

7651 Programmable DC Source



7651
213 × 88 × 350 mm 3.6 kg
(8-7/16 × 3-1/2 × 13-13/16" 7.92 lbs)

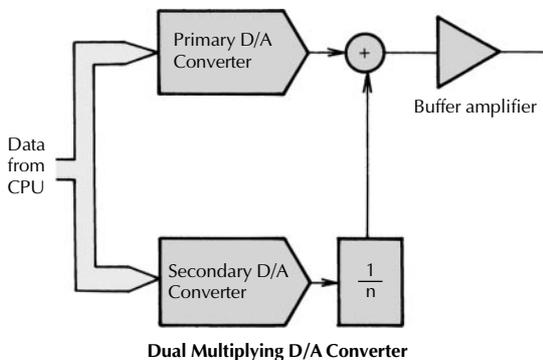
The 7651 is a general-purpose DC source developed on YOKOGAWA's state-of-the-art DC standard technology. The dual multiplying D/A converter has enabled the compatibility of high-speed response and high resolution. The 7651 also provides high accuracy and stability. In addition to the source function (current supply), the sink function (current absorption) is also available, so the 7651 can be used as not only DC voltage/current source but also high-precision electronic load. Further, a series of powerful functions to meet the system use such as the programming function up to 50 steps, the IC memory card capable of storing 7 patterns of programs, and GP-IB interface are provided as standard.

This 7651 can be used for a wide range of fields from R & D to production line, service and maintenance.

FEATURES

● High Precision Output

- High accuracy : $\pm 0.01\%$ of setting $\pm 200 \mu\text{V}$
(10 V range, 90 days, $23 \pm 5^\circ\text{C}$)
- $\pm 0.02\%$ of setting $\pm 100 \text{nA}$
(1 mA range, 90 days, $23 \pm 5^\circ\text{C}$)
- High resolution : 100 nV (DC V, 10 mV range)
- High-speed response : 10 ms/ $\pm 0.1\%$
- Low noise : 15 $\mu\text{Vp-p}$ (1 V range, DC to 10 Hz)

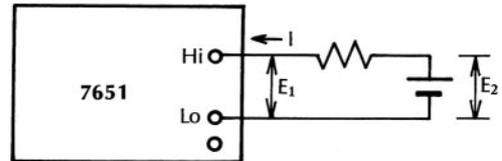


The 7651 uses multiplying D/A converter technology. Extremely high resolution is realized through the use of dual digital to analog converters. In addition, the linearity is further enhanced by software driven compensation technique. Superior output with high accuracy is assured in all the ranges.

● Sink and Source Capability

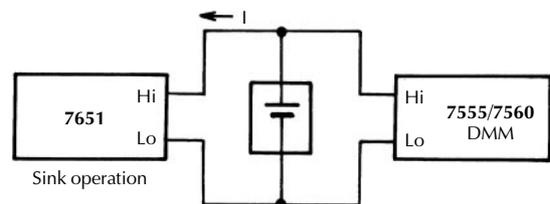
Conventional DC sources usually have the function of power supply (source) only without power absorption (sink) function. In addition to the source function, the sink is available, so the 7651 can be used for the discharge characteristics of batteries or the output characteristics of power supply as a constant current electronic load.

Further, the 4-quadrant operation becomes available by sink and source function, so both capacitive and inductive loads can be driven by the 7651.



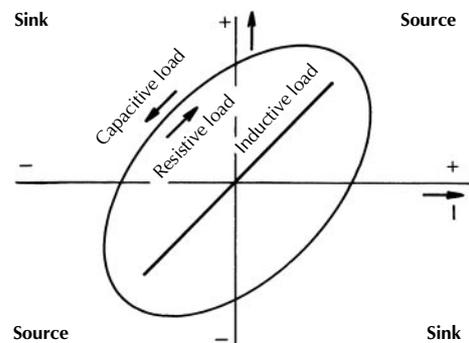
$E_1 \rightarrow E_2$ sink operation. The generation of constant voltage is possible even with active load.

As a Reliable Constant Voltage Source



Constant current discharge characteristics

Discharge Characteristics Test of Battery

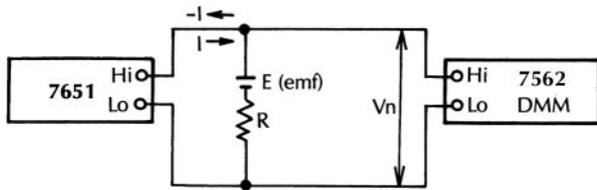


4-quadrant Operation

● Bipolar Output, Glitchless

The bipolar output of the 7651 executes polarity switching without using mechanical contact, so any abnormal voltage or current is not generated at the polarity switching. Because of this feature, true continuous output change from the negative maximum output to the positive maximum output becomes possible. An evaluation of zero cross comparator or polarity switching for the cancellation of emf in experiments of solid-state physics can easily be made.

A glitch is not generated at the change of voltage or current in the same range.



$$V_1 = I \cdot R + E$$

$$V_2 = -I \cdot R + E$$

$$\therefore V_1 - V_2 = 2I \cdot R$$

Resistance Measurement of Superconductivity

● Programming Function and IC Memory Card

FUNCTIONS

■ EASY-TO-OPERATE DESIGN

● Two Types of Data Setting Mode

- You can select the following two types of data setting mode in accordance with your application.
- Continuous variable mode The setting is made on each digit by depressing the corresponding up/down key. When you continue depressing the up/down key, the output value changes continuously.
- Data mode ... The setting data are directly entered by ten-key.

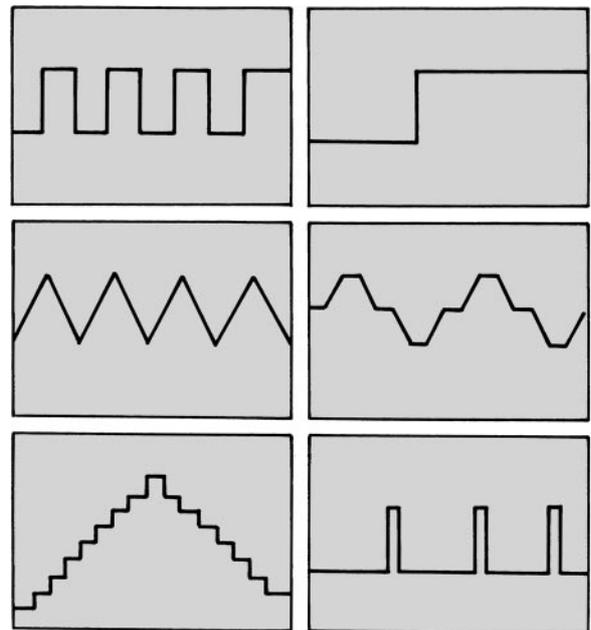


■ PROGRAMMING FUNCTION: 50-STEP OUTPUT DATA CAN BE STORED.

Up to 50 steps of output data can be saved. In addition to setting of generation interval, sweep time can also be set, and various output patterns including step response, ramp response, and triangle waveform can be generated by combining these capabilities. Up to 7 output patterns can be stored in the IC memory card. The memory card is a convenient method for providing a variety of generation patterns.

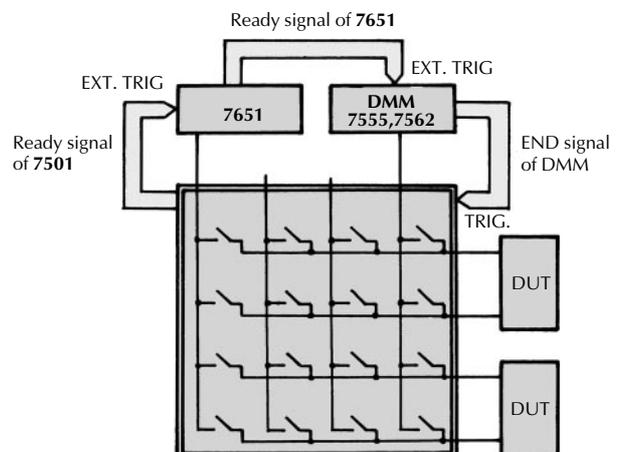
Programming setting

- Manual setting ... by panel key operations
- Remote setting ... by GP-IB interface.
- AUTO LOAD setting ... the memory contents are automatically read and programmings are set at power ON.



Examples of Output Pattern by Program Setting

By combining the programming function of the 7651 with the DMM and 7501 programmable scanner, multi-channel measurement can easily be performed.

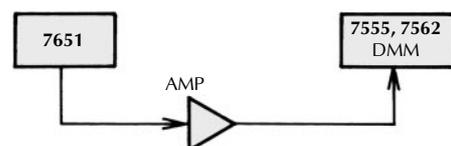


7501 Programmable Scanner

Example of Multi-channel Measurement System

Evaluation test of amplifier DC characteristics can be made by supplying input signal to the amplifier from the 7651 and reading output of the amplifier by the DMM.

The efficiency of measurement will be improved by utilizing the programming function.



Example of Amplifier Characteristics Evaluation Test

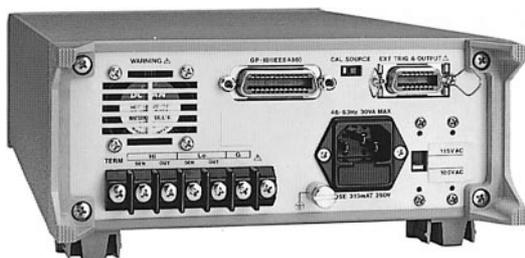
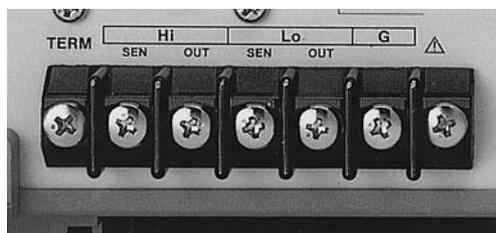
PROGRAMMABLE DC SOURCE



7651

● Output from the Front or Rear is Selectable

In addition to the front output terminal model, the 7651 includes the rear output terminal model. This allows the use of the 7651 where mounted on a bench or on a rack.



● Programmable Voltage/Current Limiter

Limiting point is programmable within the range of 1 to 30 V as the voltage limiter, and within the range of 5 to 120 mA as the current limiter.

Even if the limiter is actuated by overload or short-circuit of output and so on, the 7651 automatically recovers from limit to normal state by removing the overload.

● Calibration Function

Calibration software is integrated in the 7651, and calibration is executed by the key operation on the front panel or through communication without opening the case. So, anyone can maintain the accuracy of the 7651 without difficulty by its calibration function.

● GP-IB Interface (Standard)

The GP-IB interface can be selected according to your system needs. The following functions are available through these interfaces.

- Functions executed by panel key operation
- Setting data output
- Panel set data output
- Program step setting/reading
- Status byte output

SPECIFICATIONS

■ DC VOLTAGE (DC V)

| Range | Maximum Output | Resolution | Stability (24 h) ±(% of setting + μV) | Stability (90 days) ±(% of setting + μV) | Accuracy (90 days) ±(% of setting + μV) | Accuracy (1 year) ±(% of setting + μV) | Temperature Coefficient ±(% of setting + μV)/°C |
|--------|----------------|------------|--|---|--|---|--|
| 10 mV | ±12.0000 mV | 100 nV | 0.002 + 3 | 0.014 + 4 | 0.018 + 4 | 0.025 + 5 | 0.0018 + 0.7 |
| 100 mV | ±120.000 mV | 1 μV | 0.003 + 3 | 0.014 + 5 | 0.018 + 10 | 0.025 + 10 | 0.0018 + 0.7 |
| 1 V | ±1.20000 V | 10 μV | 0.001 + 10 | 0.008 + 50 | 0.01 + 100 | 0.016 + 120 | 0.0009 + 7 |
| 10 V | ±12.0000 V | 100 μV | 0.001 + 20 | 0.008 + 100 | 0.01 + 200 | 0.016 + 240 | 0.0008 + 10 |
| 30 V | ±32.000 V | 1 mV | 0.001 + 50 | 0.008 + 200 | 0.01 + 500 | 0.016 + 600 | 0.0008 + 30 |

The stability (24 h) is the value at 23 ± 1°C. The stability (90 days), accuracy (90 days) and accuracy (1 year) are values at 23 ± 5°C. The temperature coefficient is the value at 5 to 18°C and 28 to 40°C.

| Range | Maximum Output Current | Output Resistance | Output Noise | |
|--------|------------------------|-------------------|--------------|-------------------------------|
| | | | DC to 10 Hz | DC to 10 kHz (Reference Data) |
| 10 mV | — | approx. 2 Ω | 3 μVp-p | 30 μVp-p |
| 100 mV | — | approx. 2 Ω | 5 μVp-p | 30 μVp-p |
| 1 V | ± 120 mA | less than 2 mΩ | 15 μVp-p | 60 μVp-p |
| 10 V | ± 120 mA | less than 2 mΩ | 50 μVp-p | 100 μVp-p |
| 30 V | ± 120 mA | less than 2 mΩ | 150 μVp-p | 200 μVp-p |

Common mode rejection:
120 dB or more (DC, 50/60 Hz).

■ DC CURRENT (DC A)

| Range | Maximum Output | Resolution | Stability (24 h) ±(% of setting + μA) | Stability (90 days) ±(% of setting + μA) | Accuracy (90 days) ±(% of setting + μA) | Accuracy (1 year) ±(% of setting + μA) | Temperature Coefficient ±(% of setting + μA)/°C |
|--------|----------------|------------|--|---|--|---|--|
| 1 mA | ±1.20000 mA | 10 nA | 0.0015 + 0.03 | 0.016 + 0.1 | 0.02 + 0.1 | 0.03 + 0.1 | 0.0015 + 0.01 |
| 10 mA | ±12.0000 mA | 100 nA | 0.0015 + 0.3 | 0.016 + 0.5 | 0.02 + 0.5 | 0.03 + 0.5 | 0.0015 + 0.1 |
| 100 mA | ±120.000 mA | 1 μA | 0.004 + 3 | 0.016 + 5 | 0.02 + 5 | 0.03 + 5 | 0.002 + 1 |

The stability (24 h) is the value at 23 ± 1°C. The stability (90 days), accuracy (90 days) and accuracy (1 year) are values at 23 ± 5°C. The temperature coefficient is the value at 5 to 18°C and 28 to 40°C.

| Range | Maximum Output Voltage | Output Resistance | Output Noise | |
|--------|------------------------|-------------------|--------------|-------------------------------|
| | | | DC to 10 Hz | DC to 10 kHz (Reference Data) |
| 1 mA | ±30 V | more than 100 MΩ | 0.02 μAp-p | 0.1 μAp-p |
| 10 mA | ±30 V | more than 100 MΩ | 0.2 μAp-p | 0.3 μAp-p |
| 100 mA | ±30 V | more than 10 MΩ | 2 μAp-p | 3 μAp-p |

Common mode rejection:
100 nA/V or more (DC, 50/60 Hz).

PROGRAMMABLE DC SOURCE



7651

- **Response Time**
- **Delay time:** Approx. 10 ms (For the fixed range).
- **Response time:** Less than 10 ms to within $\pm 0.1\%$ of set value, at the max. output and max. load, without actuation of limiter, with resistive load.

● **Limiter**

| | Current limiter | Voltage limiter | |
|-----------------|-----------------|-----------------|-------------------|
| Current limiter | 5 to 120 mA | 1 mA | At voltage output |
| Voltage limiter | 1 to 30 V | 1 V | At current output |

After limiter actuation, automatic recovery from limit status is executed by removal of overload.

● **Data Setting**

- Continuous variable mode (set by each digit by up/down keys)
- Data mode (set directly by ten-key)

● **Interface Function**

● **GP-IB interface:**

Electrical and mechanical specifications: Conforms to IEEE Std 488-1978

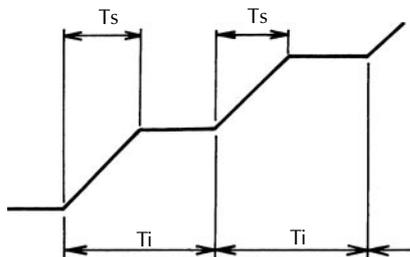
Interface function & identification: SH1, AH1, T6, L4, SR1, RL1, PP0, DC1, DT1, C0

Address mode: Address setting, Header ON/OFF are settable

● **Programming Function**

- **Internal memories:** Stores settings up to 50 steps
- **IC memory card:** Stores 7 patterns of programs, each program can store settings up to 50 steps (IC memory cards; 8K bytes, optional)
- Program actuation by external trigger
- Interval time/sweep time (by each pattern)

| | Setting Range | Resolution |
|--------------------|---------------|------------|
| Interval time (Ti) | 100 ms to 1 h | 100 ms |
| Sweep time (Ts) | 0 to 1 h | 100 ms |



● **Execution mode:**

- SINGLE ... Executes programmed pattern only once
- REPEAT ... Repeats the execution of programmed pattern

● **External Trigger**

- Signal steps actuation of program can be executed by external trigger.
- Ready output: Suitable for system use

■ **GENERAL SPECIFICATIONS**

Operating Principle: Multiplication type dual D/A conversion
Output Setting: +120,000 (setting range), continuous variable mode, data mode

Display: 7-segment LED

Unit Indication: 5 x 7 dot-matrix LED, mV/V/mA

Overload Indication: "-oL-" sign display

Allowable Input Voltage: 32 V/120 mA between Hi-Lo, 42 V peak between Lo-G, 500 V peak between G-Case

Operating Temperature Range: 5 to 40°C (41 to 104°F)

Humidity Range: 20 to 80% R.H.

Warm-up Time (approx.): 60 minutes

Power Supply*: 100/115 V AC $\pm 10\%$, 50/60 Hz, selectable by switch
 * As to source voltage 200/230 V, prescription is needed. Changeover operable.

Power Consumption (approx.): 30 VA

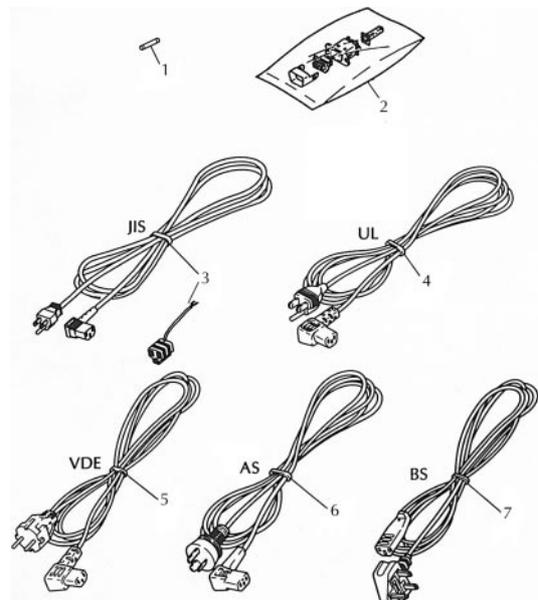
Dimensions (approx.): 213 (W) x 88 (H) x 350 (D) mm, (8-7/16 x 3-1/2 x 13-13/16")

Weight (approx.): 3.6 kg (7.92 lbs)

■ **STANDARD ACCESSORIES**

| No. | Name | Part No. | Q'ty | Description |
|-----|--------------------|----------|------|-----------------------------|
| 1 | Fuse* | A1107EF | 1 | 0.315 A, 100 V |
| | | A1104EF | 1 | 0.16 A, 200 V |
| 2 | Remote connector | A1003JD | 1 | — |
| — | Instruction manual | — | 1 | — |
| 3 | Power supply cord* | A1006WD | 1 | 100 V series (JIS standard) |
| | | A1253JZ | 1 | 115 V series (UL standard) |
| | | A1009WD | 1 | 200 V series (VDE standard) |
| | | A1024WD | 1 | 230 V series (AS standard) |
| 7 | | A1023WD | 1 | BS standard |

* Specified one.



PROGRAMMABLE DC SOURCE



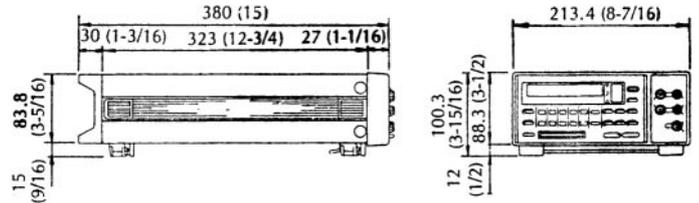
7651

AVAILABLE MODELS

| Model | Suffix Codes | Option Codes | Description |
|--------------------|--------------|--------------|--|
| 765101 | | | With front output terminal, GP-IB |
| 765111 | | | With rear output terminal, GP-IB |
| | -A | | Always A (version code) |
| Power Requirements | -1 | | 100 V AC (50 & 60 Hz), 115 V AC changeable |
| | -3 | | 115 V AC (50 & 60 Hz), 100 V AC changeable |
| | -5 | | 200 V AC (50 & 60 Hz), 230 V AC changeable |
| | -7 | | 230 V AC (50 & 60 Hz), 200 V AC changeable |
| Power Cord | /M | | JIS standard |
| | /D | | UL standard |
| | /F | | VDE standard |
| | /R | | AS standard |
| | /J | | BS standard |

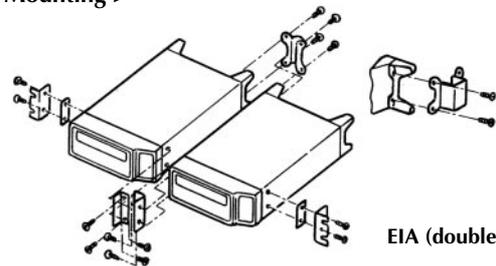
DIMENSIONS

Unit: mm (inch)

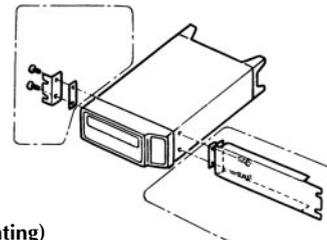


Front Output Model

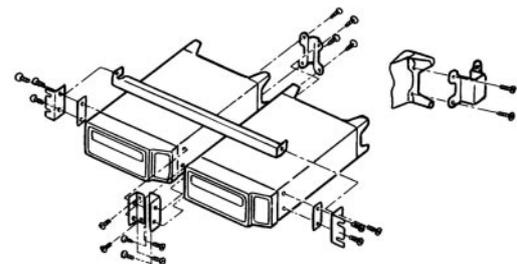
< Rack Mounting >



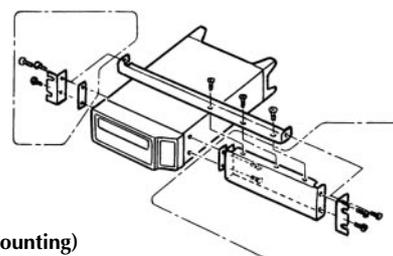
EIA (double mounting)



EIA (single mounting)



JIS (double mounting)



JIS (single mounting)

OPTIONAL ACCESSORIES FOR 7651

| No. | Code | Name | Order Q'ty |
|-----|---------|--|-------------------------|
| 8 | 378901 | IC memory card (setting data), 8 K bytes | 1 unit (1 pc./unit) |
| - | B9586NG | Dummy card (Dust cap for IC memory card slot), 2 pcs./unit | 1 unit (2 pcs./unit) |
| 9 | B9409LA | Test leads (alligator type, 0.8 m) | 1 unit (1 pc./unit) |
| - | 751501 | Rack mounting kit (EIA, single mounting) | |
| - | 751502 | Rack mounting kit (EIA, double mounting) | |
| - | 751503 | Rack mounting kit (JIS, single mounting) | |
| - | 751504 | Rack mounting kit (JIS, double mounting) | |



8 IC memory card (378901)



9 Shielded test leads (B9409LA)