

Model DH1715A Dual-Channel Regulated Voltage/Current Power Supply

User's Manual



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DESCRIPTION

The Model DH1715A Dual-Channel Regulated Voltage/Current Power Supply is an automatic switching type of high accuracy CV/CC power supply with a 3 ¹/₂ digits display meter on the front panel.

The output voltage and the output current can be displayed by ON /OFF switch on the front panel.

This instrument provides a preset circuit and an output switching circuit, the output switch is an electronic type, which does not generate chattering and noise. When the output switch is set to “OFF” state, the value indicated by the output voltmeter corresponds to the position of the voltage setting knob so as to preset the voltage.

Press “OUTPUT” switch, the output voltage is available from “OUTPUT” terminal.

This instrument has function of the remote-controlled voltage. The input socket on the rear panel is controlled remotely.

Please carefully read this instruction manual before use the power supply.

1. OPERATING FEATURES

Model		DH1715A-3 32V-2A	DH1715A-5 32V-3A
INPUT	Input Power Supply	220V±10% 50Hz±5%	
	Power Dissipation (200VAC),Rate Load	≤300VA	
OUTPUT	Output Voltage (10-turn)	0-32V	
	Theoretical Value of Voltage resolution	5mV	
	Output Current(1-turn)	0-2A	0-3A
CV FEATURE	Adj. Ratio	Source Effect (line regulation)(for 0-100% change of output current)	
		1×10 ⁻⁵ +1mV	
		Load Effect	
		1×10 ⁻⁵ +2mV	
		Ripple and Noise(5Hz-1MHz) r.m.s	
CC FEATURE		1mV	
		Type. Value of Temp. Coe.	
		2×10 ⁻⁴ ℃	
		Remote Control (Control Volt./Output Volt.)	
		about 10V/32V	
CC FEATURE	Adj. Ratio	Source Effect (line regulation)(for ±10% change of line volt)	
		2mA	
		Load Effect(load regulation) (for 0-100% change of load resistance)	
		10mA	
		Ripple and Noise (5Hz-1mHz) r.m.s	
CC FEATURE		1mA	
		Remote Control (Con. Voltage/Output Current)	
		about 10V/2A 10V/3A	
		CV Mode Indication	
		CC Mode Indication	
Operating Temperature Rang		0-40℃	
Relative Ambient Operating Humidity Range		20-90%RH	
Storage Temperature and Humidity Range		unforced air cooling	
Cooling Method		positive or negative grounded	
Polarity of Output Voltage			

Continue:

Model		DH1715A-3 32V-2A	DH1715A-5 32V-3A
DC VOLTMETER	Range Selection		
	Accuracy of Voltmeter	$\pm(0.5\%rdg + 3dpts, \text{ at } 20 \pm 2^{\circ}\text{C} \text{ and } < 80\%RH)$	
	Maximum Allowable Application Voltage		
DC AMMETER	Full Scale (Fixed Range)		
	Ammeter Accuracy(at $20 \pm 2^{\circ}\text{C}$ and $<80\%RH$)	$\pm 1rdg + 5dpts$	
	Temperature Coe.	$(+400 \times 10^{-6})/^{\circ}\text{C}$ full-scale + the accuracy mentioned above	
	Zero Drift	Not greater than 3dpts within $0-40^{\circ}\text{C}$	
Input Fuse		2A	
Output Fuse			
Weight		$\leq 8\text{kg}$	
External Dimensions		$305(L) \times 200(W) \times 170(H)\text{mm}$	
Reliability of the Instrument		MTBF (θ) ≥ 5000 hours	

2. OPERATING PRINCIPLE

The feature of this power supply is that the output voltage signal of constant Voltage circuit and the output current signal of constant current circuit both are applied to the “GATE” circuit at the same time. According to requirement of the load, the power supply is determined to operate in the CV mode or in the CC mode, the automatic switching of the regulated voltage and the regulated current can solve the problems of over—current protection of the regulated power supply and the over—voltage protection of the regulated current power supply.

CONTROL CIRCUIT: It is an adjustable reference voltage generator. The output current and voltage depend on setting the reference voltage.

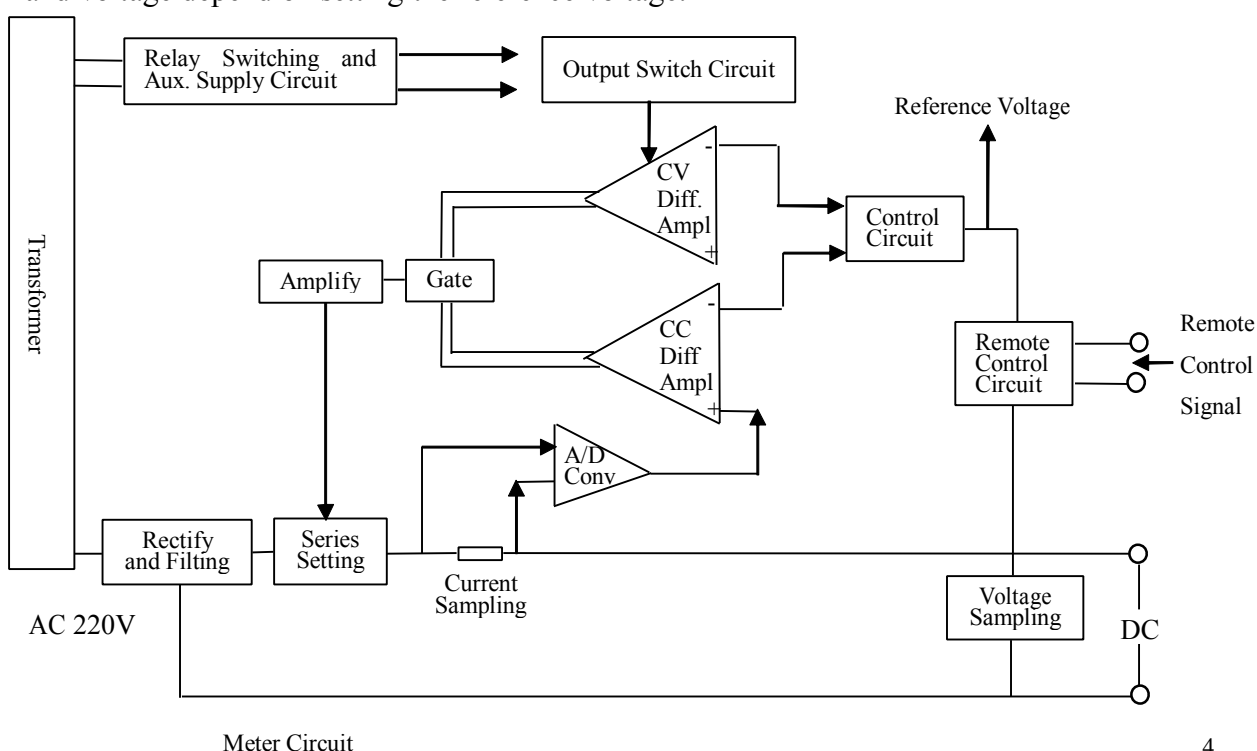


Figure 1

2.1 Description of Constant-Voltage Mode

The reference output voltage circuit is applied to the negative input terminal of a CV error amplifier, the error voltage from the voltage sampling resistor is applied to the positive input terminal of the CV error amplifier. The error signals of both voltages are compared each other and via the gate circuit by amplify then applied to the base of a regulated tube. The base current of the regulator tube is changed, then a stabilized output voltage can be obtained, the adjustment of the output voltage is realized by setting the voltage potentiometer on the front panel.

2.2 Description of Constant-Current Mode

The reference voltage from the control circuit is applied to the negative input terminal of a CC error amplifier, the current signal from A/V conversion is applied to the positive input terminal of the CC error amplifier. Both signals are compared each other and then amplified to control the base voltage of the regulator tube to reach a stable current output.

2.3 CV/CC Conversion-CV mode into CC mode

Setting CC potentiometer, a preset current value is provided as required, the resistor load is reduced, the output current is increased. When the output current reaches the preset constant - current value, the output voltage is reduced. When the power supply is power supply is operating in the constant-current mode, even of the resistor load value is reduced to zero(in short circuit state), the output current can not be increased, it always keeps pre-setting value constantly; that means this instrument can automatically be converted from constant-voltage mode to constant current mode so as to protect the load from over-current. It is an automatic CV/CC crossover system type of power supply.

The Figure 2 shows operating points and operating domain related to the load lines. The preset output voltage is 10V, the limited current is 2A, the operating point in non--load is at A, when $R_L=10\ \Omega$, operating point B, and when $R_L=5\ \Omega$, operating point is at C. The operating point moves from C to D ,if the resistor load is reduced from $R_L=5\ \Omega$ to $2.5\ \Omega$,the instrument operation is changed from the constant-voltage domain into the constant—current domain. Point C is called “ Crossover Point” owing to change modes. Wen the resistor load (R_L) is $2.5\ \Omega$, the output voltage is $I \cdot R_L=2 \times 2.5=5V$.

2.4 CC/CV Conversion-Constant Current Mode into Constant-Voltage Mode

Setting CV potentiometer, a preset value applied as required. When the output voltage reaches the preset constant voltage value, then output current is reduced.

When the output current is 2A the resistor load is $0\ \Omega$, operating point is E. While the resistor load is increased to $2.5\ \Omega$, the operating point moves from E to D. When the operating point is increased to $5\ \Omega$, the operating point moves from D to C. While the resistor load further is increased to $10\ \Omega$, the operating point moves from C to B. In this case, the instrument is converted to the constant-voltage domain. When the resistor load is increased continuously to an open circuit, the operating point moves from B to A . Generally, the voltage applied to the load is not more than the preset voltage. The instrument can convert from the CC mode to the V mode in order to protect the load. The point C serves as a crossover point.

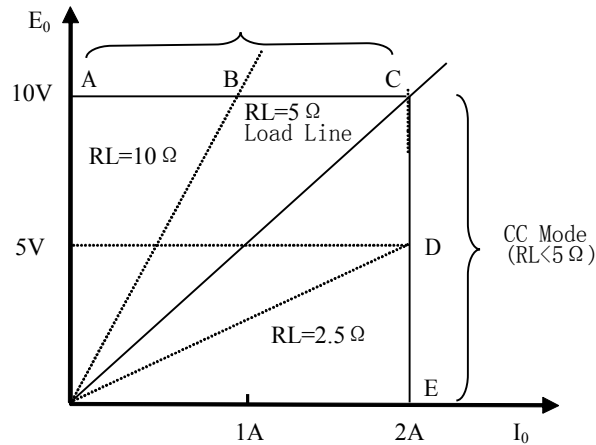


Figure 2

2.5 Output Switching Circuit

This instrument provides a special output switch, the output voltage can be preset as required before the switch is unpressed. After the voltage is adjusted, press the switch. This switch is an uncontacted electricity type of switch so it does not generate a mechanical spark, protecting users' safety.

2.6 Digital Display

Model TY-43 digital meter adopts LED digital tube as display unit. At least, one or two digits generated by the display may flicker. It is not caused by the waveform or noise of output, while by characteristics of the A/D convertor.

When there is no input voltage, the display will be recovered to zero automatically. When the input voltage is inverse, “-” polarity will be displayed automatically. When the operating voltage is 5V, its input sensitivity is $DC \pm 199.9mV$ of full-scale.

3. STRUCTURE FEATURES

The instrument is designed symmetrically between left and right on the front panel. On the upper side, there are two digital meters. A switch for output in the middle of the panel is mounted. There are four knobs in line as voltage potentiometer of each circuit, and current setting potentiometers for each way. The two external sockets are mounted in the middle or lower part of the panel and at the bottom of the panel there are a pair of output binding posts and a screw grounded with a short bar. When “+” or “-” to ground is needed, we can connect the short bar.

At the lowest bottom of the instrument's back, there are one power cord and two pairs of input sockets for the remote-control signal corresponding to the two ways on the front panel. There are L/R (local/remote control) and V/C (voltage/current control) operating selector switches, respectively. The input fuses both are mounted on the rear panel of the instrument.

4. APPLICATIONS

4.1 Before operation, should check L/R (local/remote control) selector whether on its right position or not, otherwise it doesn't operate, generally it is at L position.

4.2 Turn on the power supply, press the “V” button by adjusting the voltage setting

potentiometer to a required voltage value and then press the “OUTPUT” button. While the voltage is available at the binding post, at the moment, the constant-voltage mode starts operating. If the voltage value drops, in this case the instrument is in constant-current Mode, should set the CC setting potentiometer to the extreme position clockwise.

4.3 Preset a constant-current point and set the output current of the unit. By above, mentioned method, after the constant-voltage point is set, press the “A” button and output terminal is shorted, turn on the “OUTPUT” switch. After the current setting potentiometer is set to the required value.

To keep the voltage position, turn off the “OUTPUT” switch and remove the short bar, connect the load, press the “ OUTPUT” switch, the instrument provides the required current and voltage for the load.

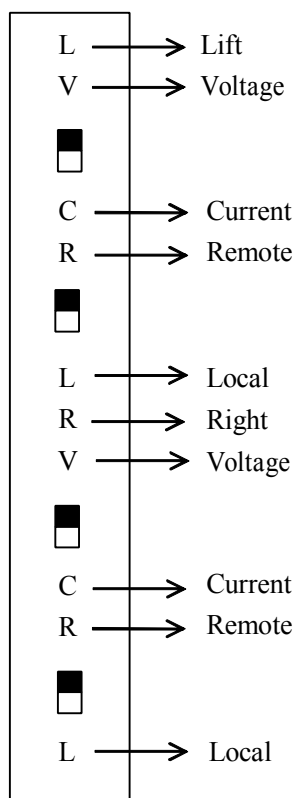


Figure 3

4.4 When turn off the power supply, first should turn off the “OUTPUT” switch, then turn off the “POWER” switch.

4.5 Remote-Control CV Output

The output voltage can be controlled by an external voltage of 0–10V.

As the external control signal, its common terminal is a “+” n output terminal.

4.5.1 Turn on the R/L (remote/local) selector switch to R position.

Turn on the V/C (voltage/current) selector switch to V position.

4.5.2 Turn on the “POWER” switch and the “OUTPUT” switch, the external control voltage is applied through the jack on the rear panel of the unit. Adjust “VOLTAGE” switch of the potentiometer to the extreme position clockwise, adjust the external control voltage so that the output voltage becomes the desired voltage.

The relationships between the output voltage (E_o) and the external control voltage (E_i) is expressed as follows:

$$E_o = 1/10 E_{max} \cdot E_1 \cdot \alpha \text{ (V)}$$

Where E_m : Maximum rated voltage (V)

E_1 : External control voltage signal (V)

$$0V \leq E_1 \leq 10V$$

Term α is factor of 0-1 which depends on the “voltage” setting potentiometer. Factor is 1 when “VOLTAGE” voltage setting potentiometer is set to the extreme positions clockwise. Factor is 0 when both potentiometers are set to the extreme positions counterclockwise. It is used to select the ratio of the output voltage (E_o) with respect to the external control voltage signal (E_1). Normally, it is adjusted to the maximum voltage.

NOTE 1: The voltage of the common line of the external control voltage signal (E_1) becomes that of the “+” output terminal.

NOTE 2: The input impedance across remote control input jack is approximately $20K \Omega$. The ripple may be amplified and conveyed to the output loop circuit.

NOTE 3: To feed the external control voltage signal, a shielded cable (or a pair of stranded wires) is used and the shielding wire is connected to the “+” output terminal. When the wiring distance is very long, should prove a full protection against noise.

NOTE 4: When the R/L (remote/local) switch is thrown to the L position, the output voltage can be controlled with the voltage setting potentiometer manually on the front panel.

NOTE 5: Make sure that the output voltage is within the rated output voltage of the instrument.

4.6 Remote Control Constant-Current Mode

The output current can be controlled by the external control voltage signal

4.6.1 Turn on the V/C (voltage/current) selector switch to C position.

4.6.2 The external control voltage signal is applied to the “INPUT” jack which is on the rear panel of the instrument. Please note the polarities of “+” and “-”.

4.6.3 Throw the R/L-switch to R (remote control) position.

4.6.4 Turn on the power supply and output switch, then the output terminal is shorted, set the current setting potentiometer mounted on the front panel to obtain the required output current which is 10V at E_2 .

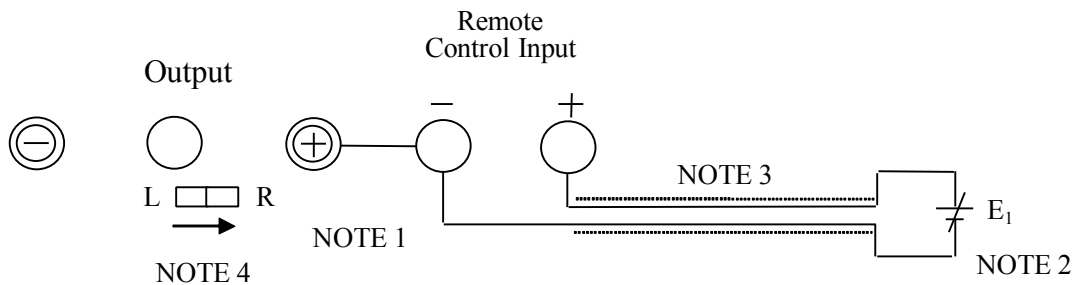


Figure 4

The relationships between the external control voltage signal E_2 and the output current I_0 can be expressed as follows:

$$I_0 = 1/10 \cdot I_{max} \cdot E_2 \cdot \beta \text{ (A)}$$

where: I_{max} - Maximum rated current (A)

E_2 - External control voltage (V)

$$0(V) \leq E_2 \leq 10(V)$$

Range of β is 0–1 which depends on the current setting potentiometer, when it is turned to the extreme position clockwise, β is 1, while it is turned to the extreme position counterclockwise, β is 0. Within the range of the factor, by adjusting the external control signal (E_2) can perform the proportional relation of the setting output current I_0 .

NOTE 1: For wiring of the external control voltage signal, use a shielded cable (or a pair of stranded wires).

NOTE 2: When the R/L-switch is thrown to L (local) position, the output current can be controlled by the current setting potentiometer on the front panel manually.

NOTE 3: Pay attention to that the output current does not exceed the rated current, be sure to disconnect the short bar on the front panel.

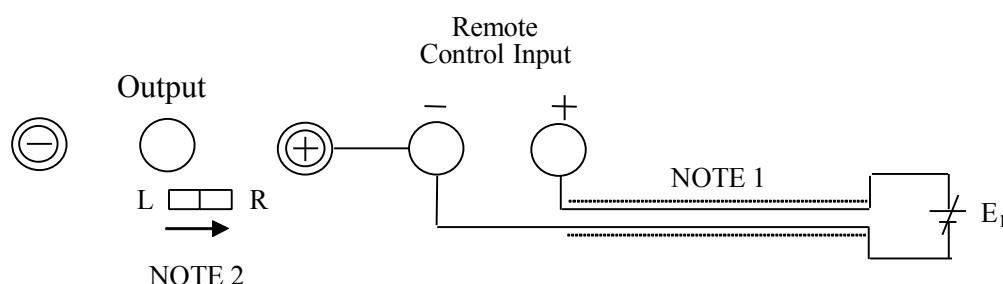


Figure 5

4.7 Series Operation

To obtain a higher voltage, two or more instruments can be connected in series. In order to eliminate potential difference among the chassis of units being due to connecting in series, disconnect the ground bars of the units and connect the ground terminals together to the same potential as required.

ATTENTION: The total series voltage should not exceed 200V.

4.8 Parallel Operation

In order to obtain a large output current, two or more instruments can be connected in parallel, then adjust their output voltage to the same voltage level. If differences of the output voltage appear, the current initially is fed by the unit which is set at the highest voltage. When the load current becomes more, it will be converted to constant current operating mode, in this case, the output voltage will be reduced. In this moment, the power supply with the higher output voltage will start operation. The total output current of the instrument is the sum of current of each unit.

NOTE 1: Pay attention that the output voltage of each unit does not exceed the rated voltage.

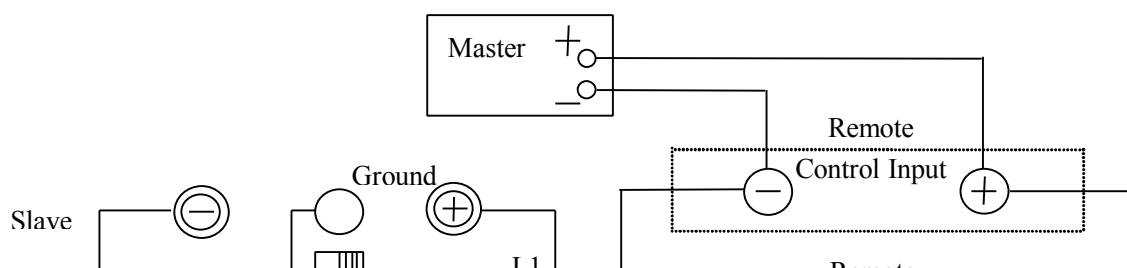
NOTE 2: For the instrument, the output voltage setting is too low, the current of several milliamperes will flow in the reverse direction.

4.9 Parallel Operation of Single Unit

In order to increase current capacity, a master unit is used to control several slave units remotely.

Method is the same as Section 4.6 Remote-control CC Mode

The output of the master unit (power supply) is 0–10V controlled voltage. The slave units are operating in remote-control constant-current mode



4.9.1 Each slave unit should be previously connected with the master unit in remote control CC operation, and then adjust the current setting potentiometer to the extreme position, making factor $\alpha = 1$. If differences of the slave unit appear, should trim the current setting potentiometer.

4.9.2 Connect the output terminals of all units to the load, using wires of same gauge and the same length.

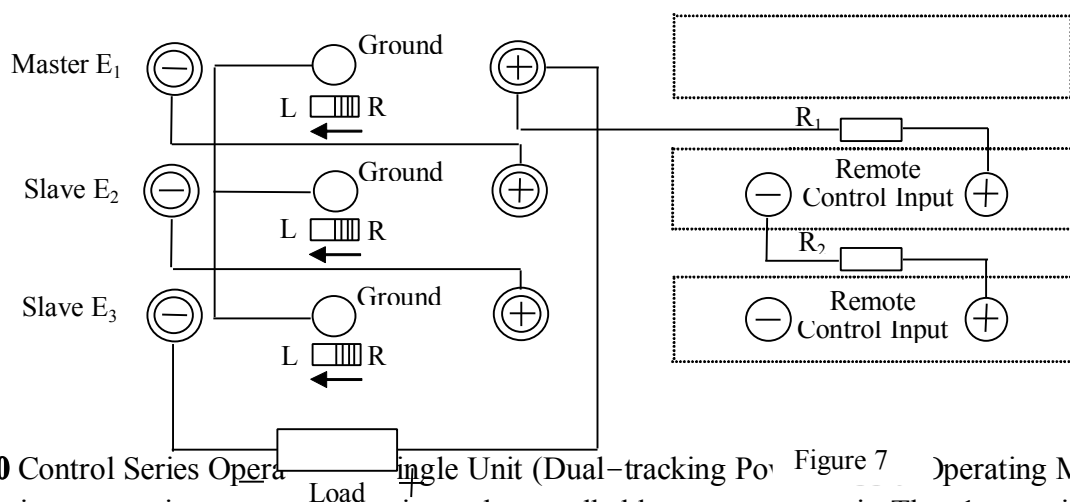
Note that the current distribution may ununiform unless the potential different between the “+” output terminals of the instruments and the “+” terminal of the load are the same. The slave units are connected in parallel as shown in Fig. 6.

4.9.3 Throw R/L switch to R position. The current setting potentiometer is set to the extreme position

4.9.4 Turn on the “OUTPUT” switches of all slave units.

4.9.5 Turn on the “OUTPUT” switch of the master unit and adjust the control voltage ($<10V$).

NOTE 1: All the parallel slave units must be the same types.



4.10 Control Series Operation Single Unit (Dual-tracking Power Figure 7 Operating Mode).

The instrument is connected in series and controlled by one master unit. The slave units can be controlled to increase the output voltage of the setup (uppermost one of the instrument

connected in series operates as the master unit).

4.10.1 Except that the master unit is operating in “L” (local) state, all the slave units are in the state of the output voltage controlled by the external voltage signal, that means the master unit’s R/L (remote/local) selector switch is thrown to “L” position, while the switch of the slave unit is turned to “R” position. V/C (voltage/current) selector switch is thrown to “V” position.

4.10.2 All the output terminals of the power supply are in series connection shown Fig8.

4.10.3 On the top of the Figure is a master unit. Resistor R1 is connected to “+” output terminal of the uppermost unit and the remote-control input jack of the first slave unit. Resistor R2 is connected between the remote control “-” input terminal of the first slave unit and the remote-control “+” input jack Of the second slave unit.

4.10.4 The voltage setting potentiometer and current setting potentiometer are turned to the extreme positions of each slave unit clockwise.

4.10.5 All the “GROUND” terminals of the instrument are connected to one common line which is connected to a potential line as required.

4.10.6 Turn on both “POWER” and “OUTUPUT” switches of the master unit and the slave unit.

NOTE: (1) For the remote-control operation, it is necessary to control the master unit only.

(2) Position of limiting current of all units must be preset previously.

(3) Calculation of resistors $R_1(R_2)$.

$$R_1 = E_1/E_2 \times A - 10K \Omega$$

$$\text{where: } R_1 \geq 0 \quad \text{or} \quad E_2 \leq A/10 \times E_1$$

$R_1(R_2)$ externally connected resistor (K Ω)

E_1 : Output voltage of the master unit (V)

E_2 : Output voltage of the slave unit 2 (V)

If $E_1 = E_2 = E_3$, then $R_1 = R_2$

(5) Maintenance of the Instrument

Rated Voltage			32V System
Coefficient A			32

5. MAINTENANCE

5.1 Inspection

Inspect the instrument at regular intervals so that it maintains its initial performance for a certain period.

5.2 Removing Dust and Dirt and Clean Treatment

When the panel has become dirty, wipe it lightly with a cloth moistured and a neutral soapsud, and then wipe it with a clean dry cloth. For cleaning the inside of the instrument, remove dust from the inside of the case and ventilation holes of the cover by using a compressed air or the exhaust air of a vacuum cleaner. Be carefully when cleaning dust of the digital meter and always keeping it cleaning.

5.3 Adjustment and Calibration of the Meter

RV1: Voltmeter calibration potentiometer for voltage precision.

- RV2: Maximum voltage setting potentiometer
RV3: Maximum current setting potentiometer
RV4: Maximum current setting potentiometer for voltage presetting
RV5: Ammeter zero-setting potentiometer
RV6: Current meter calibration potentiometer for current precision

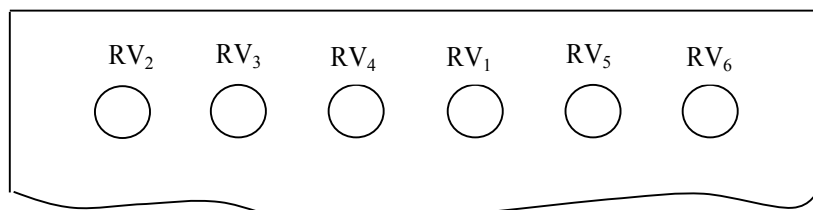


Figure 8

5.4 Calibration of Voltage Indication

- (1) Connect a digital voltmeter with accuracy $\geq 0.05\%$ to the output terminal. Turn on “OUTPUT” switch, adjust the output voltage to 17.50V.
- (2) Adjust potentiometer RV4 so that the digital meter indicates approximately the same voltage.

5.5 Calibration of Ammeter

- (1) Press A button (ammeter) switch and turn off “OUTPUT” switch.
- (2) Adjust potentiometer RVs so that the digital meter shows 0A (zero amperes)
- (3) Connect an ammeter with accuracy $\geq 0.2\%$ to the output terminal, turn on OUTPUT switch, and feed the current, after feeding the current for approximately 20 minutes, calibrate the output current with potentiometer RV6 so the indication on the digital meter is the same as the standard ammeter.

5.6 Adjustment of Maximum Variable CV Range

- (1) Press V (Voltmeter) switch and turn on “OUTPUT” switch.
- (2) Turn voltage setting potentiometers to the extreme position clockwise, adjust potentiometer RV2, so that the output voltage becomes E_0 (maximum voltage) as specified.

5.7 Adjustment of Maximum Variable CC Range.

- (1) Connect an ammeter with approximately accuracy of 0.5% to the output terminal.
- (2) Set the potentiometers to the extreme positions clockwise, adjust potentiometer RV3 so that the output current becomes I_0 (maximum current), refer to table 2.

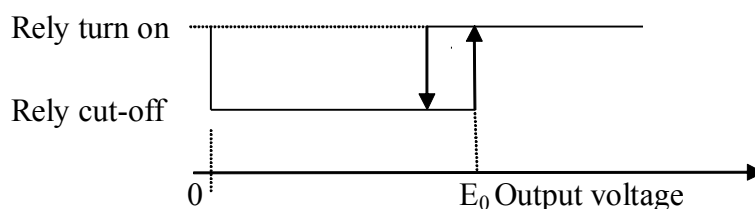


Figure 8

5.8 Calibration of Digital Meter

Press down the output switch, check the voltage accuracy in the subranges of 2V, 20V, and set RV1 to required specifications.

Table 2.

Model	DH1715A-3 32V~2A	DH1715A-5 32V~3A
Adjustment		
Calibrated. Standard Ammeter I_1	2A	3A
Max. Variable CV Setting Range E_0 (max.)	33.3V	33.3V
Max. Variable CV Setting Range I_0 (max.)	2.10A	3.15A
setting of Relay Switch Circuit	20V,10.5V	20V,10.5V

5.9 Failure and Cause

5.9.1 Without Voltage Output

- (1) The $\pm 15V$ Aux. Power supply does not work.
- (2) The Local/Remote (R/L) switch position is not correct.
- (3) The output switch is not turned on.

5.9.2 The output voltage can not be set up to the required value.

- (1) The CC point is turned to low, it should be turned to higher.
- (2) The output terminal has been shorted.
- (3) On the PC boards Q_1 or Q_2 may be damaged.

5.9.3 Unstable Operation

- (1) $\pm 15V$ voltage of the aux. Power supply does not stabilize.
- (2) V_3 or V_4 on the PC board does not operate normally

5.10 Normal Operating Voltage of the Instrument

The “+” output terminal is a reference point when the instrument is measured.

5.10.1 The voltage of the aux. power supply is $\pm 15V$.

5.10.2 The voltage of each measured point on the PC board.

$$V_2 = 6.1V$$

$$REFV = 0 \sim 10V$$

$$REFC = 0 \sim 10V$$

$$CCAMP = 0 \sim 10V$$

When operating in CV mode:

$$C.V = 0 \sim 4V \quad C.c = +14V$$

When operating in CC mode:

$$C.V = +14V \quad C.c = 0 \sim 4V$$

6. COMPLETENESS OF THE INSTRUMENT

The instrument suite includes:

- | | |
|--------------------------------------------|-------|
| (1) DH1715A master unit | 1 set |
| (2) Cartridge fuse BGxP $\Phi 5 \times 20$ | |
| Input fuse 2A | 2 |
| (3) Instrument Manual | 2 |

Model	DH1715A-3	DH1715A-5
Specs of fuse	2A	2.5A

7. STORAGE

The instrument should be save up in a ventilated room where the ambient temperature is 5–

45°C, RH \leq 90% and dew is not allowed. These conditions are needed to protect the liquid crystal display, in addition, keep the instrument from smoke, gas, acid, alkaline and other corrosive materials, be sure not to place the instrument in high temperature and more dust place so as to keep the instrument clean. After delivery within 18 months, if the users abide by the regulations of transportation, storage and operation regulation, and the quality is below the specification, our company take responsible for free repair or replace a new one.