 mV |
| Output Ripple (rms) | 15 mV | 90 mV | 10 mV | 15 mV | 15 mV |
| Output Ripple (rms) | 20 mA | 60 mA | 30 mA | 20 mA | 40 mA |
| OVP Adjustment Range | 110% of Vset to 110% of Vmax | | | | |
| Slew Rate Range | | | | | |
| Voltage (with USB) | 0.001V - 10V/ms | 0.01V - 10V/ms | 0.001V - 10V/ms | 0.001V - 10V/ms | 0.001V - 10V/ms |
| Current (with USB) | 0.001A - 1A/ms | 0.001A - 1A/ms | 0.001A - 1A/ms | 0.001A - 1A/ms | 0.001A - 2A/ms |
| Programming Response Time (Typical) | | | | | |
| Rise Time (Full & No Load) | 10 ms | 60 ms | 8 ms | 10 ms | 10 ms |
| Fall Time | 300 ms(max) | 5 s(max) | 240 ms(max) | 300 ms(max) | 850 ms(max) |
| Efficiency | 0.8 | 0.8 | 0.85 | 0.85 | 0.85 |
| Drift (8 hours) | | | | | |
| Voltage | 0.02% of Vmax | | | | |
| Current | 0.04% of Imax | | | | |
| Temperature Coefficient | | | | | |
| Voltage | 0.02% of Vmax/ ^o C | | | | |
| Current | 0.04% of Imax/ ^o C | | | | |
| Transient response time | 3 mS | 3 mS | 3 mS | 3 mS | 3 mS |
| 10 % step change | 250 mV | 600mV | 250 mV | 250 mV | 250 mV |
| Voltage limit @ Series Mode | 500V | 800V | 400V | 500V | 500V |
| AC Line Input Voltage Ranges | 95 to 250Vac | 95 to 250Vac | 190 to 250Vac (Single phase) | 190 to 250Vac (Single phase) | 190 to 250Vac(3phase 4 wire, Delta connection) or 342 to 440Vac(3phase 5 wire, Y connection) |
| Weight | 13kg | 13kg | 13kg | 13kg | 28kg |
| Operating Temperature | 0 - 40 ^o C | 0 - 40 ^o C | 0 - 40 ^o C | 0 - 40 ^o C | 0 - 40 ^o C |
| Dimensions (HxWxD) mm | 88 x 428 x 425 | 88 x 428 x 425 | 88 x 428 x 425 | 88 x 428 x 425 | 177 x 428 x 566 |

NOTE

1. Minimum output voltage <0.15% of rated voltage.
2. Minimum output current <0.2% of rated current.
3. 95-250Vac with rated load. (42024 & 42050:190-250 Vac)
4. For 0-100% load step with nominal line voltage.
5. Verified by scope with BNC cable and 50Ω termination.
6. At rated current with 10mΩ load.
7. Typical efficiency at nominal input voltage (230V) under maximum output voltage.
8. Maximum drift over 8 hours with constant line-in, loading and temperature after 30 minutes warm-up.
9. Change in output per 1 °C in ambient temperature with constant line and load.
10. Half load and above, the loading slew rate is 1A/us for rise and fall).
11. In order to meet the charge current required by V Slew rate enough I set needs to be set.
12. When model 42050-100-100 in CV mode, the lowest I set value is 1.2% of Full scale to ensure it is not entering into CC mode.

All specifications are subject to change without prior notice.

1.3.1 Other Specifications

| Programming & Measurement Resolution | |
|--|------------------------------|
| Voltage (Front Panel) | 10 mV |
| Current (Front Panel) | 10 mA |
| Voltage (Remote Interface) | 0.003% of Vmax |
| Current (Remote Interface) | 0.002% of Imax |
| Voltage (Analog Programming Interface) | 0.04% of Vmax |
| Current (Analog Programming Interface) | 0.04% of Imax |
| Programming Accuracy | |
| Voltage Programming (Front Panel and Remote Interface) | 0.1% of Vmax |
| Voltage Programming (Analog Programming Interface) | 0.2% of Vmax |
| Current Programming (Front Panel and Remote Interface) | 0.3% of Imax |
| Current Programming (Analog Programming Interface) | 0.3% of Imax |
| Programming Response Time | |
| Rise Time: For a programmed 5% to 95% step in output voltage.(Full & No Load) | See Electrical Specification |
| Fall Time: For a programmed 95% to 5% step in output voltage. (The fall time will be affected by the external loading from UUT.) | See Electrical Specification |
| Vout setting (USB send command to DC source receiver) | 10ms |
| ?Volt , ? Current (under USB command using Fetch) | 10ms |
| ?Volt , ? Current (under USB command using Measure) | 70ms |
| Analog Programming Interface | |
| Voltage and Current Programming inputs | 0~10Vdc or 0~5Vdc of F.S. |
| Voltage and Current monitor | 0~10Vdc or 0~5Vdc of F.S. |
| Isolation: Maximum working voltage of any analog programming signal with respect to chassis potential. | 70Vdc |
| Auxiliary Power Supply | |
| Output Voltage | 12Vdc |
| Maximum Current Source Capability | 10mA |
| Remote inhibit function (I/O) | |
| Use to disable the output of DC power supply; Active Low | TTL |

| | |
|--|------------------------------|
| DC-ON Output Signal | |
| Indicate the output status; Active High | TTL |
| Fault output signal | |
| Indicate if there is a fault/protection occurred; Active Low | TTL |
| Series & Parallel operation function with Master / Slave control | |
| Voltage limit @ Series Mode | See Electrical Specification |
| Voltage limit @ Series Mode (Refer to Ground) | 240 Volt |
| Number of DC Power Supplies allowed @ Master / Slave control mode | 5 |
| Auto Sequencing Programmable Function | |
| Number of program | 10 |
| Number of sequence | 100 |
| Time Range | 5ms - 15,000S |
| TTL signal out | 8 bits |
| TTL source capability | 7 mA |
| Voltage Step Mode Programmable Function | |
| Start_Voltage Range | See each mode V range |
| End_Voltage Range | See each mode V range |
| Total Run Time Range (hhh:mm:ss.sss) | 10ms - 99 hours |
| Slew Rate Control Function | |
| Voltage slew rate range (The fall slew rate will be affected by the discharge rate of the output capacitors especially under no load condition.) | See Electrical Specification |
| Current slew rate range | See Electrical Specification |
| Minimum transition time. | 0.5 ms |
| Remote Sense | |
| Line loss compensation | 5V |

All specifications are subject to change without prior notice.

⚡ CAUTION

Voltage from the two output terminals to earth varies with the 42000 Series Models as shown below:

| Model | Max. Voltage (Vdc) Difference between Output Terminal and Earth |
|---------------|---|
| 42006-30-80 | ±250 |
| 42006-100-25 | ±250 |
| 42006-300-8 | ±300 |
| 42012-40-120 | ±250 |
| 42012-80-60 | ±250 |
| 42012-100-50 | ±250 |
| 42012-600-8 | ±600 |
| 42024-80-60 | ±250 |
| 42024-100-50 | ±250 |
| 42050-100-100 | ±250 |

If the voltage exceeds the above range damage may result to the DC Power Supply.

1.4 Function Keys

1.4.1 Front Panel

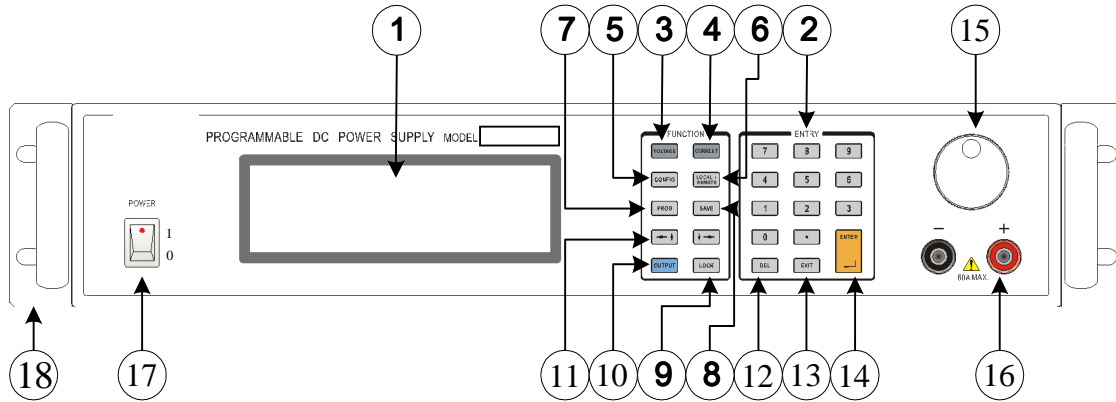


Figure 1-1 Front Panel of 42006, 42012 & 42024

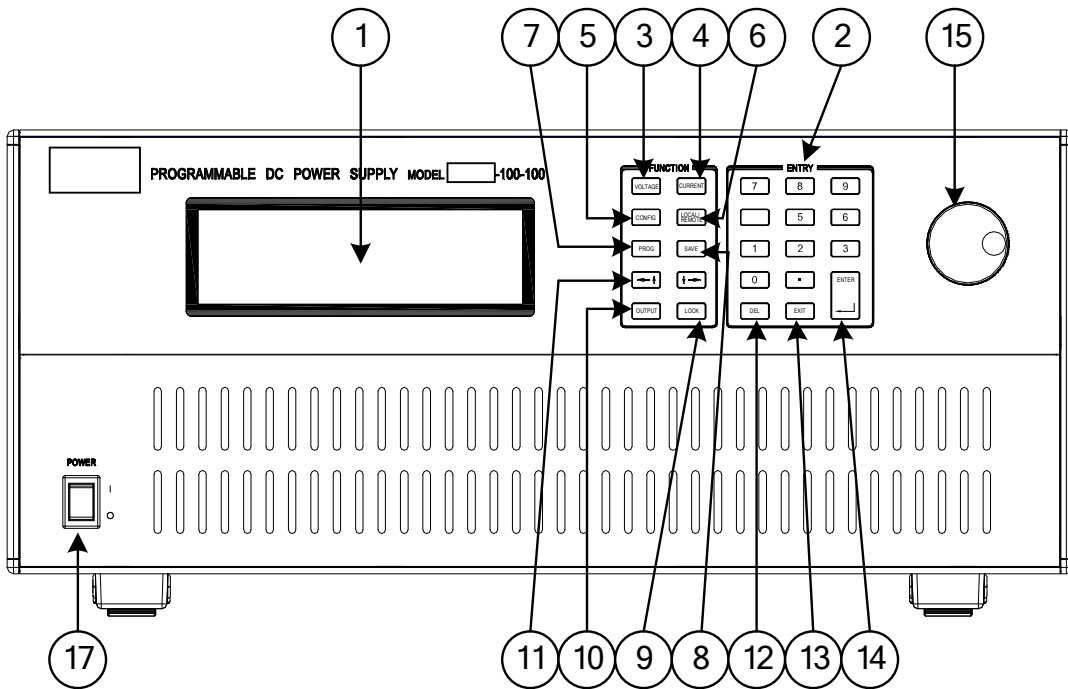

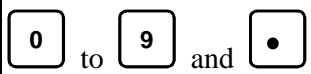




















Figure 1-2 Front Panel of 42050

| Item | Symbol | Description |
|------|---|--|
| 1 |  | DISPLAY: LCD Display: Shows the output settings and measured result. |
| 2 |  | Numeric and Decimal Point: Users can use the numeric keys and the decimal point key to enter digital data. |
| 3 |  | Voltage Setting Key: Enters the voltage setting mode. Users can use numeric keys or rotary knob to input voltage values |
| 4 |  | Current Setting Key: Enters the current limit setting mode. Users can use numeric keys or rotary knob to input current limit values. |
| 5 |  | CONFIG Key: Press this key to skip to “Config Choose Page” for setting various functions. |
| 6 |  | LOCAL/REMOTE Switch Key: Press this key to switch the control mode to “Front Panel Input” or “Remote Control”. |
| 7 |  | PROGRAM Key: Press this key to skip to “Program Function Page” for setting waveform editing mode. |
| 8 |  | SAVE Key: Press this key to save the settings in “Program and Config Function Page” |
| 9 |  | LOCK Key: Press this key to lock all keys and rotary knob. To unlock: press “  ” for three seconds to release it. |
| 10 |  | OUTPUT Key: Press this key to control the output to “ON” or “OFF”. |
| 11 |  | Cursor Movement Keys: Use “  ” and “  ” keys to move the cursor to the parameter to be modified. |
| 12 |  | Delete Key: Press this key to delete the input value. |
| 13 |  | EXIT Key: Press this key to go to previous screen. If this key is pressed before “  ” is pressed, the screen will go back to the “MAIN PAGE” and the data will not be saved. |
| 14 |  | ENTER Key: Press this key to confirm the parameter settings. |
| 15 |  | ROTARY Knob: Users can turn the knob “  ” to input data or select item. |

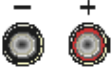
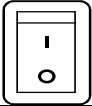
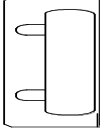
| Item | Symbol | Description |
|------|---|--|
| 16 |  | Output Terminal on Front Panel: The maximum output current differs from the models when connected with the output terminals on the rear panel. Note: 30V, 40V and 600V Models have no front panel output terminal. |
| 17 |  | Main Power Switch: Switches the power on or off. |
| 18 |  | Rack Bracket:(Option) Use the left (right) bracket to fit the Power Supply on the Rack. |

Table 1-1 Description of Front Panel

1.4.2 Rear Panel

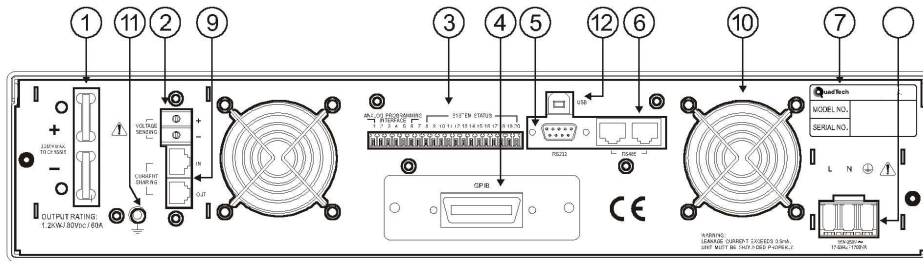


Figure 1-3 Rear Panel of 42006, 42012 & 42024 Low/Middle Voltage (30V/40V/80V/100V) Model

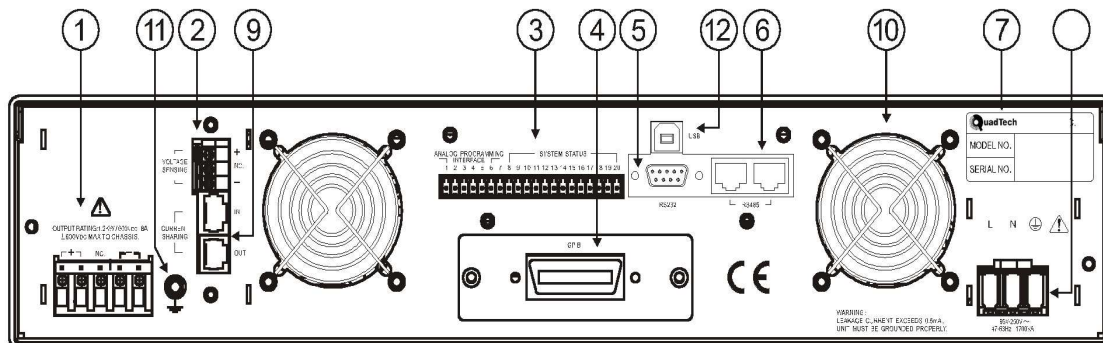


Figure 1-4 Rear Panel of 42006, 42012, 42024 High Voltage Model (300V/600V)

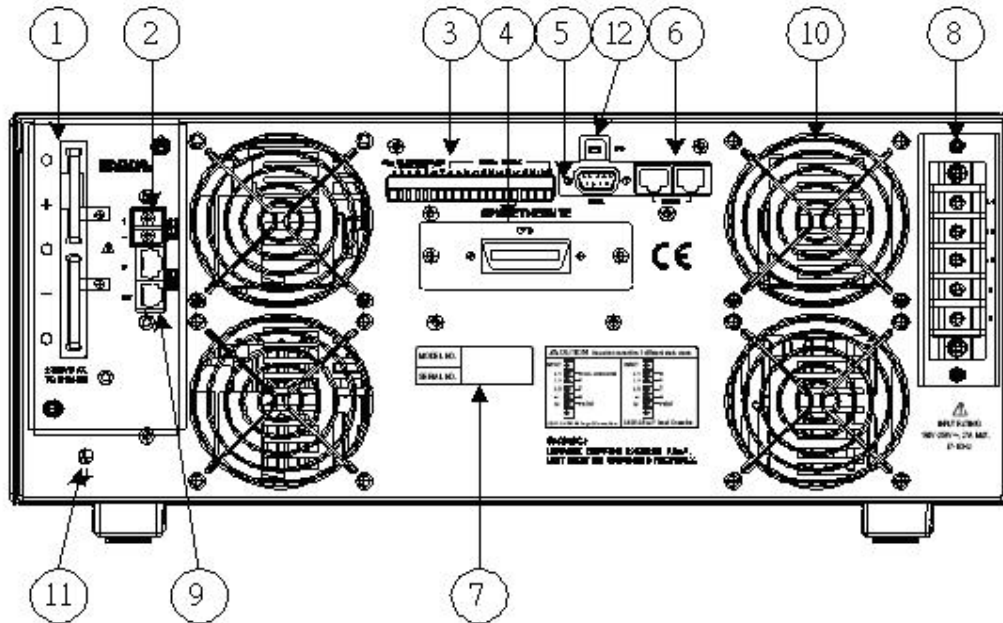


Figure 1-5 Rear Panel of 42050 Model

| Item | Name | Description |
|------|---|---|
| 1 | Output terminal | The output terminals of DC Power Supply. |
| 2 | Remote Sense Connector | Hooking this connector to the load provides voltage compensation due to the voltage drop generated due to a cable resistance. Be sure to connect the remote sense connector “+” to the positive output terminal and “-” connector to the negative output terminal. Do not connect the remote sense connector to the “+”, “-” output terminal reversely. |
| 3 | APG & Status Signal Connecting Terminal | There are two sections for these 20 pins signals. Pin 1~6 are APG input/output terminals while pin 8~20 are system status signal terminals. See <i>Appendix A</i> for detail pin assignments. Note: This terminal is sensitive to ESD. Do not touch it during operation. |
| 4 | GPIB Connector (Option) | The GPIB bus used by the remote controller is connected to the PC via this connector for remote control. |
| 5 | RS-232C | It is a 9-pin D-type male connector. The control commands are transmitted between the remote and the PC for remote control. |
| 6 | RS-485 | Serial or parallel data transmission use. |
| 7 | Label | The label has model no. and the serial no. of DC Power Supply. |
| 8 | AC Power Connector | It inputs AC power through a power line and connects to the input stage through this connector. |
| 9 | Current Sharing Connector | It shares the output current equally when connecting in parallel. It has to be removed when connecting in series for use. |
| 10 | Fan Mask | Avoid touching the fan and do not block the fan mask to avoid accumulating heat inside the machine. |
| 11 | Functional Ground | This terminal is for the user to refer to Earth Ground easily. |
| 12 | USB | The remote controller uses a USB connector to connect to the PC for remote operation. |

Table 1-2 Description of Rear Panel

2. Installation

2.1 Checking the Package

- (1) Check if there is any damage or any missing accessories after unpacking it.
- (2) Should any damage be found, contact QuadTech, Inc. immediately to request return shipment.

The packaging is shown below.

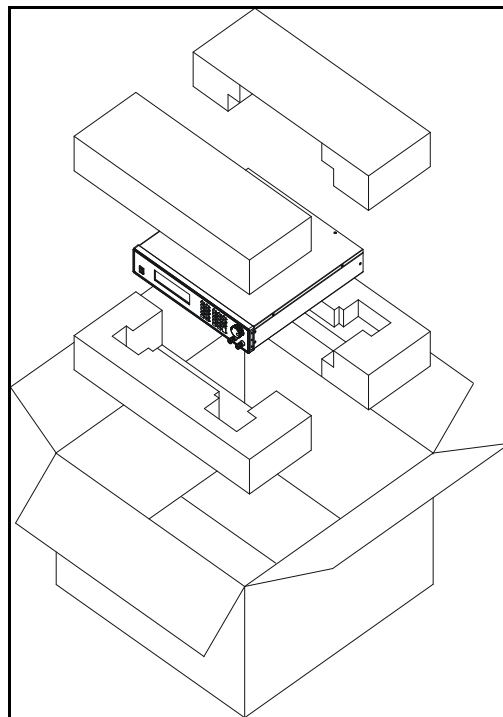


Figure 2-1

ⓘ NOTICE

1. Please keep all of the packing materials in case the device has to be returned for repair.
 2. Do not return the instrument to the factory without obtaining prior RMA acceptance from QuadTech, Inc.
-

2.1.1 Maintenance & Cleaning

Remove all the connected wires and cables on the instrument before cleaning. Use a brush to clean any dust off and if there are stains on the chassis that cannot be removed by brush, wipe it with volatile liquid (such as Cleaning Naphtha). Do not use any corrosive liquid to avoid damaging the chassis. Use a damp cloth with soapy water or a soft detergent to clean the LCD front panel. For internal cleaning, use a low-pressure air gun to dust inside or send it back to our agent for cleaning.

2.2 Preparation for Use

- (1) Be sure the Power Supply is connected to the AC line input that meets the specifications.
- (2) The instrument must be installed in an air-circulated environment to avoid the internal temperature getting too high.
- (3) The ambient temperature does not exceed 40°C.

2.2.1 Normal Environment Conditions

- (1) Indoor use.
- (2) Altitude up to 2000m.
- (3) Temperature 5°C to 40°C.
- (4) Maximum relative humidity 80% for temperatures up 31°C decreasing linearity to 50% relative humidity at 40°C.
- (5) Input AC supply voltage fluctuations can be up to +-10% of the rated voltage.
- (6) Transient over voltage is impulse withstand CAT II. (**Note:** 42050 is CAT III.)
- (7) Pollution degree II.

2.3 Requirements of Input Power

2.3.1 Ratings

- (1) 42006-xx-xx Model

| | | |
|---------------------|---|----------------------------|
| Input Voltage Range | : | 95 ~ 250 Vac, single phase |
| Input Frequency | : | 47~ 63 Hz |
| Max. Input Power | : | 1000VA |
- (2) 42012-xx-xx Model

| | | |
|---------------------|---|----------------------------|
| Input Voltage Range | : | 95 ~ 250 Vac, single phase |
| Input Frequency | : | 47~ 63 Hz |
| Max. Input Power | : | 1700VA |
- (3) 42024-xx-xx Model

| | | |
|---------------------|---|-----------------------------|
| Input Voltage Range | : | 190 ~ 250 Vac, single phase |
| Input Frequency | : | 47~ 63 Hz |
| Max. Input Power | : | 2900VA |
- (4) 42050-xx-xx Model

| | | |
|--------------------------------|----|--|
| Input Voltage Range | : | 190 ~ 250 V _{LL} , 3-phase 4-wire Δ ; |
| | or | 329 ~ 433 V _{LL} , 3-phase 5-wire Y |
| Input Frequency | : | 47~ 63 Hz |
| Max. Input Power | : | 6000VA |
| Max. Input Current (per phase) | : | 16A (3-phase 5-wire Y), 27A (3-phase 4-wire Δ) |

⚡ CAUTION

1. If the input voltage is not within the range as described above, the output will shut down automatically to protect the DC Power Supply.
2. 42050 can connect to 220 V_{LL} 3-phase 4-wire Δ and 380V_{LL} 3-phase 5-wire Y. Verify the power in-use carefully before connection is made and select the appropriate circuit breaker.

2.3.2 Input Connection

- (1) The input connector board is located on the right side of the rear panel.
- (2) The power line must be rated at least 85°C.
- (3) The power cable gage must be 10AWG or 12AWG. (**Note:** 42050 must be 8AWG or 10AWG when connecting 3-phase 4-wire Δ .)
- (4) To assemble the 42006, 42012 & 42024: See Figure 2-2 and execute the following steps:
 - a. Remove the input terminal safety cover from the rear panel of the DC Power Supply.
 - b. Strip back wires about 1cm and tin it.
 - c. Insert wire into the power terminal and secure with a Phillips screwdriver.
 - d. Lock the safety cover to avoid electric shock.
 - e. Secure the safety cover latch to prevent the cable from falling or the electric terminal from exposing.

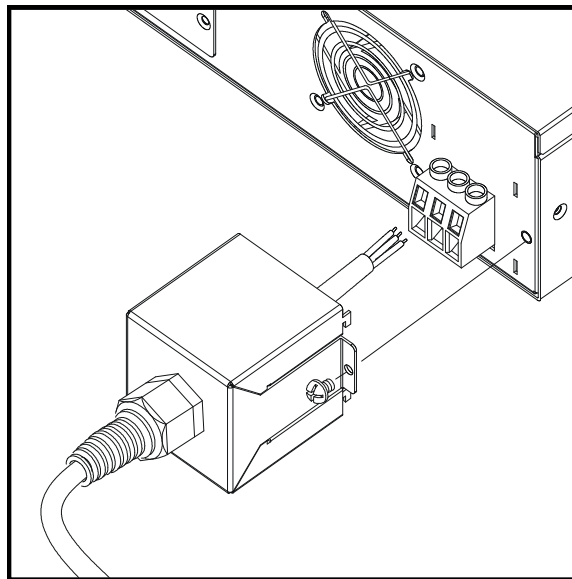



Figure 2-2

⚠ WARNING

1. Connect the green or green/yellow wire to the  terminal.
2. Connect the white or blue wire to the “N” terminal.
3. Connect the black or brown wire to the “L” terminal.

- (5) To assemble the 42050: See Figure 2-3 & Figure 2-4
 - a. Remove the input terminal safety cover from the rear panel of the DC Power Supply.
 - b. Insert wires into the power terminal and secure with a Phillips screwdriver.
 - c. Lock the safety cover to avoid electric shock. See Figure 2-5 for assembly.

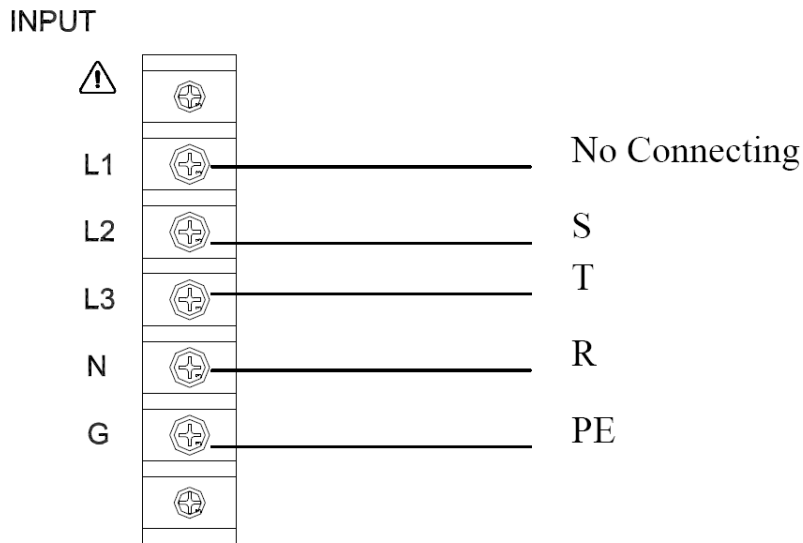


Figure 2-3 220V_{LL}, 3-phase 4-wire Δ Input Connection

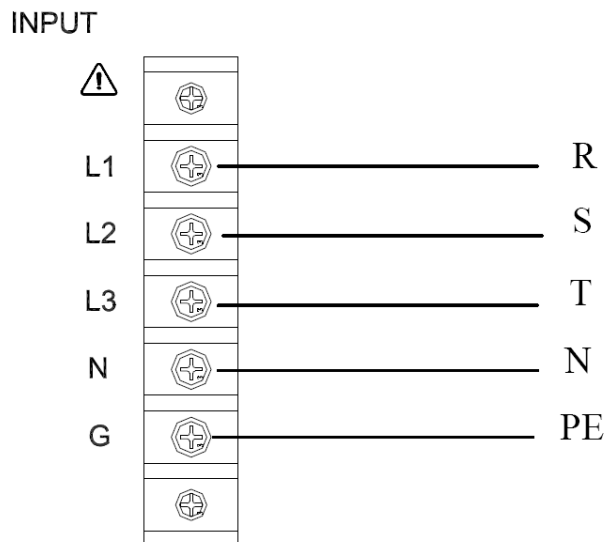


Figure 2-4 380V_{LL}, 3-phase 5-wire Y input connection

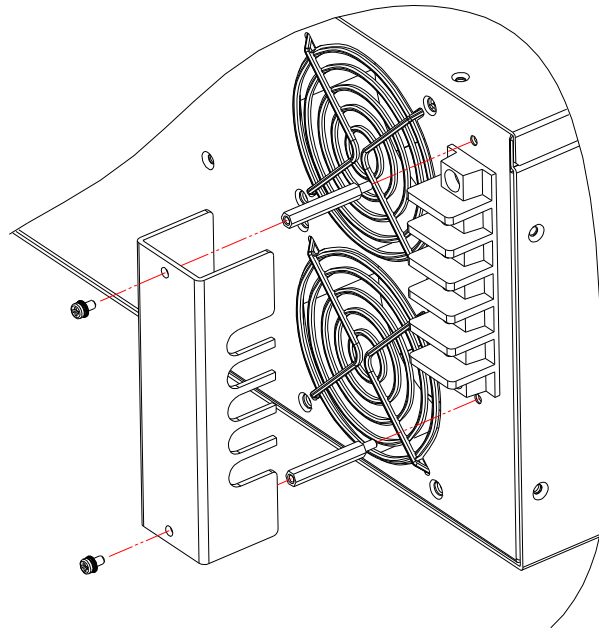



Figure 2-5 Assembling 42050 Input Terminal Safety Cover



1. To protect the operators, the wire connected to the GND terminal () must be connected to the earth. Under no circumstances shall this DC Power Supply be operated without an adequate ground connection.
2. Installation of the power cord must be done by a professional and compliant with local electrical codes.

2.4 Output Connection

The 42000 Series DC Power Supply has two output connectors, one is located at the left on the rear panel while the other one is located at the right on the front panel. The load is connected to the “+” and the “-” output terminal.

⚡ CAUTION

1. To meet the safety requirements, the safety cover must be tightly secured.
2. The diameter of the wire connected to the load must be able to carry the maximum current applied.

2.4.1 Rear Panel Output

See Figure 2-6.

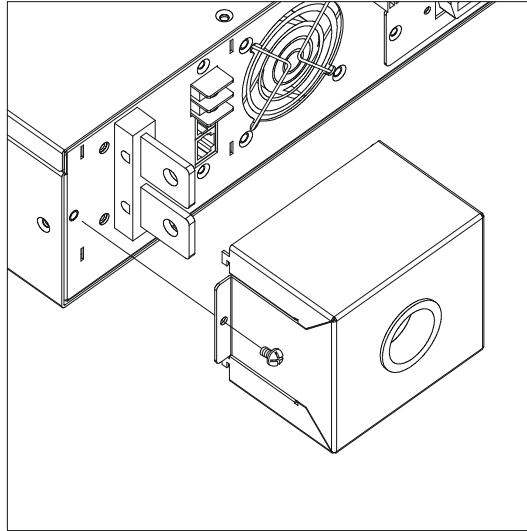


Figure 2-6 Assembling the Rear Safety Cover of 42006, 42012 & 42024

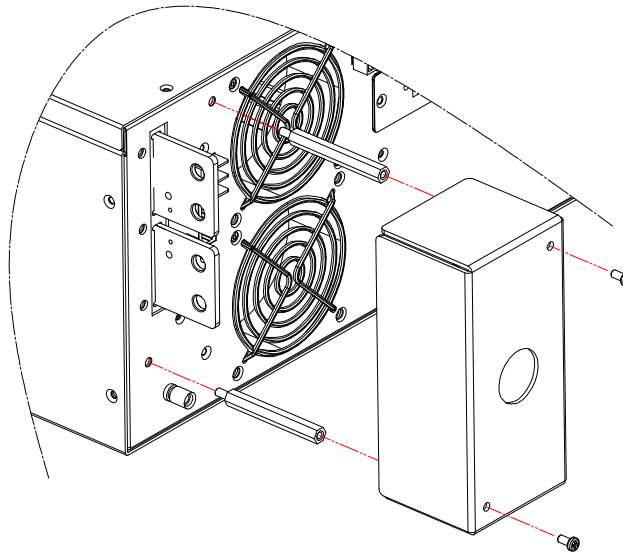


Figure 2-7 Assembling the Rear Safety Cover of 42050

2.4.2 Front Panel Output

Except for low and high voltage models, the maximum current for front panel output varies by 42000 Series model. See Figure 2-8 for connection.

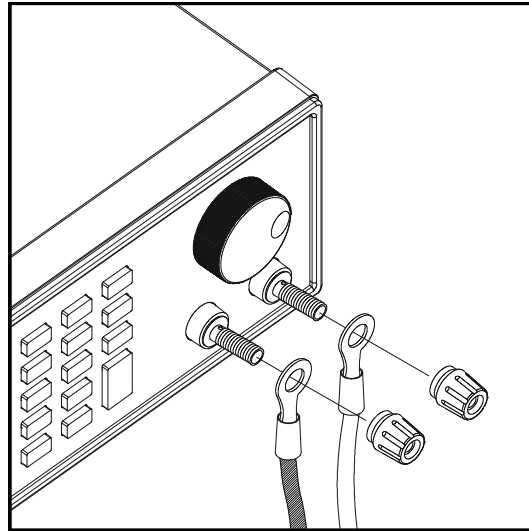


Figure 2-8

⚡ CAUTION

For safety reasons, do not exceed rated current output from 42000 Series to avoid danger.

ⓘ NOTICE

The maximum current for front panel output differs from 42000 Series models. See the table below for the maximum current for front panel output.

| Model | Max. Output Current (A) |
|--------------|-------------------------|
| 42006-100-25 | 25 |
| 42012-80-60 | 60 |
| 42012-100-50 | 50 |
| 42024-80-60 | 60 |
| 42024-100-50 | 50 |

2.4.3 Specification of Connecting Wire

The maximum output inductance of the connection wire to the source is 2 μ H. This is the total inductance of the two wires after twisted or otherwise processed including self-inductance and mutual-inductance.

⚡ CAUTION

1. To ensure the system's stability, the cable inductance should not exceed 2 μ H.
2. Use appropriate gage wire for available output current to avoid overheating and causing a fire hazard.

2.4.4 Specification of Parallel Capacitance

The parallel capacitance for output varies with the 42000 Series Models as shown below:

| Model | Max. Parallel Capacitance for Output |
|---------------|--------------------------------------|
| 42006-30-80 | 70 mF |
| 42006-100-25 | 10 mF |
| 42006-300-8 | 1.35 mF |
| 42012-40-120 | 70 mF |
| 42012-80-60 | 10 mF |
| 42012-100-50 | 10 mF |
| 42012-600-8 | 1.35 mF |
| 42024-80-60 | 10 mF |
| 42024-100-50 | 10 mF |
| 42050-100-100 | 20mF |

⚡ CAUTION

1. To ensure the system's stability, the capacitance should not exceed the value listed above.
 2. Be aware of the polarity and withstand voltage when paralleling capacitance.
-

2.5 Remote Sensing

2.5.1 Correct Connection

1. Connecting the remote sensing wires can compensate for voltage drop due to output cables. The DC Power Supply is able to compensate up to a maximum of 5V drop.
2. Figure 2-9 shows the correct connection. Use two wires to connect the positive/negative connector of load to the remote sensing connector on the rear panel. The connecting wire diameter must be larger than 30AWG the withstand voltage should be within the specifications.
3. Though the remote sensing is able to compensate a voltage drop of 5V, the maximum output power of DC Power Supply is still rated (1200W for 42012 Series and 600W for 42006 Series. The output power is calculated by multiplying the voltage on the output terminal and the current passed.) Therefore, if the power exceeds what the DC Power Supply can provide, supply will be unable to compensate for the voltage drop of 5V. The DC Power Supply will then activate the Over Power Protection (OPP).

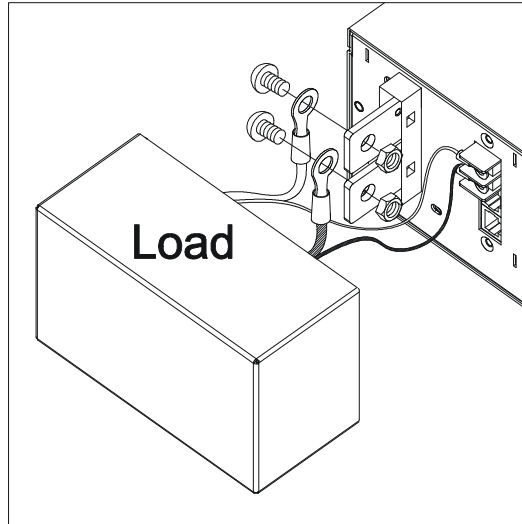


Figure 2-9

2.5.2 Disconnecting Remote Sensing Wire

If the remote sensing wires are disconnected (meaning the two cables are open), the supply will still work, however, the error will be larger. The voltage measured from the output terminal is about 2% larger than the set value; therefore, it is necessary to connect the remote sensing wire correctly. Please connect the remote sensing wire to the output terminal as Figure 2-10 shows. This connection will ignore the voltage drop due to cables.

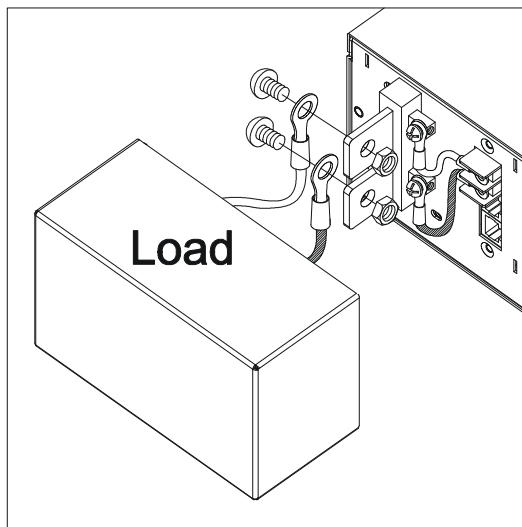


Figure 2-10

Figure 2-11 shows the Remote Sensing installation for a high voltage model.

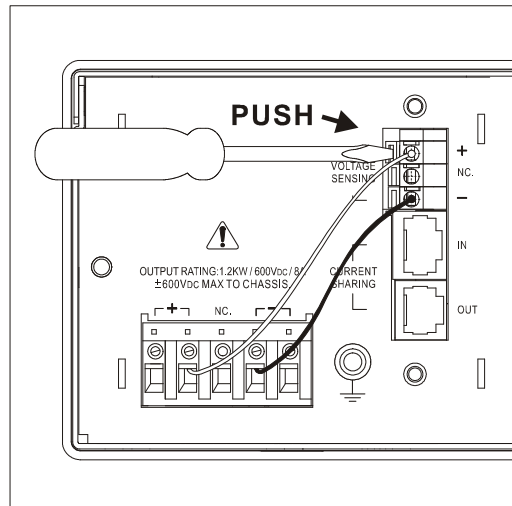


Figure 2-11

2.5.3 Reverse Connection of Remote Sensing Wire Polarity

The polarity of the remote sensing wire must be connected correctly, meaning the “+” terminal is connected to the “+” of the output terminal or to the connecting wire of the terminal. The “-” terminal is connected to the “-” of the output terminal or to the connecting wire of the terminal. If the polarity is connected in reverse, the output will drop to 0V and prompt an error message “SENSE FAULT” as Figure 2-12 shows.

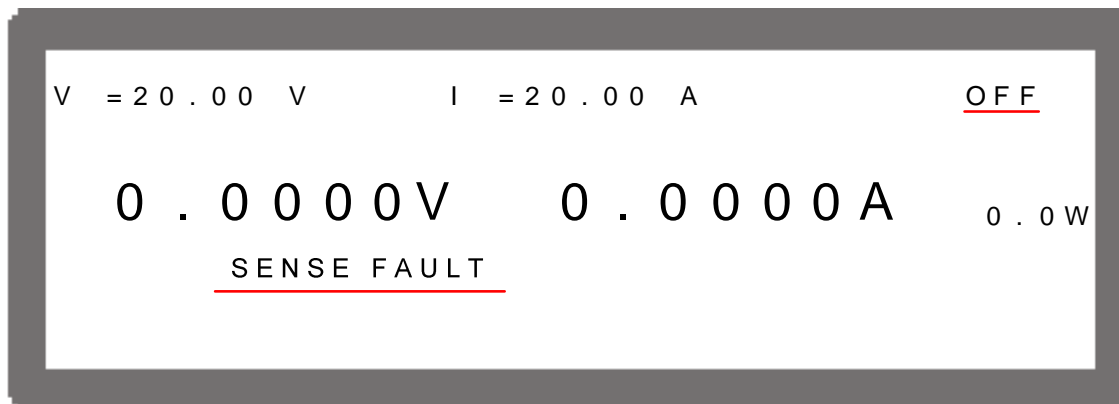


Figure 2-12

ⓘ NOTICE

The DC Power Supply will not be damaged due to the reverse connection of polarity. Do the following step to reset it:

1. First, power it off.
2. Connect the remote sensing wire properly.
3. Restart the DC Power Supply.

2.5.4 Rack Mounting Kit & Handle Installation

Remove the silver inlay from the plastic side frame and use M4X15 flat head screws to secure the rack mounting kit to the plastic side frame. If a handle is required for installation, use M4X9 flat head screws to secure it to the rack mounting kit as shown below.

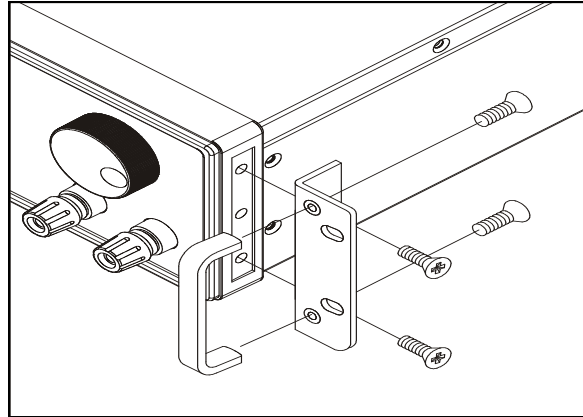


Figure 2-13 Installing the Rack Mounting Kit & Handle for 42006, 42012 & 42024

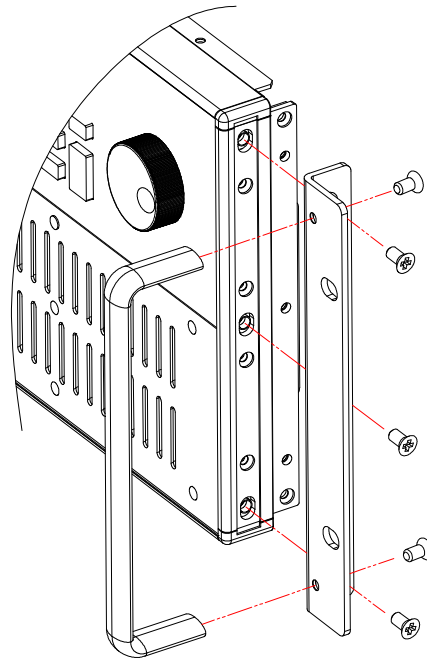


Figure 2-14 Installing the Rack Mounting Kit & Handle for 42050

2.6 Power-On Procedure

Plug in the power cord and turn on the power switch on front panel. The DC Power Supply will run a series of self-tests. The LCD on front panel will light up as shown below:

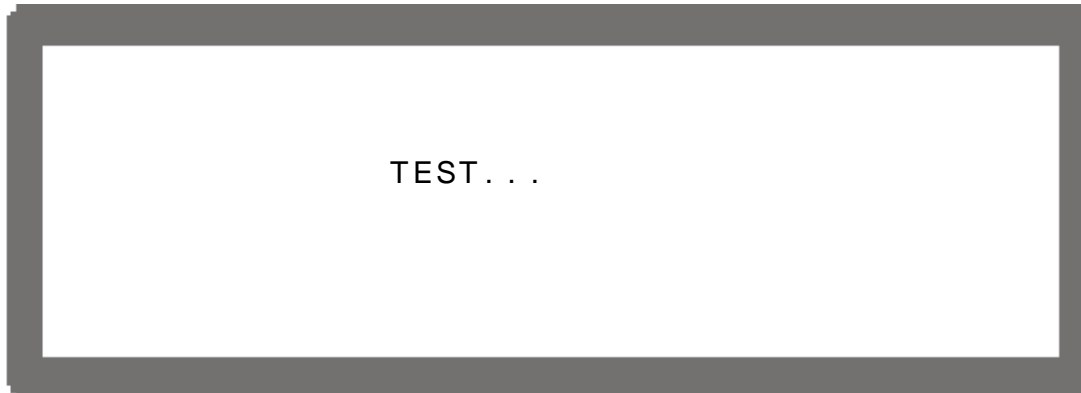


Figure 2-15

Meanwhile, the DC Power Supply will run self-tests for memory, data and communication. Once the routine of self-tests is done, the model no. and serial no. will be shown on the screen and prompt “OK” at the right in the test item has passed. When self-test is done the display below will be shown:

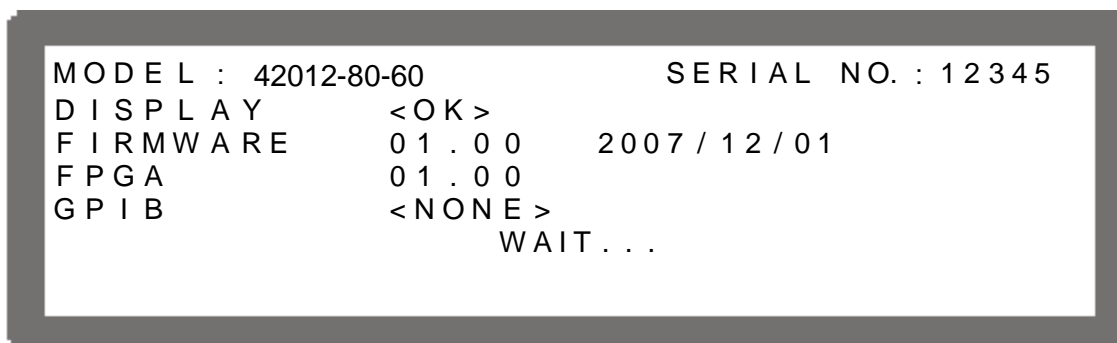


Figure 2-16

ⓘ NOTICE

1. If an item fails during self-test, an “ERROR CODE” will be shown to the right. See Section 7.2 for the error messages and troubleshooting.
 2. When the REMOTE shows <OK> it means the GPIB is connected to the Power Supply for remote operation. If GPIB fails it indicates the GPIB card is not connected, but the unit can still be operated manually.
 3. If the Power Supply beeps long and low during power-on and the LCD has no screen display, it indicates a fault with the LCD display. Please turn the Power Supply off and then on again. If the long low beep still exists, contact your agent to return the hardware for a repair service.
-

When the self tests of memory, data and communication are complete, the screen turns to MAIN PAGE automatically as shown below:

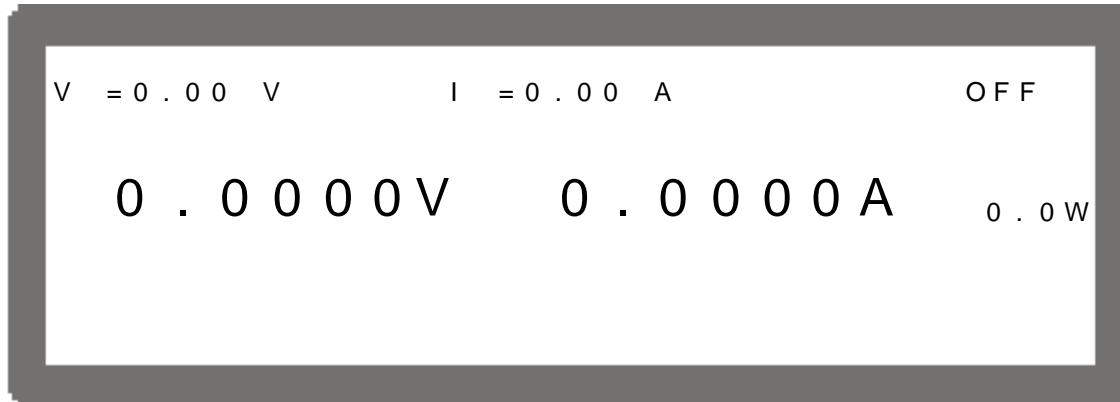


Figure 2-17

⚠ WARNING

1. Users can diagnose any fault during self-test at power-on. See section 7.2 for details.
2. The DC Power Supply internal circuit may not be able to reset if it is powered-off and then on immediately. QuadTech, Inc. suggests waiting three seconds after powering off, then turn power on again.

⚡ CAUTION

Before turning on the instrument, all protective grounding terminals, extension cords and devices must connect to earth.

The hazard of potential electric shock may occur in any interrupted grounding and could result in injury.

2.7 I/O Connector (Option)

The GPIB interface I/O connector is available for purchase.

For assembly, remove the cover plate of GPIB card (Figure 2-18) and insert it and secure with screws.

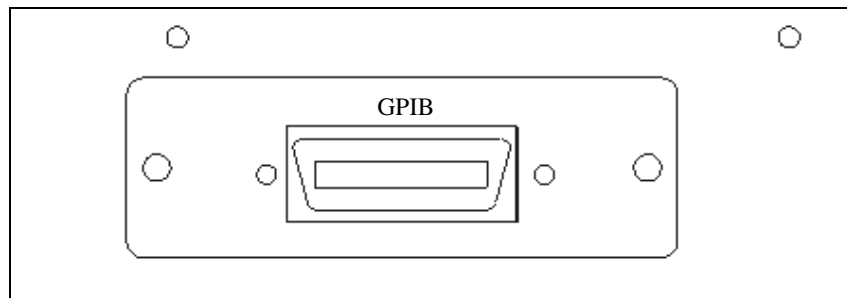


Figure 2-18

3. Manual Operation

3.1 Introduction

The DC Power Supply can be operated manually or remotely via GPIB controller, RS-232C, USB or APG interface which is described in Chapter 5 and section 3.3.1.3. The manual operation for using the front panel keyboard or rotary knob to input the data is described in this chapter.

ⓘ NOTICE

If the operation mode is not saved before the instrument is powered off, the operation mode will default to manual mode when powered on the next time..

3.2 Setting Voltage & Current

There are two ways to set the output voltage (CV MODE) as Figure 3-1 shows:

Method 1:

1. Press “**VOLTAGE**”, the cursor for V on MAIN PAGE blinks.
2. Use the numeric keys (0~9) to set the value and press “**ENTER**” to complete the voltage setting or turn the “Rotary” (⊙) knob to adjust the set value.
3. Press “**OUTPUT**” to output the set voltage. (Please note, in order to remain the output in CV mode, the current setting must be larger than the load current. Otherwise, the output voltage will not equal to the set voltage.)

Method 2:

1. Press “**VOLTAGE**”, the cursor for V on MAIN PAGE blinks.
2. When using the “Rotary” (⊙) knob for setting, the “**←↑**” and “**→↓**” keys can be used to move the cursor to the individual digits, and then turn the rotary knob to increase or decrease the minimum unit of the set value.
3. Press “**OUTPUT**” to output the set voltage. (Please note, in order to remain the output in CV mode the current setting must be larger than the load current. Otherwise, the output voltage will not equal to the set voltage.)

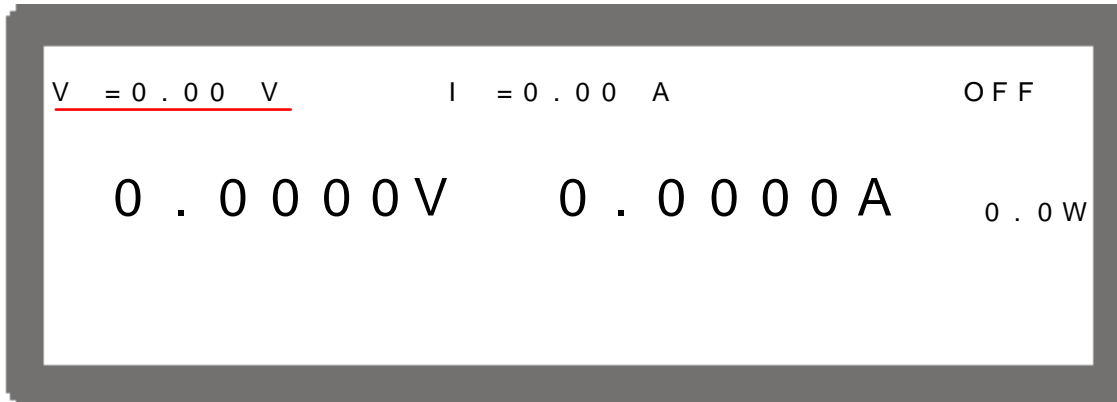


Figure 3-1

Setting the current (CC MODE):

Press **CURRENT** and the rest settings are the same as the voltage as Figure 3-2 shows. (Please note, in order to remain the output in CC mode, the load current setting must be larger than the current. Otherwise, the output current will not equal to the set current.)

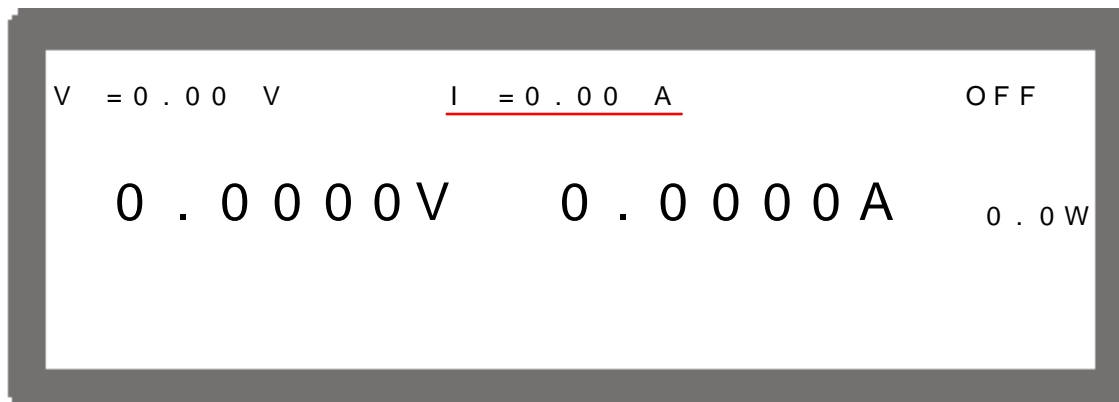


Figure 3-2

3.3 Setting Configuration

The configuration setting function allows users to set the system functions for the DC Power Supply. The system functions that can be edited by the configuration are:

1. System Setup: To set various system parameters including GPIB address.
2. Output Setup: To set various output parameters including voltage/current slew rate and etc.
3. Series/Parallel: To set the parameters for series or parallel mode.
4. Display: To set the parameter arrangement on the panel.
5. Protection: To set the parameters for each of the protection functions.
6. Factory Setting: To set the production information and settings.
7. Calibration: To calibrate the DC Power Supply.

Following explains the way to set the configuration.

Press “**CONFIG**” to enter the config setting screen as Figure 3-3 shows.

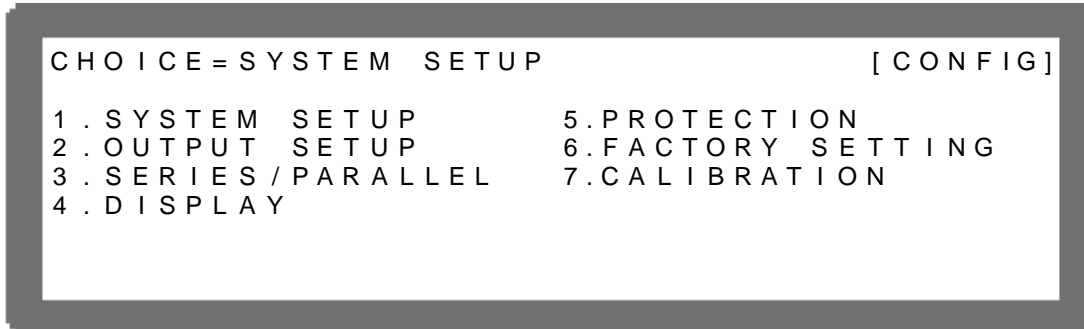


Figure 3-3

1. Use the numeric (**1**~**7**) keys or “Rotary” (⊙) knob to select the item to be set.
2. Press “**ENTER**” to confirm.

ⓘ NOTICE

1. To cancel the setting, press “**EXIT**” to return to the MAIN PAGE.
 2. Press “**VOLTAGE**” or “**CURRENT**” in any page can return to the MAIN PAGE.
-

Figure 3-4 shows the tree structure of CONFIG PAGE.

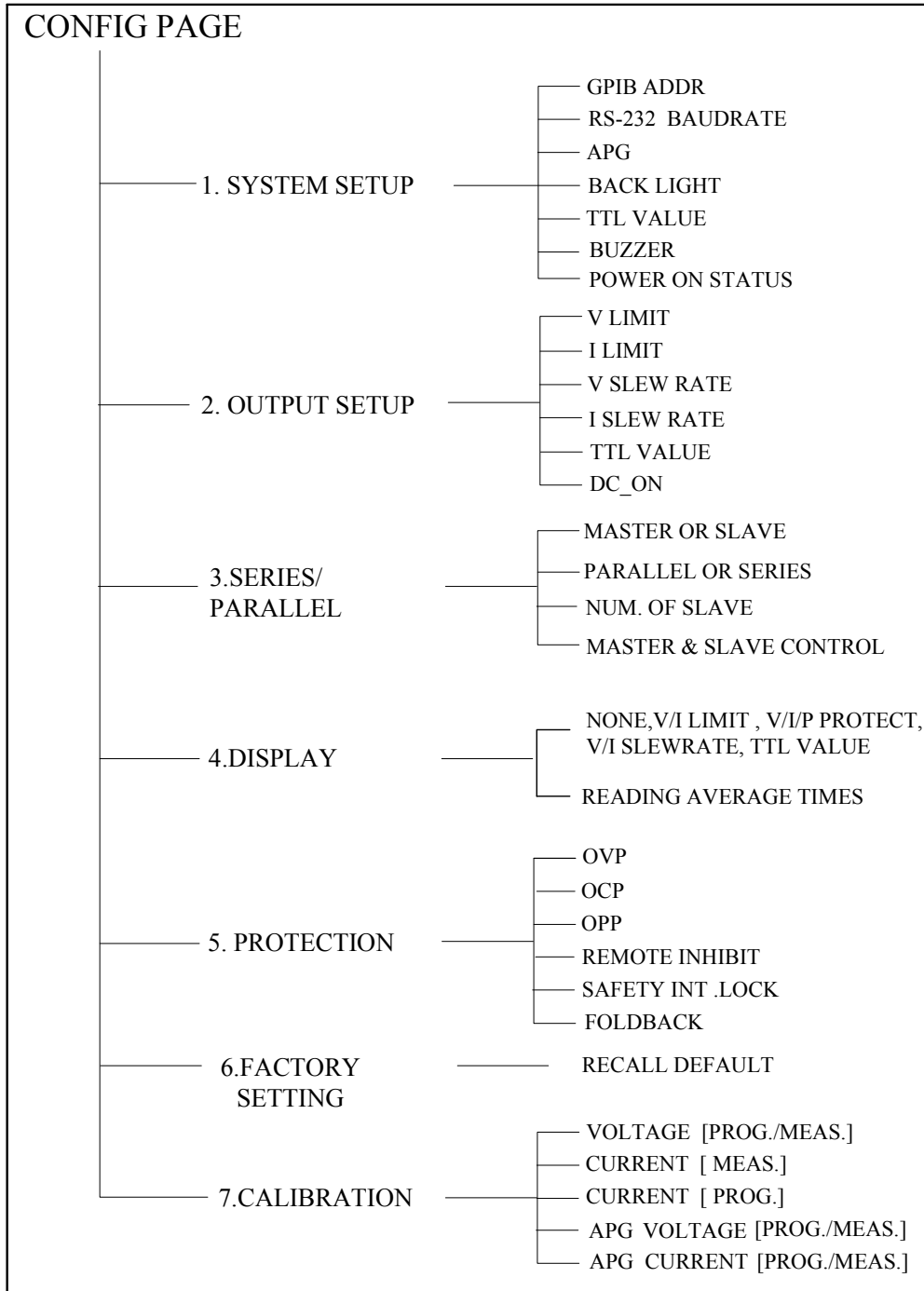


Figure 3-4

3.3.1 SYSTEM SETUP

1. In Config setup page, pressing “” will display the screen of Figure 3-5.

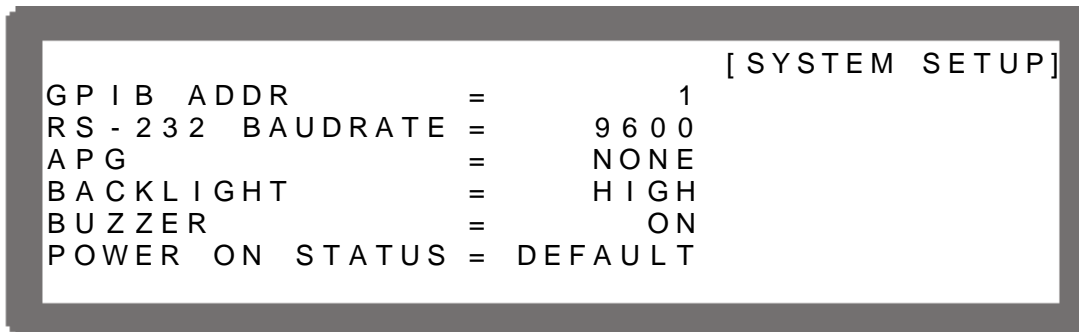









Figure 3-5

2. Press “” to edit the options in SYSTEM SETUP.

Following introduces the options of SYSTEM SETUP.

3.3.1.1 GPIB ADDRESS

This instrument is available for remote operation. Be sure to set the GPIB address before using it for a remote control.




1. Use “”, “” keys to move the cursor to GPIB ADDR column.
2. Use the numeric (~) keys or “Rotary” () to set the address.
3. Press “” to confirm.

ⓘ NOTICE

The address range is 0~30.

3.3.1.2 RS-232 BAUDRATE

This instrument is available for remote operation via RS-232. Be sure to set the RS-232 baudrate before using it for a remote control.



1. Use “”, “” keys to move the cursor to RS-232 BAUDRATE column.
2. Use “Rotary” () knob to set the BAUDRATE.

ⓘ NOTICE

The RS-232 has three baudrates 9600/19200/38400.

3.3.1.3 APG

Analog Programming interface (APG) uses analog signals to control the output. This option decides whether or which APG control function is in use. No matter what option is selected the APG measurement functions are available.

1. Use the “”, “” keys to move the cursor to the column to be set.

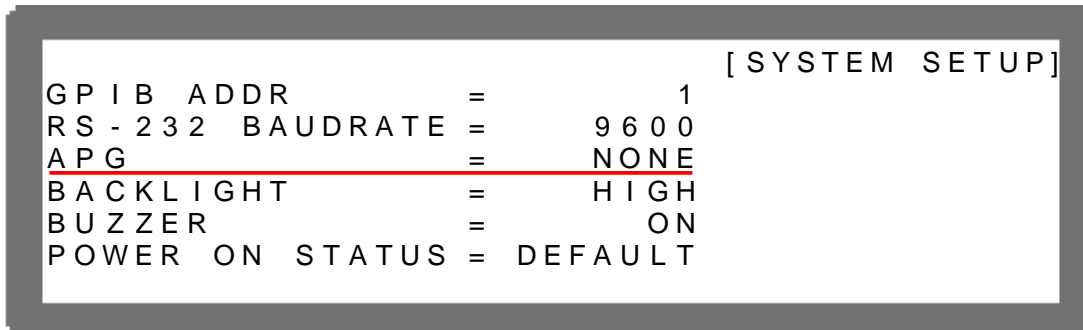




Figure 3-6

2. Use the “Rotary” () to set the mode. APG has four options: **NONE / V / I / V&I**:
NONE: Indicates the non-use of the programming function for voltage and current.
V: Indicates using voltage programming, but not the current programming function.
I: Indicates using current programming, but not the voltage programming function.
V&I: It indicates using both the voltage and the current programming function.
3. Press “” to confirm.
4. A reference potential option will prompt at the right for selection when the APG function is enabled.

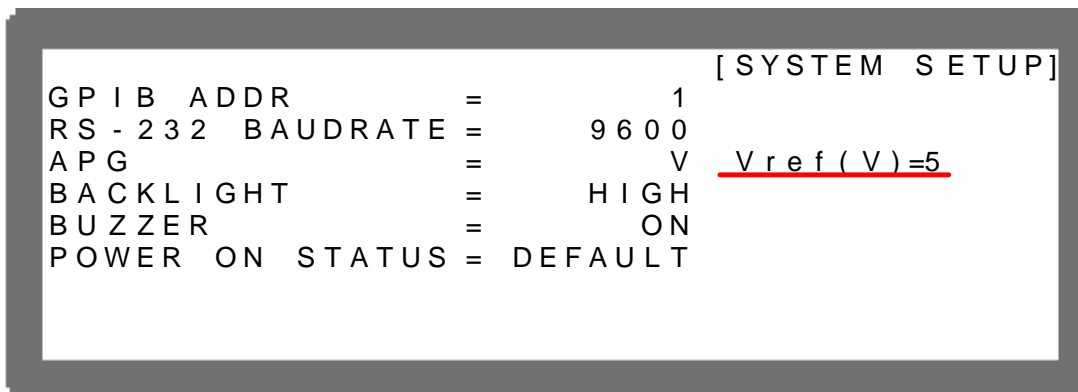








Figure 3-7

5. Use the “”, “” keys to move the cursor to the column to be set.
6. Press the “” or “” to set the value, or use the “Rotary” () knob to select the control voltage range.
7. Press “” to confirm.

8. Press “” to return to the MAIN PAGE.

① NOTICE

1. APG has two reference voltage levels: $V_{ref}(V)=5 / 10$. Take the example of the 42012-80-60:
 - a. When selecting $V_{ref}=5V$: It means the DC Power Supply’s output $0V/0A\sim 80V/60A$ will map to $0\sim 5V$ (programming or measurement) as Figure 3-8(a) shows.
 - b. When selecting $V_{ref}=10V$: It means the DC Power Supply’s output $0V/0A\sim 80V/60A$ will map to $0\sim 10V$ (programming or measurement) as Figure 3-8(b) shows.

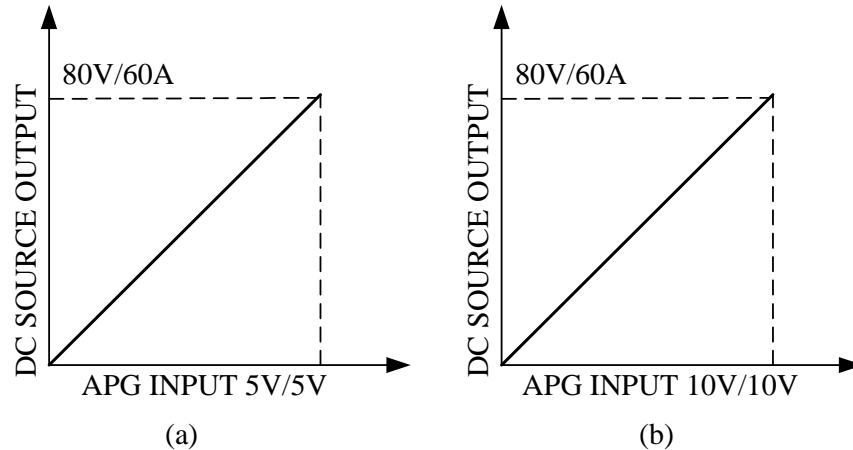


Figure 3-8

2. Short key description:
 - a. “” = 5V
 - b. “” = 10V

3.3.1.3.1 Pin Assignment of APG Control

APG control is an output of the external analog signal and its connector. It is located at the rear panel and its pin assignments are shown in Figures 3-9 and 3-10.

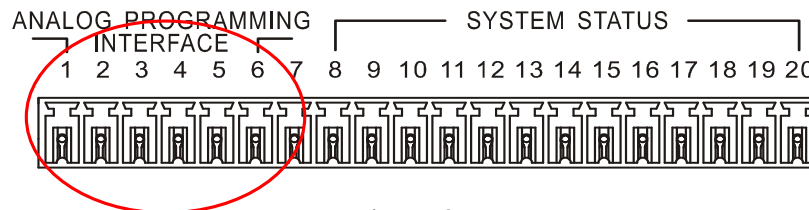


Figure 3-9

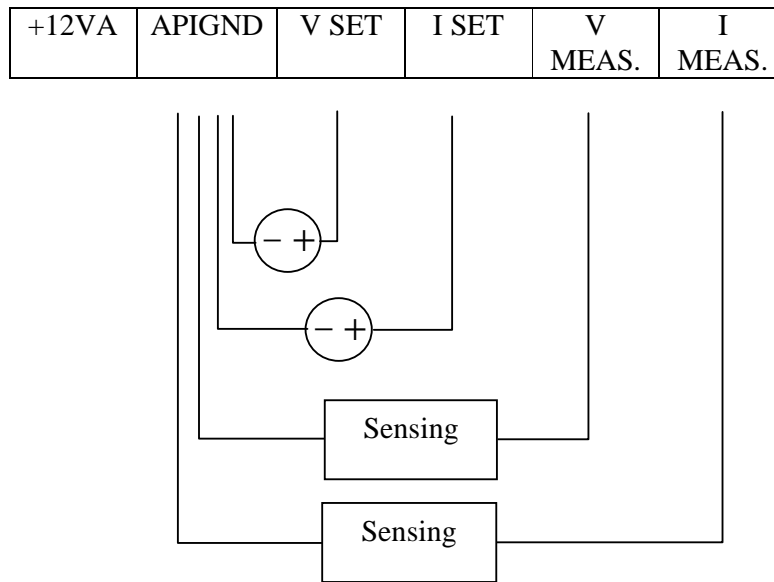




Figure 3-10

The definition of each pin:

1. Auxiliary power Vcc: This pin outputs a +12Vdc power with a maximum output current 10mA (output port).
2. APIGND: This contact is the reference potential of APG interface. The potential is separated for APG and chassis. The maximum tolerance of voltage differential is 70Vdc.
3. Voltage programming (input port): The input analog voltage (0-10Vdc or 0-5Vdc) of this pin and APIGND, controls the output voltage (CV mode) linearly.
4. Current programming (input port): The input analog voltage (0-10Vdc or 0-5Vdc) of this pin and APIGND, controls the output current (CC mode) linearly.
5. Voltage measurement (output port): This pin will output the voltage in an analog signal 0 – 10Vdc or 0 – 5Vdc in full scale for users to monitor.
6. Current measurement (output port): This pin will output the current in an analog signal 0 – 10Vdc or 0 – 5Vdc in full scale for users to monitor.

3.3.1.4 BACKLIGHT

This option sets the brightness of LCD backlight on the front panel. There are four kinds of backlight brightness to choose from (including off).

1. Use the “”, “” keys to move the cursor to the column to be set.

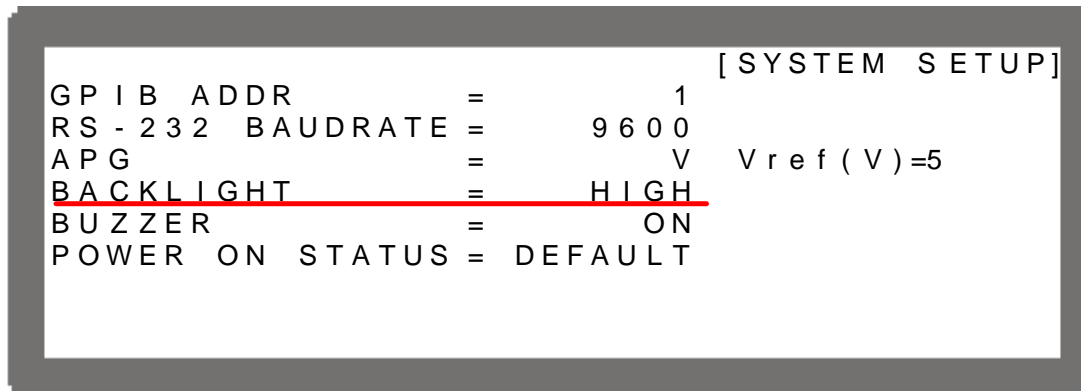


Figure 3-11

2. Press the “0” ~ 3 “” to set it, or use “Rotary” () to select the brightness of the LCD backlight.

ⓘ NOTICE

1. BACKLIGHT has four options: **HIGH / NORMAL / DIMMED / OFF**, where the option OFF will turn off the LCD backlight.
 2. Short key and brightness description:
 - a. Press the “0”, BACKLIGHT = HIGH.
 - b. Press the “1”, BACKLIGHT = NORMAL.
 - c. Press the “2”, BACKLIGHT = DIMMED.
 - d. Press the “3”, BACKLIGHT = OFF.
 3. The darker the backlight is, the longer life the panel will be. Therefore, if the instrument is in use during burn-in, it is suggested to set the backlight to OFF to prolong the LCD’s life.
-

3.3.1.5 BUZZER

The buzzer sounds when the keys or the rotary knob on the front panel is pressed or turned to remind user. It can be turned off if it is not necessary. (The default is ON.)

1. Use the “”, “” keys to move the cursor to the column to be set.

```

[ SYSTEM SETUP ]
GP I B  A D D R      =          1
RS - 2 3 2  B A U D R A T E =      9 6 0 0
AP G                =          V   V r e f ( V ) =5
B A C K L I G H T    =      H I G H
B U Z Z E R        =          O N
P O W E R  O N  S T A T U S = D E F A U L T

```

Figure 3-12

- Use the numeric (~) keys or the “Rotary”(⊙) knob to select “ON” or “OFF” mode.
- Press “ ” to confirm.
- Press “ ” to return to the MAIN PAGE.

ⓘ NOTICE

- BUZZER has two options: ON / OFF.
- When the BUZZER is set to ON, press any key or turn the rotary knob. It will beep once to remind the user.
- When the BUZZER is set to ON. The BUZZER will beep continuously if system protection occurs to remind the user.
- When the BUZZER is set to OFF, it will not beep in any situation.

3.3.1.6 POWER-ON STATUS

Default output status is loaded automatically after powered on, so users don’t have to set it again.

- Use the “”, “” keys to move the cursor to the column to be set.

```

[ SYSTEM SETUP ]
GP I B  A D D R      =          1
RS - 2 3 2  B A U D R A T E =      9 6 0 0
AP G                =          V   V r e f ( V ) =5
B A C K L I G H T    =      H I G H
B U Z Z E R        =          O N
P O W E R  O N  S T A T U S = D E F A U L T

```

Figure 3-13

- Press “0” or “2” to set the value, or use the “Rotary” (⊙) knob to set it.

POWER-ON STATUS has three options: DEFAULT / LAST TURN OFF STATUS / USER DEFINITION.

When it is set to DEFAULT, it means the output state is not defined specifically, which is $V = 0.00V$; $I = 0.00A$; $OUTPUT = OFF$.

When it is set to LAST TURN OFF STATUS, the instrument will log the command voltage, command current and the output state before powering it off. This ensures that the state before being powered off can be obtained for next power-on.

Ex.: In Figure 3-14, the voltage setting is 80.00V, current setting is 15.00A and output setting is ON. When it powers on again, the instrument will remain the previous state by setting the voltage to 80.00V, current to 15.00A and output to ON.

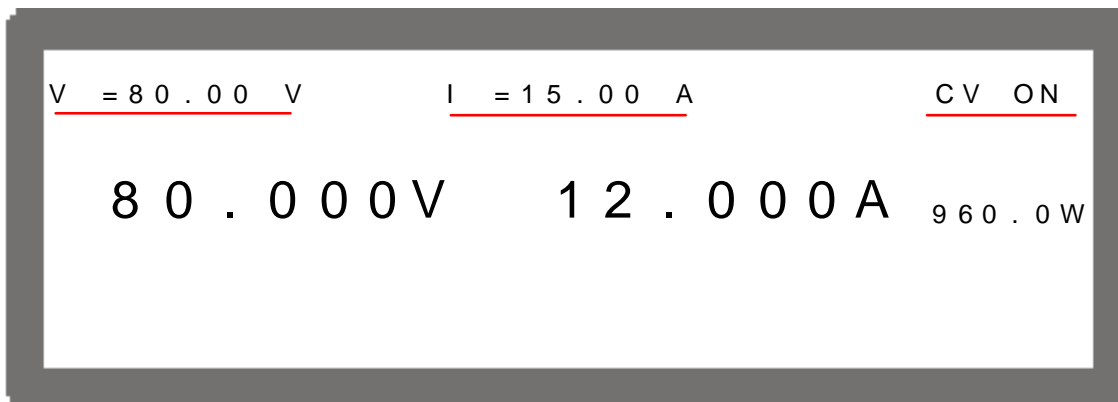


Figure 3-14

When set to USER DEFINITION, a setting line will prompt beneath the POWER-ON STATUS line for users to set to the default power-on state including voltage (V), current (I) and OUTPUT=ON/OFF.

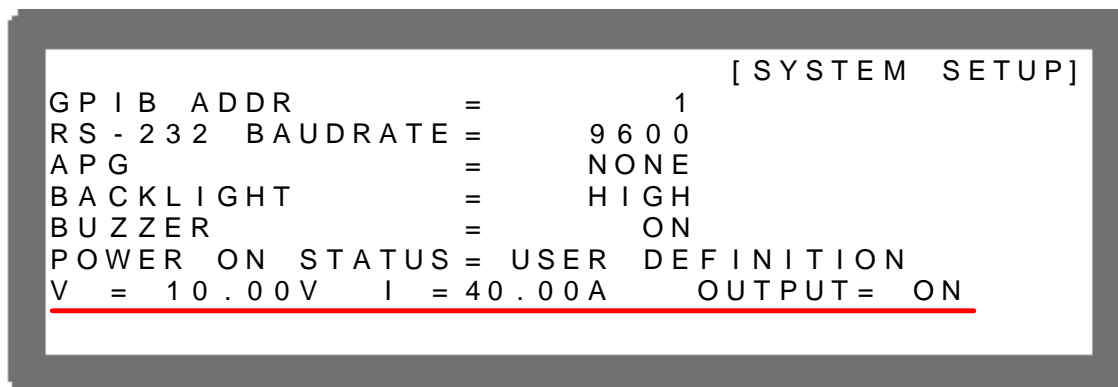


Figure 3-15

- Press “ENTER” to confirm.
- Press “EXIT” to return to the MAIN PAGE.

3.3.2 OUTPUT SETUP

1. In Config Setup page, press the “**2**” key to display the screen of Figure 3-16.
2. Press “**ENTER**”, to enter into Output Setup.
3. Press the “**←↑**”, “**→↓**” keys to move the cursor to the column to be set.
4. Press “**EXIT**” to return to the MAIN PAGE.

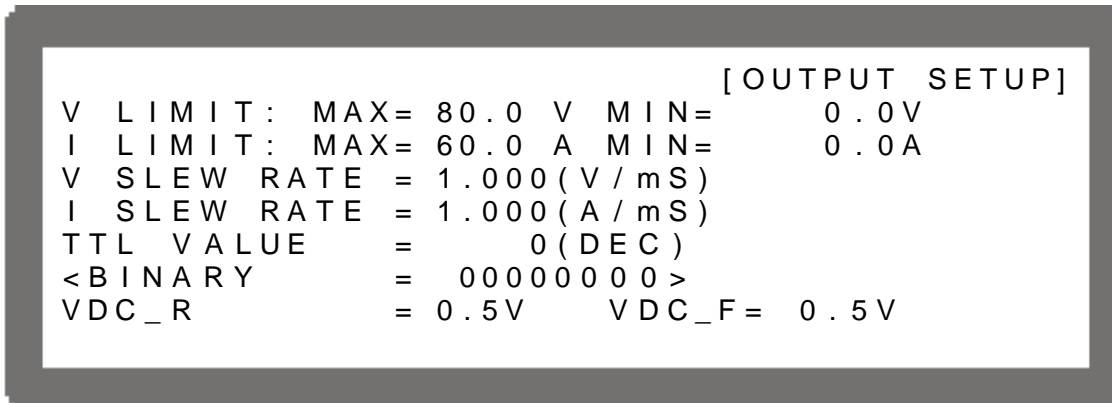


Figure 3-16

ⓘ NOTICE

The values in Figure 3-16 are the default settings of 42012-80-60.

Following introduces the options of OUTPUT SETTING.

3.3.2.1 VOLTAGE LIMIT SETTING

1. Use the “**←↑**”, “**→↓**” keys to move the cursor to the column to be set.

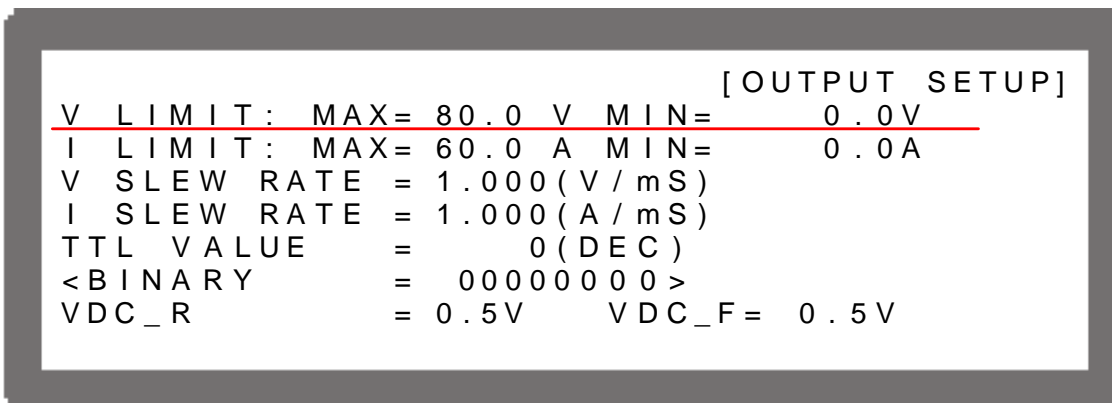


Figure 3-17

2. Use the numeric (**0** ~ **9**) keys or “Rotary” (⊙) knob to set the value.

Take, for example, the 42012-80-60, the output voltage range is 0~80V. Use this option to narrow down the range by setting MIN and MAX.

When “**VOLTAGE**” is pressed to set the output voltage, the DC Power Supply allows setting the voltage within the range of [MIN value ≤ user-defined value ≤ MAX value]. If the setting exceeds the range, the BUZZER will beep (if BUZZER is set to ON) and the main screen will prompt a warning message automatically as shown below.

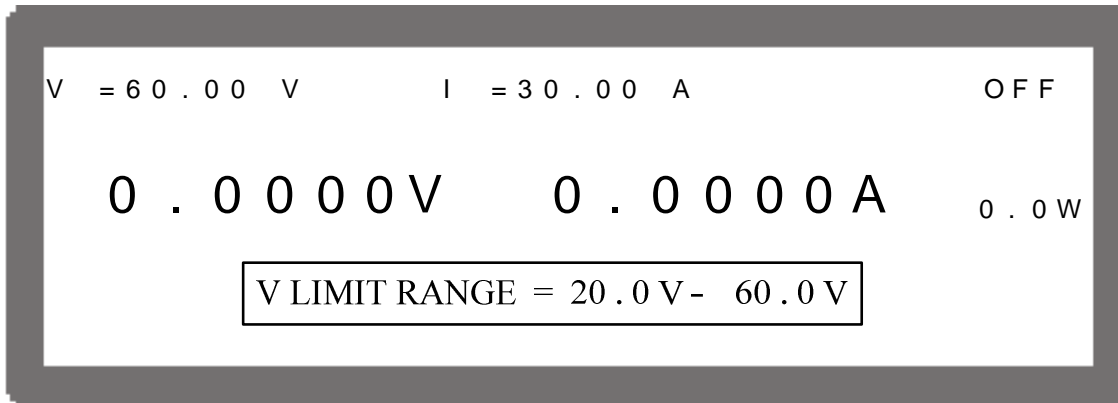


Figure 3-18

3. Press “**ENTER**” to confirm.
4. Press “**EXIT**” to return to the MAIN PAGE.

3.3.2.2 CURRENT LIMIT SETTING

1. Use the “**←↑**”, “**→↓**” keys to move the cursor to the column to be set.

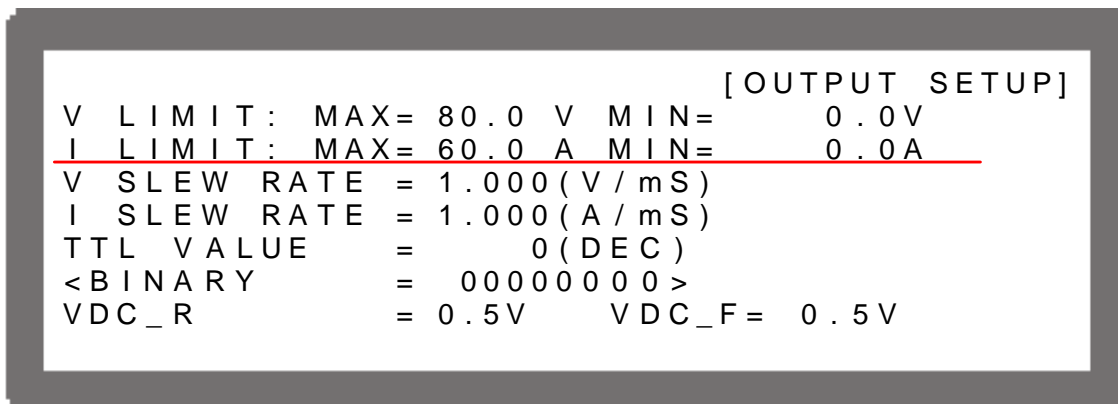


Figure 3-19

2. Use the numeric (**0** ~ **9**) keys or the “Rotary” (**⊙**) knob to set the value.

Take, for example, the 42012-80-60, the output current range is 0~60A. Use this option to narrow down its range by setting MIN and MAX.

When “CURRENT” is pressed to set the output current, the DC Power Supply allows the setting of the current within the range of [MIN value ≤ user-defined value ≤ MAX value]. If the setting exceeds the range, the BUZZER will beep (if BUZZER is set to ON) and the main screen will prompt a warning message automatically as shown below.

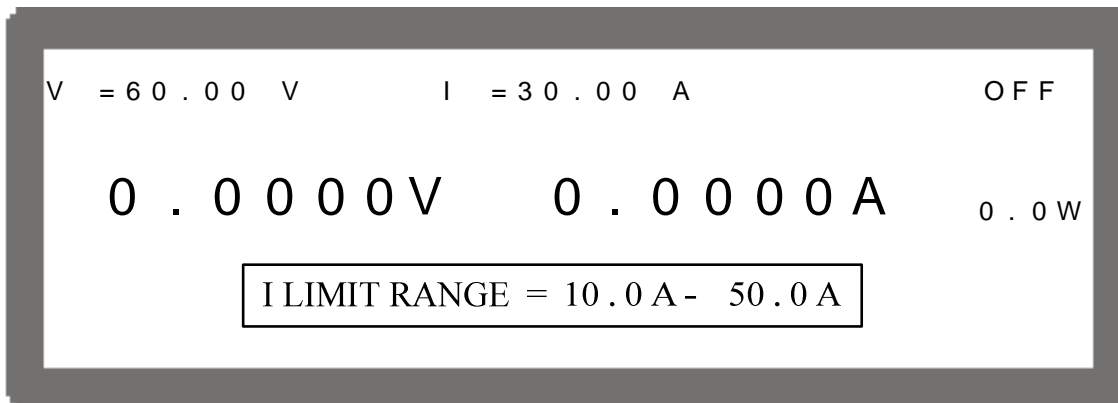






Figure 3-20

3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.

3.3.2.3 VOLTAGE SLEW RATE

1. Use the “”, “” keys to move the cursor to the column to be set.

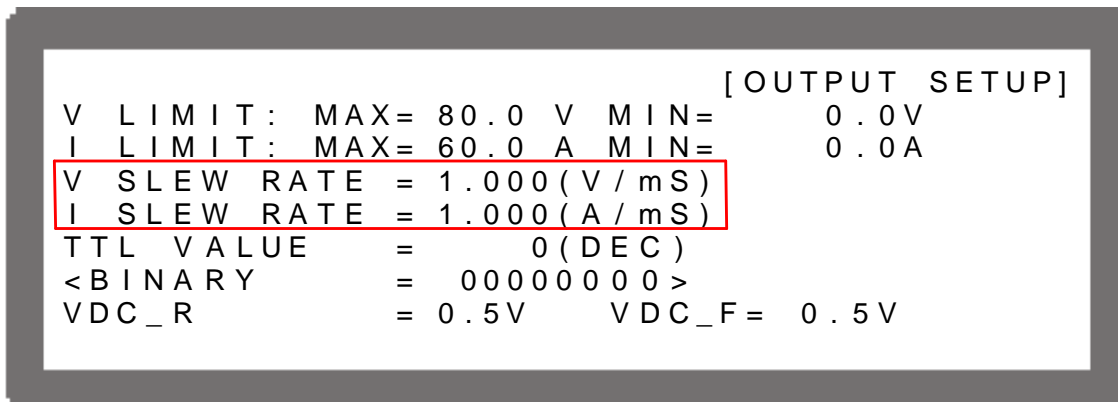





Figure 3-21

2. Use the numeric ( ~ ) keys or the “Rotary” () knob to set the value.

Take, for example, the 42012-80-60, the output voltage slew rate is set as shown in Figure 3-22. The maximum input Slew Rate is 10V/mS and the minimum is 0.001V/mS. The output of the DC the Power Supply will follow the slew rate to rise to the set output voltage. The down slew rate is limited by the load.

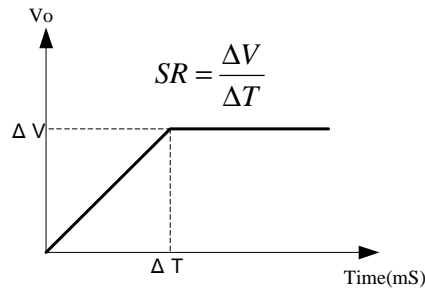









Figure 3-22

3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.

3.3.2.4 CURRENT SLEW RATE SETTING

1. Use the “”, “” keys to move the cursor to the column to be set.
2. Use the numeric ( ~ ) keys or “Rotary” () knob to set the value.

Take, for example, the 42012-80-60, the output current slew rate is set as Figure 3-23 shows. The maximum input Slew Rate is 1A/mS and the minimum is 0.001A/mS. If the input is larger than 1A/mS, the current Slew Rate will be set to INF, and change with the maximum slew rate (near infinite). The output of the DC Power Supply will follow the slew rate to rise to the set output current.

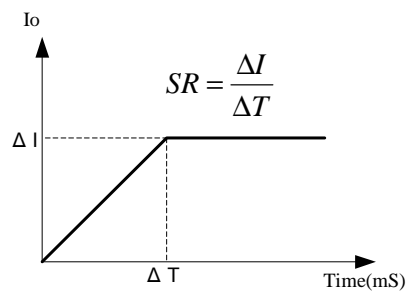






Figure 3-23

3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.

3.3.2.5 TTL Option

When the DC Power Supply is outputting, its SYSTEM STATUS connector on the rear panel offers 8-bit digital signals for other purposes. The TTL VALUE range is from **0** to **255**, in addition, the system will automatically convert it to binary for easy identification.

1. Use the “”, “” keys to move the cursor to the column to be set.

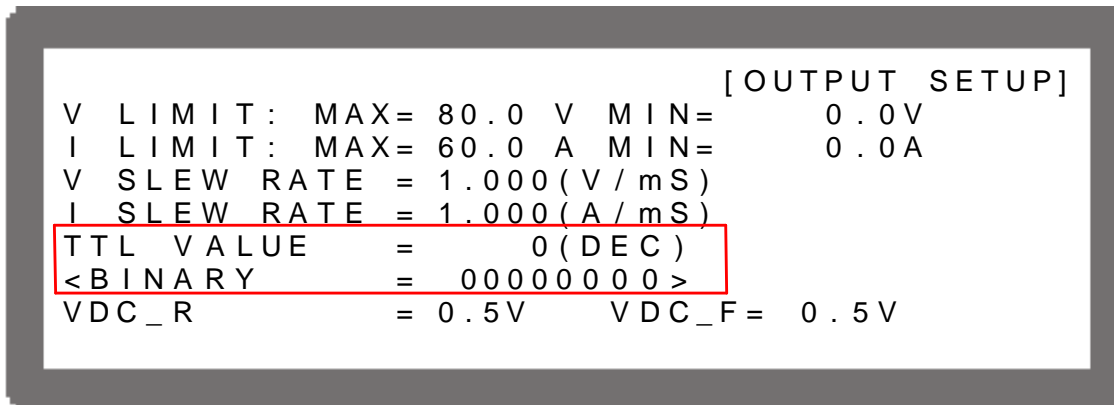





Figure 3-24

2. Use the numeric ( ~ ) keys or “Rotary” () knob to set the value.

The setting range of TTL VALUE is **0 ~ 255**, in addition the system will automatically convert it to binary for easy identification.

Figure 3-25 shows the SYSTEM STATUS pin number on rear panel, where TTL0~TTL7 is located at PIN12 ~PIN19, and PIN20 is the signal reference point of PIN8~PIN19 (GND).

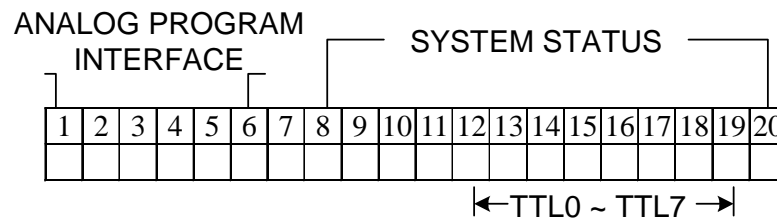




Figure 3-25

3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.

ⓘ NOTICE

1. The TTL signal can be a set PROGRAM.
2. Table 3-1 shows the TTL pin definition of SYSTEM STATUS.

| PIN NO. | PIN DEFINITION |
|---------|----------------|
| 12 | TTL0 |
| 13 | TTL1 |
| 14 | TTL2 |
| 15 | TTL3 |
| 16 | TTL4 |
| 17 | TTL5 |
| 18 | TTL6 |
| 19 | TTL7 |
| 20 | GND |

Table 3-1

- TTL is a digital signal, which is a positive logic system (5V system).

The table shows the output specification.

| OUTPUT STATE | MIN | TYP | MAX | CURRENT |
|--------------|------|-------|-------|--------------|
| H (HIGH) | 4.18 | 4.80V | | 7mA (Source) |
| L (LOW) | | 0.16V | 0.26V | -7mA (Sink) |

Table 3-2

3.3.2.6 Setting DC_ON

When the output of the DC power supply is ON and the voltage is over VDC_R, pin10 DC_ON of the SYSTEM STATUS on the rear panel will turn to HIGH. When the output voltage of the DC power supply is lower than the setting of VDC_F, pin10 DC_ON of the SYSTEM STATUS on the rear panel will turn to LOW for other usages as shown below:

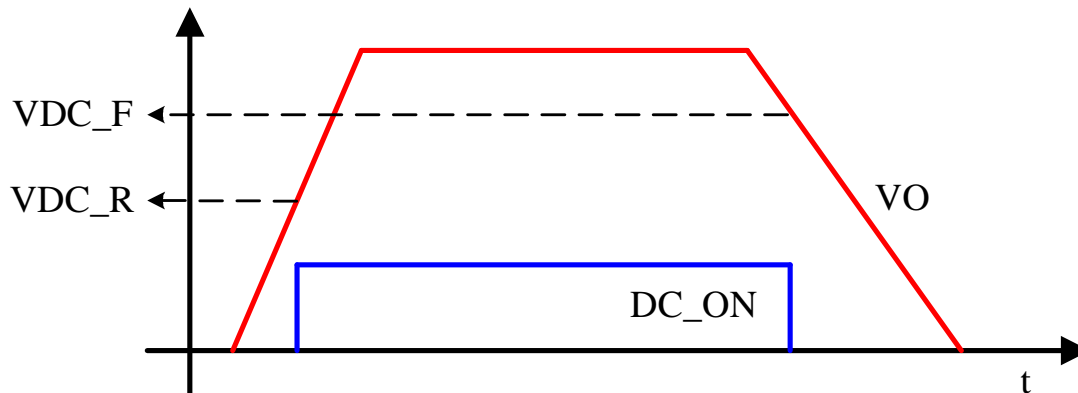


Figure 3-26

Set DC_ON as described below:

- Use the “”, “” keys to move the cursor to the column to be set.

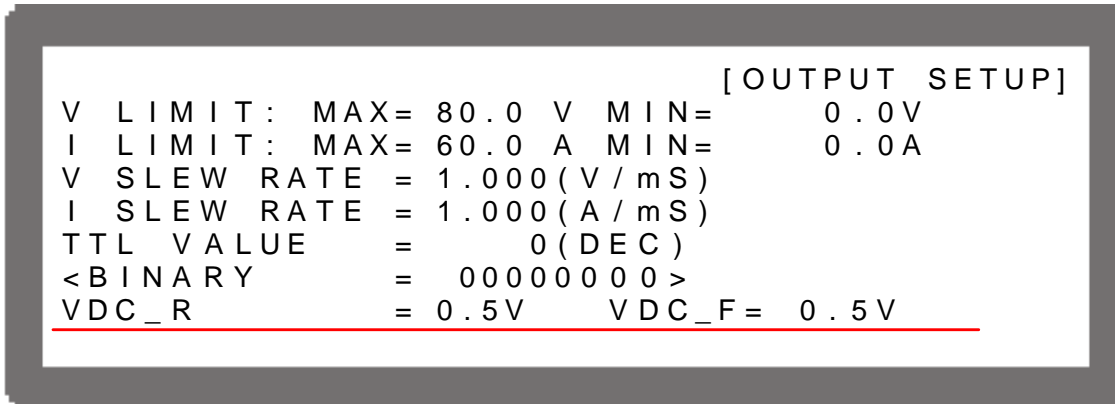


Figure 3-27

- Use the numeric (0 ~ 9) keys or “Rotary” (⊙) knob to set the value. Take, for example, the 42012-80-60, the lower limit of DC_ON is 0.5V and upper limit is 79.5V.

3.3.3 SERIES/PARALLEL

The 42000 Series DC Power Supplies are able to operate in series or parallel. Take, for example, the 42012-80-60, the voltage is up to 400V if connecting five sets in series, and the current is up to 300A if connecting five sets in parallel.

ⓘ NOTICE

- Series/Parallel cannot be mixed in use.
- Table 3-3 lists the maximum connecting numbers, voltage and current in series/parallel operation for the 42000 Series Power Supplies.

| 42000 Series Model | Serial | | Parallel | |
|--------------------|--------------|-------------------------|--------------|-------------------------|
| | Max. Devices | Max. Output Voltage (V) | Max. Devices | Max. Output Current (A) |
| 42006-30-80 | 5 | 150 | 5 | 400 |
| 42006-100-25 | 5 | 500 | 5 | 125 |
| 42006-300-8 | 5 | 800 | 5 | 40 |
| 42012-40-120 | 5 | 200 | 5 | 600 |
| 42012-80-60 | 5 | 400 | 5 | 300 |
| 42012-100-50 | 5 | 500 | 5 | 250 |
| 42012-600-8 | 5 | 800 | 5 | 40 |
| 42024-80-60 | 5 | 400 | 5 | 300 |
| 42024-100-50 | 5 | 500 | 5 | 250 |
| 42050-100-100 | 5 | 500 | 5 | 500 |

Table 3-3

- Different models are unable to be operated in parallel or serial.
- Be sure the breaker capacity is enough and the earth wire is grounded to earth ground when series/parallel is in use.

3.3.3.1 Connecting Series/Parallel Output Cable

The following figures show the connections of the serial/parallel output cables.

1. Figure 3-28 is the series connection.
2. Figure 3-29(a) is the parallel connection. For 42006-30-80 & 42012-40-120, it is suggested to use the connection in Figure 3-29 (b).

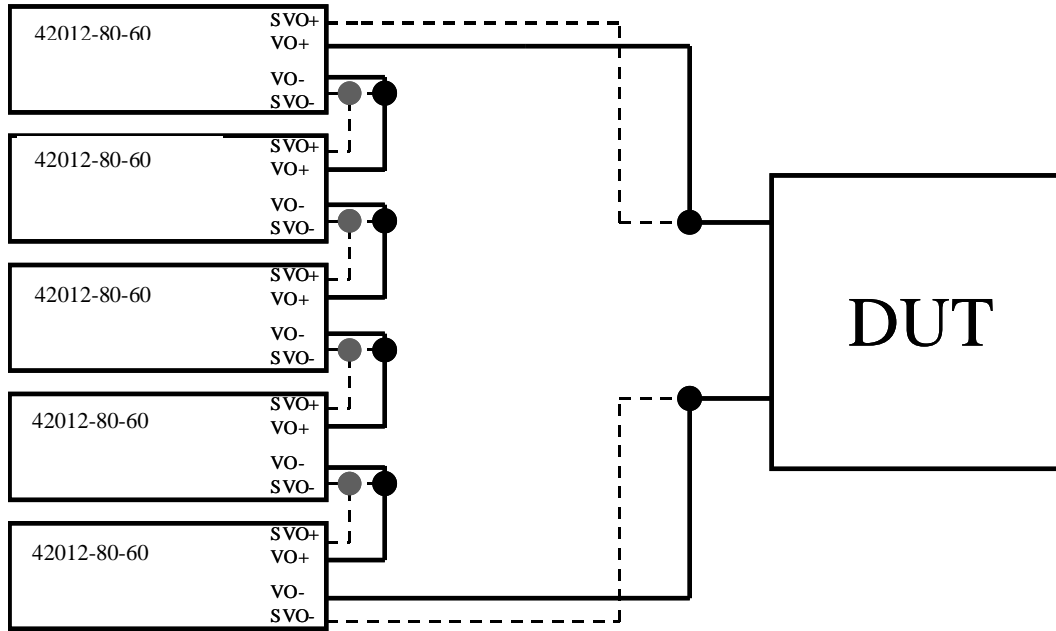


Figure 3-28

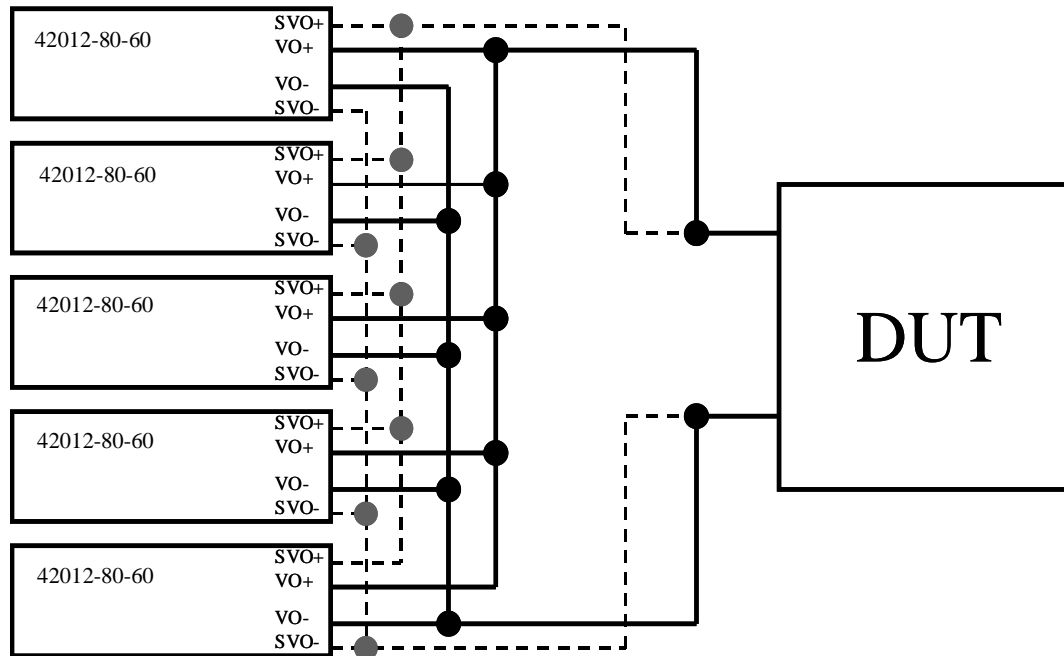


Figure 3-29 (a)

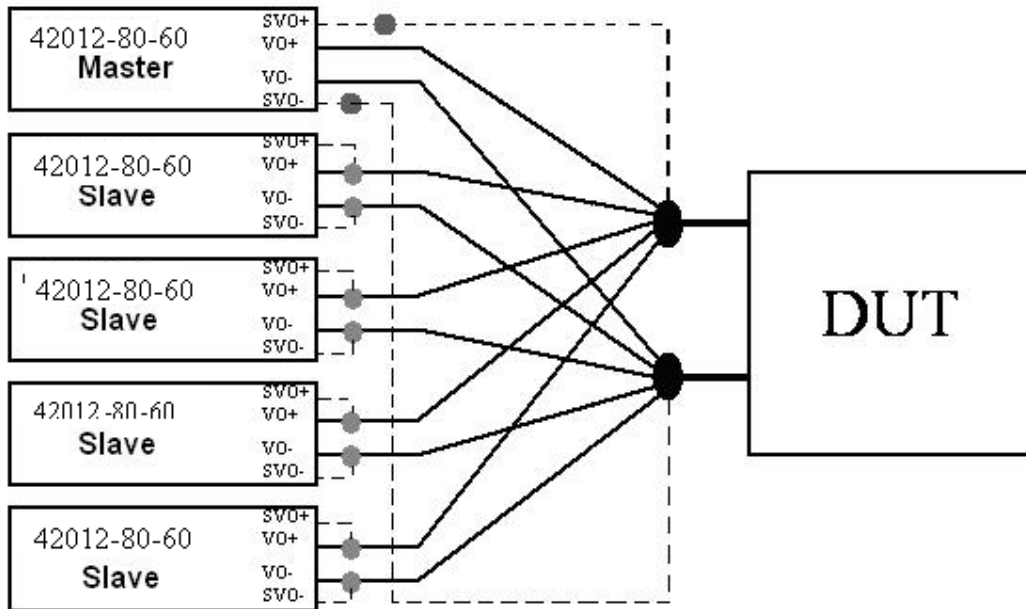


Figure 3-29 (b)

3.3.3.2 Assembling Series/Parallel Communication Interface

1. To operate the Power Supply in series, connect the RS-485 connectors on the rear panel as Figure 3-30 shows.

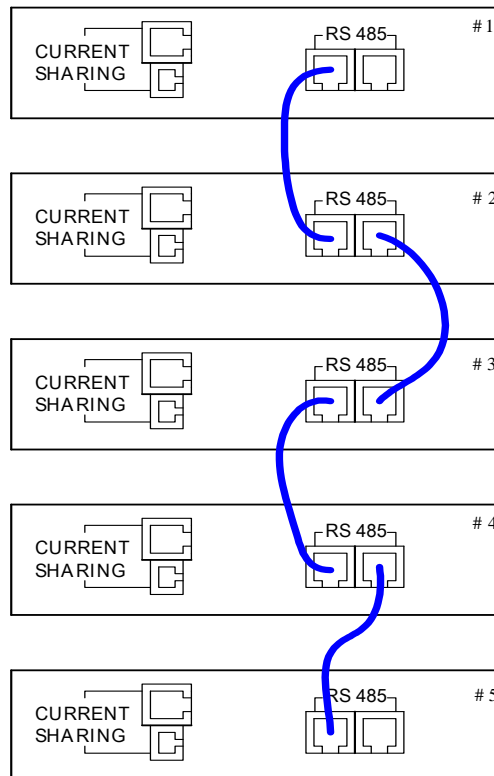


Figure 3-30

2. To operate the Power Supply in parallel, besides connecting the RS-485 connectors on the rear panel, the **CURRENT SHARING** connector has to be connected as well. See Figure 3-31.

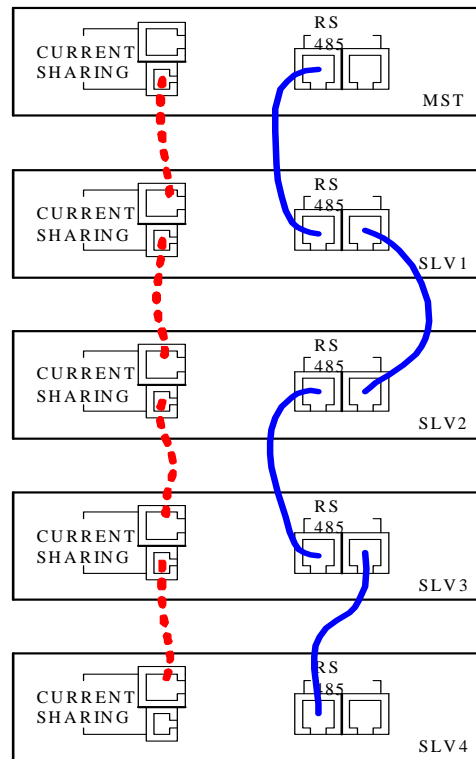


Figure 3-31

ⓘ NOTICE

1. Each DC Power Supply has two RS485 interface female connectors. They need to be connected either in series or parallel operation. There is no difference between left and right; just connect one after another as shown in Figure 3-30 or Figure 3-31.
2. Each DC Power Supply has two CURRENT SHARING connecting terminals in different outlines. Connect the output terminal of the first Power Supply to the input terminal of the second Power Supply and so forth as shown in Figure 3-31 in the dotted line. Be sure to use the CURRENT SHARING communication cable provided by QuadTech, Inc.
3. The CURRENT SHARING communication cable must be well connected when in parallel operation. If not, it may cause the DC Power Supply to run abnormally or poor results in CURRENT SHARING.



1. The DC Power Supply might be damaged if the CURRENT SHARING input and output terminals are connected incorrectly when in parallel mode.
2. Do not connect the CURRENT SHARING cable when in series operation or supply might be damaged. The DC Power Supply will detect if the CURRENT SHARING cable is connected. **SERIES FAULT** will occur as shown below when connected.

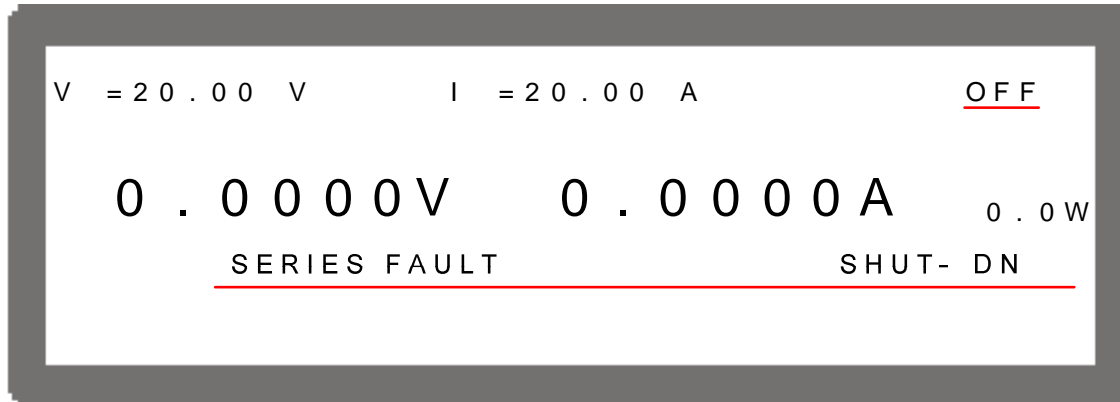


Figure 3-32

3.3.3.3 Setting Series/Parallel Operation Mode

3.3.3.3.1 Setting SLAVE

① NOTICE

1. It is necessary to set the SLAVE first and the MASTER last when operating the 42000 Series DC Power Supply in a series or parallel mode. If not, operation may not be possible due to communication errors.
2. There are SLAVE1~ SLAVE4 available for selection starting from SLAVE1.

1. In Config Setup page, press “**3**” and “**ENTER**” to select PARALLEL /SERIES and display Figure 3-33.

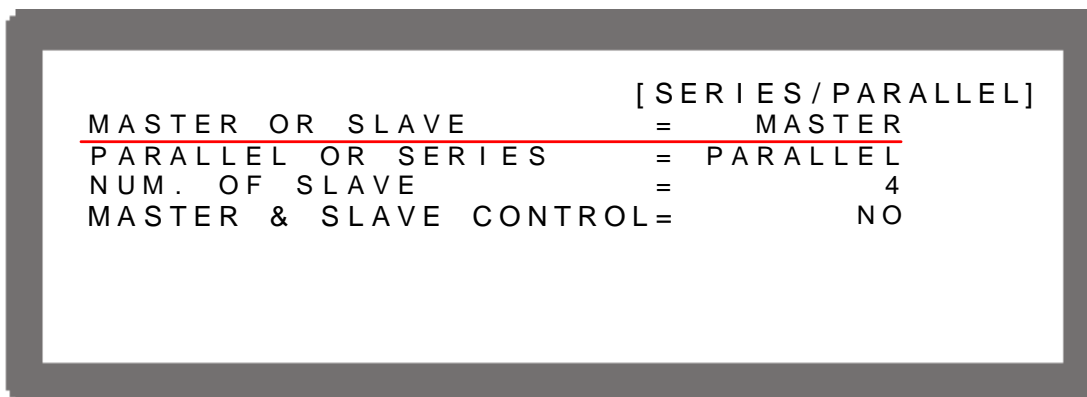


Figure 3-33

2. Use the numeric (**1**~**4**) keys or “Rotary” (⊙) knob to set SLAVE1~SLAVE4 as Figure 3-34 shows.

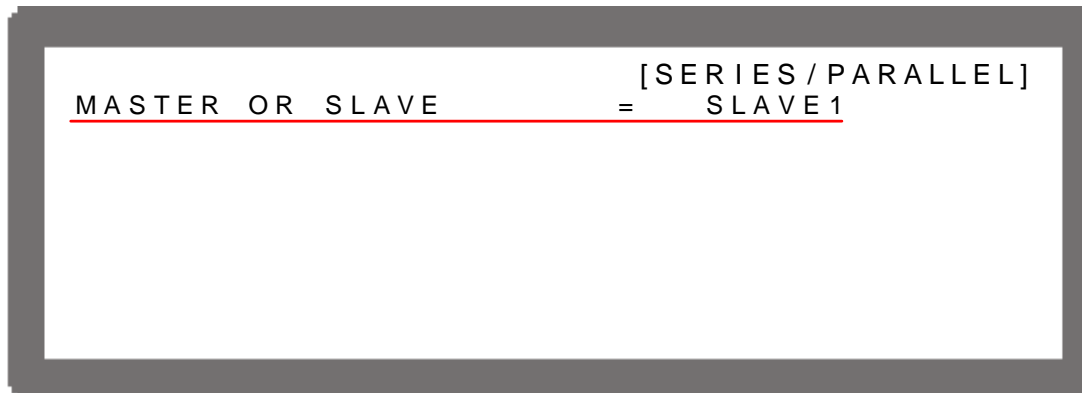




Figure 3-34

3. Press “” to confirm. Press “” and the MAIN PAGE will return to single supply.

3.3.3.3.2 Setting MASTER

If **MASTER OR SLAVE** is set to MASTER, a MASTER setup window will prompt for **PARALLEL OR SERIES** and **NUM. OF SLAVE** selections. See the description of **PARALLEL OR SERIES** in section 3.3.3.3.3 and **NUM. OF SLAVE** in section 3.3.3.3.4.





MASTER has two main functions:

- (1) It issues commands to all SLAVE units, such as voltage setting, current setting, protection setting and etc. This means all settings in SLAVE are from the MASTER. The original settings in SLAVE are temporarily invalid.
- (2) It accepts all measurement values and protection signals from SLAVE. The MASTER calculates all the measurement values and displays them in the main page. Moreover, when protection occurs in one SLAVE, the MASTER will notify other SLAVE units to enable protection and protection will be shown in the MASTER’s main page.

NOTICE

When multiple DC Power Supplies are connected in series or parallel, only one DC Power Supply can be the Master and the rest have to be set to Slave.

Set MASTER as described below:

1. In Config Setup page, press “” and “” to select PARALLEL/SERIES.
2. Use the numeric () key or “Rotary” () knob to set MASTER as Figure 3-35 shows.

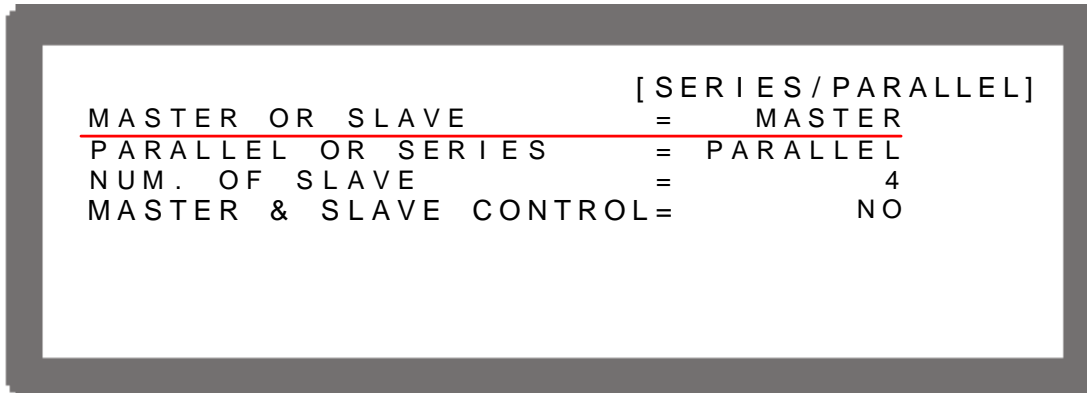




Figure 3-35

3.3.3.3 Setting PARALLEL or SERIES

This option is to set the Power Supply to be operated in Series or Parallel mode as Figure 3-36 shows. There are two selections: **PARALLEL** and **SERIES**.

1. Use the “”, “” keys to move the cursor to the column to be set.

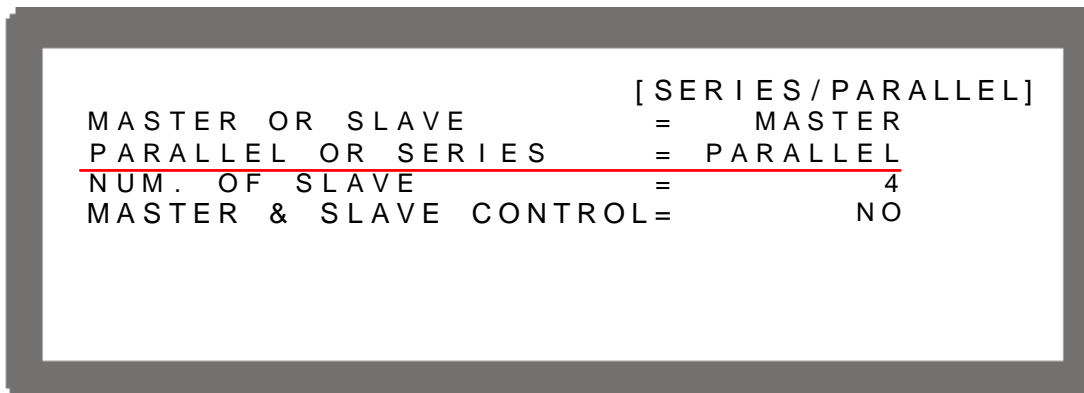





Figure 3-36

2. Use the numeric ( ~ ) keys or “Rotary” () knob to set **PARALLEL** or **SERIES**.

Connect the cables on the rear panel as Figure 3-30 shows when setting to SERIES, and as Figure 3-31 shows on the rear panel when setting to PARALLEL.

Select **SERIES** will prompt the following window and remind the user to disconnect the CURRENT SHARING cable on the rear panel.

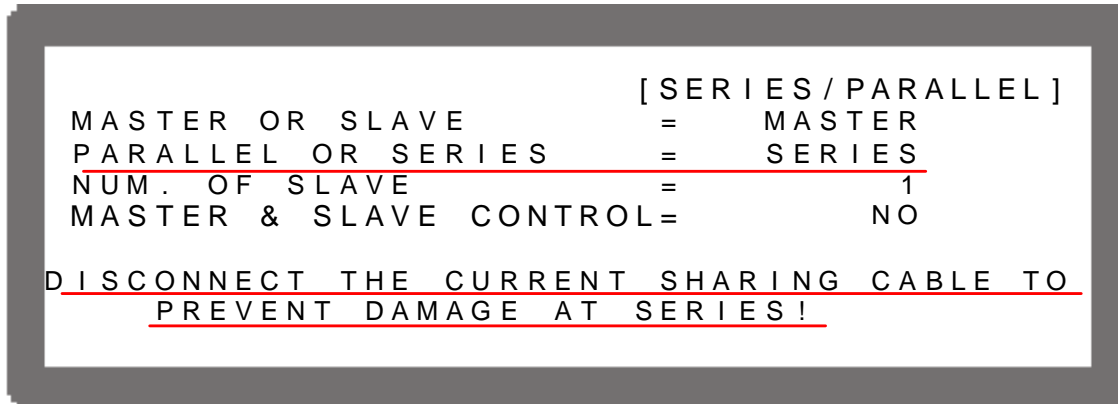









Figure 3-37

3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.

3.3.3.3.4 Setting NUM. OF SLAVE

Take, for example, the 42012-80-60, when the DC Power Supply is set to MASTER (see section 3.3.3.3.1), the controlled number, meaning the SLAVE number, has to be set. If the number of controlled supplies are four, then set NUM. OF SLAVE = 4 as shown below.

1. Use the “”, “” keys to move the cursor to the column to be set.
2. Use the numeric ( ~ ) keys or “Rotary” () knob to set the number of SLAVE.

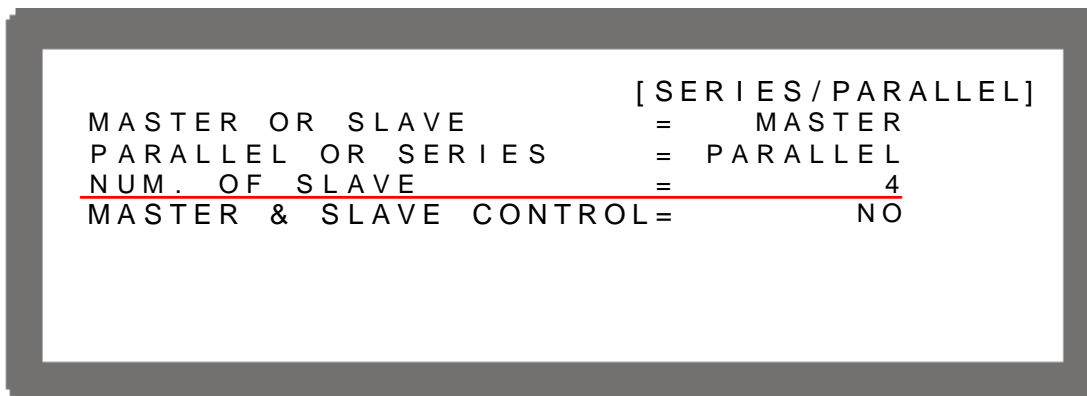




Figure 3-38

3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.





① NOTICE

Take, for example, the 42012-80-60:

1. If there are five sets connected in a parallel and 80V/300A is set, the setting of each set is 80V/60A and the total output will be 80V/300A.
2. If there are five sets connected in a series and 400V/60A is set, the setting of each set is 80V/60A and the total output will be 400V/60A.
3. The total sets for connecting 42012-80-60 in a series or parallel are five; therefore, the maximum number of **NUM. OF SLAVE** is four.

3.3.3.3.5 Activating MASTER & SLAVE CONTROL

When a PARALLEL OR SERIES, NUM. OF SLAVE is set to MASTER, the MASTER supply can be programmed to activate series/parallel control as described below:

1. Use the “”, “” keys to move the cursor to the column to be set.
2. Use the numeric () key or “Rotary” () knob to set YES.

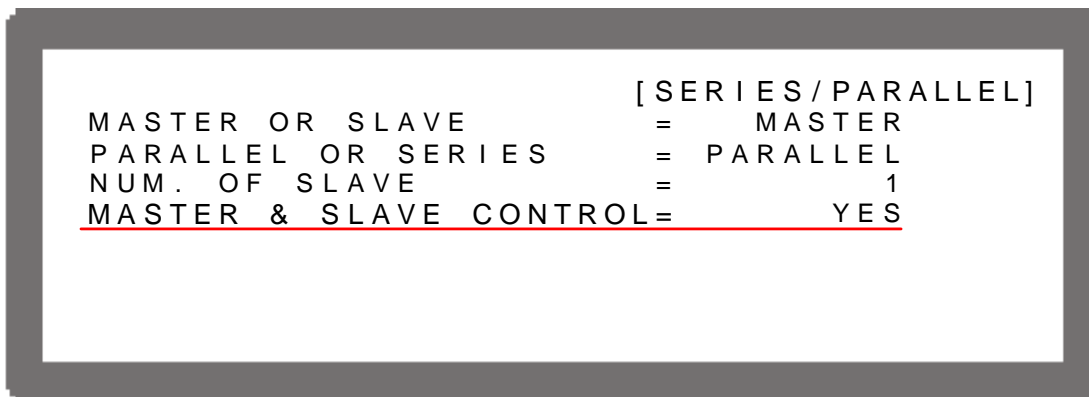



Figure 3-39

3. Press “” to confirm, it will skip to the series/parallel MASTER page automatically as Figure 3-40 shows.

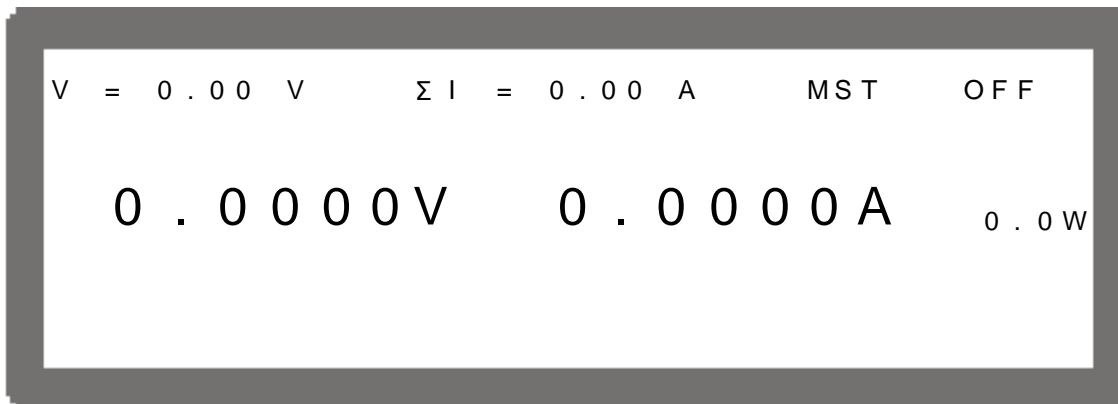


Figure 3-40

- The SLAVE page will skip to Figure 3-41 automatically.



Figure 3-41

- Start the series/parallel usage.

ⓘ NOTICE

- A communication error will occur if the SLAVE settings are the same (such as **SLAVE 1** & **SLAVE 1**). The MAIN PAGE of MASTER will show an error see Figure 3-42. When this type of error occurs, exit the series/parallel operation first, then change the SLAVE setting to resume the operation.



Figure 3-42

- Once the series/parallel is set, the settings can be saved. After all machines are powered off, turn on SLAVE(s) first and MASTER last, the MASTER supply will automatically set series/ parallel operation.
-

3.3.3.4 Setting Series Parameters

When the software communication and hardware settings for series operation are completed, the settings of following windows are introduced in the sections below - (1) MAIN PAGE, (2) SYSTEM SETUP, (3) OUTPUT SETUP, (4) PROTECTION and (5)PROGRAM.

3.3.3.4.1 Setting MAIN PAGE

The MAIN PAGE is mainly used to set voltage (V) and current (I). The difference between a single supply and a series operation is the voltage set will increase by the number connected in series. The voltage set is indicated by ΣV for easy identification. When set to MASTER, MST will appear at the window's upper right corner as the figure shows below.

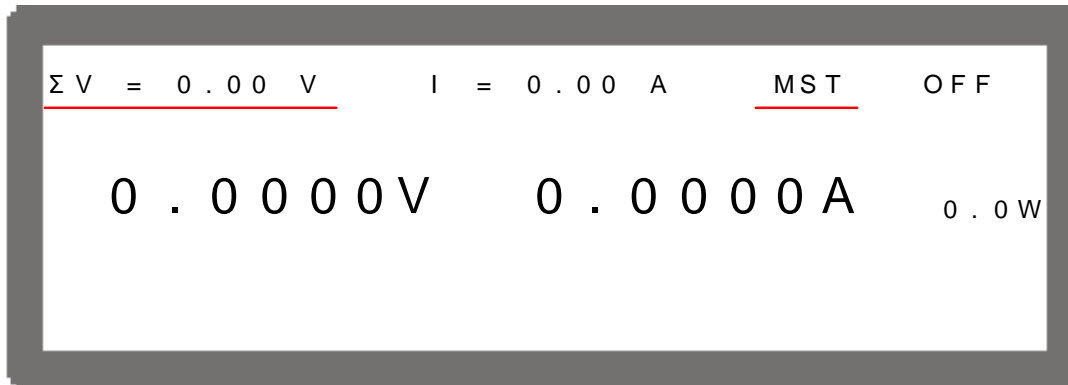


Figure 3-43

3.3.3.4.2 Setting SYSTEM SETUP for Series

The operation of POWER- ON STATUS in SYSTEM SETUP for series operation is the same as a single supply. Only the output voltage will increase following the number of supplies in series. For example if there are five sets of 42012-80-60 in a series, the maximum output voltage can be set is 400V, and the maximum output current is 60A as shown below:

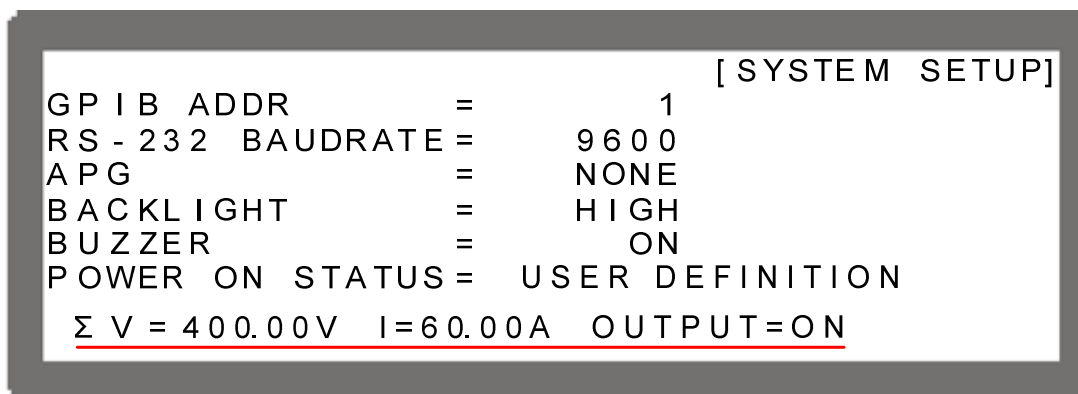


Figure 3-44

① NOTICE

Supply will return to single unit mode once the POWER-ON STATUS is set in series mode. The POWER-ON STATUS automatically sets the output voltage and current to 0 and OUTPUT to OFF.

3.3.3.4.3 Setting OUTPUT SETUP for Series

The V LIMIT MAX in OUTPUT SETUP of MASTER for a series connection will increase by the number of supplies connected in series. It is indicated by Σ V LIMIT MAX; for easy identification as the figure shows below. The setting range of Σ V SLEW RATE will also increase by the number of supplies connected in series.

```

[ OUTPUT SETUP ]
Σ V LIMIT: MAX= 400.0 V MIN= 0.0V
I LIMIT: MAX= 60.0 A MIN= 0.0A
Σ V SLEW RATE = 5.000 (V / mS)
I SLEW RATE = 1.000 (A / mS)
TTL VALUE = 0 (DEC)
< BINARY = 00000000 >
VDC_R = 2.5V VDC_F = 2.5V
    
```

Figure 3-45

3.3.3.4.4 Setting PROTECTION for a Series

The OVP and OPP in PROTECTION of MASTER for a series connection will increase by the number of supplies connected in series. It is indicated by Σ OVP and Σ OPP for easy identification as the figure shows below.

```

[ PROTECTION ]
Σ OVP = 440.0 V
OCP = 63.0 A
Σ OPP = 6300.0 W
REMOTE INHIBIT = OFF
SAFETY INT.LOCK = DISABLE
FOLDBACK = DISABLE
    
```

Figure 3-46

3.3.3.4.5 Setting PROGRAM for Series

The LIST MODE and V_STEP MODE in PROGRAM can also be applied for series operation. The operation of PROGRAM for series is the same as a single unit, see Chapter 4 *Program Sequence*. LIST MODE is indicated by Σ VOLTAGE for easy identification and

the [SEQUENCE] screen is shown in Figure 3-47. The setting range of Σ V S. R. will increase by the number of supplies connected in series as well. The start and end voltages of V_STEP MODE are indicated by Σ START_VOLTAGE and Σ END_VOLTAGE as Figure 3-48 shows.

```

[ SEQUENCE ]
SEQ NO. = 1          SEQ. TYPE= AUTO
 $\Sigma$  VOLTAGE = 0.00 V  $\Sigma$  V S. R. = 5.000 ( V / m S )
CURRENT = 0.00 A I S. R. = 1.000 ( A / m S )
TTL OUT = 0 ( DEC ) < BINARY = 00000000 >
TIME = 0.000 ( S )

```

Figure 3-47

```

[ PROGRAM / STEP ]
 $\Sigma$  START VOLTAGE = 0.00 V
 $\Sigma$  END VOLTAGE = 0.00 V
RUN_TIME = 0 : 0 : 0.00

```

Figure 3-48

3.3.3.5 Setting Parallel Parameters

When the software communication and hardware settings for parallel operation are completed, the settings of following windows are introduced in the sections below - (1) MAIN PAGE, (2) SYSTEM SETUP, (3) OUTPUT SETUP, (4) PROTECTION and (5) PROGRAM.

3.3.3.5.1 Setting MAIN PAGE

MAIN PAGE is mainly used to set the voltage (V) and the current (I). The difference between a single unit and parallel operation is the current setting will increase by the number of supplies connected in parallel. The current set is indicated by Σ I for easy identification. When set to MASTER, MST will appear at the window's upper right corner as the figure shown below.

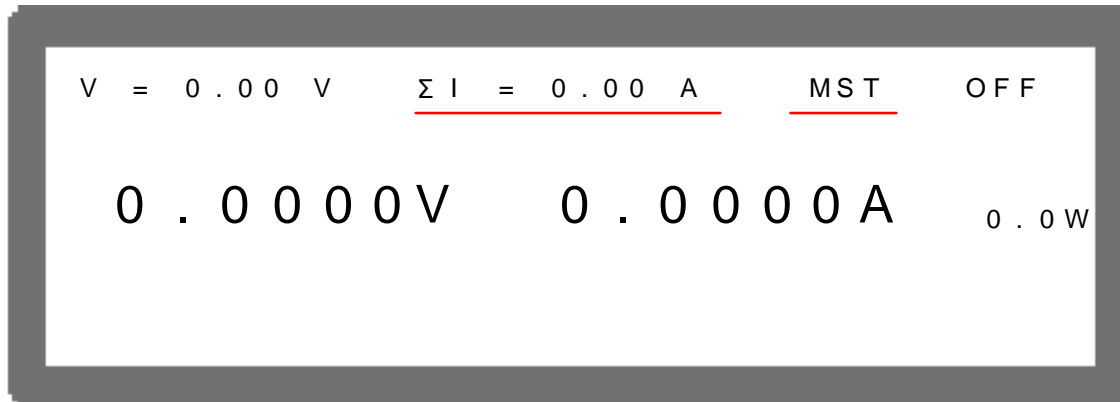


Figure 3-49

3.3.3.5.2 Setting SYSTEM SETUP for Parallel

The operation of **POWER-ON STATUS** in SYSTEM SETUP for a parallel is the same as a single unit; only the output current will increase by the number of supplies connected in parallel. For example, if there are five sets of 42012-80-60 in a parallel, the maximum output voltage that can be set is 80V, and the maximum output current is 300A as shown below:

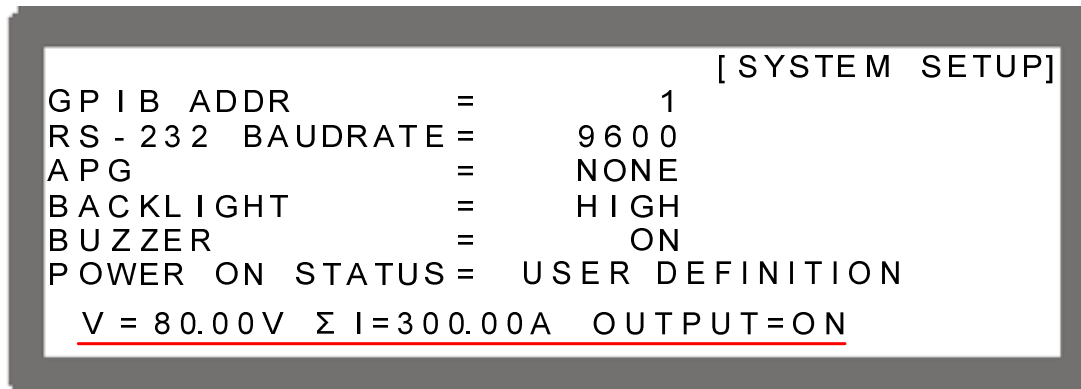


Figure 3-50

ⓘ NOTICE

It will return to single unit mode once the POWER-ON STATUS is set in parallel mode. The POWER-ON STATUS automatically sets the output voltage and current to 0 and OUTPUT to OFF.

3.3.3.5.3 Setting OUTPUT SETUP for Parallel

The I LIMIT MAX in OUTPUT SETUP of MASTER for a parallel connection will increase by the number of supplies connected in parallel. It is indicated by **Σ I LIMIT MAX** for easy identification as the figure shown below. The setting range of **Σ I SLEW RATE** will also increase by the number of supplies connected in parallel.

```

[OUTPUT SETUP]
V LIMIT: MAX= 80.0 V MIN= 0.0V
Σ I LIMIT: MAX= 300.0 A MIN= 0.0A
V SLEW RATE = 1.000 (V / mS)
Σ I SLEW RATE = 5.000 (A / mS)
TTL VALUE = 0 (DEC)
<BINARY = 00000000>
VDC_R = 2.5V VDC_F = 2.5V

```

Figure 3-51

3.3.3.5.4 Setting PROTECTION for Parallel

The OCP and OPP in PROTECTION of MASTER for parallel connection will increase by the number of supplies connected in parallel. It is indicated by Σ OCP and Σ OPP for easy identification as the figure shown below.

```

[PROTECTION]
OVP = 88.0 V
Σ OCP = 315.0 A
Σ OPP = 6300.0 W
REMOTE INHIBIT = OFF
SAFETY INT.LOCK = DISABLE
FOLDBACK = DISABLE

```

Figure 3-52

3.3.3.5.5 Setting PROGRAM for Parallel

The LIST MODE and V_STEP MODE in PROGRAM can also be applied for parallel operation. The operation of PROGRAM for parallel is the same as a single unit, see Chapter 4 *Program Sequence*. LIST MODE is indicated by Σ CURRENT for easy identification and the [SEQUENCE] screen is shown as Figure 3-53. The setting range of Σ I S. R. will increase by the number of supplies connected in parallel. V_STEP MODE has no current setting so the screen is the same as the single Power Supply as Figure 3-54 shows.

```
                               [ SEQUENCE ]
SEQ NO. = 1          SEQ. TYPE= AUTO
VOLTAGE= 0.00 V V S.R. = 1.000 ( V / mS )
Σ CURRENT= 0.00 A Σ I S.R. = 5.000 ( A / mS )
TTL OUT= 0 ( DEC ) < BINARY= 00000000 >
TIME      = 0.000 ( S )          ▲
                                   ▼
```

Figure 3-53

```
                               [ PROGRAM / STEP ]
START_VOLTAGE = 0.00 V
END_VOLTAGE   = 0.00 V
RUN_TIME      = 0 :0 :0.00
```

Figure 3-54

3.3.3.6 Setting Procedure for APG in Series or Parallel

Operation in a series and a parallel can also be applied via APG. See section 3.3.1.3 and 3.3.3.1 to 3.3.3.6 for detail information.

3.3.3.6.1 Series Setting

To connect five 42012-80-60 DC Power Supplies for operation in series, set the APG option to **APG = V &I** and **Vref(V) = 5**. The MAIN PAGE of MASTER will show as in Figure 3-55.

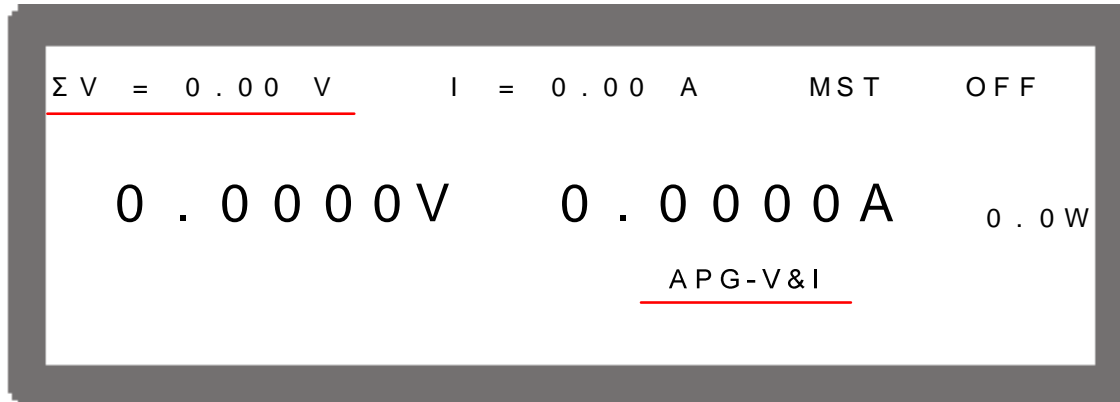


Figure 3-55

As with the APG voltage setting (AVO_SET), the inputted analog voltage 0~5V maps to the actual output 0~400V. As with APG current setting (AIO_SET), the inputted analog voltage 0~5V maps to the actual output 0~60A as Figure 3-56(a) shows. Set the APG option to **APG = V & I** and **Vref(V) = 10** means the inputted analog voltage 0~10V maps to the actual output 0~400V. APG voltage (AVO_SET) also maps to the actual output 0~60A for APG current (AIO_SET) as Figure 3-56(b) shows. The inputted analog voltage (0~5V or 0~10V) for the above voltage/current setting has to be entered respectively for the devices in a series to obtain the effect of serial operation in APG mode.

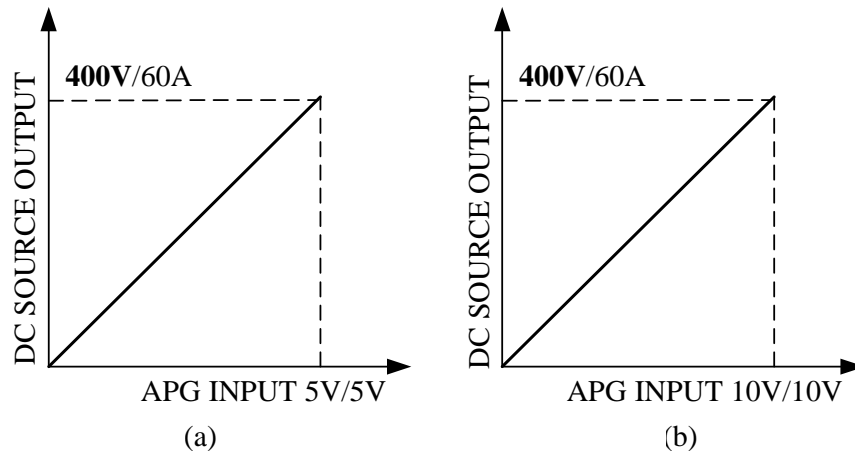


Figure 3-56

With APG voltage measurement (AVO_MEAS), the supplies in series will output analog voltage 0~5 V respectively and add the total output of five sets of 42012-80-60 getting 0~25 V analog voltage which maps to the actual output voltage 0~400 V. With APG current measurement (AIO_MEAS), the devices output analog voltage 0~5 V respectively and the add up total is 0~25 V analog voltage which maps to the actual output current 0~60 A as Figure 3-57(a) shows. Setting the APG option to **APG = V & I** and **Vref(V) = 10** means the supplies in series will output analog voltage 0~10 V respectively for APG voltage measurement (AVO_MEAS). Therefore, adding the total output of five sets 42012-80-60 analog voltage would get 0~50 V analog voltage which maps to the actual output voltage 0~400 V. As for APG current measurement (AIO_MEAS), the devices output analog voltage

0~10 V respectively, the total is 0~50 V analog voltage which maps to the actual output current 0~60 A as Figure 3-57(b) shows.

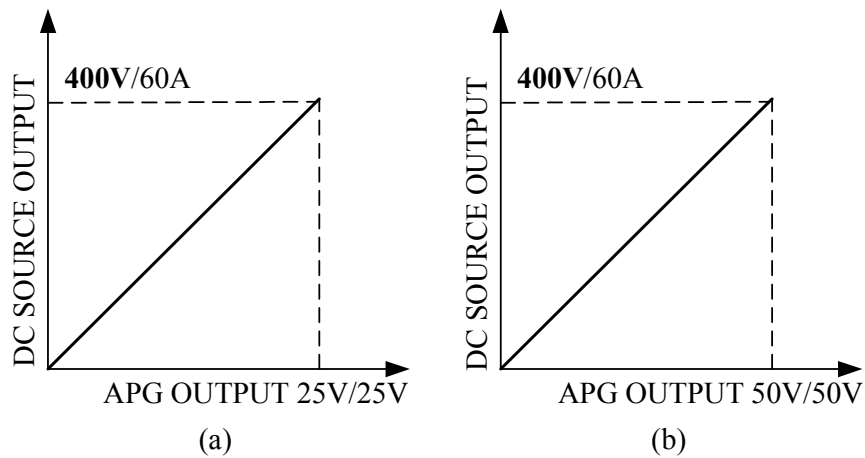


Figure 3-57

3.3.3.6.2 Parallel Setting

To connect five 42012-80-60 DC Power Supplies for operation in parallel, set the APG option to `APG = V & I` and `Vref(V) = 5`, the MAIN PAGE of MASTER will show as Figure 3-58.

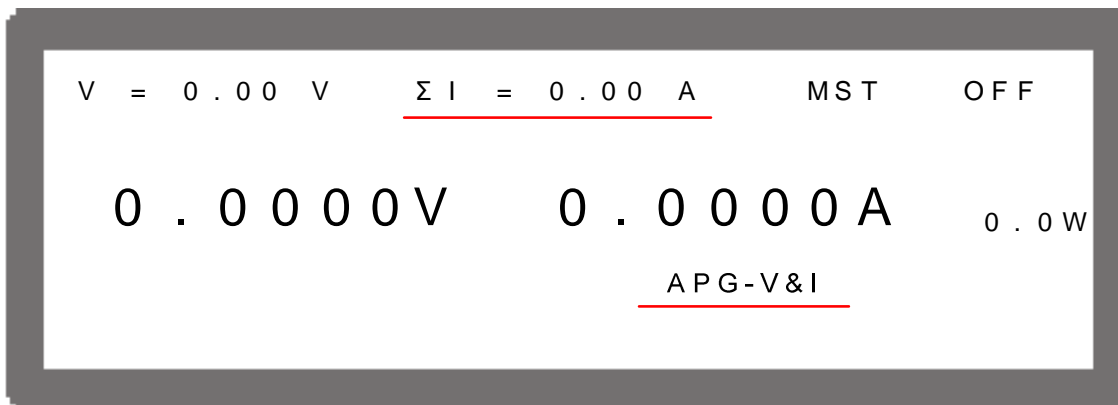


Figure 3-58

As with the APG voltage setting (AVO_SET), the inputted analog voltage 0~5 V maps to the actual output 0~80 V. For APG current setting (AIO_SET), the inputted analog voltage 0~5 V maps to the actual output 0~300 A as Figure 3-59(a) shows. Setting the APG option to `APG = V & I` and `Vref(V) = 10` means the inputted analog voltage 0~10 V maps to the actual output 0~80 V for APG voltage (AVO_SET). It also maps to the actual output 0~300 A for APG current (AIO_SET) as Figure 3-59(b) shows. The inputted analog voltage (0~5V or 0~10V) for the above voltage/current setting has to be entered respectively for supplies in parallel to obtain the effect of parallel operation in APG mode.

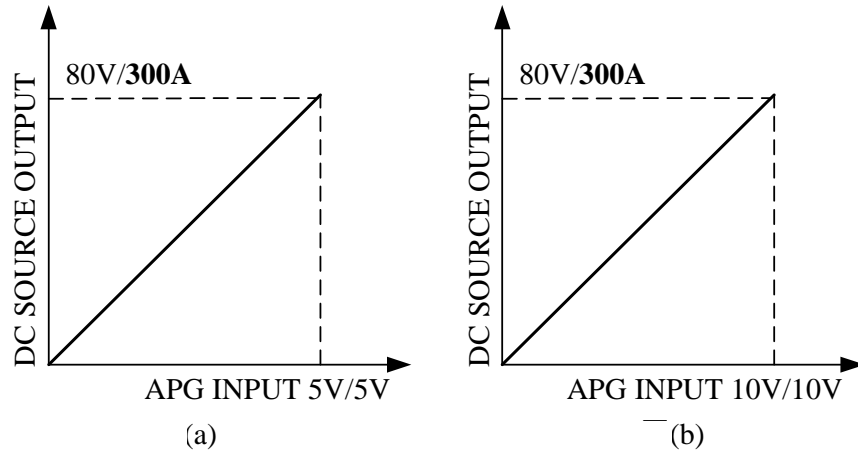


Figure 3-59

With APG voltage measurement (AVO_MEAS), the supplies in parallel will output analog voltage 0~5 V respectively and adding the total output of five sets 42012-80-60 getting 0~25 V analog voltage which maps to the actual output voltage 0~80 V. With APG current measurement (AIO_MEAS), the devices output analog voltage 0~5 V respectively and the add up total is 0~25 V analog voltage which maps to the actual output current 0~300 A as Figure 3-60(a) shows. Setting the APG option to `APG = V & I` and `Vref(V) = 10` means the supplies in parallel will output analog voltage 0~10 V respectively for APG voltage measurement (AVO_MEAS). Therefore, adding the total output of five sets 42012-80-60 analog voltage getting 0~50 V analog voltage which maps to the actual output voltage 0~80 V. As for APG current measurement (AIO_MEAS), the devices output analog voltage 0~10 V respectively, and the add-up total is 0~50 V analog voltage which maps to the actual output current 0~300A as Figure 3-60(b) shows.

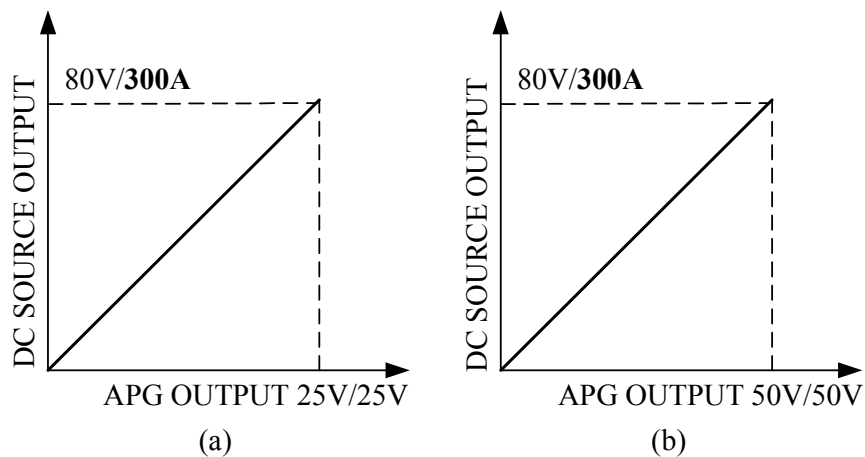


Figure 3-60

ⓘ NOTICE

For example, to connect five sets of 42012-80-60 in series or parallel, the fixture circuit in Figure 3-61 can be referenced if expecting the relationship of APG total voltage/current measurements mapping to what the actual output voltage/current is as Figure 3-62 shows.

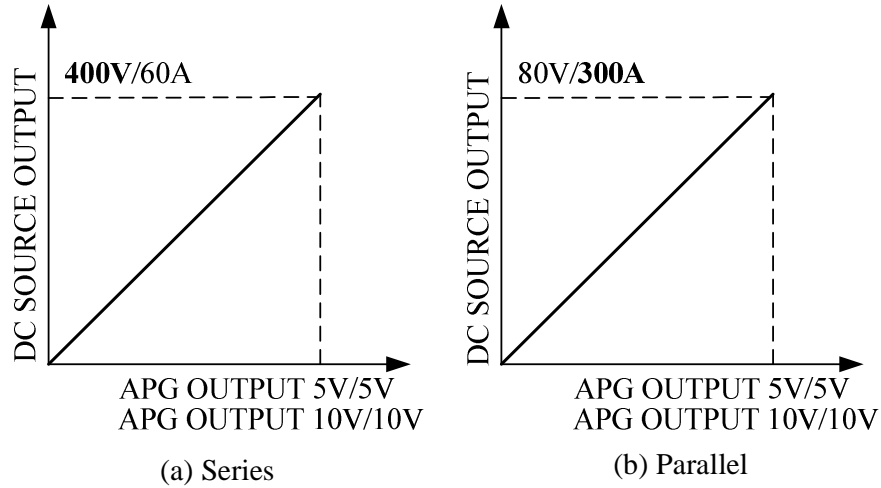


Figure 3-61

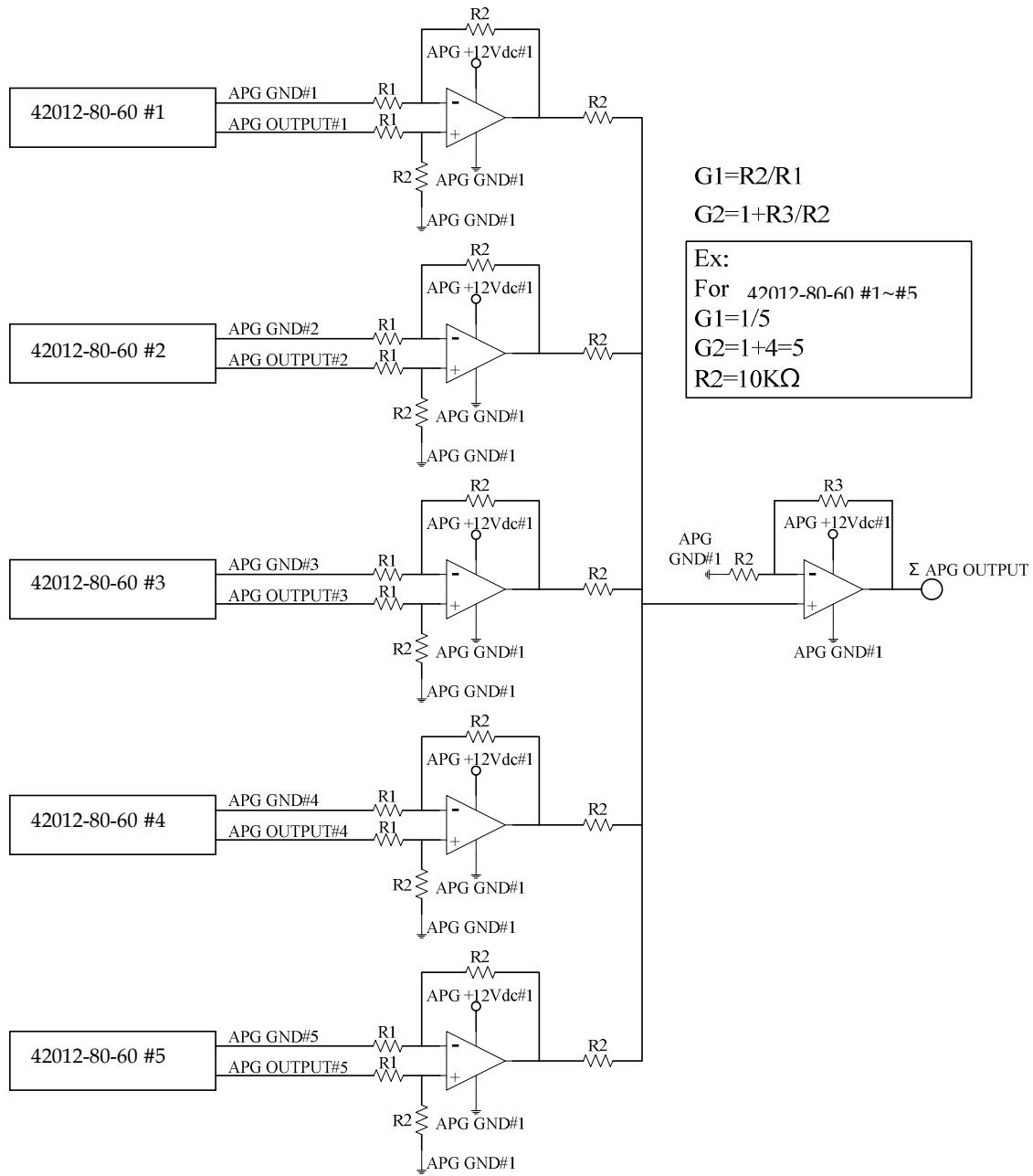


Figure 3-62

3.3.4 DISPLAY

DISPLAY setting has two options: (1) DISPLAY SELECTION and (2) READING AVERAGE TIMES.

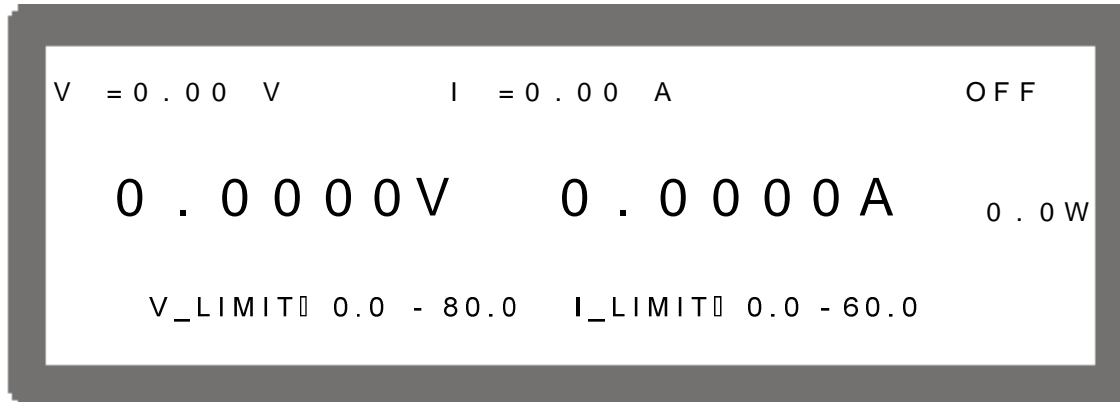


Figure 3-64

3.3.4.1.3 V/I/P PROTECT

When it is set to V/I/P PROTECT the last line on the MAIN PAGE will show the OVP, OCP and OPP settings in PROTECTION. See section 3.3.5.1 to 3.3.5.3 for detailed information.

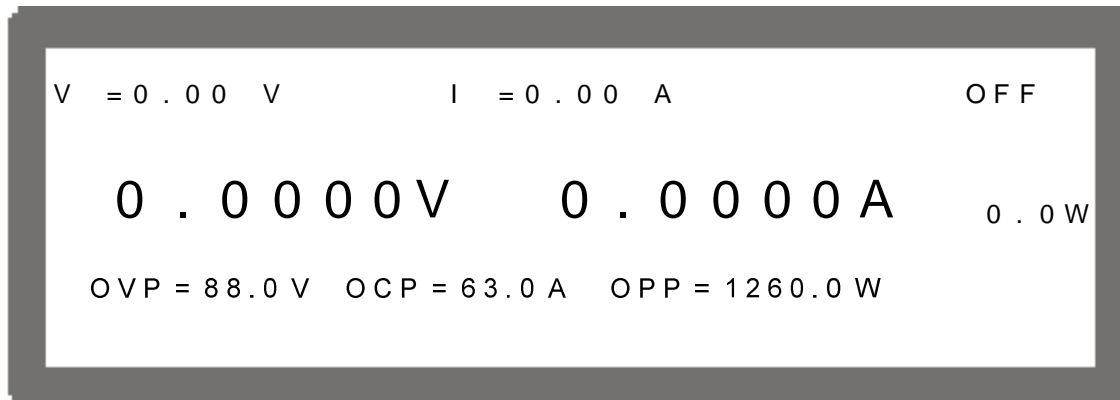


Figure 3-65

3.3.4.1.4 V/I SLEW RATE

When it is set to V/I SLEW RATE the last line on the MAIN PAGE will show the V SLEWRATE and I SLEWRATE settings in OUTPUT SETUP. See section 3.3.2.3 and 3.3.2.4 for detailed information.

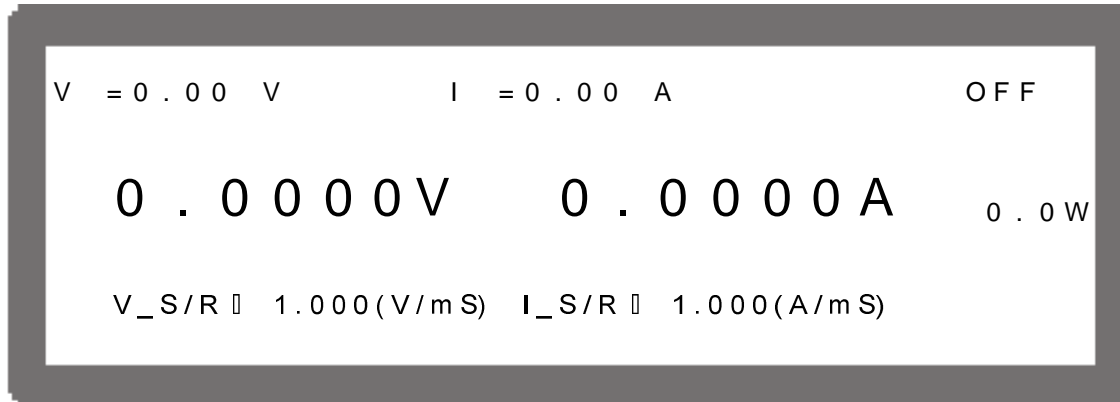


Figure 3-66

3.3.4.1.5 TTL VALUE

When it is set to **TTL VALUE** the last line on the MAIN PAGE will show the TTL VALUE settings in OUTPUT SETUP. See section 3.3.2.5 for detailed information.

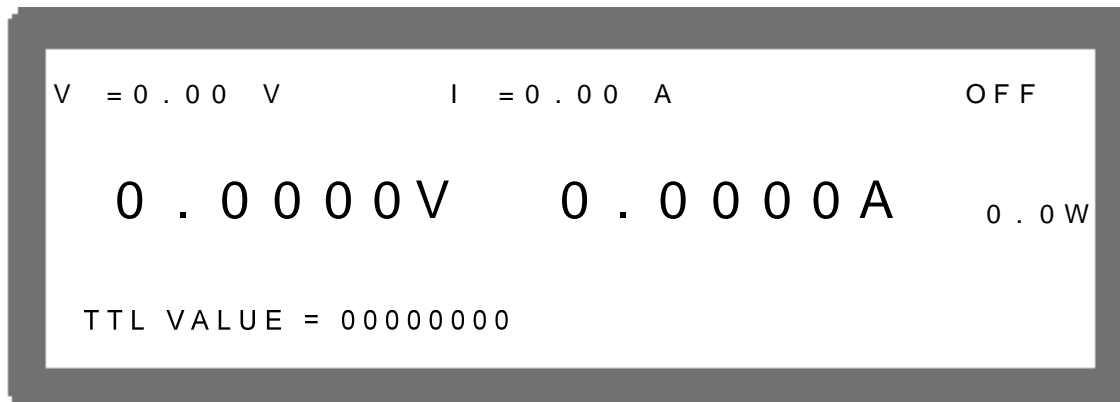


Figure 3-67

3.3.4.2 READING AVERAGE TIMES

The voltage and current readings, displayed on the MAIN PAGE, is five and half digits, and the option **READING AVERAGE TIMES** is able to set the average times for voltage and current readings. The higher the average time is set, the slower the voltage and current are updated. The default setting is 1 as Figure 3-68 shows.

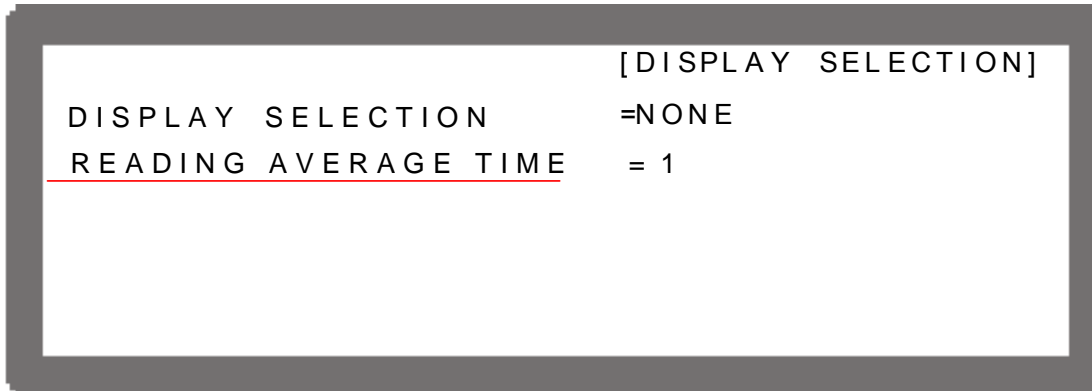


Figure 3-68

READING AVERAGE TIMES can be set to 1, 2, 4 and 8.

① NOTICE

1. The reading is averaged using a ROLLING. Therefore, when the actual output is changed dramatically and the average times are larger than 1, the displayed reading will gradually reach the actual output based on the average times.
2. The panel reading is updated in the rate of 200mS.

3.3.5 PROTECTION

The QuadTech, Inc. 42000 Series DC Power Supplies have complete protection functions divided in two classes. The first protection type includes over voltage, over current, over power and FOLDBACK; while the second protection type includes over temperature, fan failure and over/under input voltage. The first class protection trigger point is set by the user as described below, while the second class protection is auto detected by the system hardware protection circuit.

To enter it:

1. In Config Setup page, press “**5**” to show Figure 3-69.

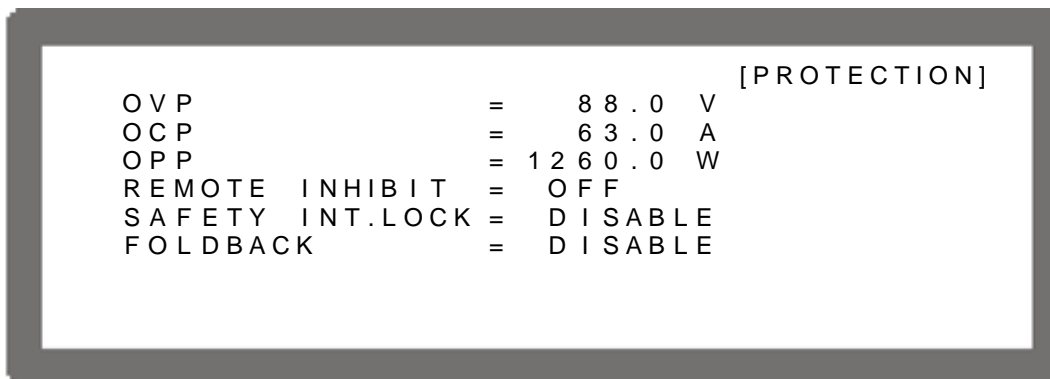







Figure 3-69

2. Press “” to enter into the PROTECTION option.

NOTICE

1. When in the option page, use the “”, “” keys to move the cursor to the column to be set.
2. The value in Figure 3-69 is the default of 42012-80-60.

3.3.5.1 OVP Protection

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 3-70 shows.

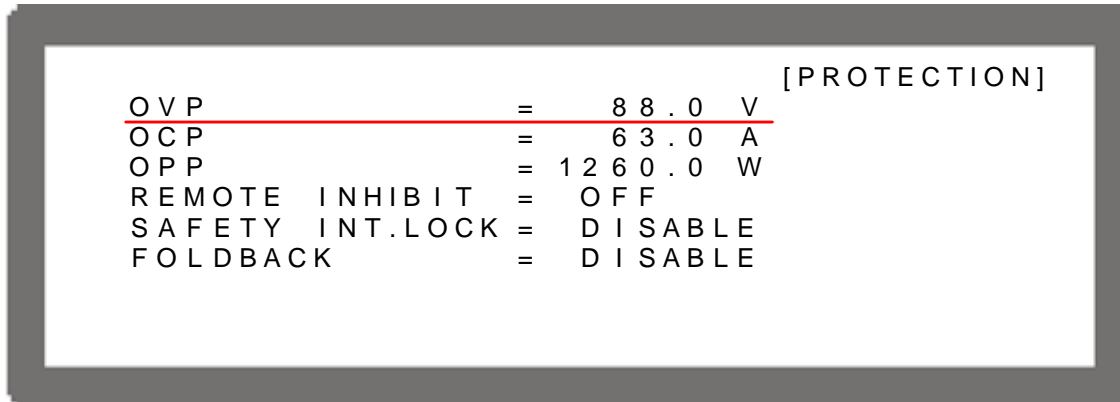







Figure 3-70

2. Use the numeric (, ) keys or “Rotary” () knob to set the value.
3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.

This function sets the protection point for Over Voltage. Once the output voltage exceeds the range, it will turn off the output, **OUTPUT = OFF**, to protect the unit under test.

NOTICE

1. The table below is the voltage range of OVP.

| Model | Min. OVP (V) | Max. OVP (V) |
|-------------|---------------|---------------|
| 420xx-xx-xx | 1.10 x Vo_SET | 1.10 x Vo_MAX |

Table 3-4 OVP Range

2. When 0 is set for the OVP, it means the function is disabled.

When OVP occurs, the main page will prompt a protection message as shown below:

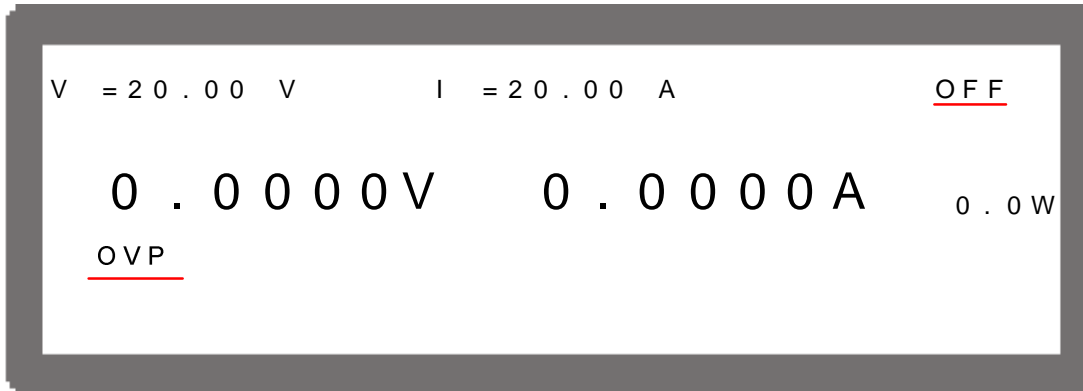


Figure 3-71

3.3.5.2 OCP Protection

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 3-72 shows.

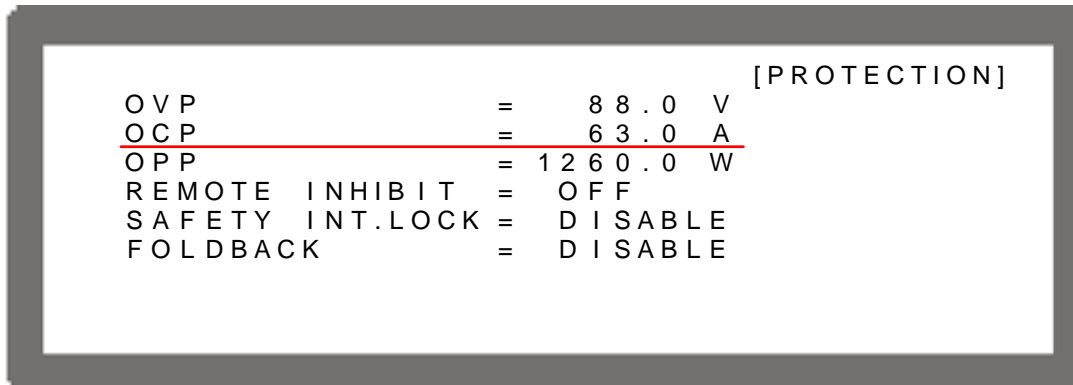


Figure 3-72

2. Use the numeric (,) keys or “Rotary” () knob to set the value.
3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.

This function sets the protection point for Over Current. Once the output current exceeds the range, it will turn off the output, OUTPUT = OFF, to protect the unit under test.

ⓘ NOTICE

1. The table below is the current range of OCP.

| Model | Min. OCP (A) | Max. OCP (A) |
|-------------|---------------|---------------|
| 420xx-xx-xx | 1.05 x Io_SET | 1.05 x Io_MAX |

Table 3-5 OCP Range

- When 0 is set for the OCP, it means the function is disabled.

When OCP occurs the main page will prompt a protection message as shown below:

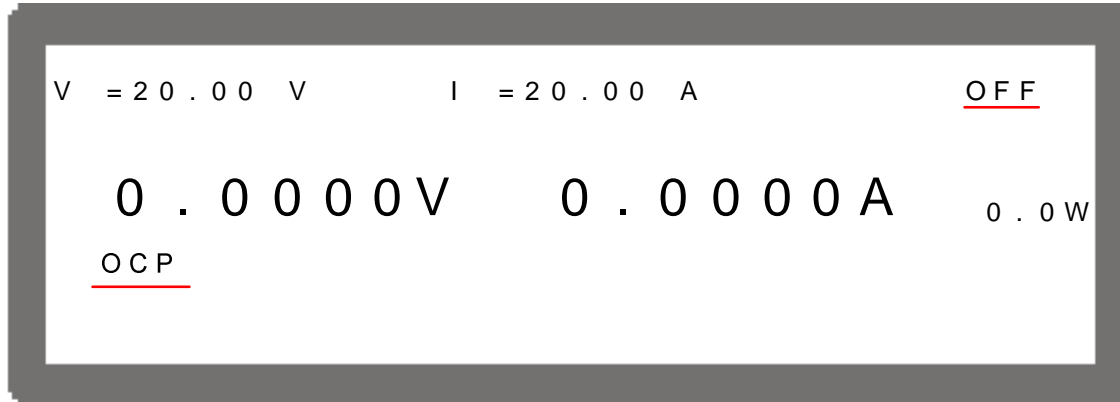


Figure 3-73

3.3.5.3 OPP Protection

- Use the “”, “” keys to move the cursor to the column to be set as Figure 3-74 shows.

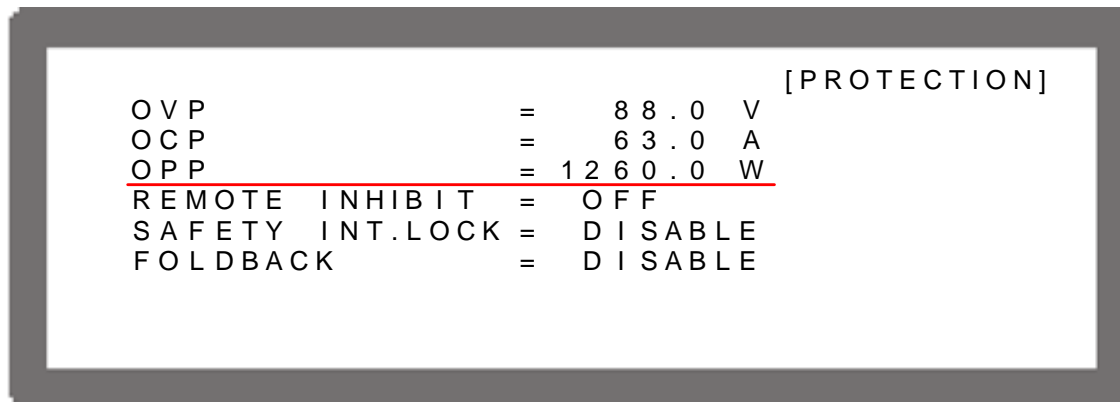


Figure 3-74

- Use the numeric (,) keys or “Rotary” () knob to set the value.
- Press “” to confirm.
- Press “” to return to the MAIN PAGE.

This function sets the protection point for Over Power. Once the output power exceeds the range, it will turn off the output, OUTPUT = OFF, to protect the unit under test.

① NOTICE

1. The table below is the power range of OPP.

| Model | Max. OPP (W) |
|-------------|--------------|
| 42006-xx-xx | 630 |
| 42012-xx-xx | 1260 |
| 42024-xx-xx | 2520 |
| 42050-xx-xx | 5250 |

Table 3-6 OPP Range

2. When 0 is set for the OPP, it means the function is disabled.
3. The OPP protection point is based on the comparison of the calculated power of output current and remote sense voltage. However, if the power measured by the output terminal on rear panel is larger than the listed maximum output power in Table 3-6, the system will still prompt OPP and turn off the output.

When OPP occurs, the main page will prompt a protection message as shown below:

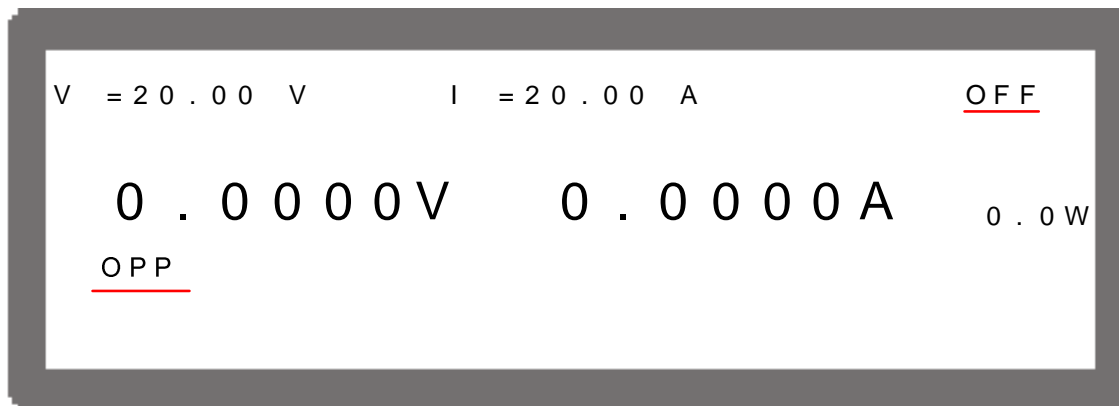




Figure 3-75

3.3.5.4 REMOTE INHIBIT

This function allows users to close the outputting power supply or control the power supply's ON/OFF directly through the PIN9 _INHIBIT in APG & SYSTEM STATUS.

1. Use the “” & “” keys to move the cursor to the column to be set as Figure 3-76 shows.

| | | | |
|-----------------|---|---------|--------------|
| | | | [PROTECTION] |
| OVP | = | 88.0 | V |
| OCP | = | 63.0 | A |
| OPP | = | 1260.0 | W |
| REMOTE INHIBIT | = | OFF | |
| SAFETY INT.LOCK | = | DISABLE | |
| FOLDBACK | = | DISABLE | |

Figure 3-76

2. Use the “Rotary” (⊙) knob to set REMOTE INHIBIT mode. There are three options: **OFF**, **TRIGGER** and **EXT. ON/OFF**.
 1. Selecting OFF: It closes the function.
 2. Selecting TRIGGER: It sets the REMOTE INHIBIT to TRIGGER. When low level triggers the PIN9 _INHIBIT in APG & SYSTEM STATUS, it equals pressing the “**OUTPUT**” key to set **OUTPUT = OFF**.
 3. Selecting EXT. ON/OFF: It sets the REMOTE INHIBIT to EXT. ON/OFF and replaces the “**OUTPUT**” key by disabling it to control the activation of power supply. When the voltage level of PIN9 _INHIBIT in APG & SYSTEM STATUS turns to LOW, the power supply is unable to output. The power supply outputs normally when the voltage level of this pin turns to HIGH.
3. Press “**ENTER**” to confirm.
4. Press “**EXIT**” to return to the MAIN PAGE.

When protection occurs to REMOTE INHIBIT, the main page will show the protection message as below.

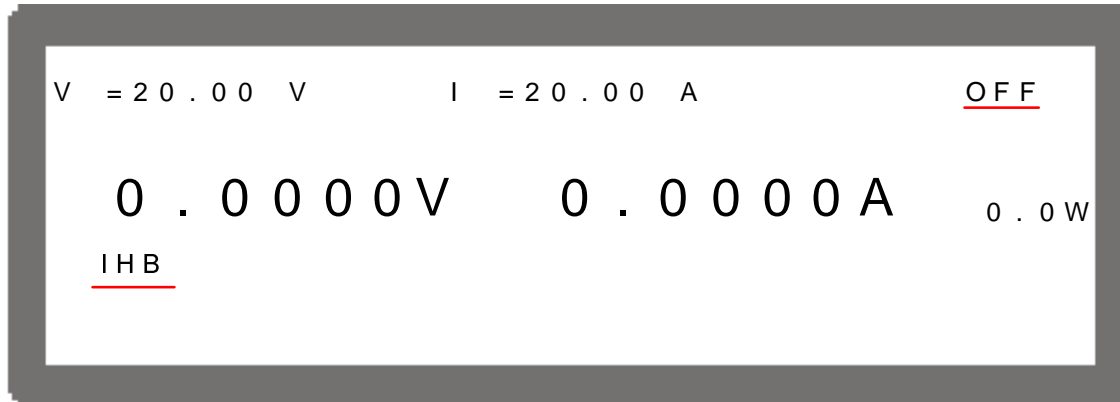




Figure 3-77

3.3.5.5 SAFETY INT.LOCK

This function allows users to control the power supply's ON/OFF through the PIN7 of APG & SYSTEM STATUS.

1. Use the “” & “” keys to move the cursor to the column to be set as Figure 3-78 shows.

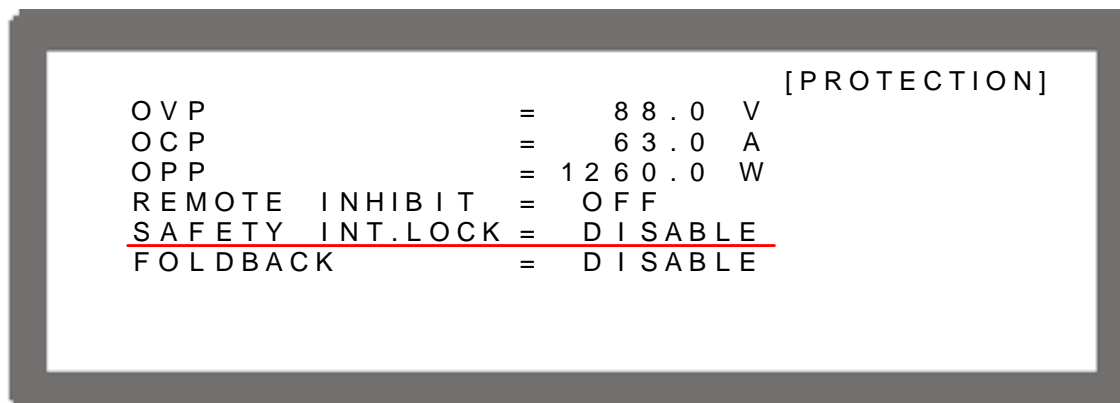




Figure 3-78

2. Use the “Rotary” () knob to set SAFETY INT.LOCK mode. There are two options: DISABLE and ENABLE.
 1. Selecting DISABLE: It closes this function.
 2. Selecting ENABLE: It sets SAFETY INT.LOCK to ENABLE. When the PIN7 of APG & SYSTEM STATUS is at high level, it indicates the power supply is outputting normally and its ON/OFF is still controlled by “OUTPUT”. When the PIN7 of APG & SYSTEM STATUS is at low level, it closes the power supply output directly and issues protection signal.
3. Press “” to confirm.

4. Press “**EXIT**” to return to the MAIN PAGE.

When protection occurs to SAFETY INT.LOCK, the main page will show the protection message as below.

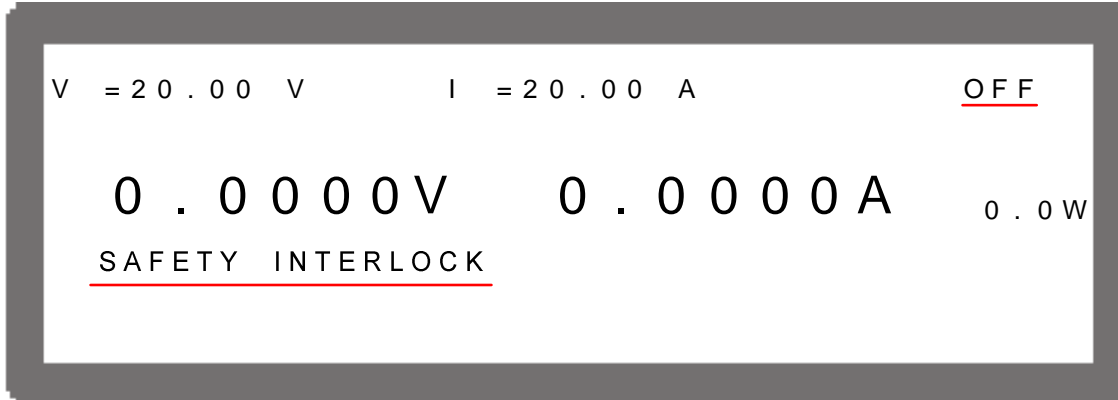


Figure 3-79

3.3.5.6 FOLDBACK

This function allows users to turn off the output, **OUTPUT = OFF**, when changing output mode (CV to CC, or CC to CV) to protect the unit under test.

1. Use the “**←↑**”, “**→↓**” keys to move the cursor to the column to be set as Figure 3-80 shows.

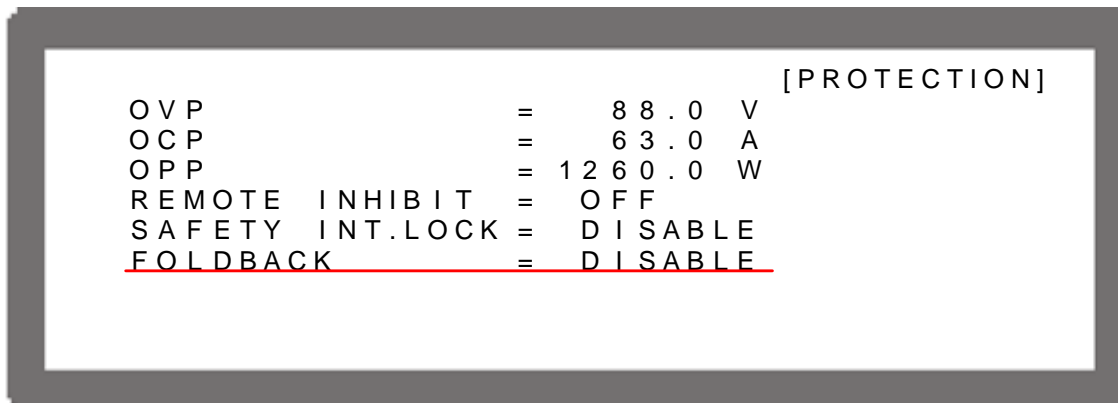


Figure 3-80

2. Use “Rotary” (⊙) knob to set the protection mode.

There are three options available for selection: **DISABLE**, **CV TO CC** and **CC TO CV**.

1. **DISABLE:** Ignore the output off function.
2. **CV TO CC:** Active in CV MODE only. Once the operation mode mode changes to CC MODE, the system will turn off the output to protect the UUT.
3. **CC TO CV:** Active in CC MODE only. Once the operation mode changes to CV MODE, the system will turn off the output to protect the UUT.

When the FOLDBACK option set to **CV TO CC** or **CC TO CV**, a selection for **DELAY TIME** will prompt beneath for users to set the time delayed for protection after the mode changes as Figure 3-81 shows.

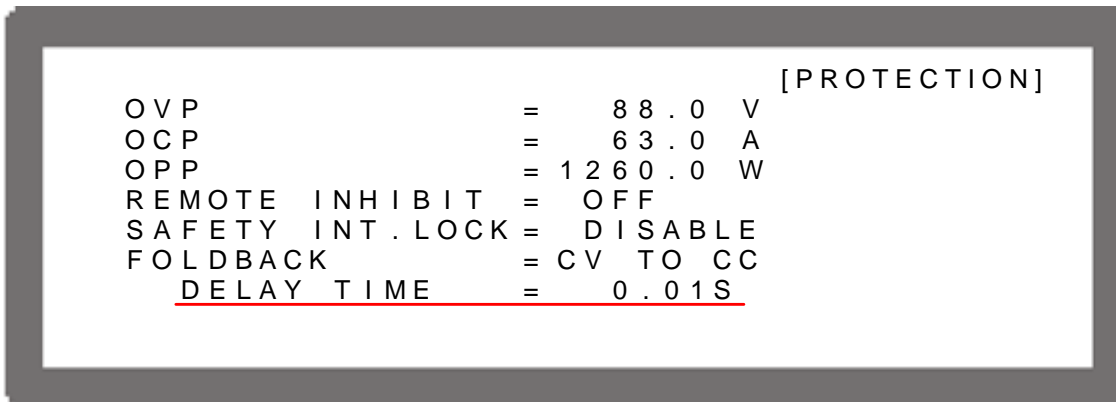




Figure 3-81

3. Press “” to confirm.
4. Press “” to return to the MAIN PAGE.

When FOLDBACK protection occurs, the main page will prompt a protection message as shown below:

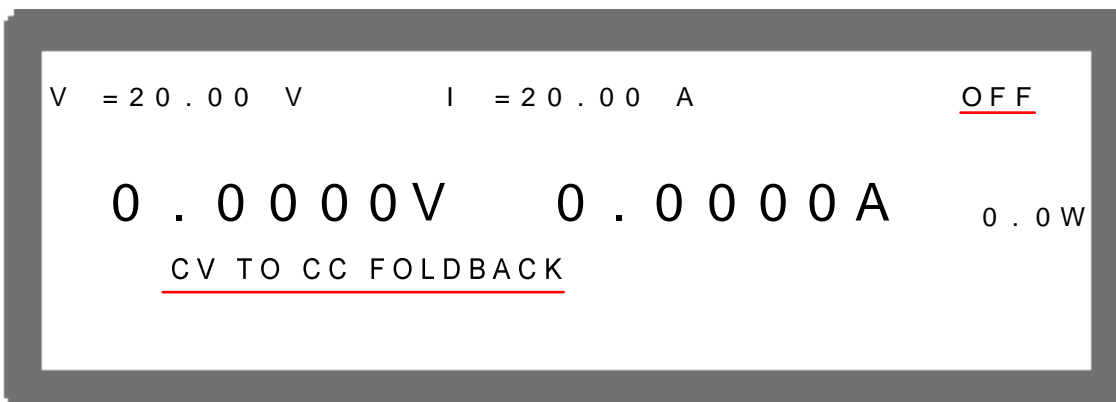


Figure 3-82

Be aware that if DELAY TIME is set to t seconds, it means the FOLDBACK that sets CV to CC or CC to CV won't be activated unless t seconds is achieved when a mode change is detected. If the change time of mode is less than t seconds it will return to its original state and FOLDBACK protection will not occur as Figure 3-83 shows.

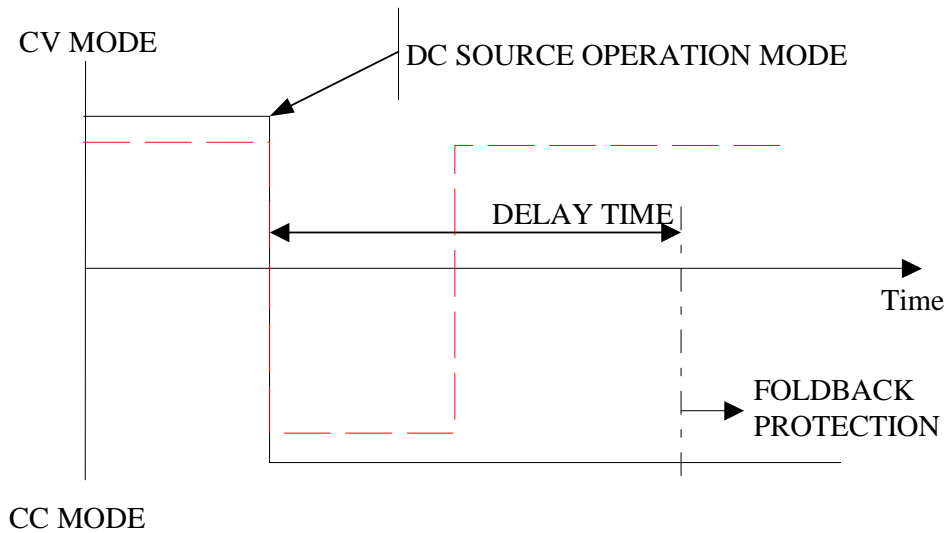


Figure 3-83

Assuming the FOLDBACK is set to CV TO CC, the solid line in Figure 3-83 will create Foldback protection while the dot line will not. It is vice versa for CC TO CV.

3.3.5.7 OTP

The OTP protection will activate when the internal temperature reaches the high limit and the output will be turned off, **OUTPUT = OFF**, for protection.

When **OTP** occurs, the main page will prompt a protection message as shown below:

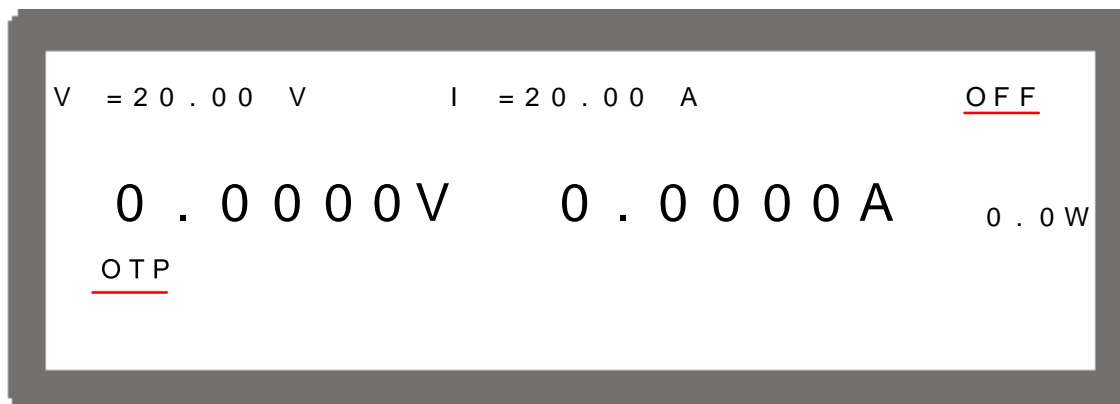


Figure 3-84

ⓘ NOTICE

1. User is unable to change the OTP setting.
2. The output will turn off when OTP occurs and will not turn on again **OUTPUT = ON**, until the internal temperature drops to a certain set value.

3.3.5.8 AC FAULT

The AC FAULT protection will activate when the internal input voltage is not within the model's range. The output will turn off, **OUTPUT = OFF**, for protection.

When **AC FAULT** occurs, the main page will prompt a protection message as shown below:

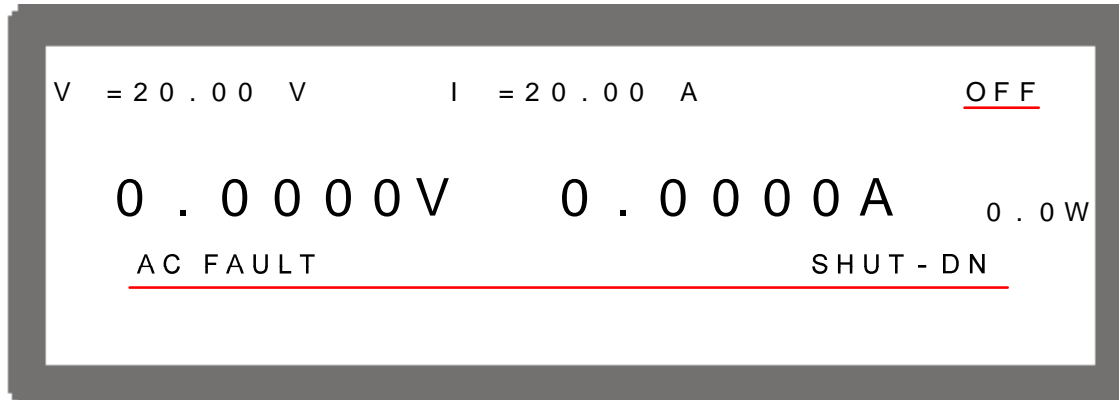


Figure 3-85

① NOTICE

1. The table below lists the typical value of AC FAULT for 42000 Series:

| | Less than (Vac) | More than (Vac) |
|---------------------------|-----------------|-----------------|
| 42006-xx-xx Input Voltage | 80 | 286 |
| 42012-xx-xx Input Voltage | 80 | 286 |
| 42024-xx-xx Input Voltage | 160 | 285 |
| 42050-xx-xx Input Voltage | 160 | 285 |

Table 3-7 AC FAULT Range


2. Once the AC FAULT is activated, the output is turned off, **OUTPUT = OFF**. It can be rebooted for use when the input voltage is within SPEC.
3. Be aware that the gage of the input wire cannot be too thin, or the line loss generated may cause the input voltage to be out of SPEC and AC FAULT to occur. See section 2.3.2 for the specifications of wire gage.

3.3.5.9 SENSE FAULT Protection

The remote sense is located at the rear panel near to output terminal. See section 2.5.1 for correct connection. When the connection is correct, it can adjust the UUT's voltage to be consistent with the panel set voltage without affecting the voltage drop of load wire.

When the connection is wrong for instance:

- (1) **VOLTAGE SENSING** polarity is reversed, meaning the UUT's “ - ” terminal is connected to the “ + ” of output terminal, and UUT's “ + ” terminal is connected to the “ - ” of output terminal.
- (2) One of the **VOLTAGE SENSING** wire's polarity is connected reversely, but the other is disconnected (fallen or broken).
- (3) One of the **VOLTAGE SENSING** wire's polarity is connected correctly, but the other one is disconnected.

Wrong connections of the above three may cause **SENSE FAULT** protection. The output will turn off, **OUTPUT = OFF**, for protection. It is necessary to connect the REMOTE SENSING wires correctly and press “” to remove the protection.

When **SENSE FAULT** occurs, the main page will prompt a protection message as shown below:

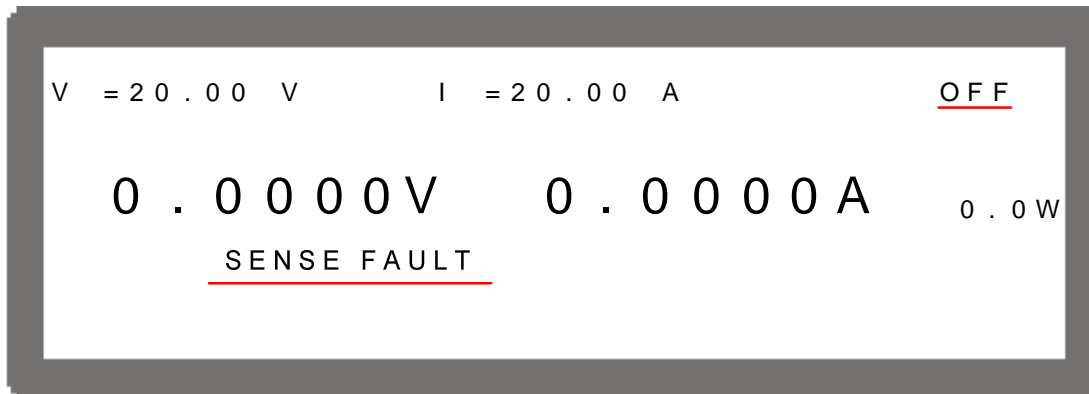


Figure 3-86

3.3.5.10 FANLOCK Protection

Built-in fans are installed inside the DC Power Supply to ventilate the heat generated by components. If one of the fans fails (not running), FANLOCK protection will occur and the output will turn off, **OUTPUT = OFF**, for protection.

When **FANLOCK** occurs, the main page will prompt a protection message as shown below:

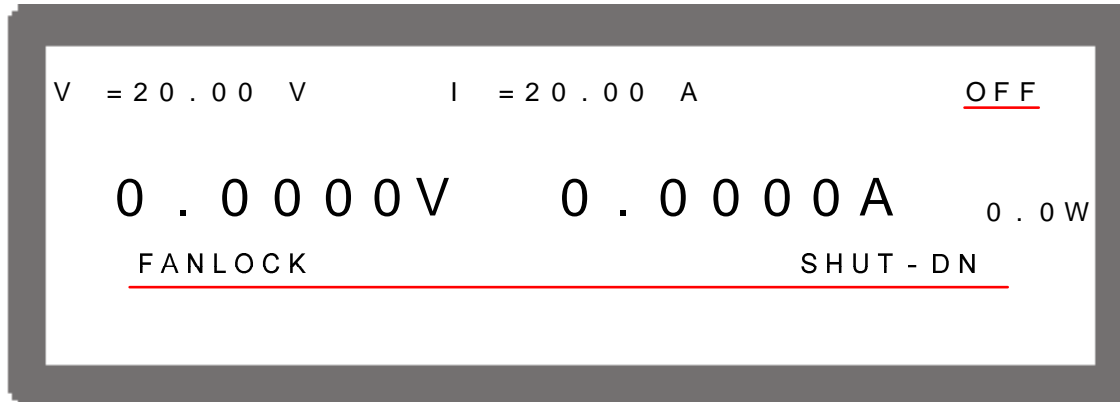


Figure 3-87

① NOTICE

1. Troubleshooting:
 - (1) If **FANLOCK** protection occurs again, please contact sales agent for repair services.
 - (2) Keep the two sides and the rear of DC Power Supply clear when in the loading state to prevent Over Temperature Protection from occurring.
2. When **FANLOCK** protection occurs, power-off the instrument first and then power it on again to see if it is caused by error action.

3.3.5.11 BUSOVP Protection

The PFC stage of internal main circuit converts the AC mains voltage to DC voltage for the main circuit DC TO DC stage use. If the DC voltage is abnormal, the **BUSOVP** signal will occur and the output will turn off, **OUTPUT = OFF**, for protection.

When **BUSOVP** occurs, the main page will prompt a protection message as shown below:

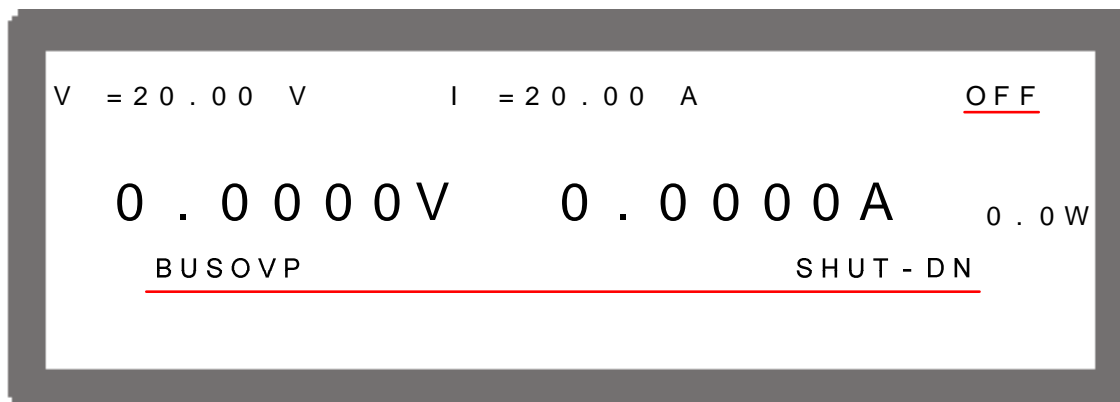


Figure 3-88

① NOTICE

1. Troubleshooting:
 - (1) When **BUSOVP** occurs, power-off the instrument first and then power it on again to see if it has caused an error action.

- (2) If **BUSOVP** occurs again, please contact sales agent for repair services.
-

3.3.5.12 SERIES FAULT Protection

Do not connect the CURRENT SHARING cable when operating in series or damage to the supply may occur. The DC power supply will detect the connection of CURRENT SHARING in series mode. **SERIES FAULT** protection will occur if connected. Figure 3-89 shows when it is in MASTER while Figure 3-90 shows the SLAVE:

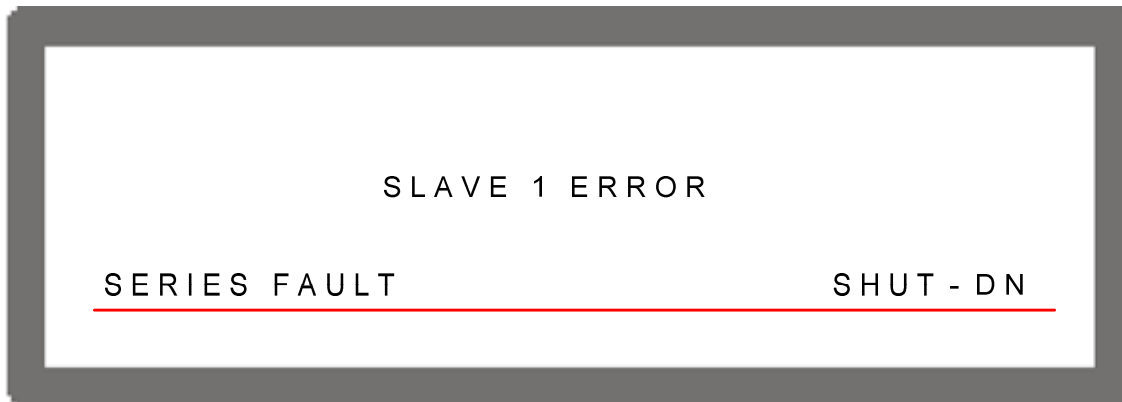


Figure 3-89



Figure 3-90

① NOTICE

1. Troubleshooting:
 - (1) When **SERIES FAULT** protection occurs, power-off the instrument first and remove the connecting cable of CURRENT SHARING and then power it on again.
 - (2) If **SERIES FAULT** occurs again, please contact a sales agent for repair services
-

3.3.6 FACTORY SETTING

This function allows users to reset the instrument to its factory default settings.

To enter it:

1. In Config Setup page, press “” to show Figure 3-91.
2. Press “” to enter into FACTORY SETTING option.

FACTORY DEFAULT has two options: (1) and (2) .

When set to , the instrument will retain the last configuration saved by the user. On the contrary, if it is set to , all configuration settings will return to the factory default.

In the mean time, the screen will display the messages of , and .

DEVICE MODEL : Display the model no. as 42012-80-60 in the figure below.
 SERIAL NO. : Display the serial no. as 00001 in the figure below.
 FIRMWARE VERSION: Display firmware version as 1.00 and released date as 2005/01/01 in the figure below.

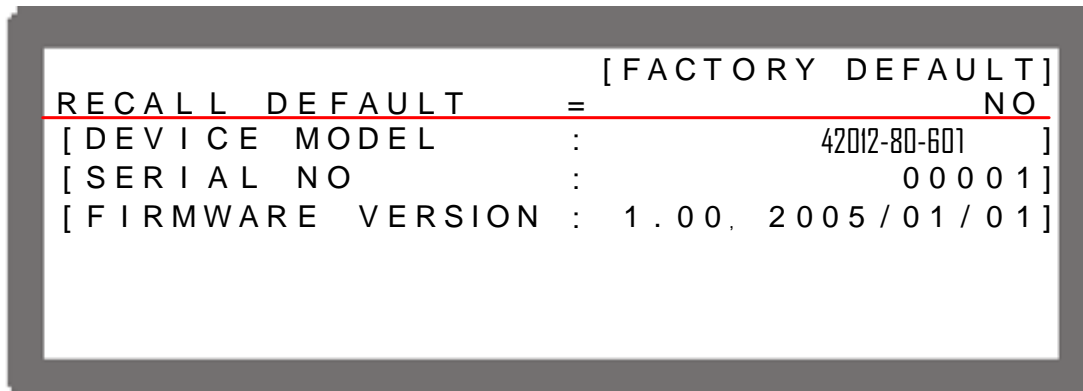


Figure 3-91

3.3.7 CALIBRATION

QuadTech, Inc. 42000 Series DC Power Supplies has five calibration functions:

- (1) VOLTAGE: the actual voltage output (CV mode) and its measurement accuracy.
- (2) CURRENT: the measurement accuracy of current.
- (3) CURRENT: the actual current out (CC mode).
- (4) APG VOLTAGE: the actual voltage output and its accuracy of analog V Monitor under analog voltage control mode.



- (5) APG CURRENT: the actual current output and its accuracy of analog I Monitor under analog current control mode.

Follow the procedure below to enter into calibration mode:

1. In CONFIG Setup page, press “7”.
2. Press “” to enter into CALIBRATION option as Figure 3-92 shows.



Figure 3-92

3. Enter the password and press “” to confirm. The screen will display four calibration options as Figure 3-93 shows. The calibration steps are described from section 3.3.7.1 to 3.3.7.5.
4. To abort CALIBRATION, press “” to return to the MAIN PAGE.

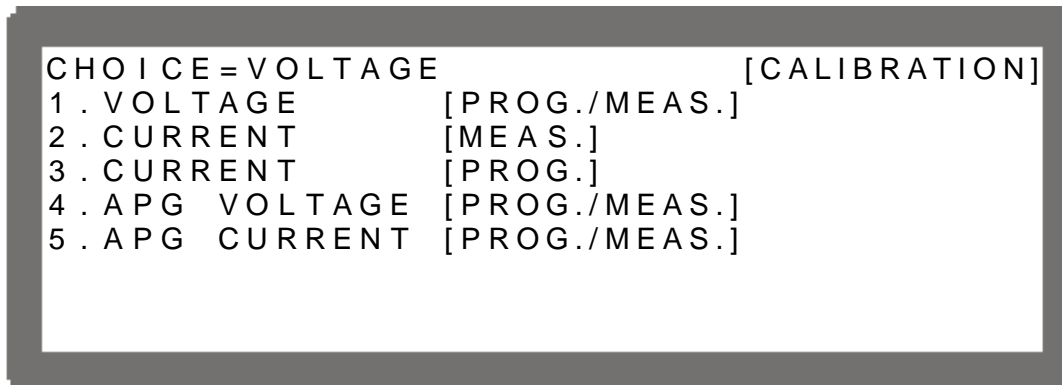


Figure 3-93

ⓘ NOTICE

Password is required for CALIBRATION. The password is “3636”.

3.3.7.1 Voltage Output & Measurement Calibration

3.3.7.1.1 Hardware Requirements

| Device | Suggested Model or Capacity |
|--------|-----------------------------|
| DVM | HP 34401A or equivalent DVM |

Table 3-8

3.3.7.1.2 SETUP

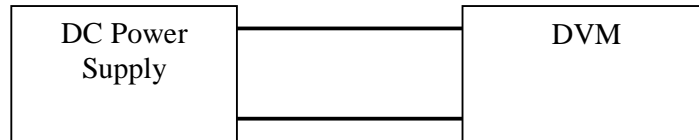



Figure 3-94

ⓘ NOTICE

For the instrument that performs calibration its accuracy has to be higher than the accuracy of spec.

3.3.7.1.3 Calibration Procedure (Example: Model 42012-80-60)

- Enter into the page of Figure 3-93.
- In CALIBRATION page, press “1” or turn “Rotary” (⊙) knob to set CHOICE=1.
- Press “” to confirm entering into voltage calibration options as Figure 3-95 shows.

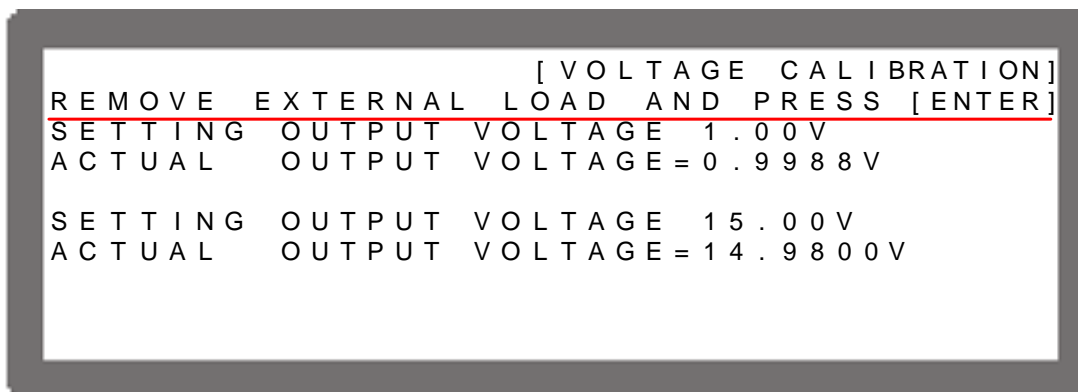






Figure 3-95

- When in Voltage calibration page, press “” to confirm.

- (5) First, do the low voltage range calibration (16V), the instrument will set the output voltage to 1.00V and the cursor is stopped at position [1] as Figure 3-96 shows. Enter the voltage measured by DVM (4 digits after decimal point) and press “” to confirm.
- (6) Press the “” again to do the low voltage range calibration for its second point, the instrument will set the output voltage to 15.00V and the cursor is stopped at position [2] as Figure 3-96 shows. Enter the voltage measured by DVM (4 digits after decimal point) and press “” to confirm.

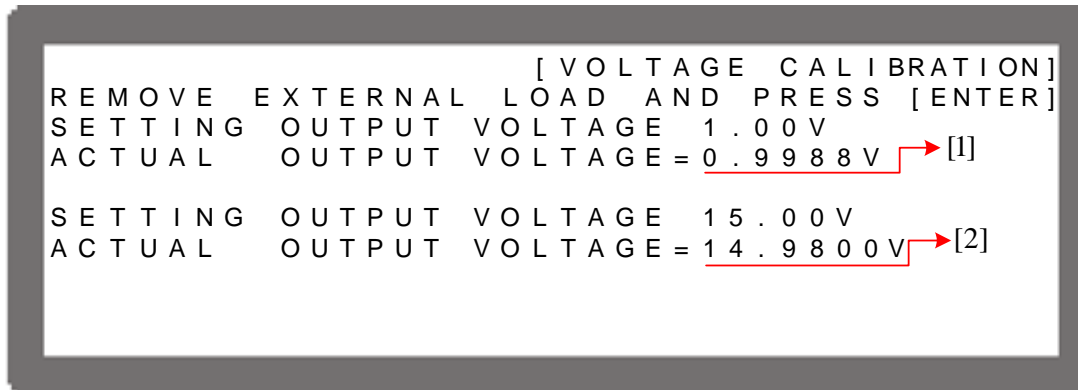






Figure 3-96

- (7) Press the “” to do the high voltage range calibration (80V), the instrument will set the output voltage to 20.00V first and the cursor is stopped at position [3] as Figure 3-97 shows. Enter the voltage measured by DVM (4 digits after decimal point) and press “” to confirm.
- (8) Press the “” again to do the high voltage range calibration for its second point, the instrument will set the output voltage to 70.00V and the cursor is stopped at position [2] as Figure 3-97 shows. Enter the voltage measured by DVM (4 digits after decimal point) and press “” to confirm.

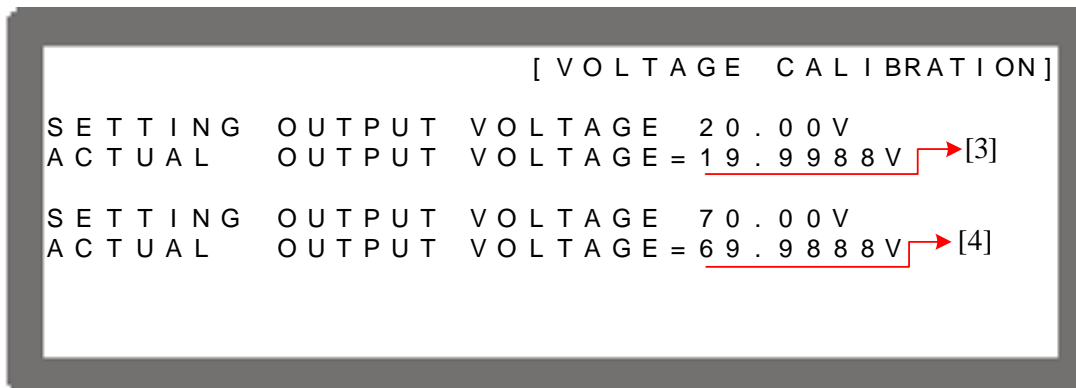


Figure 3-97

- (9) Now the voltage calibration is done. To save the calibration data, press “**SAVE**” will prompt a confirmation page as Figure 3-98 shows, press “**ENTER**” to save it. Press “**EXIT**” to return to the MAIN PAGE.



Figure 3-98

① NOTICE

1. The calibration point may be different for other models (non 42012-80-60), please operate it following the instructions displayed.
2. It is necessary to remove the output load when performing voltage calibration. The LCD panel will show the text as Figure 3-96 and once no load is confirmed for the output, press “**ENTER**” to start calibration.

3.3.7.2 Current Measurement Calibration

3.3.7.2.1 Hardware Requirements

| Device | | Suggest Model or Capacity |
|---------------|-----------------|-----------------------------|
| DVM | | HP 34401A or equivalent DVM |
| CURRENT SHUNT | | Prodigit 7530 or equivalent |
| LOAD | ELECTRICAL LOAD | Chroma 63204 or equivalent |
| | BREAKER | Capable current $\geq 100A$ |

Table 3-9

3.3.7.2.2 SETUP

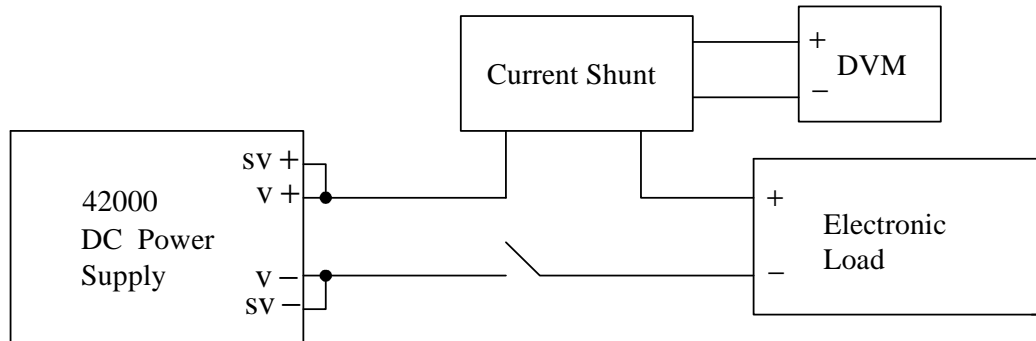


Figure 3-99

3.3.7.2.3 Calibration Procedure (Example: Model 42012-80-60)

1. In CALIBRATION page, press “” or turn “Rotary” (⊙) knob to set CHOICE=2.
2. Press “” to confirm and entering into current calibration options as Figure 3-100 shows.

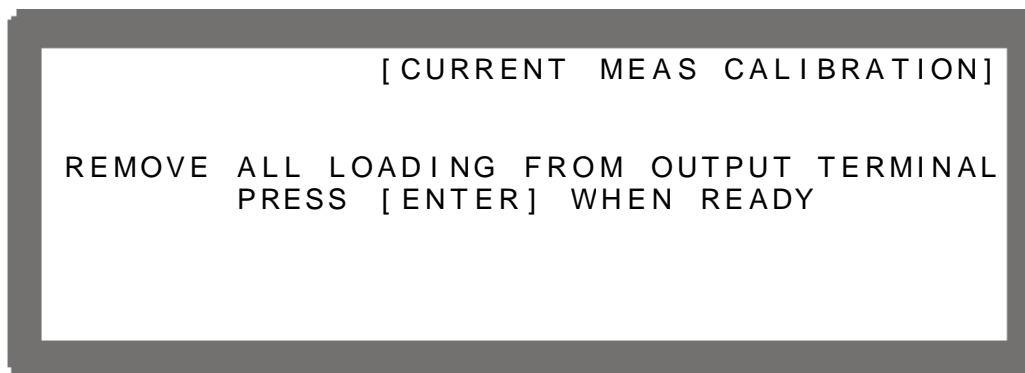


Figure 3-100

3. Open the Breaker to ensure the DC Power Supply has no load and press “” to confirm.
4. **It is important** to reconnect the DC Power Supply to current shunt whose rating is closest to, but still covers 2A. For Prodigit 7530, use 2A shunt directly.
5. Then it will show Figure 3-101 and press “”. First, it will calibrate the low current range, the system outputs 5V voltage and then sets the loading current of Electronic LOAD to 2.00A. The cursor is stopped at position [1] as Figure 3-101 shows. Enter the current (4 digits after decimal point) read by Current Shunt (DVM) and press “” to confirm and wait for it to end.

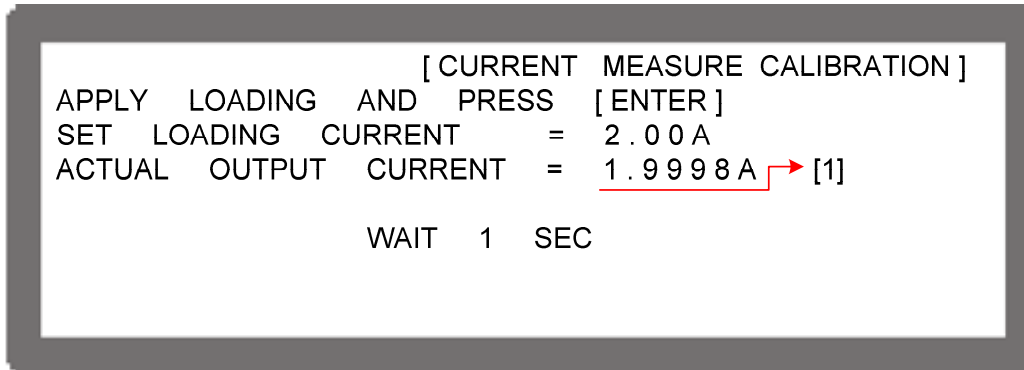



Figure 3-101

6. Once the 2A point was calibrated, **it is important** to turn the loading of Electronic Load off, reconnect the DC Power Supply to current shunt whose rating is closest to, but still covers 10A. For Prodigit 7530, use 20A shunt directly.
7. Next, press the “


```

[ CURRENT MEASURE CALIBRATION ]
APPLY LOADING AND PRESS [ENTER]
SET LOADING CURRENT      = 10.00A
ACTUAL OUTPUT CURRENT    = 9.9998A [2]

WAIT 5 SEC

```

Figure 3-102

8. After the low current range was calibrated, **it is important** to turn the loading of Electronic Load off, reconnect the DC Power Supply to current shunt whose rating is closest to, but still covers 20A. For Prodigit 7530, use 20A shunt directly.
9. For high current range calibration, press “Page 99 of 167

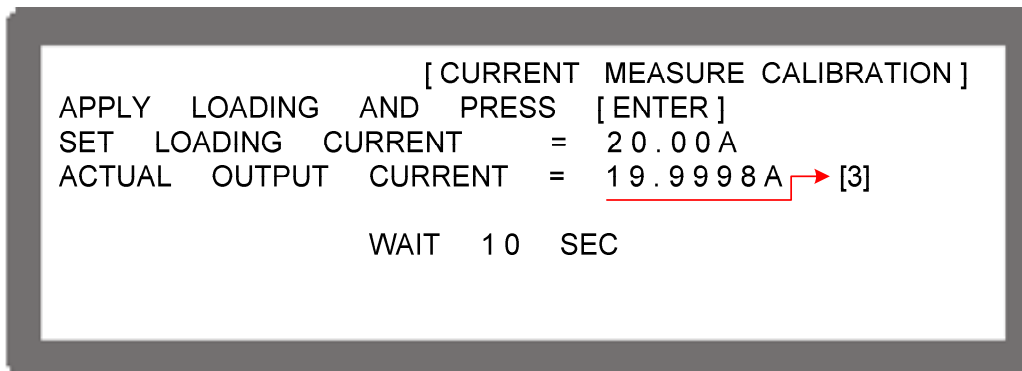




Figure 3-103

10. Once the 20A point is calibrated, **it is important** to turn the loading of Electronic Load off, reconnect the DC Power Supply to current shunt whose rating is closest to, but still covers 50A. For Prodigit 7530, use 250A shunt directly.
11. Press the “” to perform 50A calibration. The cursor will stop at position [4] as Figure 3-104 shows for setting the loading current of Electronic LOAD to 50.00A. Enter the current (4 digits after decimal point) read by Current Shunt (DVM) and press “” to confirm and wait for it to end. Use 20A and 50A for calibration, the system will calculate the calibration factor for the high current range.

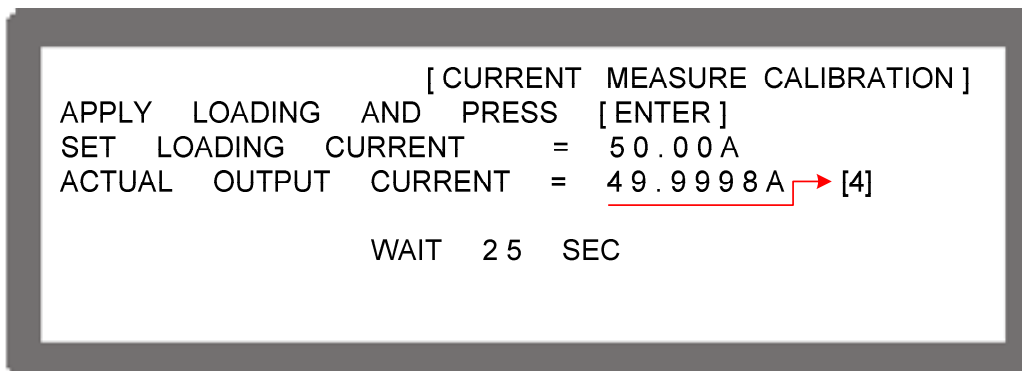


Figure 3-104




12. The current calibration is done once the above actions are completed. Remove the load of Electronic LOAD and press “” and “” to save the calibrated data as Figure 3-105 shows, or press “” to return to the MAIN PAGE.



Figure 3-105



Improper shunt range selection may cause damage to the current shunt.

NOTICE

The calibration point may be different for other models (non 42012-80-60), please operate it following the instructions displayed.

3.3.7.3 Current Output (PROG.) Calibration

3.3.7.3.1 Hardware Requirements

| Device | | Suggest Model or Capacity |
|---------------|-----------------|-----------------------------|
| DVM | | HP 34401A or equivalent DVM |
| CURRENT SHUNT | | Prodigit 7530 or equivalent |
| LOAD | ELECTRICAL LOAD | Chroma 63204 or equivalent |
| | BREAKER | Capable current $\geq 100A$ |

Table 3-10

3.3.7.3.2 SETUP

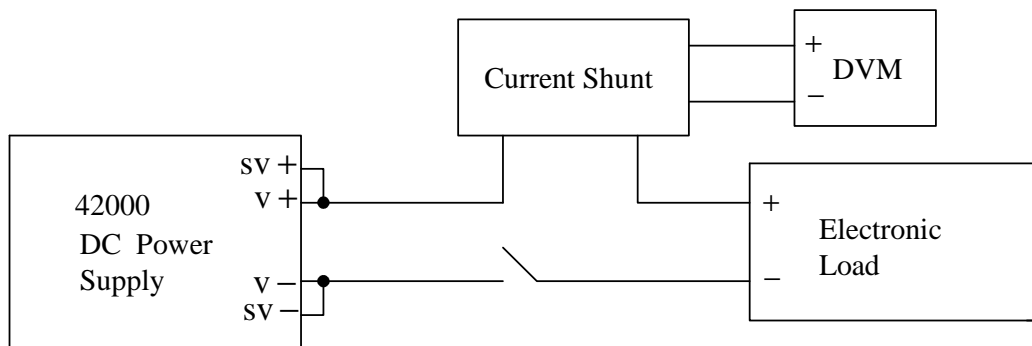



Figure 3-106

3.3.7.3.3 Calibration Procedure (Example: Model 42012-80-60)

- (1) Set the Electronic Load to CV mode 5V. Short the output terminal directly if there is no Electronic Load.
- (2) In CALIBRATION page, press “3” or turn “Rotary” (⊙) knob to set CHOICE=3.
- (3) Press “” to confirm and enter into current calibration options as Figure 3-107 shows.

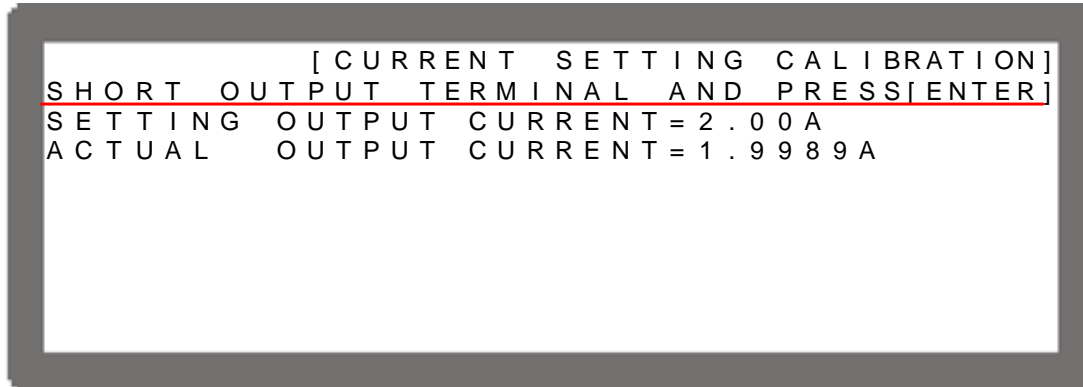



Figure 3-107

- (4) The output of the DC Power Supply will be off before the user presses ENTER. Once ENTER is pressed, a message will pop up to remind users to connect to proper current shunt range. Set current shunt whose rating is closest to, but still covers 2A. For Prodigit 7530, use 2A shunt directly.
- (5) Press ENTER, the system will set the output current to 2.00A automatically and a second reading will appear on the screen. Once the reading is done, the cursor will stop at position [1] as Figure 3-108 shows. Input the current (4 digits after decimal point) read by Current Shunt (DVM) and press “” to confirm.

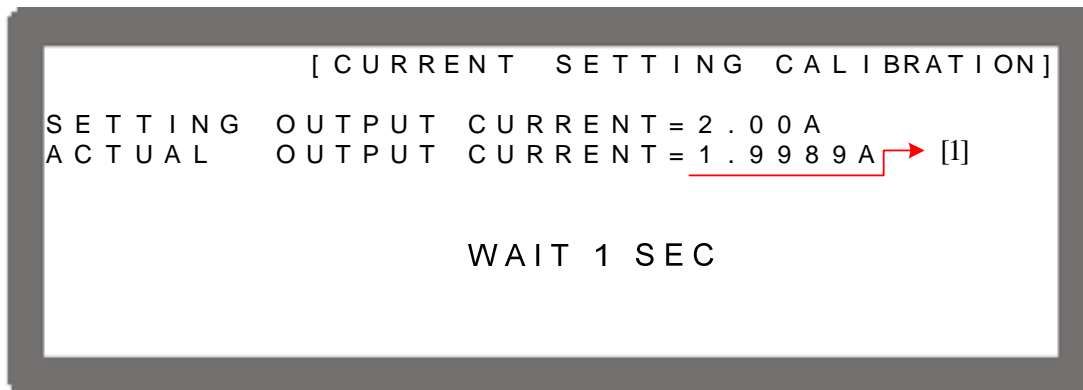





Figure 3-108

- (6) Now, the DC Power Supply will be set to off again. Press the “” to do 10A calibration, a message will pop up to remind the user to reconnect to the proper current shunt range. Set current shunt whose rating is closest to, but still covers 10A. For Prodigit 7530, use 20A shunt directly.
- (7) Press the “” will perform 10A calibration. The system will set the output current to 10.00A automatically and a second reading will appear on the screen. Once the reading is done, the cursor will stop at position [2] as Figure 3-109 shows. Input the current (4 digits after decimal point) read by Current Shunt (DVM) and press “” to confirm. Use 2A and 10A for calibration, the system will calculate the calibration factor for the low current range.

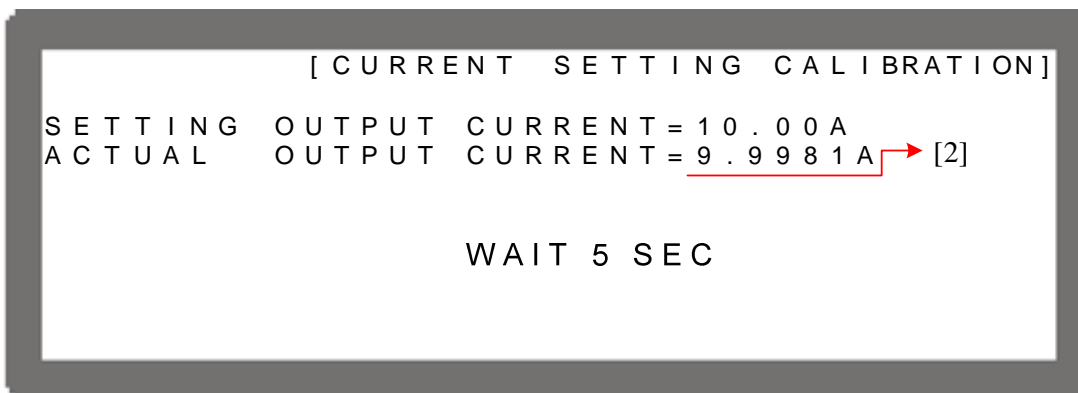





Figure 3-109

- (8) Now, the DC Power Supply will be set to off again. Press the “” to do 20A calibration, a message will pop up to remind the user to reconnect to the proper current shunt range and start high current range calibration. Setting the current shunt whose rating is closest to, but still covers 20A. For Prodigit 7530, use 20A shunt directly.
- (9) Pressing the “” will perform 20A calibration. The system will set the output current to 20.00A automatically and a second reading will appear on the screen. Once the reading is done, the cursor will stop at position [3] as Figure 3-110 shows. Input the current (4 digits after decimal point) read by Current Shunt (DVM) and press “” to confirm.

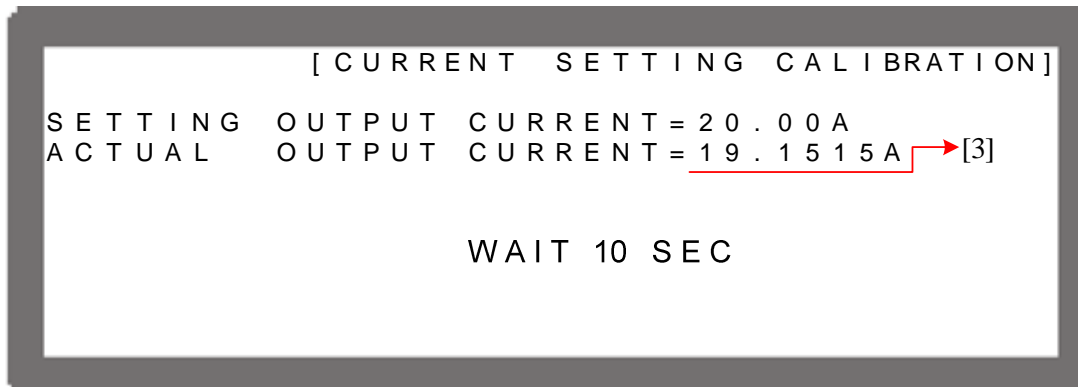





Figure 3-110

(10) Now, the DC Power Supply will be set to off again. Press the “” to do 50A calibration, a message will pop up to remind the user to reconnect to proper current shunt range. Set current shunt whose rating is closest to, but still covers 50A. For Prodigit 7530, use 250A shunt directly.

(11) Pressing the “” will perform 50A calibration. The system will set the output current to 50.00A automatically and a second reading will appear on the screen. Once the reading is done, the cursor will stop at position [4] as Figure 3-111 shows. Input the current (4 digits after decimal point) read by Current Shunt (DVM) and press “” to confirm.

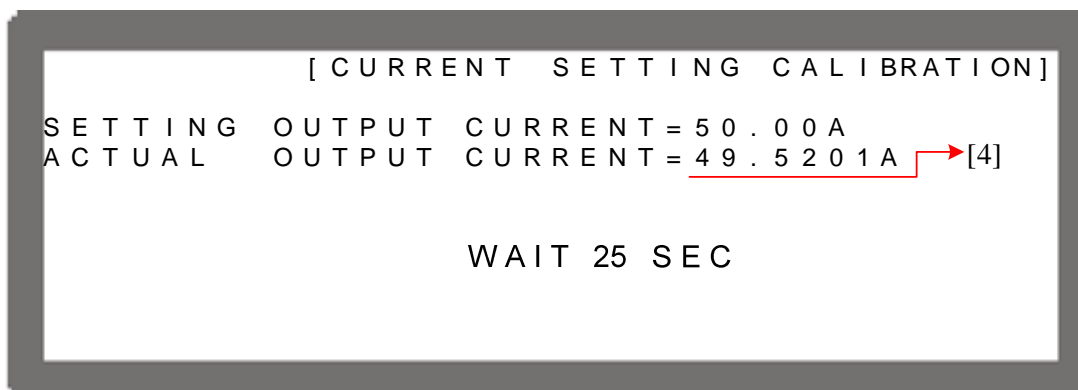





Figure 3-111

(12) The current calibration is done once the above actions are completed. Turn off the DC Power Supply output and press “” and “” to save the calibrated data as Figure 3-112 shows, or press “” to return to the MAIN PAGE.

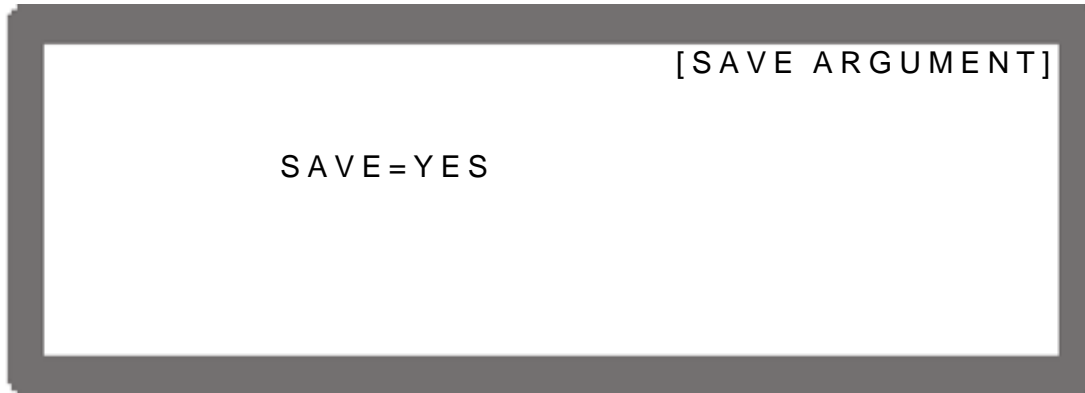


Figure 3-112



Improper shunt range selection may cause damage to the current shunt.

NOTICE

The calibration point may be different for other models (non 42012-80-60), please operate it following the instructions displayed.

3.3.7.4 APG Voltage Calibration

3.3.7.4.1 Hardware Requirements

| Device | Suggest Model or Capacity |
|-----------------|--|
| DVM | HP 34401A or equivalent DVM |
| DC Power Supply | Any DC Power Supply or DC signal source that can output 10Vdc and drive 100mA. |

Table 3-11

3.3.7.4.2 SETUP

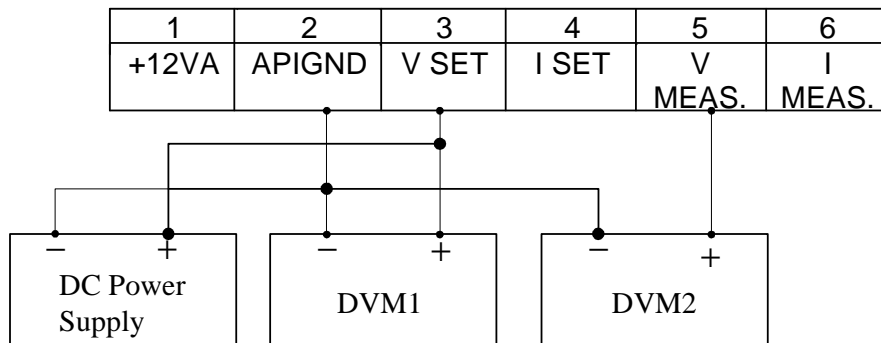



Figure 3-113

3.3.7.4.3 Calibration Procedure (Example: Model 42012-80-60)

- (1) In the CALIBRATION page, press “4” or turn “Rotary” (⊙) knob to set CHOICE = 3.
- (2) Press “” to confirm entry into APG Voltage Calibration options as Figure 3-114 shows.

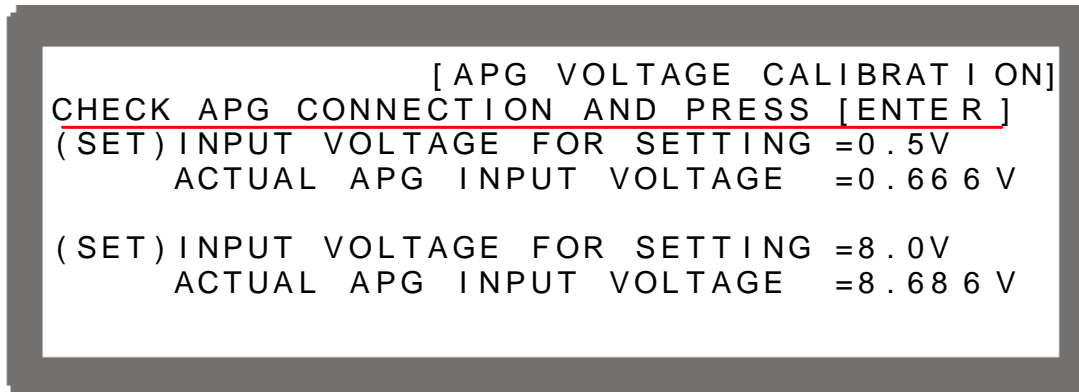






Figure 3-114

ⓘ NOTICE

1. When entering into the CALILBRATION page, be sure to check that the interface connection on the rear panel is correct and then press “” to start calibration.
 2. If Agilent 34401 is used, the DVM1 and DVM2 can be connected to the front and rear measurement input terminal respectively.
 3. Before doing APG voltage calibration, it is necessary to complete the voltage/current output and measurement calibration first.
-
- (3) When in the APG Voltage Calibration pages and the connection is correct, press “” to confirm.
 - (4) It will ask users to input about 0.5V voltage signal (Pin 3). The cursor stops at position [1] as Figure 3-115 shows after “” is pressed in the above step. Adjust the Power Supply to $0.5V \pm 0.2V$ and use DVM1 to measure the reading of Power Supply. Input the voltage (3 digits after decimal point) read by DVM 1 to position [1] and press “” to confirm.

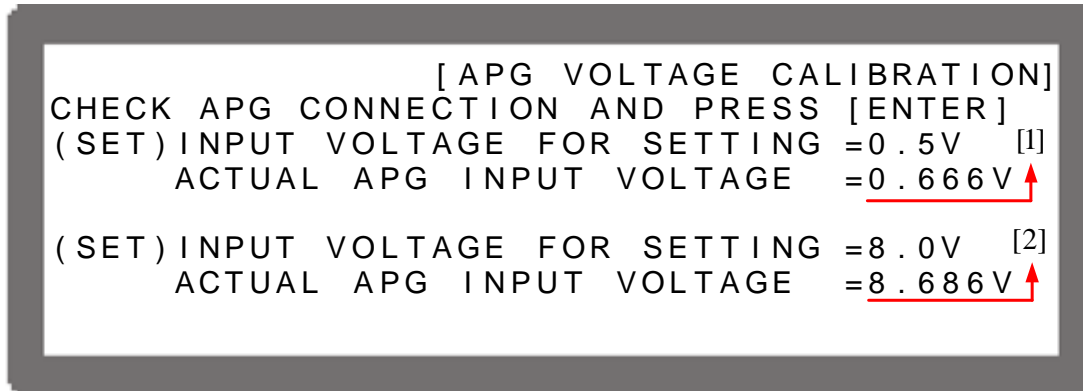







Figure 3-115

- (5) Pressing the “” again will ask users to input about 8.0V voltage signal (Pin 3). The cursor stops at position [2] as Figure 3-115 shows after “” is pressed. Adjust the Power Supply to $8V \pm 0.2V$ and use DVM1 to measure the reading of the Power Supply. Input the voltage (3 digits after decimal point) read by DVM 1 to position [2] and press “” to confirm.
- (6) Pressing the “” again stops the cursor at position [3] as Figure 3-116 shows. Open the device cover to find VR402 (adjustable resistor) on the PCB of 42xxx-xx-xx C ver.x. Make the DVM2 reading of Pin5 to be $0.00V \pm 2.5mV$ by adjusting the resistance of VR402. Once the reading is adjusted correctly, press “” to confirm it.

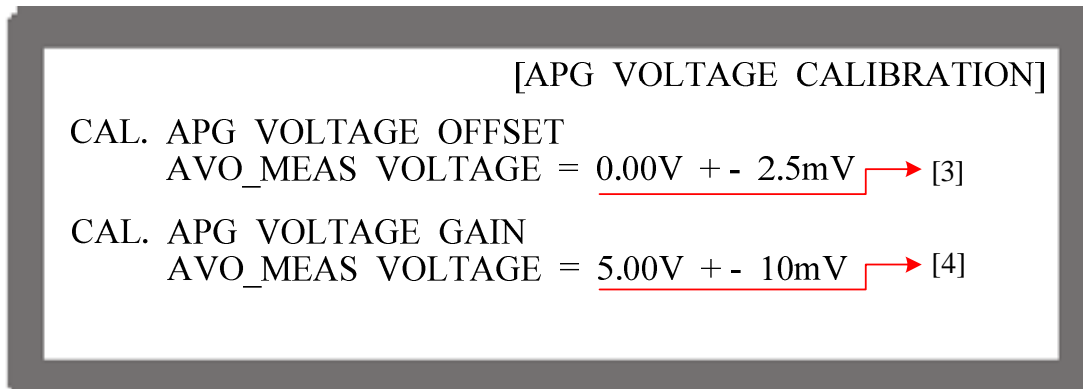




Figure 3-116

- (7) Pressing the “” again stops the cursor at position [4] as Figure 3-116 shows. Open the device cover to find VR401 (adjustable resistor) on the PCB of 42xxx-xx-xx C ver.x. Make the DVM2 reading of Pin5 to be $5.00V \pm 10mV$ by adjusting the resistance of VR401. Once the reading is adjusted correctly, press “” to confirm it.

- (8) The APG Voltage calibration is done once the above actions are completed. Press “**SAVE**” and “**ENTER**” to save the calibrated data as Figure 3-112 shows, or press “**EXIT**” to return to the MAIN PAGE.

ⓘ NOTICE

The calibration point may be different for other models (non 42012-80-60), please operate it following the instructions displayed.

3.3.7.5 APG Current Calibration

3.3.7.5.1 Hardware Requirements

| Device | | Suggest Model or Capacity |
|-----------------|-----------------|--|
| DVM | | HP 34401A or equivalent DVM |
| DC Power Supply | | Any DC Power Supply or DC signal source that can output 10Vdc and drive 100mA. |
| LOAD | ELECTRICAL LOAD | Chroma 63204 or equivalent |
| | BREAKER | Capable current >=100A |

Table 3-12

3.3.7.5.2 SETUP

(1) APG CURRENT PROGRAM

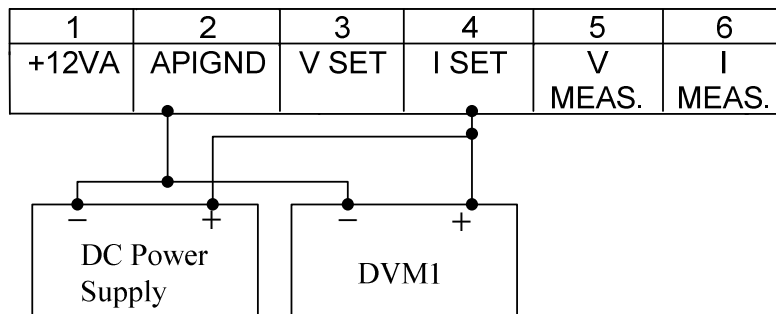


Figure 3-117

(2) APG CURRENT MEASUREMENT

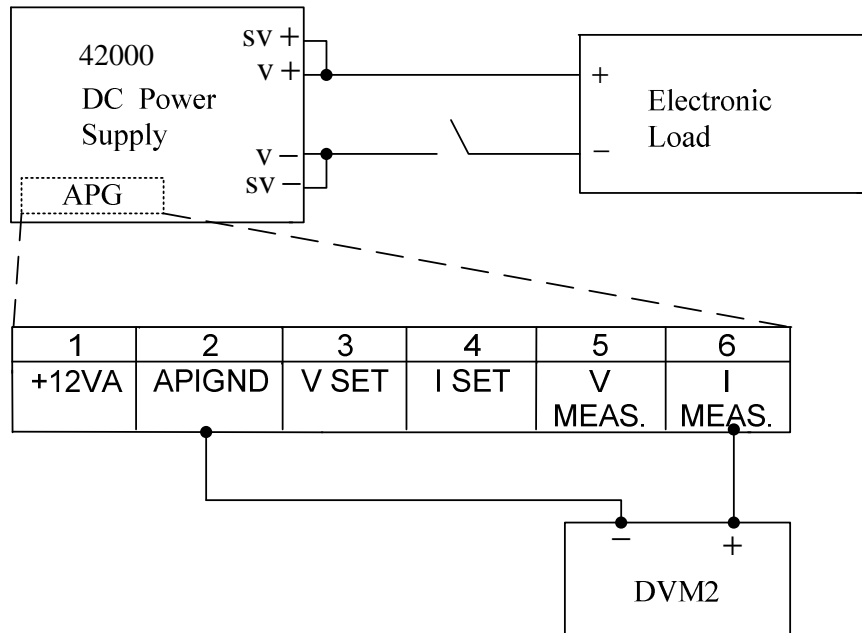



Figure 3-118

3.3.7.5.3 Calibration Procedure (Example: Model 42012-80-60)

- (1) In CALIBRATION page, press “5” or turn “Rotary” (⊙) knob to set CHOICE = 4.
- (2) Press “” to confirm the entry into APG Voltage Calibration options as Figure 3-119 shows.

```


[APG CURRENT CALIBRATION]
CHECK APG CONNECTION AND PRESS [ENTER]
(SET) INPUT VOLTAGE FOR SETTING =0.5V
    ACTUAL APG INPUT VOLTAGE =0.666V

(SET) INPUT VOLTAGE FOR SETTING =8.0V
    ACTUAL APG INPUT VOLTAGE =8.686V




```

Figure 3-119

ⓘ NOTICE

1. When entering into the CALILBRATION page, be sure to check that the interface connection on the rear panel is correct and then press “” to start calibration.

2. Before doing APG current calibration, it is necessary to complete the voltage/current output and measurement calibration.

- (3) When in the APG Current Calibration pages and the connection is correct, press “” to confirm.
- (4) It will ask users to input about 0.5V voltage signal (Pin 4). The cursor stops at position [1] as Figure 3-120 shows after “” is pressed in the above step. Adjust the Power Supply to $0.5V \pm 0.2V$ and use DVM1 to measure the reading of Power Supply. Input the voltage (3 digits after decimal point) read by DVM 1 to position [1] and press “” to confirm.

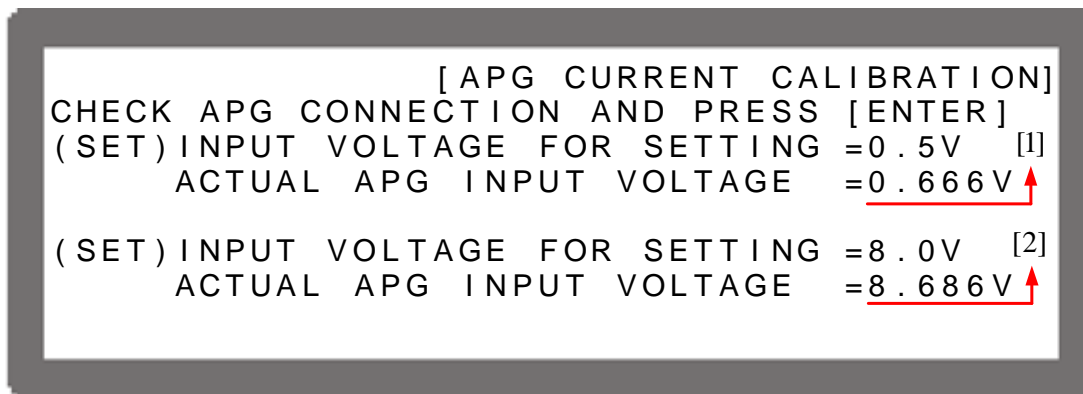







Figure 3-120

- (5) Pressing the “” again will ask users to input about 8.0V voltage signal (Pin 4). The cursor stops at position [2] as Figure 3-120 shows after “” is pressed in the above step. Adjust the Power Supply to $8V \pm 0.2V$ and use DVM1 to measure the reading of the Power Supply. Input the voltage (3 digits after decimal point) read by DVM 1 to position [2] and press “” to confirm.
- (6) Pressing the “” again stops the cursor at position [3] as Figure 3-121 shows. Open the device cover to find VR404 (adjustable resistor) on the PCB of 42-xx-xx C ver.x. Make the DVM2 reading of Pin6 to be $0.00V \pm 2.5mV$ by adjusting the resistance of VR404. Once the reading is adjusted correctly, press “” to confirm it.

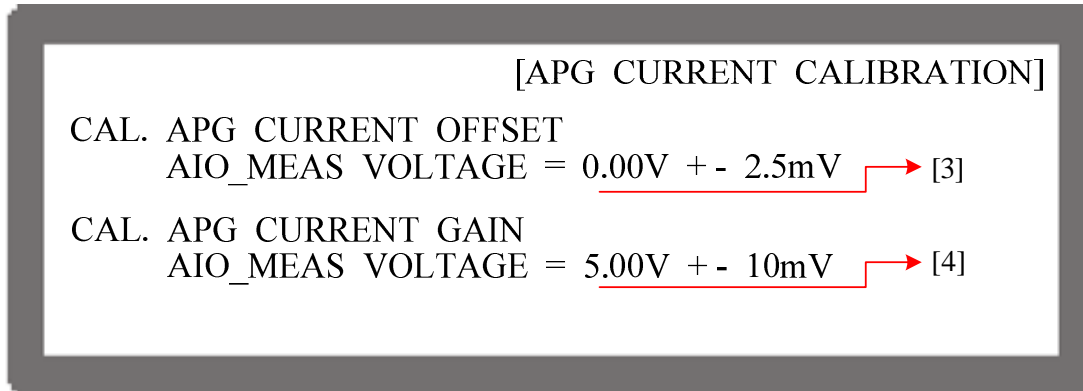







Figure 3-121

- (7) Pressing the “” again stops the cursor at position [4] as Figure 3-121 shows. Open the device cover to find VR403 (adjustable resistor) on the PCB of 42xxx-xx-xx C ver.x. Make the DVM2 reading of Pin6 to be 5.00V±10mV by adjusting the resistance of VR403. Once the reading is adjusted correctly, press “” to confirm it.
- (8) The APG Voltage calibration is done once the above actions are completed. Press “” and “” to save the calibrated data as Figure 3-112 shows, or press “” to return to the MAIN PAGE.

ⓘ NOTICE

The calibration point may be different for other models (non 42012-80-60), please operate it following the instructions displayed.

4. Program Sequence

42012-80-60 allows users to program the sequence for output in **LIST MODE** and **V_STEP MODE**. **LIST MODE** has 10 Programs. Each Program can add new sequences upto a total of 100 sequences that will be available for editing. **V_STEP MODE** provides a run time voltage program with the maximum of 99 hours, 59 minutes and 59.99 seconds.

Each sequence in **LIST MODE** can be edited with the voltage setting, voltage slew rate, current setting, current slew rate, running time and trigger type. In addition, it provides 8-bit TTL signal outputs that can apply to almost any situation.

1. Press “**PROG**” on the front panel.
2. It displays PROGRAM options as Figure 4-1 shows.
3. Use the numeric (**1** ~ **2**) keys or “Rotary” (⊙) knob to set the desired mode.
4. Press “**ENTER**” to confirm.
5. To quit PROGRAM, just press “**EXIT**” to return to the MAIN PAGE.

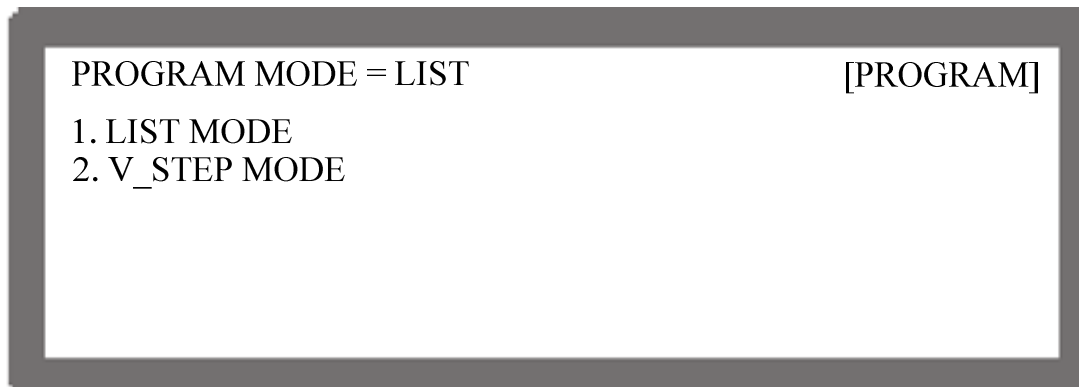


Figure 4-1

4.1 LIST MODE

In **LIST MODE**, there are maximum 100 sequences that can be added in one program. The sequence setting is described in section 4.1.2 and the complete program structure is listed in Figure 4-2.


```

[ PROGRAM ]
PROG NO .      = 1
RUN COUNT     = 1
PROG CHAIN    = NO
CLEAR PROG    = NO

[ SEQUENCE ]
SEQ NO . = 1
VOLTAGE = 10.00 ( V )
CURRENT = 20.00 ( A )
TTL OUT = 1 (DEC)
TIME = 5.000 ( S )
SEQ TYPE = AUTO
V S . R . = 1.000 ( V / m S )
I S . R . = 1.000 ( A / m S )
< B I N A R Y = 0 0 0 0 0 0 1 >

[ SEQUENCE ]
SEQ NO . = 2
VOLTAGE = 80.00 ( V )
CURRENT = 15.00 ( A )
TTL OUT = 4 (DEC)
TIME = 0.100 ( S )
SEQ TYPE = MANUAL
V S . R . = 10.000 ( V / m S )
I S . R . = 0.100 ( A / m S )
< B I N A R Y = 0 0 0 0 0 1 0 0 >

[ SEQUENCE ]
SEQ NO . = 3
VOLTAGE = 0.00 ( V )
CURRENT = 0.00 ( A )
TTL OUT = 0 (DEC)
TIME = 0.100 ( S )
SEQ TYPE = AUTO
V S . R . = 1.000 ( V / m S )
I S . R . = 1.000 ( A / m S )
< B I N A R Y = 0 0 0 0 0 0 0 0 >

[ SEQUENCE ]
SEQ NO . = 4
VOLTAGE = 0.00 ( V )
CURRENT = 0.00 ( A )
TTL OUT = 0 (DEC)
TIME = 0.100 ( S )
SEQ TYPE = AUTO
V S . R . = 1.000 ( V / m S )
I S . R . = 1.000 ( A / m S )
< B I N A R Y = 0 0 0 0 0 0 0 0 >

|
|
|


```

Figure 4-2



4.1.1 Description of PROGRAM Settings

A PROGRAM has four settings: (1) **PROG NO.**, (2) **RUN COUNT**, (3) **PROG CHAIN**, (4) **CLEAR PROG**.

4.1.1.1 Setting PROG NO.

1. Use the “

Page 113 of 167

2. Use the numeric (0-9) keys or “Rotary” (⊙) knob to set the value.
3. Press “” to confirm.
4. Press “” to return to Figure 4-1.

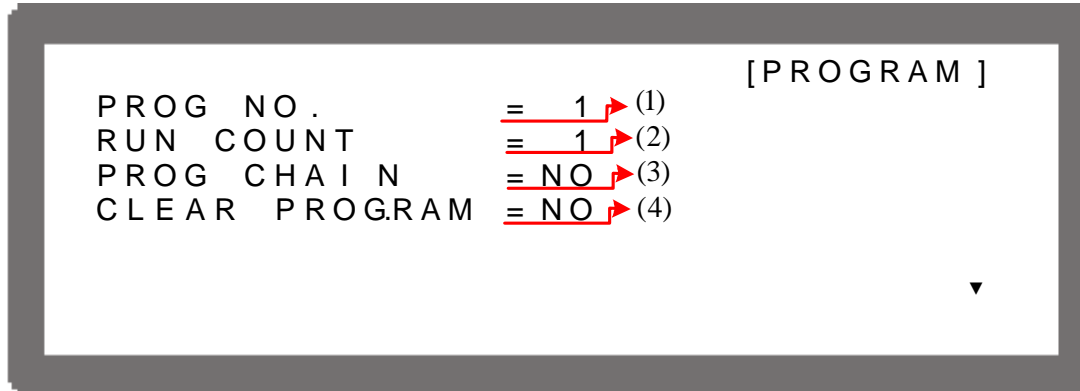




Figure 4-3

Since there are 10 programs for setting, the **PROG NO.** range is 1 ~ 10.

4.1.1.2 Setting RUN COUNT

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-3 (2) shows.
2. Use the numeric (0-9) keys or “Rotary” (⊙) knob to set the value.

Each PROGRAM has a RUN COUNT that sets the execution number. Following table lists the RUN COUNT range:

| RUN COUNT | MIN | MAX |
|-----------|-----|-------|
| TIMES | 0 | 15000 |

Table 4-1

Ex.1: Set RUN COUNT for a PROGRAM

Set PROG #1 to NEXT TO PROG NO =3, RUN COUNT=2.

PROG #3 to NEXT TO PROG NO =0, RUN COUNT=3.

The program execution flow of RUN COUNT is listed as Figure 4-4 shows.

A1: Execution steps:

- (1) When all PROG #1 SEQUENCES are done, return to PROG #1.
- (2) Repeat step (1) twice and skip PROG #2 and return to PROG #3.
- (3) When all PROG #3 SEQUENCES are done, return to PROG #3.
- (4) Repeat step (3) for 3 times.
- (5) End

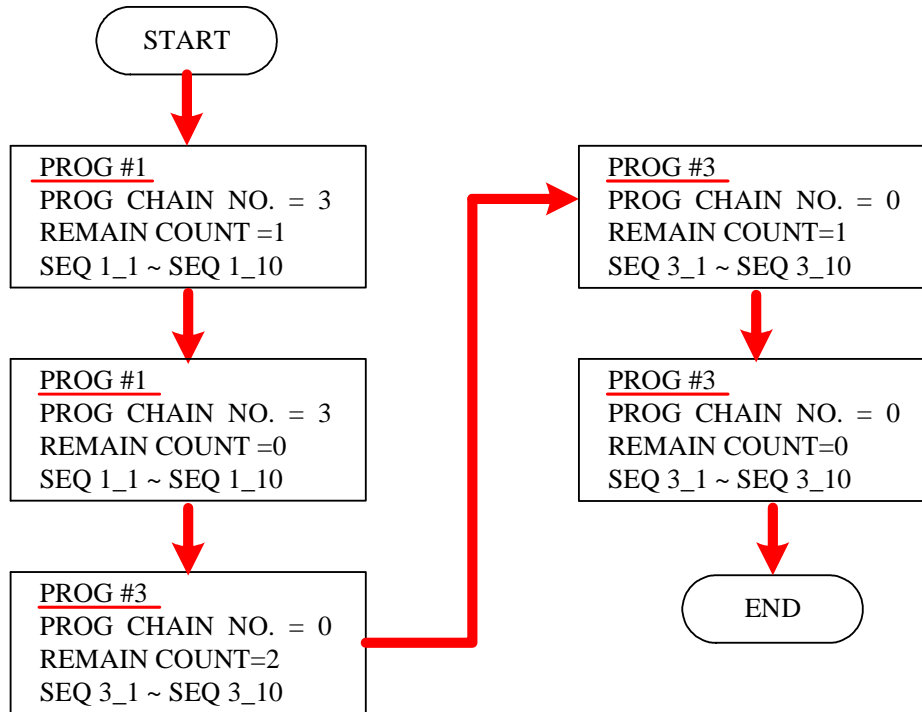









Figure 4-4



3. Press “” to confirm.
4. Press “” to return to Figure 4-1.

4.1.1.3 Setting PROG CHAIN

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-3 (3) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set YES or NO.

The PROGRAM CHAIN indicates the link among programs. YES must be set before executing different programs. Next, select the PROGRAM to be executed next (NEXT TO PROG NO.).

The setting range is 0 ~ 10.

- (1) Set NEXT TO PROG NO. to 0
When setting , it means no program link.
- (2) Set NEXT TO PROG NO. to non 0
When setting  to non-0, it means to perform program link as the example listed below.

Ex.2: Link execution among programs

Set PROG #1 to NEXT TO PROG NO =3, RUN COUNT=1

PROG #3 to NEXT TO PROG NO.=4, RUN COUNT=1
 PROG #4 to NEXT TO PROG NO =6, RUN COUNT=1
 PROG #6 to NEXT TO PROG NO =0, RUN COUNT=1
 The program execution flow is listed as Figure 4-5 shows.

A2: Execution steps:

- (1) When all PROG #1 SEQUENCES are done, skip PROG #2 and jump to PROG #3
- (2) When all PROG #3 SEQUENCES are done, jump to PROG #4
- (3) When all PROG #4 SEQUENCES are done, skip PROG #5 and jump to PROG #6
- (4) End

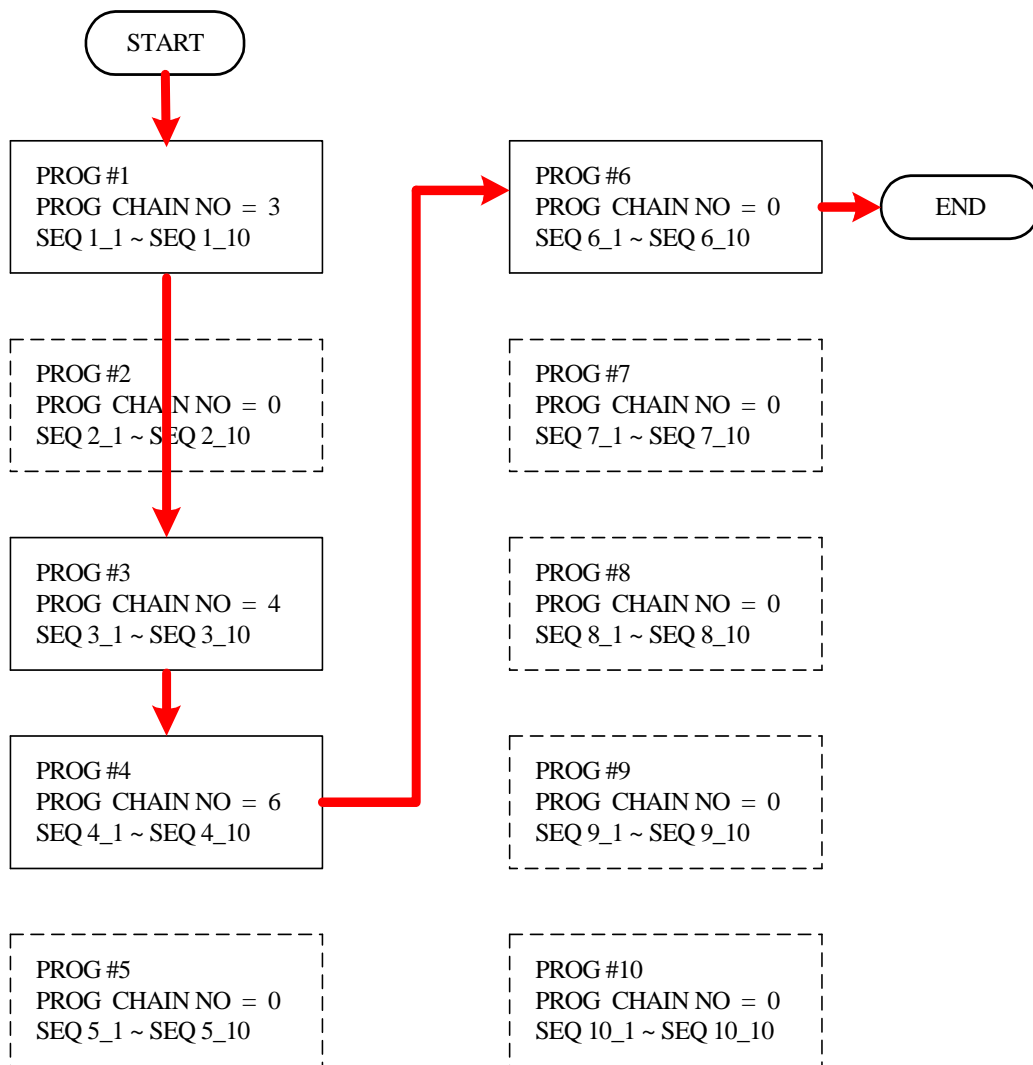


Figure 4-5

Ex. 3: Use a PROGRAM to form an infinite loop

Set PROG #1 to NEXT TO PROG NO =1, RUN COUNT=1

The program execution flow is listed as Figure 4-6 shows.

A3: Execution steps:

- (1) When all PROG #1 SEQUENCES are done, jump to PROG #1.
- (2) Rerun step (1).
- (3) Form an infinite loop.

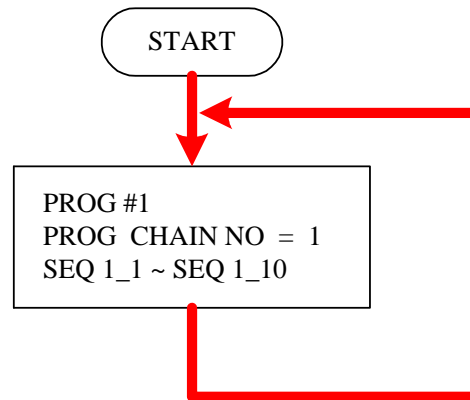


Figure 4-6

Ex.4: Use multiple PROGRAMS to form an infinite loop

- Set PROG #1 to NEXT TO PROG NO =3, RUN COUNT=1
 - PROG #3 to NEXT TO PROG NO =4, RUN COUNT=1
 - PROG #4 to NEXT TO PROG NO =6, RUN COUNT=1
 - PROG #6 to NEXT TO PROG NO =1, RUN COUNT=1
- The program execution flow is listed as Figure 4-7 shows.

A4: Execution steps:

- (1) When all PROG #1 SEQUENCES are done, skip PROG #2 and jump to PROG #3.
- (2) When all PROG #3 SEQUENCES are done, jump to PROG #4.
- (3) When all PROG #4 SEQUENCES are done, skip PROG #5 and jump to PROG #6.
- (4) When all PROG #6 SEQUENCES are done, skip PROG #7~ PROG #10 and jump to PROG #1.
- (5) Rerun step (1) ~ step (4).
- (6) Form an infinite loop.

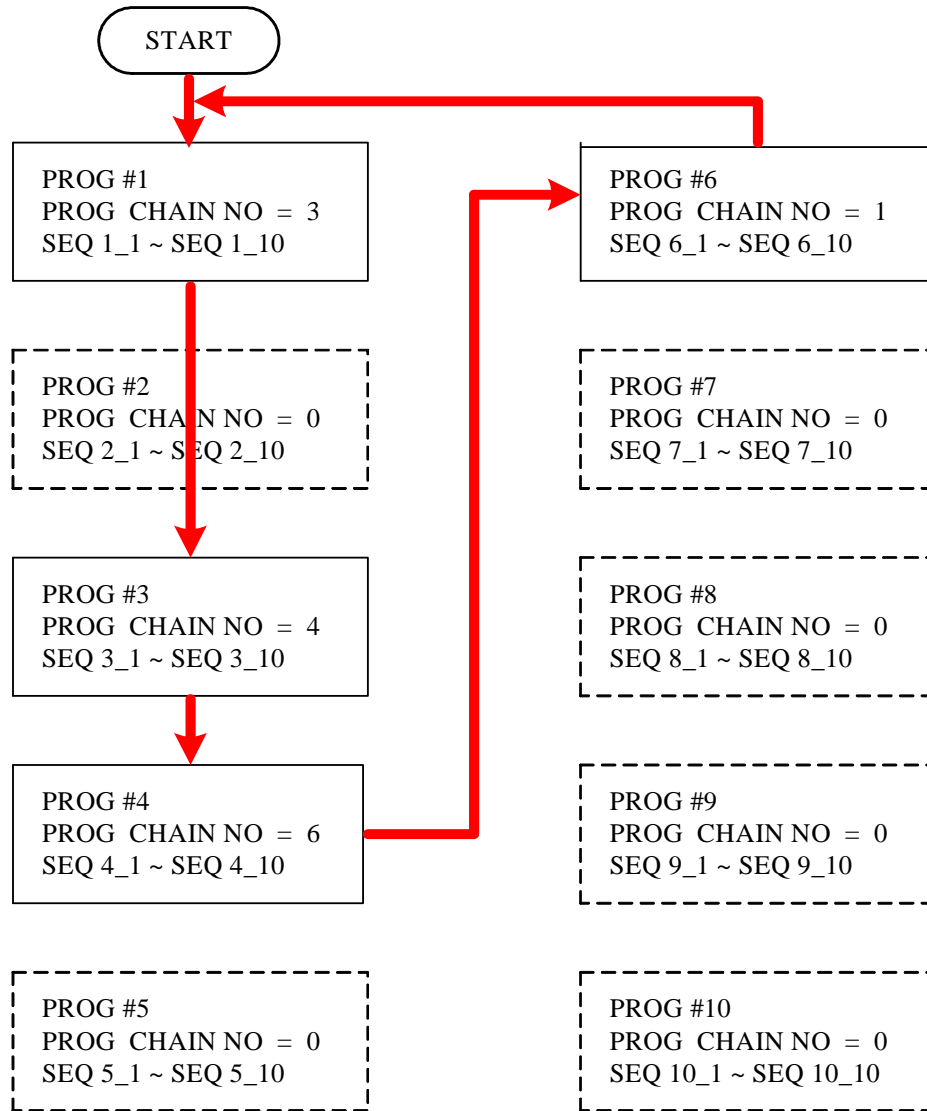









Figure 4-7

3. Press “” to confirm.
4. Press “” to return to Figure 4-1.

NOTICE

If it skips to the next PROGRAM, which has no SEQUENCE, all SEQUENCES will set top SKIP (see 4.1.2.2 SEQUENCE TYPE) and the PROGRAM will stop execution.

4.1.1.4 Setting CLEAR PROGRAM

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-3 (4) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set the value.

Clear Program has two options, which are **CLEAR PROG.** = **YES** / **NO**. The main function of Clear Program is to clear all sequences in that program.

3. Press “**ENTER**” to confirm.
4. Press “**EXIT**” to return to Figure 4-1.

4.1.2 Setting Sequence

1. The default SEQUENCE of all PROGRAMS is 0 and maximum 100 SEQUENCES can be added freely to a PROGRAM. In other words, the total SEQUENCES to be used by 10 PROGRAMS are 100 maximum.
2. Adding a new SEQUENCE:
 - a. In the PROGRAM page (Figure 4-3), if the PROGRAM has no SEQUENCE when the cursor is at (4), pressing the “**→↓**” can add a new SEQUENCE. The page will skip to Figure 4-8.
 - b. When the cursor is at (8) in Figure 4-8 as the SEQUENCE of a PROGRAM, pressing the “**→↓**” can add a new SEQUENCE.

NOTICE

The “**→↓**” function key is usually used as cursor movement key, only when in the above situations can it be used for adding new SEQUENCE.

3. Use the “**←↑**”, “**→↓**” keys to move the cursor to the column to be set as Figure 4-8 shows.
4. Use the numeric (**0**~**1**) keys or “Rotary” (**○**) knob to set the value.

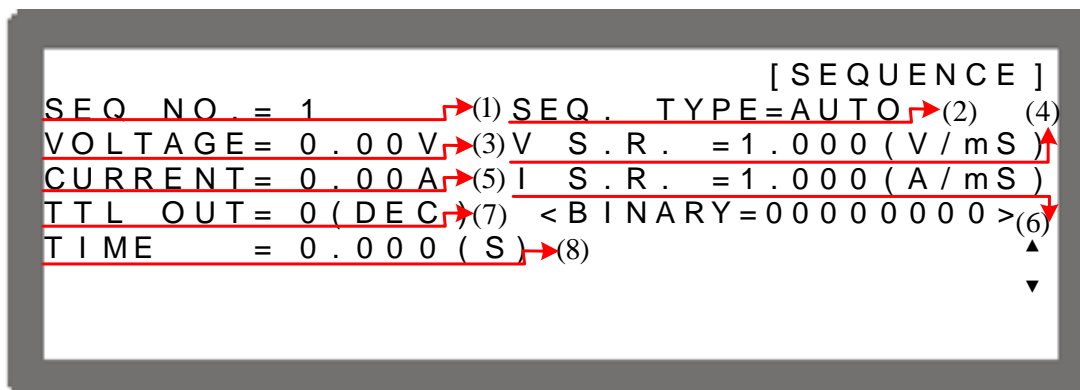










Figure 4-8



Each sequence has eight options: (1) **SEQ NO.**, (2) **SEQ. TYPE**, (3) **VOLTAGE**, (4) **CURRENT**, (5) **V S.R.**, (6) **I S.R.**, (7) **TTL OUT**, and (8) **TIME**. They are described below.

5. Press “” to confirm.
6. Press “” to return to the Program PAGE (Figure 4-3).






4.1.2.1 Setting Sequence Number

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-8 (1) shows.
2. When the cursor is in Figure 4-8 (8), pressing the “” can add a new SEQUENCE. Also, it can use the numeric (~) keys or “Rotary” () knob to set the value and return to the previous set Sequence Number.

A program has maximum 100 sequences, therefore the range of **SEQ NO.** is: **1~100**.

3. Press “” to confirm.
4. Press “” to return to the Program PAGE (Figure 4-3).

4.1.2.2 Setting Sequence Type

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-8 (2) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set the Sequence Type.

There are four Sequence Types: (1) **AUTO**, (2) **MANUAL**, (3) **TRIGGER**, (4) **SKIP**.

(1) Setting Sequence Type to AUTO

When **SEQ TYPE = AUTO** is set, the page shown as Figure 4-9 indicates the sequence will complete the execution automatically and skip to next sequence. **TIME=** will prompt at the lower left corner to ask users entering the time remained for this sequence.

① NOTICE

1. Table 4-2 lists the range for setting the time remains (**TIME =**).

| TIME | Min. (Sec) | Max. (Sec) |
|------|------------|------------|
| | 0.005 | 15000 |

Table 4-2

2. When **SEQ. TYPE = AUTO** and **TIME = 0** it indicates the program is done before setting **TIME = 0** for previous Sequence.
-


```

[ SEQUENCE ]
SEQ NO. = 1          SEQ. TYPE=AUTO
VOLTAGE= 0.00V      V S.R. =1.000 (V/mS)
CURRENT= 0.00A      I S.R. =1.000 (A/mS)
TTL OUT= 0(DEC)    <BINARY=00000000>
TIME = 0.000 (S)

```

Figure 4-9

Ex. 5: Set Sequence Type to AUTO

If PROGRAM 1 is set as Figure 4-10 shows the output load is 10(Ω).

```

[ PROGRAM ]
PROG NO .      = 1
RUN  COUNT    = 2
PROG CHAIN    = NO
CLEAR PROG    = NO

[ SEQUENCE ]
SEQ NO . = 1
VOLTAGE = 10.00 ( V )
CURRENT = 20.00 ( A )
TTL OUT = 1 (DEC)
TIME    = 5.000 ( S )
SEQ TYPE = AUTO
V S . R . = 1.000 ( V / m S )
I S . R . = 1.000 ( A / m S )
< B I N A R Y = 0 0 0 0 0 0 1 >

[ SEQUENCE ]
SEQ NO . = 2
VOLTAGE = 30.00 ( V )
CURRENT = 20.00 ( A )
TTL OUT = 4 (DEC)
TIME    = 10.000 ( S )
SEQ TYPE = AUTO
V S . R . = 10.000 ( V / m S )
I S . R . = 1.000 ( A / m S )
< B I N A R Y = 0 0 0 0 0 1 0 0 >

[ SEQUENCE ]
SEQ NO . = 3
VOLTAGE = 0.00 ( V )
CURRENT = 0.00 ( A )
TTL OUT = 0 (DEC)
TIME    = 0.000 ( S )
SEQ TYPE = AUTO
V S . R . = 1.000 ( V / m S )
I S . R . = 1.000 ( A / m S )
< B I N A R Y = 0 0 0 0 0 0 0 0 >

[ SEQUENCE ]
SEQ NO . = 10
VOLTAGE = 0.00 ( V )
CURRENT = 0.00 ( A )
TTL OUT = 0 (DEC)
TIME    = 0.000 ( S )
SEQ TYPE = AUTO
V S . R . = 1.000 ( V / m S )
I S . R . = 1.000 ( A / m S )
< B I N A R Y = 0 0 0 0 0 0 0 0 >

```

Figure 4-10

A5: Execution step:

(1) SEQ#1:

- (1) Since **SEQ TYPE = AUTO** is set for SEQ#1, it begins to execute the settings in SEQ#1.
- (2) During SEQ#1 voltage rise, the maximum loading current is 1A and does not exceed the current setting 20A; therefore SEQ#1 is in CV Mode during voltage rise.
- (3) Once the voltage reached the set 10V, the program lasts for five seconds from rising.
- (4) Skip to SEQ#2.

(2) SEQ#2:

- (1) Since **SEQ TYPE = AUTO** is set for SEQ#2, it begins to execute the settings in SEQ#2.

- (2) During SEQ#2 voltage rise, the maximum loading current is 3A and does not exceed the current setting 20A; therefore, SEQ#2 is in CV Mode during voltage rise.
- (3) Once the voltage reached the set 30V, the program lasts for 10 seconds from rising.
- (4) Skip to SEQ#3.

(3) SEQ#3:

- 1. Since `SEQ TYPE = AUTO` and `TIME=0` are set for SEQ#3, it indicates SEQ#3 is not executing and the Program is ended.

- (4) As `RUN COUNT=2` is set, steps (1), (2) and (3) are executed again.
- (5) End.

Figure 4-11 shows the output waveform:

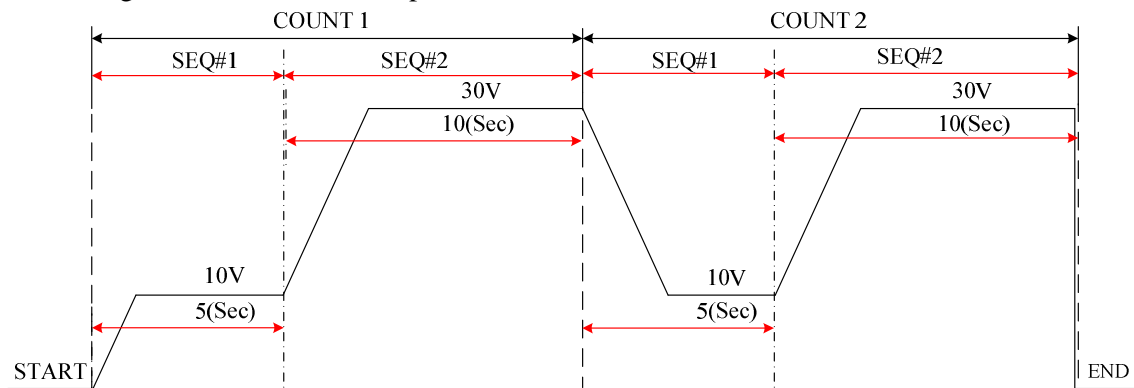


Figure 4-11

(2) Setting Sequence Type to MANUAL

When `SEQ TYPE = MANUAL` is set, the Sequence page shown as Figure 4-12 indicates, the sequence will run automatically and stop at the setting of `VOLTAGE` or `CURRENT` without skipping to the next sequence until any key on the front panel is pressed. It will not ask users to enter the time the sequence will remain when the type is set to MANUAL.

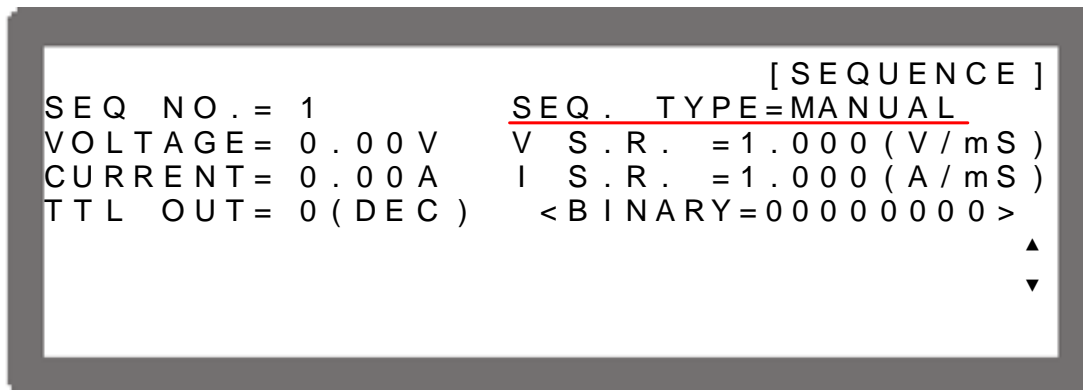


Figure 4-12

(3) Setting Sequence Type to TRIGGER

When **SEQ TYPE = TRIGGER** is set, the Sequence page shows as Figure 4-13 indicates, the sequence will run automatically and stop at the setting of **VOLTAGE** or **CURRENT** without skipping to next sequence until inputting a sine wave (positive edge triggered TTL level) from PIN 8 of Analog Interface on the rear panel. It will not ask users to enter the time the sequence will remain when the type is set to TRIGGER.

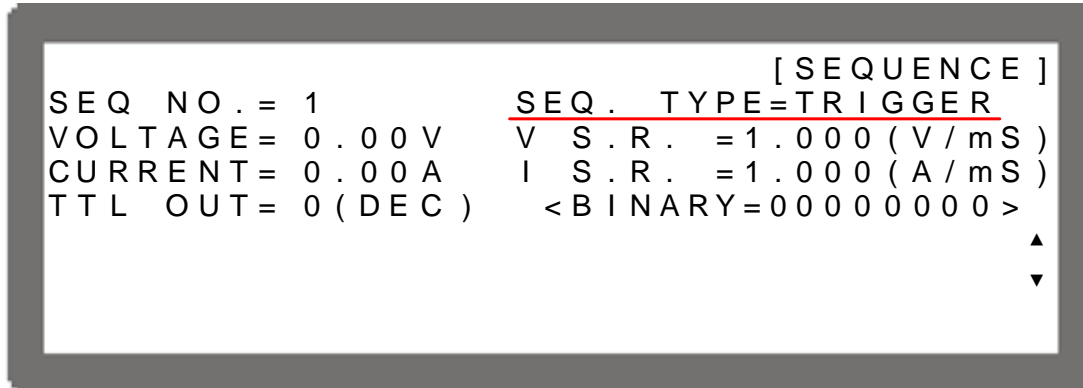


Figure 4-13

(4) Set Sequence Type to SKIP

When **SEQ TYPE = SKIP** is set, the Sequence page shows as Figure 4-14 indicates, the Sequence will skip automatically and jump to next SEQUENCE. This Sequence page will not ask users to enter the time sustained for this Sequence.

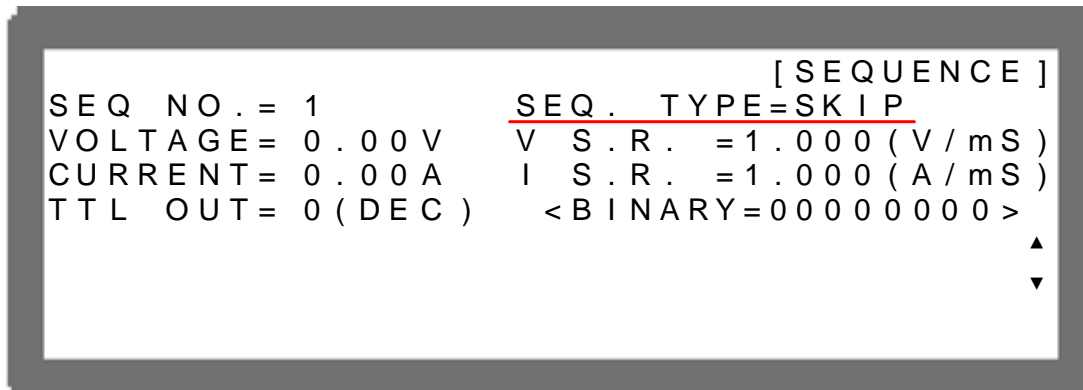











Figure 4-14








3. Press “” to confirm.
4. Press “” to return to the Program PAGE (Figure 4-3).

4.1.2.3 Setting Voltage

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-8 (3) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set the SEQ output voltage
3. Press “” to confirm.
4. Press “” to return to the Program PAGE (Figure 4-3).








See section 3.2 for detail description of settings.

4.1.2.4 Setting Current

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-8 (5) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set the SEQ output current limit.
3. Press “” to confirm.
4. Press “” to return to the Program PAGE (Figure 4-3).








See section 3.2 for detail description of settings.

4.1.2.5 Setting Voltage Slew Rate

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-8 (4) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set the SEQ voltage conversion slew rate.
3. Press “” to confirm.
4. Press “” to return to the Program PAGE (Figure 4-3).








See section 3.3.2.3 for detail description of settings.

4.1.2.6 Setting Current Slew Rate

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-8 (6) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set the SEQ current conversion slew rate.
3. Press “” to confirm.
4. Press “” to return to the Program PAGE (Figure 4-3).






See section 3.3.2.4 for detail description of settings.



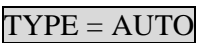
4.1.2.7 Setting TTL OUT



1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-8 (7) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set the SEQ digital output state.
3. Press “” to confirm.
4. Press “” to return to the Program PAGE (Figure 4-3).

See section 3.3.2.5 for detail description of settings.

4.1.2.8 Setting Time

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-8 (8) shows.
2. Use the numeric (~) keys or “Rotary” () knob to set the value.

This function is to set the time sustained. This setting  only appears with  .

3. Press “” to confirm.
4. Press “” to return to the Program PAGE (Figure 4-3).

4.1.3 Execution in LIST MODE

When the sequences are finished for editing, press “” to start execution and press “” to abort it.

4.1.3.1 Running LIST MODE

1. Pressing “” will prompt a confirmation page as Figure 4-15 shows.

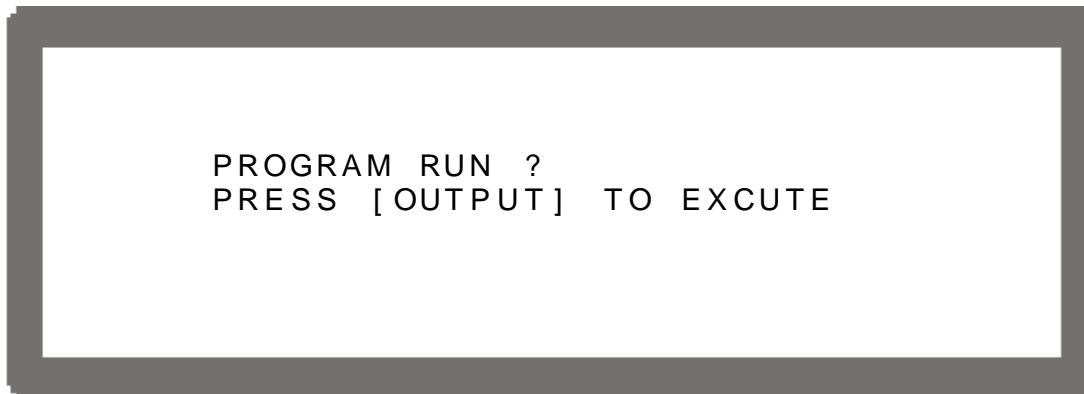


Figure 4-15

2. Pressing “” again will confirm the execution and go to the MAIN PAGE as Figure 4-16 shows. To quit the execution, pressing “” will return to the standby MAIN PAGE.

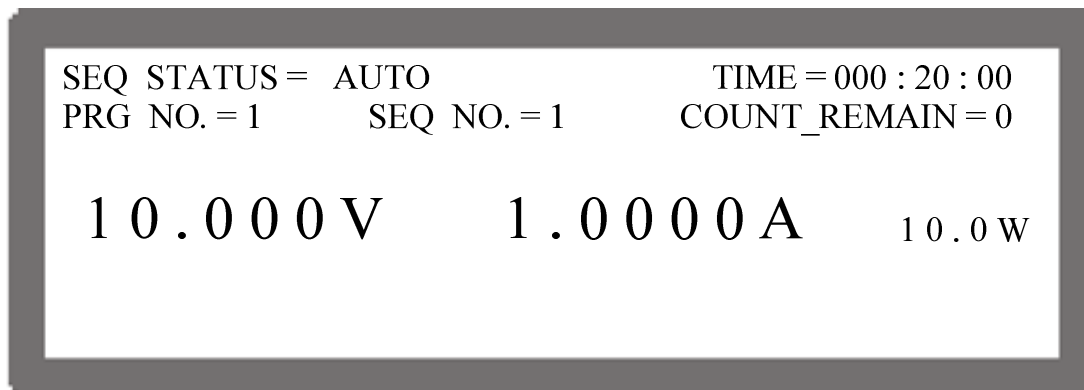


Figure 4-16

ⓘ NOTICE

1. Pressing “” in the Program page (Figure 4-3) or Sequence page (Figure 4-8) will prompt a confirmation page as Figure 4-15 shows.
 2. Pressing “” will abort the executing program which means stopping the Power Supply from output.
-

4.1.3.2 Program List Mode Description

Figure 4-17 shows the main execution page of LIST MODE. Items (1)~(5) in the figure are explained below.

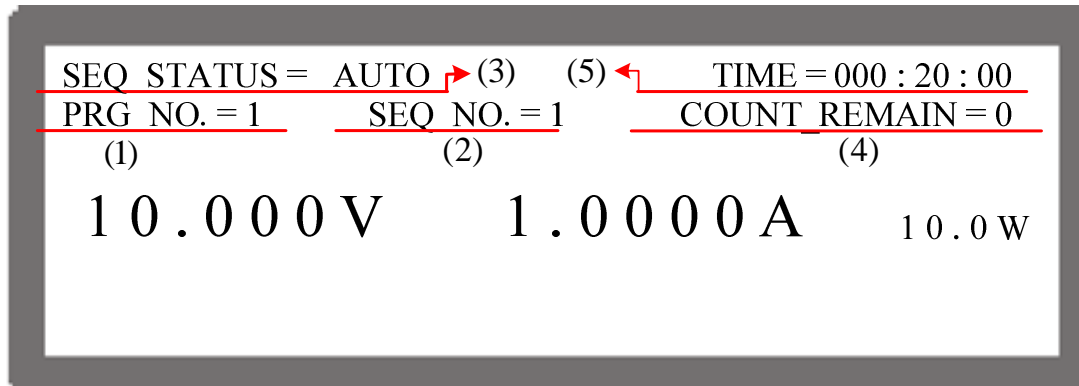


Figure 4-17

- (1) **Program Number:** `PRG NO.` indicates the Program Number being presently executed.
- (2) **Sequence Number:** `SEQ NO.` indicates the Sequence Number being presently executed.
- (3) **Sequence Status:** `SEQ STATUS` indicates the Sequence state being presently executed.
- (4) **Count Remain:** `COUNT_REMAIN` indicates the numbers to be executed for the current Program.
- (5) **Running Time:** `TIME` indicates the sum of time from when the program is executed till the sequence is run on Main Page.

The time format is `HOUR:MIN:SEC` and the maximum display limit is 999 hours, 59 minutes and 59 seconds. If the time accumulated exceeds the maximum display limit, it will reset to 0 and recount.

4.2 V_STEP MODE

Voltage is step up from a start voltage to an end voltage in a user programmed time in `V_STEP MODE`. Figure 4-18 shows the screen when V_STEP MODE is selected.

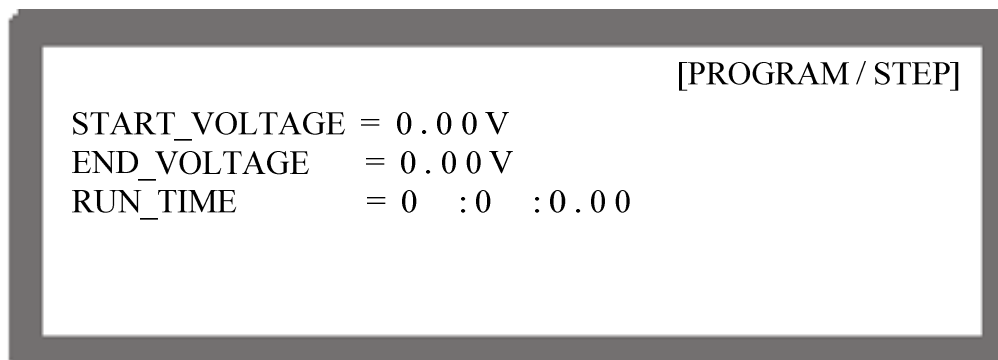









Figure 4-18

4.2.1 Setting V_STEP MODE

V_STEP MODE has three settings: (1) **START_VOLTAGE**, (2) **END_VOLTAGE** and (3) **RUN_TIME**.

4.2.1.1 Setting START_VOLTAGE

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-19 (1) shows. Set the start voltage of STEP MODE.
2. Use the numeric (~) keys or “Rotary” () knob to set the value.
3. Press “” to confirm.
4. Press “” to return to Figure 4-1.

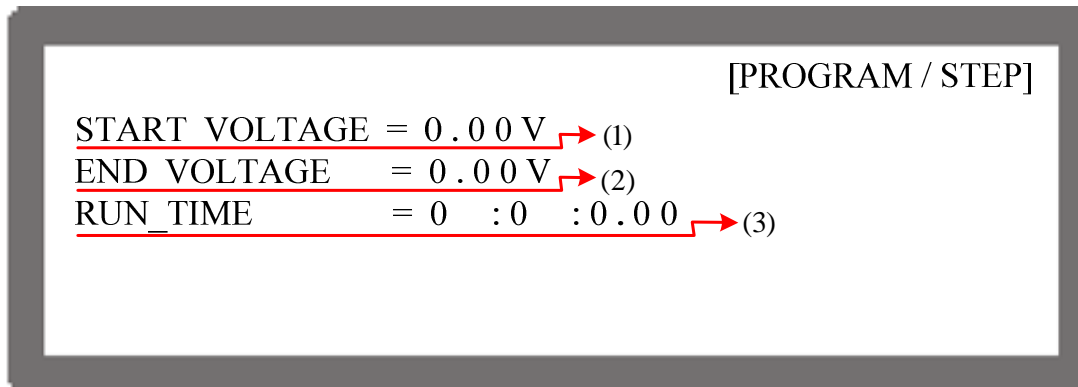









Figure 4-19








i NOTICE

The initial voltage of the hardware does not equal to the setting of START_VOLTAGE. There are two circumstances that may occur in V_STEP MODE: (1) The output voltage rises to the setting of START_VOLTAGE and the V SLEW RATE is 1V/mS, or (2) it falls to the setting of START_VOLTAGE and the falling time is calculated by 1V/mS while the actual V SLEW RATE is varied by load.

4.2.1.2 Setting END_VOLTAGE

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-19 (2) shows. Set the end voltage of STEP MODE.
2. Use the numeric (~) keys or “Rotary” () knob to set the value.
3. Press “” to confirm.
4. Press “” to return to Figure 4-1.

4.2.1.3 Setting RUN_TIME

1. Use the “”, “” keys to move the cursor to the column to be set as Figure 4-19 (3) shows. Set the run time of STEP MODE. The time format is **HOUR:MIN:SEC** and the maximum setting is 99 hours, 59 minutes and 59.99 seconds.
2. Use the numeric (~) keys or “Rotary” () knob to set the value.
3. Press “” to confirm.
4. Press “” to return to Figure 4-1.

ⓘ NOTICE

When V_STEP MODE ends, the hardware output voltage will remain at the setting of END_VOLTAGE.

Ex. 1: Set the START_VOLTAGE to 10V, END_VOLTAGE to 50V and RUN_TIME to 10 minutes.

CASE1: The hardware initial voltage is 0V and the output waveform is as Figure 4-20 shows.

CASE2: The hardware initial voltage is 10V and the output waveform is as Figure 4-21 shows.

CASE3: The hardware initial voltage is 20V and the output waveform is as Figure 4-22 shows.

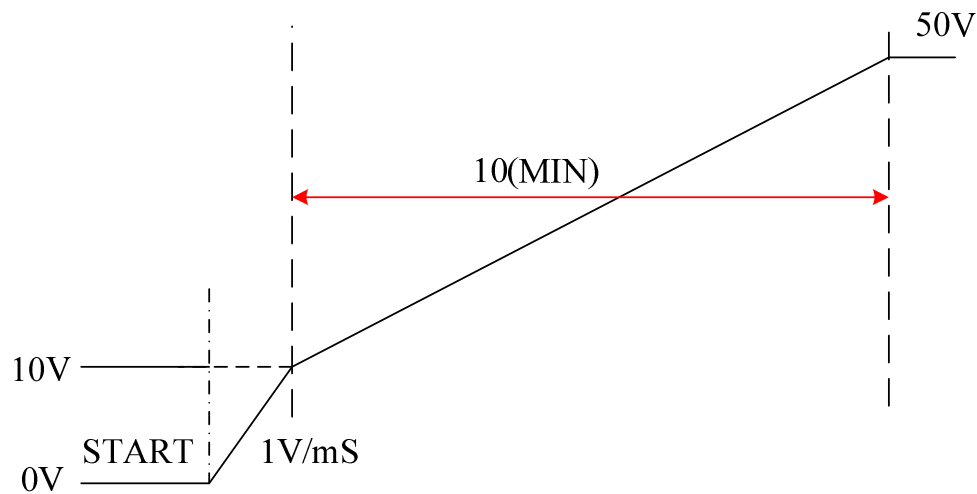


Figure 4-20

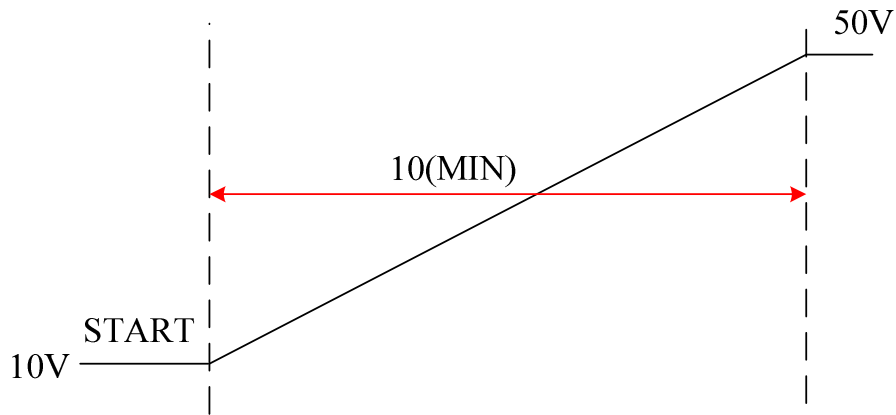


Figure 4-21

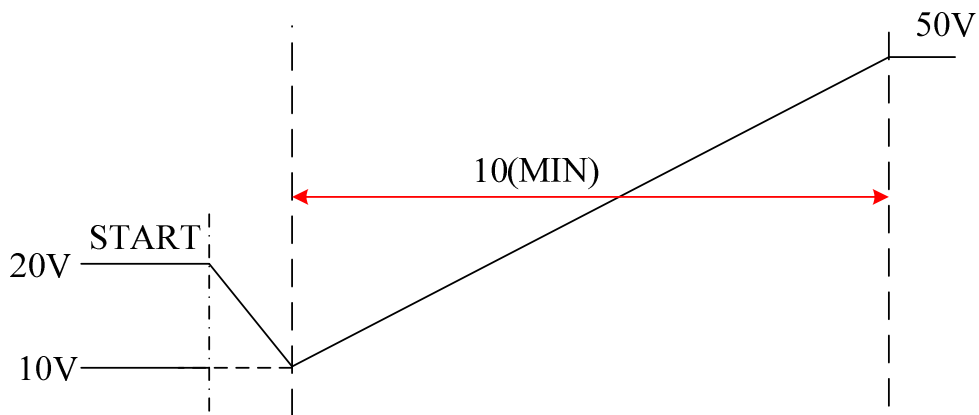


Figure 4-22

4.2.2 Execution of V_STEP MODE

After the setting is done, press “” to confirm and start the execution. To abort it, just press “”.

4.2.2.1 Running V_STEP MODE

1. Pressing “” will prompt a confirmation window as Figure 4-15 shows.
2. Press “” one more time to confirm the execution. It will skip to the MAIN PAGE during execution as shown in Figure 4-23. To quit the execution, pressing “” will return to the MAIN PAGE window at standby.

ⓘ NOTICE

Pressing “” can interrupt the Program execution forcibly meaning the Power Supply stops output.

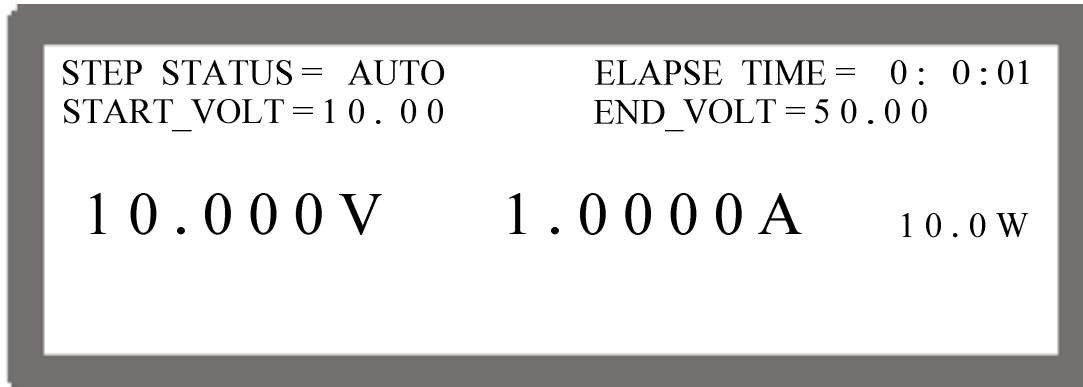


Figure 4-23

4.2.2.2 Description of Program V_Step Mode

When executing V_STEP MODE, its main screen is as shown in Figure 4-24. The following explains the meaning of (1)~(4) in Figure 4-24.

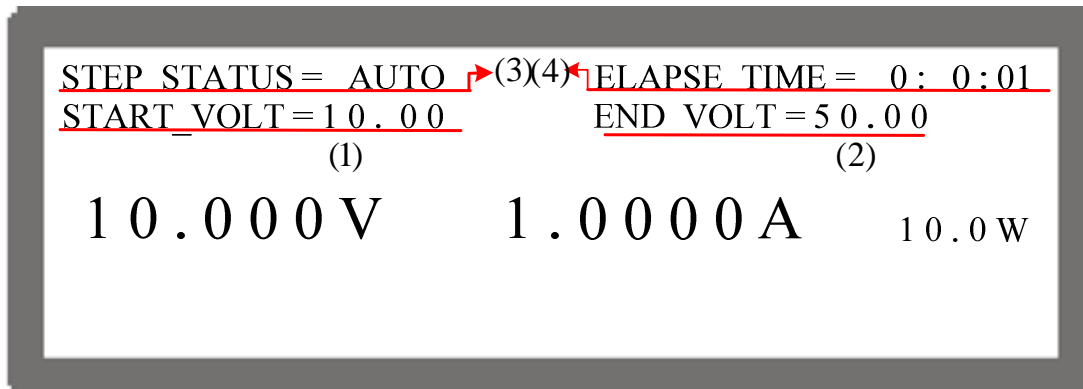


Figure 4-24

- (1) START_VOLT: It is the start voltage setting of V_STEP MODE.
- (2) END_VOLT: It is the end voltage setting of V_STEP MODE.
- (3) STEP STATUS: It is the executing status of V_STEP MODE.
- (4) ELAPSE TIME: It is the executed time of V_STEP MODE. The time format is HOUR:MIN:SEC and the maximum display is 99 hours, 59 minutes and 59 seconds.

5. Remote Operation

5.1 Overview

The 42000 Series DC Power Supply can be controlled remotely via USB, GPIB or RS-232 port.

USB interface supports USB 2.0/USB 1.1. GPIB interface is an 8-bit parallel data bus that synchronizes with the host bus commands. RS-232C is a serial bus with less powerful functions. However, users can do remote control easily via simple programming.

5.1.1 USB Interface

- (1) Hardware Support: USB 2.0 and USB 1.1
- (2) Software Support: USBTMC class and USB488 subclass
- (3) OS Support: Windows 98/2000/XP/Vista
- (4) Installing Driver: 42000 Series USB Interface supports USBTMC, so if the PC OS supports USBTMC (installed NI-VISA runtime version 3.00 or above) it is no need to install other drivers. The OS will search for the standard USBTMC driver installation program automatically.

If the PC OS does not support USBTMC, it is suggested to install the NI-VISA runtime version 3.00 or above first. When the installation of NI-VISA runtime is done, the USBTMC driver program is stored in OS. The PC can communicate with the 42000 Series via NI-VISA after using the USB cable to connect them.

Related Documents:

1. USB Test and Measurement Class (USBTMC) specification, Revision 1.0,
<http://www.usb.org>
2. USB Test and Measurement Class USB488 subclass specification, Revision 1.0,
<http://www.usb.org>

5.1.2 Setting GPIB Address & RS-232C Parameters

See section 3.3.1.1 and 3.3.1.2.

5.1.3 Connecting RS-232C

The default baudrate of 42000 Series DC Power Supply is 9600 and the parity check is set to none. Only TxD and RxD signal can be used for data transmission. The connector of RS-232C is a 9-pin, D-type small female connector. Table 5-1 lists the pins and signals of RS-232C connector. Use a 9 pin Null modem cable for connection.

| Pin No. | INPUT/OUTPUT | Description |
|---------|--------------|-------------|
| 1 | --- | “N.C.” |
| 2 | INPUT | RxD |
| 3 | OUTPUT | TxD |
| 4 | --- | DSR |
| 5 | --- | GND |
| 6 | --- | DTR |
| 7 | --- | CTS |
| 8 | --- | RTS |
| 9 | --- | “N.C.” |

Table 5-1

Table 5-2 lists the connection between PC (IBM compatible) and 42000 Series DC Power Supply.

| Pin NO. | PC | 42000 |
|---------|--------|--------|
| 1 | DCD | “N.C.” |
| 2 | RX | RX |
| 3 | TX | TX |
| 4 | DTR | “N.C.” |
| 5 | GND | DGND |
| 6 | DSR | “N.C.” |
| 7 | RTS | “N.C.” |
| 8 | CTS | “N.C.” |
| 9 | “N.C.” | “N.C.” |

Table 5-2

NOTICE

“N.C.” stands for “Not Connected”.

5.2 GPIB Function of 42000 Series

| GPIB Function | Description |
|-----------------|--|
| Talker/Listener | Command and response messages can be sent and received over the GPIB bus. Status information can be read using a series poll. |
| Service Request | It sets the SRQ line to “true” if there is an enabled service request condition. |
| Remote/Local | Power-on in local mode, the front panel can be operated and the commands are responded through GPIB. When in remote mode, all front panel keys except LOCAL/REMOTE are invalid. Pressing LOCAL/REMOTE will return to local mode. |

Table 5-3

5.3 Introduction to Programming

All commands and response messages are transmitted in ASCII codes. The response messages must be read completely before a new command is sent, or the remaining response messages will be lost and occur a query interrupt error.

5.3.1 Conventions

The table below lists the convention used in this section.

| | | |
|-----------------|-----|--|
| Angle brackets | < > | Items in angle brackets are parameter abbreviations. |
| Vertical bar | | Vertical bar separates alternative parameters. |
| Square brackets | [] | Items in square brackets are optional. For example, OUTP [: STATE] means that: STATE may be omitted. |
| Braces | { } | Braces indicate the parameters that may be repeated. The notation <A> {<, B>} means that parameter "A" must be entered while parameter "B" may be omitted or entered once or more times. |

Table 5-4

5.3.2 Numerical Data Formats

The numerical data format of the 42000 DC Power Supply is listed in Table 5-5. Numerical data can be added to the suffix to distinguish data while the multiplier can be placed prior to the suffix. Table 5-6 lists the suffix used by the 42000 DC Power Supply and Table 5-7 lists the multiplier.

| Symbol | Description | Example |
|--------|--|------------------------------|
| NR1 | A digit without decimal point. The decimal is assumed to be at the right of the least significant digit. | 123, 0123 |
| NR2 | A digit with a decimal point. | 12.3, .123 |
| NR3 | A digit with a decimal point and an exponent. | 1.23E+2 |
| NRf | Flexible decimal format including NR1 or NR2 or NR3. | 123, 12.3, .23E+3 |
| NRf+ | Extended decimal format including NRf and MIN, MAX. MIN and MAX is the high and low limit of parameter. | 123, 12.3, 1.23E+3, MIN, MAX |

Table 5-5 Format of Numerical Data

| Type | Suffix | Unit |
|---------|--------|--------|
| Current | A | Ampere |
| Voltage | V | Volt |

| | | |
|------|---|--------|
| Time | S | Second |
|------|---|--------|

Table 5-6

| Multiplier | Symbol | Definition |
|-------------|--------|------------|
| 1E6 | MA | Mega |
| 1E3 | K | Kilo |
| 1E-3 | M | Milli |
| 1E-6 | U | Micro |
| 1E-9 | N | Nano |

Table 5-7

5.3.3 Boolean Data Format

The Boolean parameter <Boolean> takes only the form ON|OFF.

5.3.4 Character Data Format

The character strings returned by query command are shown in either of the following forms:

- <CRD> Character Response Data: character string with maximum length of 12.
- <SRD> String Response Data: character string.

5.3.5 Basic Definition

5.3.5.1 Command Tree Structure

The commands of the DC Power Supply are based on a hierarchical structure, also known as a tree system. In order to obtain a particular command, the full path to that command must be specified. This path is represented in the structure by placing the highest node in the farthest left position of the hierarchy. Lower nodes in the hierarchy are indented in the position to the right, below the parent node.

5.3.5.2 Program Headers

Program headers are key words that identify the command. They follow the syntax described in subsection 5.6 of IEEE 488.2. The DC Power Supply accepts characters in both upper and lower case without distinguishing the difference. Program headers consist of two distinctive types, common command headers and instrument-controlled headers.

5.3.5.3 Common Command and Query Headers

The syntax of common command and query headers is described in IEEE 488.2. It is used together with the IEEE 488.2-defined common commands and queries. The commands with a leading “*” are common commands.

5.3.5.4 Instrument-Controlled Headers

Instrument-controlled headers are used for all other instrument commands. Each of them has a long form and a short form. The 42000 Series only accepts the exact short and long forms. A special notation will be taken to differentiate the short form header from the long one of the same header in this subsection. The short form header is shown in characters of upper case, whereas the rest of the headers are shown in those of lower case.

5.3.5.5 Program Header Separator (:)

If a command has more than one header, the user must separate them with a colon (FETC:CURR FUNC:SHAP). Data must be separated from a program header by at least one space.

5.3.5.6 Program Message

Program messages consist of a sequence of zero or other elements of program message unit that is separated by separator elements of a program message unit.

5.3.5.7 Program Message Unit

Program message unit represents a single command, programming data, or query.

Example: VOLT?, OUTPut ON.

5.3.5.7.1 Program Message Unit Separator (;)

The separator (semicolon ;) separates the program message unit elements from one another in a program message.

Example: VOLT 80; CURR 15<PMT>

5.3.5.7.2 Program Message Terminator (<PMT>)

A program message terminator represents the end of a program message. Three permitted terminators are:

- (1) <END> : end or identify (EOI)
- (2) <NL> : new line which is a single ASCII-encoded byte 0A (10 decimals).
- (3) <NL> <END> : new line with EOI.

ⓘ NOTICE

The response message is terminated by <NL> <END> for GPIB, and <NL> for RS-232C.

5.4 Command Tree

Multiple program message unit elements can be sent in a program message. The first command is always referred to the root node. Subsequent commands are referred to the same tree level as the previous command in a program message. A colon preceding a program message unit changes the header path to root level.

Example:

| | |
|---------------------------------|--|
| SOURce:VOLTage:SLEW 1 | All colons are header separators. |
| :SOURce:VOLTage:SLEW 1 | Only the first colon is a specific root. |
| SOURce:VOLTage:SLEW 1;:VOLT 100 | Only the third colon is a specific root. |

5.5 Execution Order

The 42000 DC Power Supply executes program messages by the order received. Program message units except coupled commands are executed in order of reception. The execution of coupled commands is deferred until program message terminator is received. A coupled command sets parameters, which are affected by the setting of other commands. Problems may arise, because the prior state of the 42000 DC Power Supply will affect the response of a coupled parameter to its programming.

5.6 Commands of DC Power Supply

This section describes the syntax and parameters of all commands for DC Power Supply.

5.6.1 Common Command Syntax

Commands are defined by IEEE488.2 standard containing common and query commands. Common commands begin with a “*” and consist of three letters and/or one “?” (query). Common commands and queries are listed alphabetically.

| | |
|-------------------|--|
| *CLS | Clear Status |
| Type: | Device status |
| Description: | *CLS command acts the follows: Clear Error Code Reset Error Message. If “*CLS” is followed by <nl>, the “output queue” and MAV bit will be clear as well. |
| Syntax: | *CLS |
| Parameter: | None |
| | |
| *ESE | Standard Event Status Enable |
| Type: | Device status |
| Description: | This command sets the condition of the Standard Event Status Enable register, which determines which events of the Standard Event Status Event register (see *ESR?) are allowed to set the ESB (Event Summary Bit) of the Status Byte register. A "1" in the bit position enables the corresponding event. All of enable events of the Standard Event Status Event register are logically ORed to cause the ESB (bit 5) of the Status Byte register to be set. |
| Syntax: | *ESE <NRf> |
| Parameter: | 0 to 255 |
| Example: | *ESE 48 This command enables the CME and EXE events of the Standard Event Status Event register. |
| Query Syntax: | *ESE? |
| Return Parameter: | <NR1> |
| Query Example: | *ESE? This query returns current setting of Standard Event Status Enable. |
| | |
| *ESR? | Standard Event Status Register |
| Type: | Device status |
| Description: | This query reads the Standard Event Status register and clears it. |
| Query Syntax: | *ESR? |
| Return Parameter: | <NR1> |
| Query Example: | *ESR? Return status readings of Standard Event Status register. |
| Return Example: | 48 |
| | |
| *IDN? | Identification Query |
| Type: | System interface |
| Description: | This query requests the 42000 to identify itself. |
| Query Syntax: | *IDN? |
| Query Example: | *IDN? |
| | String Description |
| | QuadTech, Inc. Manufacturer |
| | 42012 Model name |
| | 01.00 Firmware version |
| | 2005/07/14 Date |
| Return Example: | QuadTech, Inc. 42012-80-60, 01.00,2005/07/14 |

| | |
|-------------------|--|
| *OPC | Operation Complete Command |
| Type: | Device status |
| Description: | This command causes the interface to set the OPC bit (bit 0) of the Standard Event Status register when the 42012 Series has completed all pending operations. |
| Syntax: | *OPC |
| Parameter: | None |
| *OPC? | Operation Complete Query |
| Type: | Device status |
| Description: | This query returns an ASCII "1" when all pending operations are completed. |
| Query Syntax: | *OPC? |
| Return Parameter: | <NR1> |
| Query Example: | 1 |
| *RCL | Recall Instrument State Command |
| Type: | Device status |
| Description: | This command restores the High Slew Rate Load to a state that was previously stored in memory with the *SAV command to the specified location (see *SAV). |
| Syntax: | *RCL <NRf> |
| Parameter: | None |
| Example: | *RCL |
| *RST | Reset Command |
| Type: | Device status |
| Description: | Reset System |
| Syntax: | *RST |
| Parameter: | None |
| *SAV | Save Command |
| Type: | Device status |
| Description: | This command stores the present state of the single 42012 Series and the states of the current mode in a specified location in memory. |
| Syntax: | *SAV |
| Example: | *SAV |
| *SRE | Service Request Enable Command/Query |
| Type: | Device status |
| Description: | This command sets the condition of the Service Request Enable register, which determines which events of the Status Byte register (see *STB) are allowed to set the MSS (Master Status Summary) bit. A "1," in the bit position, enables bits that are logically ORed to cause Bit 6 (the Master Summary Status Bit) of the Status Byte register to be set. See Status Byte register for detail description. |
| Syntax: | *SRE <NRf> |
| Parameter: | 0 to 255 |
| Example: | *SRE 20 Enable the CSUM and MAV bit of the Service Request. |

Query Syntax: *SRE?
 Return Parameter: <NR1>
 Query Example: *SRE? Return the current setting of Service Request Enable.

***STB? Read Status Byte Query**

Type: Device status
 Description: This query reads the Status Byte register. Note that the MSS (Master Summary Status) bit instead of RQS bit is returned in Bit 6. This bit indicates if the High Slew Rate Load has at least one reason for requesting service. *STB? does not clear the Status Byte register, which is cleared only when subsequent action has cleared all its set bits.

Query Syntax: *STB?
 Return Parameter: <NR1>
 Query Example: *STB? Return the contents of Status Byte.
 Return Example: 20

NOTICE

1. Status Byte Register:
 The Status Byte Register is composed of eight bits that summarize an overlaying status data structure. The Status Byte Register can be read using *STB? to return a decimal expression of the register contents (which means the total byte weight of all the byte set to "1".)

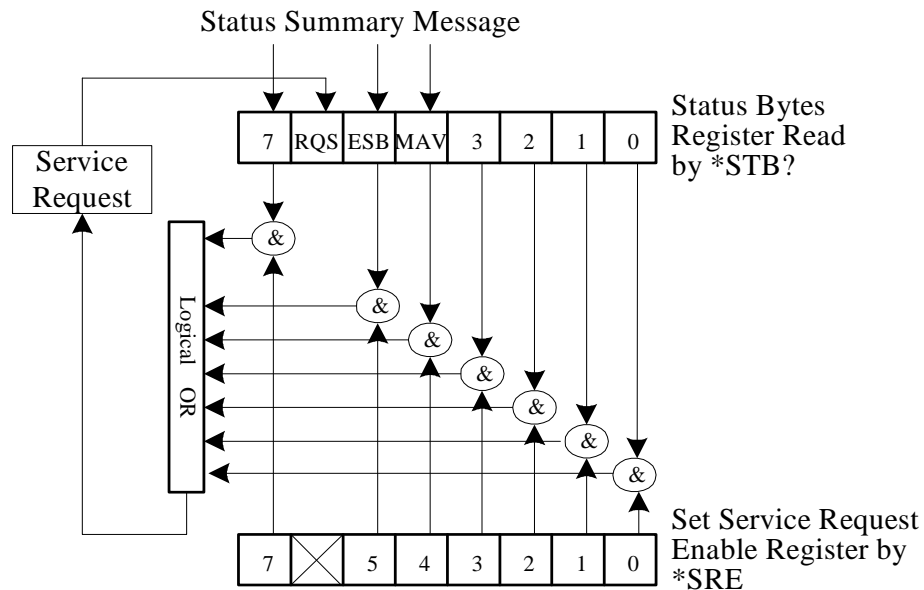


Figure 5-1

| Bit No. | Bit Weight | Description |
|---------|------------|--|
| 7 | 128 | Operation Status Register Summary Bit |
| 6 | 64 | Request Service Bit. This bit is set when any enabled bit of the Status Byte Register has been set, which indicates it has at least one reason for requesting service. |
| 5 | 32 | Standard Event Status Register Summary Bit. |
| 4 | 16 | Message Available Bit. This bit is set whenever there is data available in the output queue, and is reset when the available data is read. |
| 3-0 | | Always 0. |

Table 5-8

2. Standard Event Status Register:

The Standard Event Status Register is frequently used. The common use commands *ESE and *ESR? can be utilized to program it.

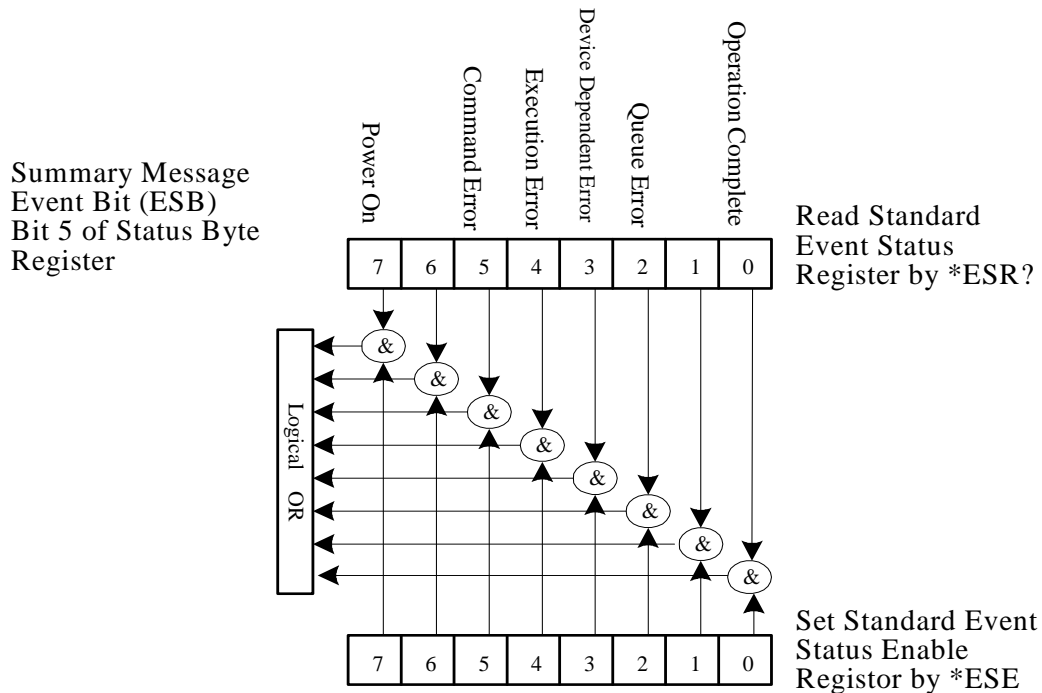


Figure 5-2

| Bit No. | Bit Weight | Description |
|---------|------------|---|
| 7 | 128 | Power-on Bit. Rebooting the Power Supply can set this bit to 1. |
| 6 | | Always 0. |
| 5 | 32 | Command Error Bit. This bit is set to 1 if there is any IEEE 488.2 syntax error. |
| 4 | 16 | Execution Error Bit. This bit is set to 1 when the command parameter is out of valid range or inconsistent. |
| 3 | 8 | Device Dependent Error Bit. This bit is set to 1 when too many errors have occurred that the error queue is full. |

| | | |
|---|---|--|
| 2 | 4 | Queue Error Bit. This bit is set to 1 when reading data from the output buffer and no data is present, or when the data is lost. |
| 1 | | Always 0. |
| 0 | 1 | |

Table 5-9

5.6.2 Specific RS-232 and GPIB Commands for 42000 Series

5.6.2.1 ABORT Subsystem

ABORt

Description: It sets all output state to "OFF".

Syntax: ABORt

5.6.2.2 CONFIGURE Subsystem

(1) CONFigure:TTLport

Description: It sets the output value for TTL Port.

Syntax: CONFigure:TTL <NR1>

Parameter: <NR1>

Example: CONF:TTL 0
CONF:TTL 255

Query Syntax: CONFigure:TTL?

Return Parameter: <NR1>

Query Example: CONF:TTL? It returns the output value of TTL Port.

Return Example: 0 or 255

(2) CONFigure:BEEPer

Description: It sets the beeper to ON or OFF.

Syntax: CONFigure:BEEPer ON
CONFigure:BEEPer OFF

Parameter: ON|OFF

Example: CONF: BEEPer ON
CONF: BEEPer OFF

Query Syntax: CONFigure:BEEPer?

Return Parameter: ON | OFF

Query Example: CONF:BEEPer? It returns the beeper control status.

Return Example: ON or OFF

(3) CONFigure:REMote

Description: It sets the remote control status (valid for RS232C only).

Syntax: CONFigure:REMote ON
CONFigure:REMote OFF

Parameter: ON|OFF

Example: CONF:REM OFF It disables remote control.

- (4) CONFigure:OUTPut
 Description: It sets the output voltage/current.
 Syntax: CONFigure:OUTPut ON
 CONFigure: OUTPut OFF
 Parameter: ON|OFF
 Example: CONFigure: OUTPut The power supply starts output.
 CONFigure: OUTPut OFF The power supply stops output.
 Query Syntax: CONFigure: OUTPut?
 Query Example: CONF: OUTPut?
 Return Example: ON or OFF
- (5) CONFigure:FOLDBack
 Description: It sets the type of FOLDBACK PROTECT.
 Syntax: CONFigure:FOLDBack DISABLE
 CONFigure:FOLDBack CVTOCC
 CONFigure:FOLDBack CCTOCV
 Parameter: DISABLE|CVTOCC|CCTOCV
 Example: CONFigure:FOLD DISABLE
 CONFigure:FOLD CVTOCC
 Query Syntax: CONFigure:FOLD?
 Query Example: CONF:FOLD? It returns the status set.
 Return Example: DISABLE or CVTOCC or CCTOCV
- (6) CONFigure:FOLDT
 Description: It sets the delay time of FOLDBACK PROTECT
 Syntax: CONFigure:FOLDT <NRf1>
 Parameter: 0.01~600.00 (Unit:Sec)
 Example: CONF:FOLDT 10
 Query Syntax: CONF:FOLDT?
 Return Parameter: <NRf1>
 Query Example: CONF:FOLDT?
 Return Example: 1.000000e+01
- (7) CONFigure:APGmode
 Description: It sets the type APG mode.
 Syntax: CONFigure:APGmode V
 CONFigure:APGmode I
 CONFigure:APGmode VI
 Parameter: NONE | V | I | VI
 Example: CONF:APG VI
 Query Syntax: CONFigure:APG?
 Query Example: CONF:APG? It returns the status set.
 Return Example: NONE | V | I | VI
- (8) CONFigure:APGV
 Description: It sets the APG reference voltage.
 Syntax: CONFigure:APGV FIVE
 CONFigure:APGV TEN

Parameter: FIVE | TEN
 Example: CONF:APGV FIVE
 CONF:APGV TEN
 Query Syntax: CONF:APGV?
 Return Parameter: 5V | 10V
 Query Example: CONF:APGV? It returns the status set.
 Return Example: 5V or 10V

(9) CONF:MEASURE:SPeED

Description: It sets the reading speed of AD for input voltage/current.
 Syntax: CONF:MEASURE:SPeED <NR1>
 Parameter: <NR1>
 0: 240SPS (0.25PLC)
 1: 120SPS (0.5PLC)
 2: 60SPS (1PLC)
 3: 30SPS (2 PLC)
 Example: CONF:MEASURE:SPeED 0
 CONF:MEASURE:SPeED 1
 Query Syntax: CONF:MEASURE:SPeED?
 Return Parameter: <NR1>
 Query Example: CONF:MEASURE:SPeED?
 Return Example: 1

(10) CONF:AVG:TIMES

Description: It sets the average times of AD for input voltage/current.
 Syntax: CONF:AVG:TIMES <NR1>
 Parameter: <NR1>
 0: 1 time
 1: 2 times
 2: 4 times
 3: 8 times
 Example: CONF:AVG:TIMES 0
 CONF:AVG:TIMES 1
 Query Syntax: CONF:AVG:TIMES?
 Return Parameter: 1 | 2 | 4 | 8
 Query Example: CONF:AVG:TIMES?
 Return Example: 1

(11) CONF:AVG:METHoD

Description: It sets the average method of AD for input voltage/current.
 Syntax: CONF:AVG:METHoD <NR1>
 Parameter: FIX/MOV
 Example: CONF:AVG:METHoD FIX
 CONF:AVG:METHoD MOV
 Query Syntax: CONF:AVG:METHoD?
 Return Parameter: FIX | MOV
 Query Example: CONF:AVG:METHoD?
 Return Example: FIX

(12) CONFigure:BACKLight

Description: It sets the LCD backlight.
Syntax: CONFigure:BACKLIGHT
CONFigure:BACKLIGHT OFF
Parameter: HIGH | NOR | DIM | OFF
Example: CONFigure:BACKLIGHT HIGH
CONFigure:BACKLIGHT NOR
CONFigure:BACKLIGHT DIM
CONFigure:BACKLIGHT OFF
Query Syntax: CONFigure:BACKLIGHT?
Return Parameter: HIGH | NOR | DIM | OFF
Query Example: CONFigure:BACKLIGHT? It returns the LCD backlight state.
Return Example: HIGH

(13) CONFigure:MSTSLV:ID

Description: It sets to Master or Slave.
Syntax: CONFigure:MSTSLV:ID MASTER
CONFigure:MSTSLV:ID SLAVE1
Parameter: MASTER, SLAVE1, SLAVE2, SLAVE3, SLAVE4
Example: CONFigure:MSTSLV:ID MASTER
CONFigure:MSTSLV:ID SLAVE2
Query Syntax: CONFigure:MSTSLV:ID?
Return Parameter: MASTER | SLAVE1 | SLAVE2 | SLAVE3 | SLAVE4
Query Example: CONF:MSTSLV:ID?
Return Example: MASTER or SLAVE1 or SLAVE2 or SLAVE3 or SLAVE4

Note: CONFigure:MSTSLV? must be OFF when setting it. (Not in series/parallel mode.)

(14) CONFigure:MSTSLV:PARSER

Description: It sets to series or parallel mode.
Syntax: CONFigure:MSTSLV:PARSER PARALLEL
CONFigure:MSTSLV:PARSER SERIES
Parameter: PARALLEL | SERIES
Example: CONFigure:MSTSLV:PARSER PARALLEL
CONFigure:MSTSLV:PARSER SERIES
Query Syntax: CONFigure:MSTSLV:PARSER?
Return Parameter: PARALLEL | SERIES
Query Example: CONF:MSTSLV:PARSER?
Return Example: PARALLEL

Note: CONFigure:MSTSLV? must be OFF when setting it. (Not in series/parallel mode.)

(15) CONFigure:MSTSLV:NUMSLV

Description: It sets the number of SLAVE to be controlled.
Syntax: CONFigure:MSTSLV:NUMSLV <NR1>
Parameter: <NR1>
Example: CONFigure:MSTSLV:NUMSLV 1
CONFigure:MSTSLV:NUMSLV 2
Query Syntax: CONFigure:MSTSLV:NUMSLV?

Return Parameter: <NR1>
 Query Example: CONF:MSTSLV:NUMSLV?
 Return Example: 1

Note: CONFigure:MSTSLV? must be OFF when setting it. (Not in series/parallel mode.)

(16) CONFigure:MSTSLV

Description: It executes the Master/Slave control.
 Syntax: CONFigure:MSTSLV ON
 CONFigure:MSTSLV OFF
 Parameter: ON | OFF
 Example: CONFigure:MSTSLV ON
 CONFigure:MSTSLV OFF
 Query Syntax: CONFigure:MSTSLV?
 Return Parameter: ON| OFF
 Query Example: CONF:MSTSLV?
 Return Example: ON| OFF

Note 1: Set the following three commands before controlling this function:

- CONFigure:MSTSLV:ID
- ONFigure:MSTSLV:PARSER
- **CONFigure:MSTSLV:NUMSLV**

Note 2: When Program RUN is executed, series/parallel control is not available.

In addition, Master/Slave Control must be off when executing this command in Program:Run.

(17) CONFigure:INHibit

Description: It executes the Remote Inhibit control function.
 Syntax: CONFigure:INHibit TRIG
 Parameter: OFF| TRIG | LIVE
 Example: CONFigure:INHibit OFF
 CONFigure:INHibit TRIG
 CONFigure:INHibit LIVE
 Query Syntax: CONFigure:INHibit?
 Return Parameter: OFF, TRIG, LIVE
 Query Example: CONF:INH?
 Return Example: OFF

Note: LIVE on the panel is External ON/OFF.

5.6.2.3 SOURCE Subsystem

(1) SOURce:VOLTage

Description: It sets the output voltage.
 Syntax: SOURce:VOLTage <NRf+>[suffix]
 SOURce:VOLTage <NRf+>[suffix]
 Parameter: Refer to individual specs for valid numeric range.

- Example: SOUR:VOLT 0.01 It sets the output voltage to 0.01 volt.
 SOUR:VOLT 80.00 It sets the output voltage to 80.00 volt.
- Query Syntax: SOUR:VOLT?
 Return Parameter: <NRf+> [Unit Volt]
 Query Example: SOUR:VOLT? It returns the voltage.
 Return Example: 8.000000e1
- (2) SOURce:VOLTage:LIMit:{HIGH/LOW}
- Description: It sets the output voltage range.
 Syntax: SOURce:VOLTage:LIMIT:HIGH <NRf+>[suffix]
 SOURce:VOLTage:LIMIT:LOW <NRf+>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOUR:VOLT:LIMIT:HIGH 60.0 It sets the output voltage range to 60V maximum.
 SOUR:VOLT:LIMIT:LOW 20.0 It sets the output voltage range to 20V minimum.
- Query Syntax: SOUR:VOLT:LIMIT:HIGH?
 SOUR:VOLT:LIMIT:LOW?
 Return Parameter: <NRf+> [Unit Volt]
 Query Example: SOUR:VOLT:LIMIT:HIGH? It returns the maximum range set for voltage.
 Return Example: 80.0
- (3) SOURce:VOLTage:PROTeCt:{HIGH}
- Description: It sets the voltage range for over voltage protection.
 Syntax: SOURce:VOLTage:PROTeCt:HIGH <NRf+>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOUR:VOLT:PROT:HIGH 60.0 It sets the high limit to 60V for voltage output protection.
- Query Syntax: SOUR:VOLT:PROT:HIGH?
 Return Parameter: <NRf+> [Unit Volt]
 Query Example: SOUR:VOLT:PROT:HIGH? It returns the high limit of voltage protection.
 Return Example: 88.00
- (4) SOURce:VOLTage:SLEW
- Description: It sets the rising or falling slew rate (volt/ms) of output voltage.
 Syntax: SOURce:VOLTage:SLEW <NR1>[suffix]
 SOURce:VOLTage:SLEW <NR1>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOUR:VOLT:SLEW 0.01 It sets the output voltage slew rate to 0.01 volt/mS
 SOUR:VOLT:SLEW 10 It sets the output voltage slew rate to 100 volt/mS
- Query Syntax: SOUR:VOLT:SLEW?
 Return Parameter: <NR1> [Unit Volt/ms]
 Query Example: SOUR:VOLT:SLEW? It returns the voltage slew rate.
 Return Example: 10

(5) SOURce: CURRent

Description: It sets the output current (ampere).
 Syntax: SOURce:CURRent <NRf+>[suffix]
 SOURce:CURRent <NRf+>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOUR:CURR 1 It sets the output current to 1 amps.
 SOUR:CURR 60.00 It sets the output current to 60.00 amps.
 Query Syntax: SOUR:CURR?
 Return Parameter: <NRf+> [Unit Amp]
 Query Example: SOUR:CURR? It returns the current.
 Return Example: 9.000000e1

(6) SOURce:CURRent:LIMit:{HIGH/LOW}

Description: It sets the output current range.
 Syntax: SOURce:CURRent:LIMIT:HIGH <NRf+>[suffix]
 SOURce:CURRent:LIMIT:LOW <NRf+>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOUR:CURR:LIMIT:HIGH 60.0 It sets the output current range to 60A maximum.
 SOUR:CURR:LIMIT:LOW 20.0 It set the low limit to 20A for current output protection.
 Query Syntax: SOUR:CURR:LIMIT:HIGH?
 SOUR:CURR:LIMIT:LOW?
 Return Parameter: <NRf+> [Unit Amp]
 Query Example: SOUR:CURR:LIMIT:HIGH? It returns the maximum range set for current.
 Return Example: 60.00

(7) SOURce:CURRent:PROTect:{HIGH }

Description: It sets the current range for over current protection.
 Syntax: SOURce:CURRent:PROTect:HIGH <NRf+>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOUR:CURR:PROT:HIGH 60.0 It sets the high limit to 60A for current output protection.
 Query Syntax: SOUR:CURR:PROT:HIGH?
 Return Parameter: <NRf+> [Unit Amp]
 Query Example: SOUR:CURR:PROT:HIGH? It returns the high limit of current protection.
 Return Example: 50.00

(8) SOURce:CURRent:SLEW

Description: It sets the rising or falling slew rate (amp/ms) of output current.
 Syntax: SOURce:CURRent:SLEW <NR1>[suffix]
 SOURce:CURRent:SLEW <NR1>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOUR:CURR:SLEW 0.01 It sets the output current slew rate to 0.01 Amp/mS.
 SOUR:CURR:SLEW 1.00 It sets the output current slew rate to 1.00 Amp/mS.

Query Syntax: SOUR:CURR:SLEW?
 Return Parameter: <NR1> [Unit Amp/ms]
 Query Example: SOUR:CURR:SLEW? It returns the current slew rate.
 Return Example: 1.00

(9) SOURce:CURRent:SLEWINF

Description: It sets the I Slewrate to INF.
 Syntax: SOURce:CURRent:SLEWINF ENABLE
 SOURce:CURRent:SLEWINF DISABLE
 Parameter: ENABLE/DISABLE
 Example: SOUR:CURR:SLEWINF ENABLE It sets the I Slewrate to INF.
 SOUR:CURR:SLEWINF DISABLE It resets the I Slewrate and
 returns to 1A/ms.
 Query Syntax: SOUR:CURR:SLEW?
 Return Parameter: INF. Or <NRf+>[Unit = Ampere]
 Query Example: SOUR:CURR:SLEW? It returns the setting.
 Return Example: INF.

(10) SOURce:POWer:PROTeCt:HIGH

Description: It sets the over power point(Watt) of output power.
 Syntax: SOURce:POWer:PROTeCt:HIGH <NR1>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOURce:POWer:PROTeCt:HIGH 1260 It sets the over power
 point 1260.
 Query Syntax: SOURce:POWer:PROTeCt:HIGH?
 Return Parameter: <NR1> [Watt]
 Query Example: SOURce:POWer:PROTeCt:HIGH? It returns the over
 power setting value.
 Return Example: 1260.00

(11) SOURce:DCON:{RISE/FALL}

Description: It sets the DC_ON signal active point.
 Syntax: SOURce:DCON:RISE <NRf+>[suffix]
 SOURce:DCON:FALL <NRf+>[suffix]
 Parameter: Refer to individual spec for valid numeric range.
 Example: SOUR:DCON:RISE 79.5 It sets the DC_ON rise to 79.5V.
 SOUR:DCON:FALL 0.5 It sets the DC_ON fall to 0.5V.
 Query Syntax: SOUR:DCON:RISE?
 SOUR:DCON:FALL?
 Return Parameter: <NRf+> [Unit = Volt]
 Query Example: SOUR:DCON:RISE? It returns the setting.
 Return Example: 79.5
Note: The output must be OFF for setting.

5.6.2.4 FETCh Subsystem

- (1) FETCh:VOLTage?
 Description: It measures the output of the Power Supply and returns real time voltage.
 Query Syntax: FETCh:VOLTage?
 Return Parameter: <NRf+> [Unit Volt]
 Query Example: FETC:VOLT?
 Return Example: 8.12
- (2) FETCh:CURRent?
 Description: It measures the output of the Power Supply and returns real time current.
 Query Syntax: FETCh:CURRent?
 Return Parameter: <NRf+> [Unit Amp]
 Query Example: FETC:CURR?
 Return Example: 3.15
- (3) FETCh:POWer?
 Description: It measures the output of the Power Supply and returns real time power.
 Query Syntax: FETCh:POWer?
 Return Parameter: <NRf+> [Unit Amp]
 Query Example: FETC:POW?
 Return Example: 1100.00
- (4) FETCh:STATus?
 Description: It returns the status code of the Power Supply's state.
 Query Syntax: FETCh:STATus?
 Return Parameter: <Arg1><,><Arg2><,><Arg3>
 <Arg1>: return warning message 0~65535, 0: no warning, use binary for the rest and identify the cause of error.
 BIT 0 : OVP
 BIT 1 : OCP
 BIT 2: OPP
 BIT 3: Remote Inhibit
 BIT 4: OTP
 BIT 5: FAN_LOCK
 BIT 6: SENSE FAULT
 BIT 7: SERIES FAULT
 BIT 8: BUS OVP
 BIT 9: AC FAULT
 BIT 10: FOLD Back CV to CC
 BIT 11: FOLD Back CC to CV
 BIT 12: Reserved
 BIT 13: Reserved
 BIT 14: Reserved
 BIT 15: Reserved
 <Arg2> : ON|OFF output status at present

<Arg3>: CV or CC status at present

5.6.2.5 MEASURE Subsystem

- (1) MEASure:VOLTage?
 Description: It returns the voltage measured at the output of the Power Supply.
 Query Syntax: MEASure:VOLTage?
 Return Parameter: <NRf+> [Unit Voltage]
 Query Example: MEAS:VOLT?
 Return Example: 8.12
- (2) MEASure:CURREnt?
 Description: It returns the current measured at the output of the Power Supply.
 Query Syntax: MEASure:CURREnt?
 Return Parameter: <NRf+> [Unit Amp]
 Query Example: MEAS:CURR?
 Return Example: 3.15
- (3) MEASure:POWer?
 Description: It returns the power measured at the output of the Power Supply.
 Query Syntax: MEASure:POWer?
 Return Parameter: <NRf+> [Unit Amp]
 Query Example: MEAS:POW?
 Return Example: 1000.00

5.6.2.6 PROGRAM Subsystem

- (1) PROGram: SElected
 Description: It sets the executed program no.
 Syntax: PROGram: SElected <NR1>
 Parameter: 1 to 10
 Example: PROG:SEL 10
 Query Syntax: PROG:SEL? It returns the program no. in use.
 Return Parameter: <NR1>
 Query Example: PROG:SEL?
 Return Example: 10
- (2) PROGram:LINK
 Description: It links a program to another when ends.
 Syntax: PROGram:LINK <NR1>
 Parameter: 0 to10 (0 is not linked)
 Example: PROG:LINK 7
 Query Syntax: PROG:LINK?
 Return Parameter: <NR1>
 Query Example: PROG:LINK?
 Return Example: 7

(3) PROGram:COUNT

Description: It sets the program file to be executed in series.
Syntax: PROGram:COUNT <NR1>
Parameter: 1 to 15000
Example: PROG:COUNT 7
Query Syntax: PROG: COUNT ?
Return Parameter: <NR1>
Query Example: PROG: COUNT ?
Return Example: 7

(4) PROGram:RUN

Description: It executes the program.
Syntax: PROGram:RUN ON
PROGram:RUN OFF
Parameter: ON/1, OFF/0
Example: PROG:RUN ON
Query Syntax: PROGram:RUN?
Return Parameter: <NR1>
Query Example: PROGram:RUN?
Return Example: 1

(5) PROGram:SAVE

Description: It saves the program.
Syntax: PROGram:SAVE
Parameter: None
Example: PROG:SAVE

(6) PROGram:SEQuence:SElected

Description: It sets the execution sequence of a program.
Syntax: PROGram:SEQuence:SElected <NR1>
Parameter: 1 to 10
Example: PROG:SEQ:SEL 3
Query Syntax: PROGram:SEQuence:SElected?
Return Parameter: <NR1>
Query Example: PROG:SEQ:SEL?
Return Example: 3

(7) PROGram:SEQuence:TYPE

Description: It sets the action type of sequence.
Syntax: PROGram:SEQuence:TYPE TRI
PROGram:SEQuence:TYPE AUTO
PROGram:SEQuence:TYPE MANUAL
Parameter: SKIP, AUTO, MANUAL
Example: PROG:SEQ:TYPE TRI
PROG:SEQ:TYPE AUTO
PROG:SEQ:TYPE MANUAL
Query Syntax: PROG:SEQ:TYPE?
Return Parameter: SKIP, AUTO, MANUAL
Query Example: PROG:SEQ:TYPE?

Return Example: 1

(8) PROGRAM:SEQuence:VOLTAge

Description: It sets the sequence for voltage output.
 Syntax: PROGRAM:SEQuence:VOLTAge <NRf+>
 Example: PROG:SEQ:VOLT 40.5
 Query Syntax: PROG:SEQ:VOLT?
 Return Parameter: <NRf+>
 Query Example: PROG:SEQ:VOLT?
 Return Example: 40.5

(9) PROGRAM:SEQuence:VOLTAge:SLEW

Description: It sets sequence for output voltage slew rate.
 Syntax: PROGRAM:SEQuence:VOLTAge:SLEW <NR1>
 Parameter: 0.01 to 10.00
 Example: PROG:SEQ:VOLT:SLEW 1
 Query Syntax: PROG:SEQ:VOLT:SLEW?
 Return Parameter: <NR1>
 Query Example: PROG:SEQ:VOLT:SLEW?
 Return Example: 1

(10) PROGRAM:SEQuence:CURREnt

Description: It sets sequence for output current.
 Syntax: PROGRAM:SEQuence:CURREnt <NRf+>
 Example: PROG:SEQ:CURR 40.5
 Query Syntax: PROG:SEQ:CURR?
 Return Parameter: <NRf+>
 Query Example: PROG:SEQ:CURR?
 Return Example: 40.5

(11) PROGRAM:SEQuence:CURREnt:SLEW

Description: It sets sequence for output voltage slew rate.
 Syntax: PROGRAM:SEQuence:CURREnt:SLEW <NRf1>
 Example: PROG:SEQ:CURR:SLEW 10
 Query Syntax: PROG:SEQ:CURR:SLEW?
 Return Parameter: <NR1>
 Query Example: PROG:SEQ:CURR:SLEW?
 Return Example: 10

(12) PROGRAM:SEQuence:CURREnt:SLEWINF

Description: It sets the slewrate of sequence current output to INF.
 Syntax: PROGRAM:SEQuence:CURREnt:SLEWINF ENABLE
 PROGRAM:SEQuence:CURREnt:SLEWINF DISABLE
 Parameter: ENABLE/DISABLE
 Example: PROGRAM:SEQuence:CURREnt:SLEWINF ENABLE sets the
 Slewrate to INF
 PROGRAM:SEQuence:CURREnt:SLEWINF DISABLE releases the
 Slewrate INF and return to 1A/ms
 Query Syntax: PROGRAM:SEQuence:CURREnt:SLEW?

Return Parameter: INF. Or <NRf+>[Unit Amp]
Query Example: PROGram:SEQuence:CURRent:SLEW? It returns the settings.
Return Example: INF.

(13) PROGram:SEQuence:TTLport

Description: It sets the sequence for TTL Port output
Syntax: PROGram:SEQuence:TTLport <NRf1>
Example: PROG:SEQ:TTL 10
Query Syntax: PROG:SEQ:TTL?
Return Parameter: <NR1>
Query Example: PROG:SEQ:TTL?
Return Example: 10

(14) PROGram:SEQuence:TIME

Description: It sets the sequence for the duration of time.
Syntax: PROGram:SEQuence:TIME <NRf1>
Example: PROG:SEQ:TIME 10
Query Syntax: PROG:SEQ:TIME?
Return Parameter: <NR1>
Query Example: PROG:SEQ:TIME?
Return Example: 6000

(15) PROGram:CLEAR

Description: It clears the sequence.
Syntax: PROGram:CLEAR
Example: PROG:CLEAR

(16) PROGram:ADD

Description: It adds a sequence.
Syntax: PROGram:ADD <NR1>
Parameter: 1~100 (based on the remaining SEQUENCE no. for configuration)
Example: PROG:ADD
Query Syntax: PROGram:ADD?
Return Parameter: <NR1>
Query Example: PROGram:ADD?
Return Example: 85 – it indicates the remaining no. is 85.

(17) PROGram:MAX?

Description: It queries the sequence number of present program.
Syntax: PROGram:MAX?
Parameter:
Example: PROG:MAX?
Return Example: 2 means there are two sequences under the present program.

(18) PROGram:SEQuence

Description: It sets the parameters of a single sequence.
Syntax: PROGram:SEQuence
<arg1><,><arg2><,><arg3><,><arg4><,><arg5><,><arg6><,><arg
7>

Parameter: Arg1: Sequence TYPE (NR1 0:Auto, 1:Manual, 2:EXT.Trig, 3:Skip)
 Arg2: Sequence Voltage (NRf+ unit: voltage)
 Arg3: Sequence Voltage Slewrate (NRf+ unit: voltage)
 Arg4: Sequence Current (NRf+ unit: current)
 Arg5: Sequence Current Slewrate (NRf+ unit: current) / INF –I
 Slewrate sets to INF
 Arg6: Sequence TTL <NR1>
 Arg7: Sequence TIME (NRf+ unit: SEC, only valid when Sequence Type is AUTO)

Example: Set the Sequence
 PROGRAM:SEQUENCE 0,80,10,15,1,255,1

Query Syntax: PROG:SEQ ?
 Return Parameter: 0,80,10,15,1,255,1
 Query Example: PROG:SEQ?
 Return Example: 0,80,10,15,1,255,1

(19) PROGRAM:MODE

Description: It sets the Program Mode for output.
 Syntax: PROGRAM:Mode LIST
 PROGRAM:Mode STEP

Parameter: LIST | STEP

Example: It changes the Program Mode to STEP Mode.
 PROGRAM:Mode STEP

Query Syntax: PROGRAM:Mode?
 Return Parameter: LIST | STEP
 Query Example: PROG:MODE?
 Return Example: STEP

(20) PROGRAM:STEP:STARTV

Description: It sets the Step Mode start voltage for output.
 Syntax: PROGRAM:STEP:STARTV <NRf+>
 Example: It changes the start voltage of STEP Mode to 20.0 V.
 PROGRAM:STEP:STARTV 20

Query Syntax: PROGRAM:STEP:STARTV?
 Return Parameter: <NRf+>
 Query Example: PROGRAM:STEP:STARTV?
 Return Example: 20.0

(21) PROGRAM:STEP:ENDV

Description: It sets the Step Mode end voltage for output.
 Syntax: PROGRAM:STEP:ENDV <NRf+>
 Example: It changes the end voltage of STEP Mode to 50.0 V.
 PROGRAM:STEP:ENDV 50

Query Syntax: PROGRAM:STEP:ENDV?
 Return Parameter: <NRf+>
 Query Example: PROGRAM:STEP:ENDV?
 Return Example: 50.0

(22) PROGram:STEP:TIME

Description: It sets the execution time for Step Mode.
 Syntax: PROGram:STEP:TIME <Hour><,><Minute><,><Second>
 Parameter: Hour : <NR1> 0 ~ 99
 Minute : <NR1> 0 ~ 59
 Second : <NRf1>0 ~ 59.99
 Example: It changes the time for STEP Mode action to 1 hour, 30 min. and 5 sec.
 PROGram:STEP:TIME 1,30,5
 Query Syntax: PROGram:STEP:TIME?
 Return Parameter: <Hour><,><Minute><,><Second>
 Query Example: PROGram:STEP:TIME?
 Return Example: 1,30,5

5.6.2.7 SYSTEM Subsystem

(1) SYSTem:ERRor?

Description: It returns the error message and code of the Power Supply.
 Query Syntax: SYSTem:ERRor?
 Return Parameter: aard
 Query Example: SYST:ERR?
 Return Example: -203, "Data out of range"

| Code | Error Message | Code | Error Message |
|------|------------------------------|------|-------------------------------|
| 0 | "No error" | -101 | "Invalid character" |
| -102 | "Syntax error" | -103 | "Invalid separator" |
| -104 | "Data type error" | -105 | "GET not allowed" |
| -106 | "Illegal parameter value" | -108 | "Parameter not allowed" |
| -109 | "Missing parameter" | -112 | "Program mnemonic too long" |
| -113 | "Undefined header" | -121 | "Invalid character in number" |
| -123 | "Numeric overflow" | -124 | "Too many digits" |
| -131 | "Invalid suffix" | -141 | "Invalid character data" |
| -148 | "Character data not allowed" | -151 | "Invalid string data" |
| -158 | "String data not allowed" | -202 | "Setting conflict" |
| -203 | "Data out of range" | -204 | "Too much data" |
| -211 | "Data stale" | -224 | "Self-test failed" |
| -225 | "Too many errors" | -226 | "INTERRUPTED" |
| -227 | "UNTERMINATED" | -228 | "DEADLOCKED" |
| -229 | "MEASURE ERROR" | -230 | "Sequence overflow" |
| -231 | "Sequence selected error" | | |

Table 5-10

6. Theory of Operation

6.1 Overview

The 42000 Series DC Power Supply has A, B, C, D, G, I, K, M, N and S total 10 circuit boards in it.

- A board contains input stage and auxiliary power.
- B board is the output stage.
- C board is the digital control board.
- D board is the connecting board from digital board to the LCD panel.
- G board is the GPIB control board (optional).
- I board connects the RS232, RS485, TTL and APG signals to the rear panel.
- K board controls the keys connected to the front panel.
- M board connects S board and B board. It is the control board connecting Current Sharing and Remote Sense wire in parallel for reverse protection.
- N board connects to the output copper bus to filter out the high frequency noise.
- O board that connected to the B board is DC_ON and the control board for hardware OPP protection.
- S board connects to M board and is used for processing current signal, as well as, receiving remote voltage signal in parallel.

Figure 6-1 shows the system diagram.

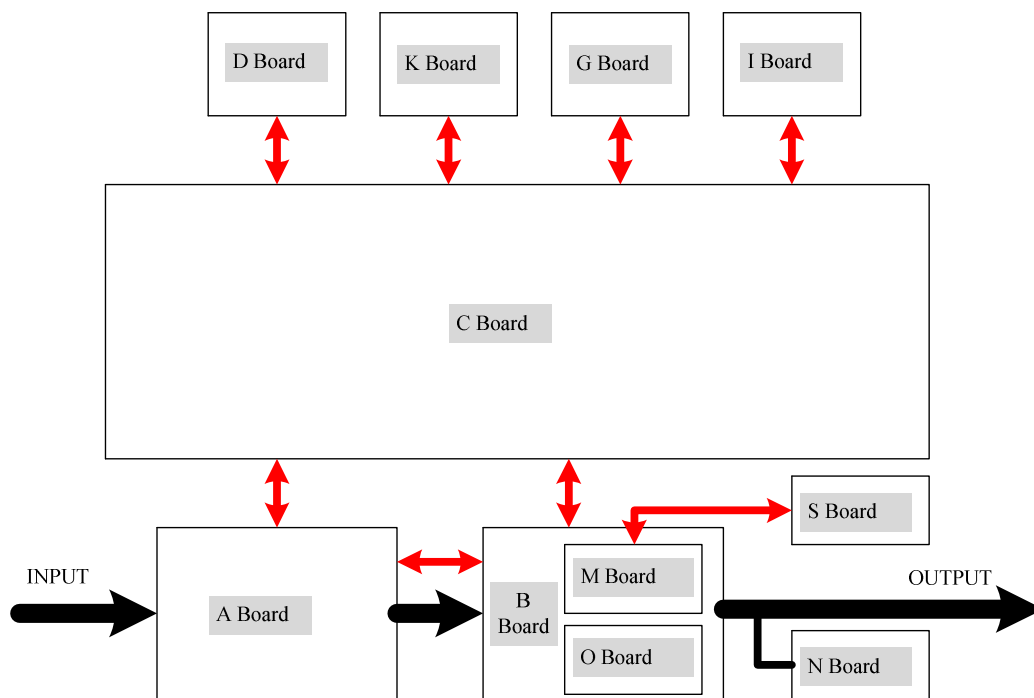


Figure 6-1

Figure 6-2 shows the input stage structure.

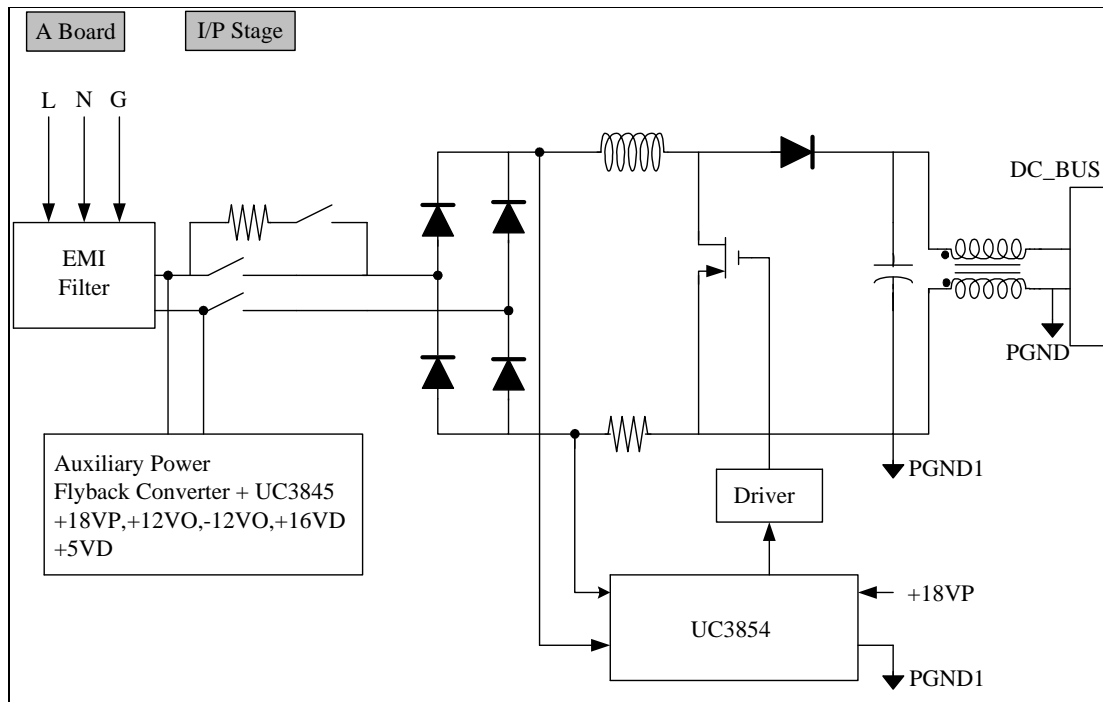


Figure 6-2

Figure 6-3 shows the output stage structure.

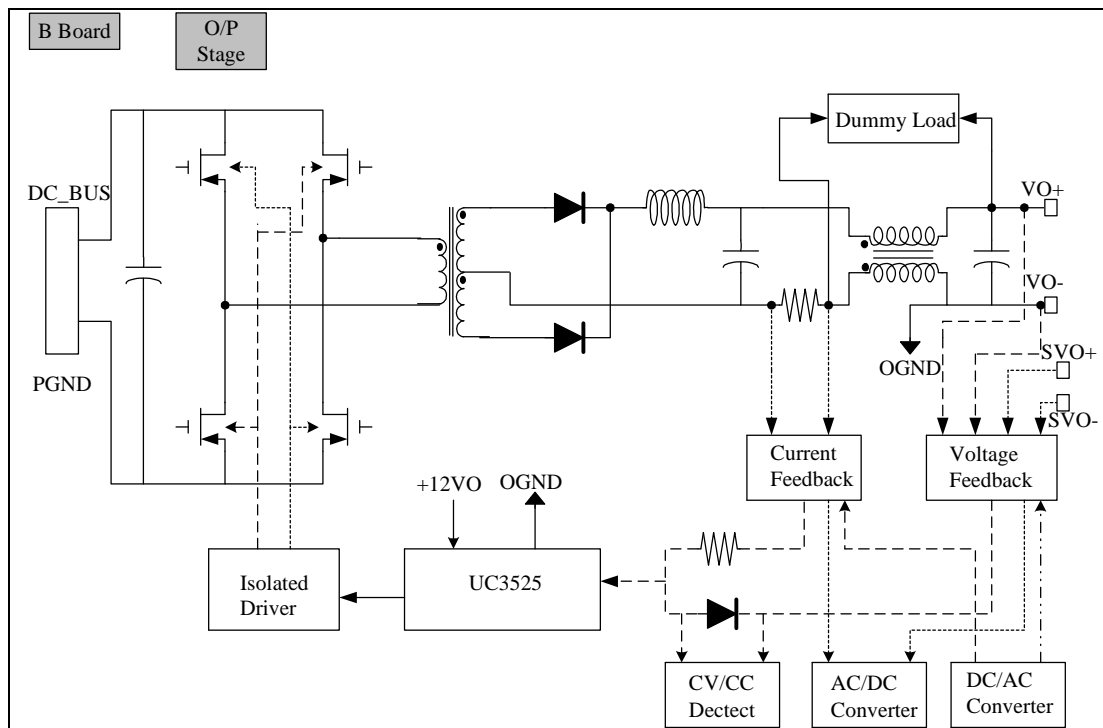


Figure 6-3

Figure 6-4 shows the digital stage structure.

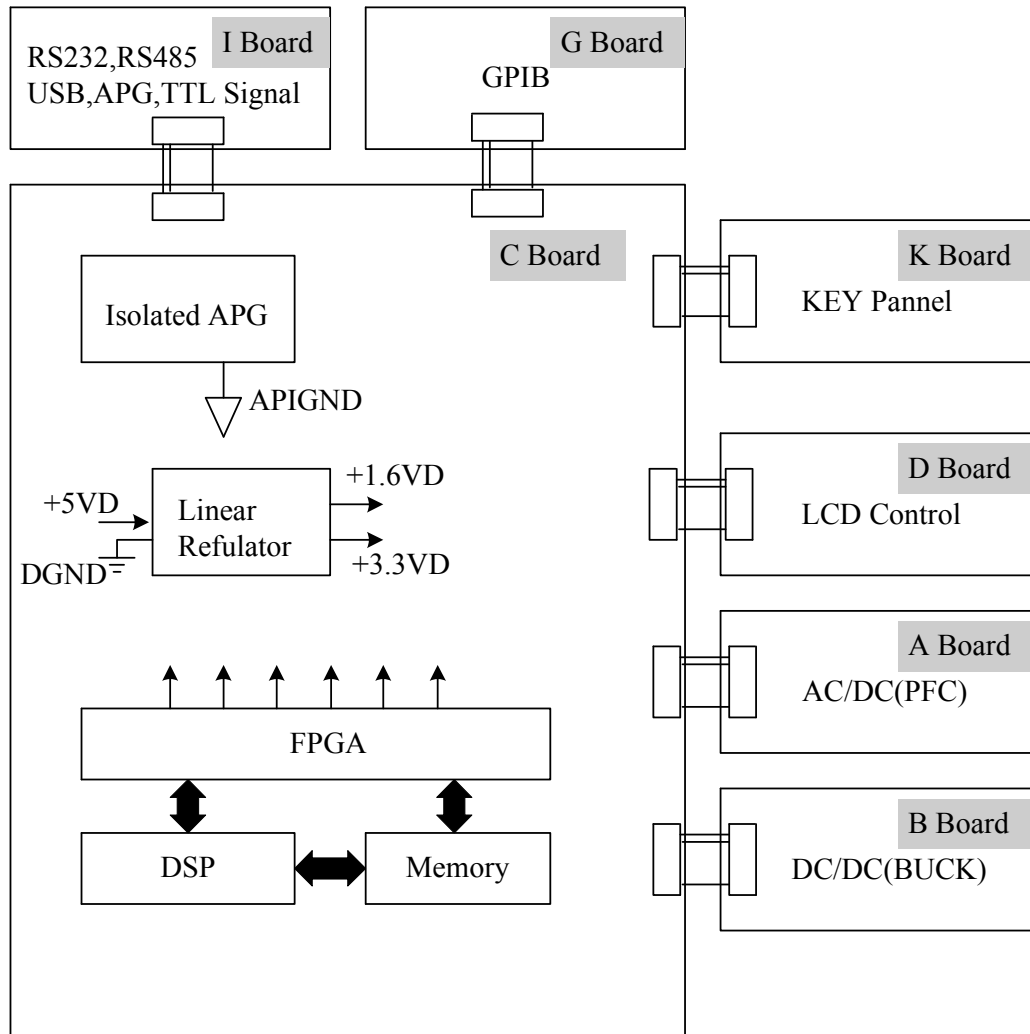


Figure 6-4

6.2 Function Description

6.2.1 I/P (PFC) Stage

1. The input stage is a bridge rectifier plus a boost converter with PFC function. The PWM IC is the UCC3854 of Unirode and controlled by the average current mode under the switch frequency of 30KHz.
2. The way input stage inhibits inrush current is to switch the relay to a series of 300~400Ω resistance during power-on to charge the PFC output capacitance. Turn on another relay after a few seconds and bypass this current limit resistance to enable UCC3854.
3. The PFC output has over voltage protection. When the output voltage is set too high, it will disable UCC3854 and send a signal back to the CPU to shutdown the system.

6.2.2 Auxiliary Power

1. The input terminal of auxiliary power, the AC source, (after EMI filter, but before PFC relay and fuse) goes through the bridge rectifier and passes the flyback converter to get the desired output voltage. The PWM IC used is Unitrode UC3845.
2. The output of auxiliary power is divided into three types of isolate power and they are named PGND, OGND and DGND based on their potential. The PGND is to input PFC and primary side reference potential of output stage, while OGND is the secondary side reference potential of the output stage and DGND is the reference potential of the digital signal and communication interface.

6.2.3 Output Stage

1. The output stage structure is a full bridge that uses Unitrode UC3525 as PWM IC and controlled under voltage mode.
2. There are two output modes – Constant Voltage (CV Mode) and Constant Current (CC Mode) that switch automatically according to load state.

In Constant Voltage mode, the following controls the IC detecting signal:

- (1) Output voltage;
- (2) The load actual voltage (remote sense) through the output line, in which the remote sense can be disconnected, but the accuracy will drop.

In Constant Current mode, the following controls the IC detecting signal:

- (1) Output current.

3. The secondary side is two stages, LC filter to lower down ripple voltage and ripple current.
4. The action of Dummy load is the Constant Current Source and the Dummy load current will adjust following the output voltage. Moreover, it will act if the programmed voltage is less than the present output. The output has OVP and when it exceeds the OVP voltage (12 bit DAC) set by the front panel, the output will be disabled.

6.2.4 Digital Circuit

1. The digital circuit control unit is composed of TI TMS320VC5501PGF300 with Lattice FPGA (LFXP6C3QN208CES).
2. The power source 3.3V required by FPGA is received from +5VD.
3. The DSP required 3.3V and 1.6V power is received from +5VD.
4. The signal of the analog program interface and digital circuit are isolated by the power source of +12VD with the free-run flyback converter and linear regulator.
5. The TTL output is +5V level and the internal digital signal is +3.3V level, therefore, there are actions for level change.

7. Self Test & Troubleshooting

7.1 Overview

Follow the actions described in this chapter to inspect the instrument and troubleshoot a problem when the 42000 Series DC Power Supply is operating abnormally. Please consult a sales agent or distributor if the information provided in this manual is unable to resolve the problem.

7.2 Troubleshooting

Operation problems and suggestions for resolution:

| Problem | Cause | Resolution |
|-------------------------------------|---|---|
| Bad measurement for V, I | Component Changes | It needs calibration. See section 3.3.7 Calibration. |
| Output is not within Accuracy SPEC. | Component Changes | It needs calibration. See section 3.3.7 Calibration. |
| Over Temperature Protection (OTP) | 1. The ambient temperature is too high. 2. The vent is blocked. | 1. Operate the instrument within the temperature of 0 ~ 40°C. 2. Clear the vent. |
| Over Power Protection (OPP) | The output power exceeded specifications. | Remove the over load or enlarge the OPP settings. |
| Over Current Protection (OCP) | The output current exceeded specifications or OCP settings. | Remove the over load or enlarge the OCP settings. |
| Fan Fail Protection (FAN LOCK) | 1. The fan is defective. 2. The feedback circuit is abnormal. | Consult a local sales agent if it is unable to reset to the protection state. |
| Input Error Protection 1 AC OFF | The voltage of AC input line is either too low or too high. | Adjust the voltage if it exceeds the specs when measuring the input voltage. |
| Input Error Protection 1 BUS_OVP | 1. The DC_BUS feedback is abnormal. 2. The control IC (UC3854) is out of order. 3. The AD power stage is damaged. | Consult a local sales agent if it is unable to reset to the protection state. |
| No output voltage | 1. The output voltage feedback is abnormal. 2. The D/D power stage is damaged. | Consult a local sales agent if it is unable to reset to the protection state. |

| Problem | Cause | Resolution |
|-------------------------|----------------------------|-------------------------|
| Over Voltage Protection | The output voltage exceeds | Check the OVP settings. |

| Problem | Cause | Resolution |
|--|--|---|
| (OVP) | the specifications or OVP settings. | Consult a local sales agent if it is unable to reset the protection state. |
| Series Fault Protection | The Current Sharing cable is connected in a series mode. | Remove the Current Sharing cable. |
| Unable to control DC Power Supply via GPIB | <ol style="list-style-type: none">1. The address of DC Power Supply is incorrect.2. The GPIB cable is loose and fallen at rear. | <ol style="list-style-type: none">1. Update the address.2. Check the cable connection and secure it with screws. |

Appendix A APG & System Status Pin Assignment

The 20-pin horizontal socket connector is located at rear panel in green.

| PIN No. | PIN Definition | PIN No. | PIN Definition |
|---------|-----------------|---------|----------------|
| 1 | +12VAPI | 11 | _FAULT |
| 2 | APIGND | 12 | TTL0 |
| 3 | AVO_SET | 13 | TTL1 |
| 4 | AIO_SET | 14 | TTL2 |
| 5 | AVO_MEAS | 15 | TTL3 |
| 6 | AIO_MEAS | 16 | TTL4 |
| 7 | SAFETY INT.LOCK | 17 | TTL5 |
| 8 | EXT. TRIGGER | 18 | TTL6 |
| 9 | _INHIBIT | 19 | TTL7 |
| 10 | DC_ON | 20 | DGND |

- (1) PIN 1: 12V auxiliary power; see section 3.3.1.3.
- (2) PIN 2: Ground of 12V auxiliary power; see section 3.3.1.3.
- (3) PIN 3: Voltage programming; see section 3.3.1.3.
- (4) PIN 4: Current programming; see section 3.3.1.3.
- (5) PIN 5: Voltage measurement; see section 3.3.1.3.
- (6) PIN 6: Current measurement; see section 3.3.1.3.
- (7) PIN 7: SAFETY INT.LOCK, see section 3.3.5.5.
- (8) PIN 8: External trigger signal of Program mode; see section 4.1.2.2.
- (9) PIN 9: When the voltage level of this pin turns to LOW, it inhibits the output of the DC Power Supply. When REMOTE INHIBIT is set to OFF, the pin is invalid and when REMOTE INHIBIT is set to TRIGGER, the low level triggers it, it equals pressing the “” key to set . When REMOTE INHIBIT is set to EXT. ON/OFF and the voltage level turns to LOW, it equals pressing the “” key to set . However, when the voltage level of this pin turns to HIGH the power supply returns to normal output. Figure A-1 shows the detail actions.
- (10) PIN 10: When the DC power supply output is ON and the voltage is over VDC_R, the pin10 DC_ON of SYSTEM STATUS on the device rear panel will turn to HIGH. When the DC power supply output voltage is lower than VDC_F setting, the pin10 DC_ON of SYSTEM STATUS on the device rear panel will turn to LOW.
- (11) PIN 11: When protection occurs as described in section 3.3.5, this will turn to LOW.
- (12) PIN 12: Bit 0 of TTL signal output; see section 3.3.2.5 for detail setting.
- (13) PIN 13: Bit 1 of TTL signal output; see section 3.3.2.5 for detail setting.
- (14) PIN 14: Bit 2 of TTL signal output; see section 3.3.2.5 for detail setting.
- (15) PIN 15: Bit 3 of TTL signal output; see section 3.3.2.5 for detail setting.
- (16) PIN 16: Bit 4 of TTL signal output; see section 3.3.2.5 for detail setting.
- (17) PIN 17: Bit 5 of TTL signal output; see section 3.3.2.5 for detail setting.
- (18) PIN 18: Bit 6 of TTL signal output; see section 3.3.2.5 for detail setting.

- (19) PIN 19: Bit 7 of TTL signal output; see section 3.3.2.5 for detail setting.
- (20) PIN 20: Ground of TTL (digital) signal.

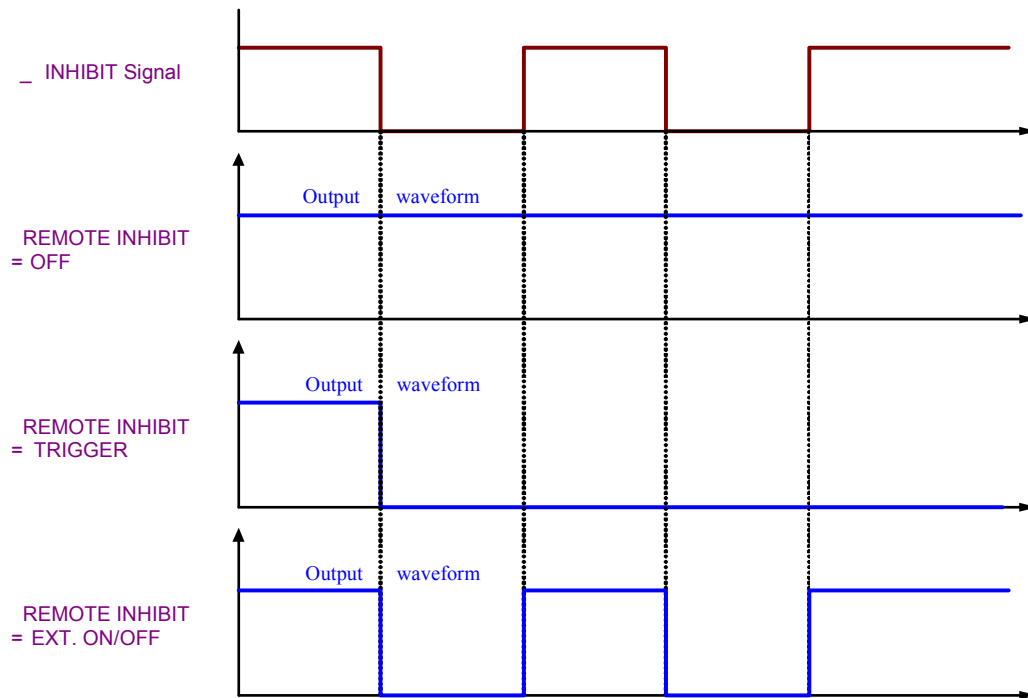


Figure A-1 Detail Actions of PIN9

Appendix B List of Protection

| Protection | Message on Panel | Protection | Message on Panel |
|--------------------------|------------------|----------------------------------|-------------------|
| Over voltage protect | OVP | Input voltage abnormal protect | AC FAULT |
| Over current protect | OCP | Input stage over voltage protect | BUS_OVP |
| Over power protect | OPP | Remote sense reverse protect | SENSE FAULT |
| Over temperature protect | OTP | CV TO CC mode change protect | CV TO CC FOLDBACK |
| Fan fail protect | FANLOCK | CC TO CV mode change protect | CC TO CV FOLDBACK |
| Series Fault Protect | SERIES FAULT | | |