ADCMT®

6166
DC Voltage/Current Source

6½-digit working standard suitable for calibration
High-accuracy and highly stable with bipolar output

- **Wide dynamic range and high resolution**
  Voltage source: ±10nV to ±1200V
  Current source: ±1nA to ±120mA
- **High accuracy: ±35ppm/year (±25ppm/90days)**
- **High stability: ±5ppm/24hrs**
- **Smooth polarity switching by bipolar output**
- **Memory up to 1000 data sets**
- **JIS-compliant thermal electromotive force output function**
- **Compliance voltage in 1mA/10mA range can be changed from ±120V to ±1200V. (factory option)**

New

GPIB USB BCD
Factory option

Bipolar Output
Working Standard

±10nV to ±1200V
±1nA to ±120mA

http://www.adcmt-e.com

The 6166 is a DC voltage/current source that uses a PWM system in the reference voltage generation block for high accuracy, high stability and high resolution.

The DC voltage can be output over a wide range of ±10nV to ±1199.999V and the DC current over a wide range of ±1nA to ±119.9999mA. Especially with its high stability for DC voltage source of 25ppm per 90 days or 35ppm per year (typical value), the 6166 can be widely used for calibration of high-precision digital voltmeters or analog indicator instruments or as a generation source for a variety of tests.

In addition, the 6166 has a built-in function to generate thermal electromotive force of thermocouples according to the JIS table, enabling easy calibration of thermometers and other instrumentation systems.

The GPIB and USB interfaces are installed as standard so that voltage and current operations are externally programmable. Also, up to 1000 data including voltage, current, thermocouple, temperature, voltage limit and current limit can be stored by hand and read out freely. A simplified auto test system can be built by nothing but the 6166.

The BCD parallel interface is available optionally, allowing more flexible system architect.

DC Voltage/Current Sourcing in 10nV/1nA Steps

The output voltage normally can be set in four ranges of 0 to ±1199.999V in the minimum 1µV steps. When the divider voltage function is selected, it can be set in three ranges of 0 to ±1199.999mV in the minimum 10nV steps. This is ideal for the adjustment, test, maintenance and calibration of high-sensitivity devices and elements.

The output current can be set in three ranges of 0 to ±119.9999mA in 1nA steps.

Both a voltage limit and a current limit can be set for voltage sourcing (except divider voltage) or current sourcing. They can protect against damage caused by an operation mistake.

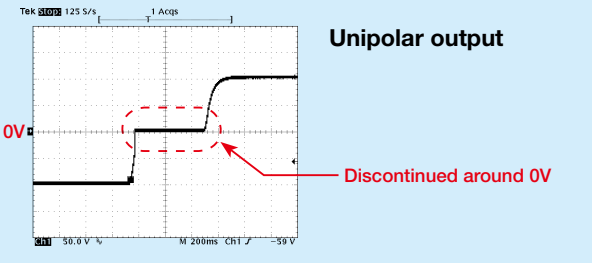
JIS-Compliant Thermal Electromotive Force Output Function

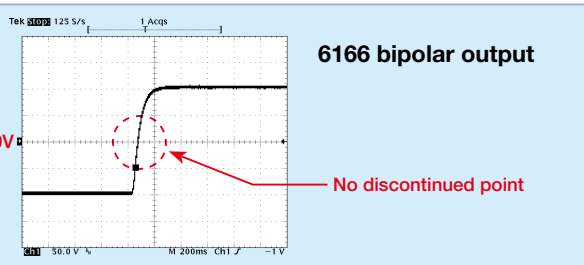
The 6166 has a function to generate thermal electromotive force of thermocouples according to the JIS table. Selecting the type of thermocouple and temperature to be generated will output voltage corresponding to the setting temperature. The type of thermocouple is selectable from eight types: T, J, E, K, S, R, B and N. The JIS standard is JISC1602-1995 or JISC1602-1981. For type N, only JISC1602-1995 is applicable. The reference junction temperature can be set arbitrarily within a range from -270°C to 120°C.

This function enables temperature calibration of thermometers and other instrumentation systems.

Smooth Polarity Switching by Bipolar Output

As the 6166 employs bipolar output, the source polarity can alternate between negative and positive without switching the internal relays. Consequently, even zero-crossing evaluation is made smoothly in a shorter time. While offering improved operability, the 6166 can be used free from the concern of the mechanical parts lifetime.

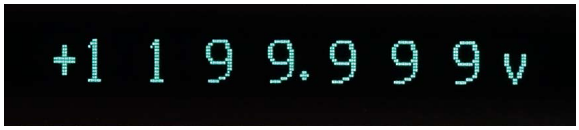




Easy Viewing Display (Dot Matrix VFD Display)

The 6166 adopts an eye-friendly dot matrix vacuum fluorescent display with increased information capacity.

1-line display: Displays the polarity, setting value and unit for sourcing.



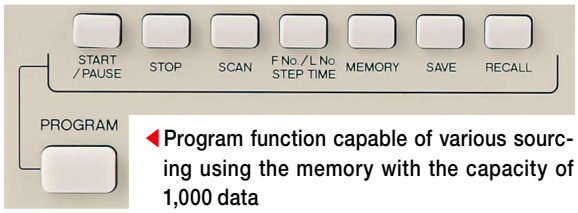
2-line display: Displays the voltage and current limit values and the source range in addition to the above. Menu-driven parameter setting is available, enhancing the usability.

LCD backlighting is used on the primary keys. As the whole key emits light, the key operability is much improved.

Greatly Improved Operating Efficiency by Program Function

The 6166 has a memory with the capacity of 1,000 data sets for the program function. Voltage, current, thermal electromotive force, temperature, voltage limit and current limit can be stored in this memory. Any of these data can be output or the data from the first number through the last number can be scanned.

By using the function, a simplified auto test system can be built easily and the operating efficiency can be greatly improved.

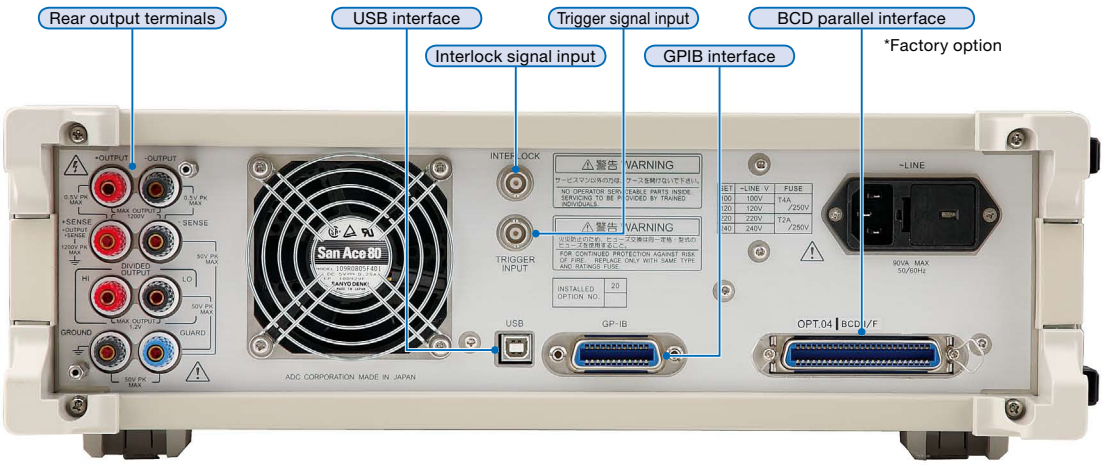


◀Program function capable of various sourcing using the memory with the capacity of 1,000 data

Expanded Specifications for System Use

The 6166 is equipped with the GPIB and USB interfaces. The BCD parallel interface that is installed on the former model 6161 is also available optionally.
In addition to the TRIGGER IN signal input for starting the output voltage or current saved in the program memory, the INTERLOCK signal input for controlling the output status by a foot switch, etc. is newly added in consideration of voltage sourcing up to 1200V, thereby securing easily the safety control.

To give flexibility to the output lines incorporated in a system, the rear output terminals are also mounted.
For external control, the remote commands of the former model 6161 are available by using the compatible mode. The 6166 can be replaced with a minimum modification of an existing system.



Specifications

Voltage/current source

Voltage source range (The 10mV to 1000mV ranges are divided output.):

Range	Source range	Setting resolution
10mV	0 to ±11.99999mV	10nV
100mV	0 to ±119.9999mV	100nV
1000mV	0 to ±1199.999mV	1μV
1V	0 to ±1.199999V	1μV
10V	0 to ±11.99999V	10μV
100V	0 to ±119.9999V	100μV
1000V	0 to ±1199.999V	1mV

Current source range:

Range	Source range	Setting resolution
1mA	0 to ±1.199999mA	1nA
10mA	0 to ±11.99999mA	10nA
100mA	0 to ±119.9999mA	100nA

Accuracy (common) : At constant power and load, with a compliance voltage of ±10V or less

Overall accuracy: Includes calibration accuracy, 1-day stability, the temperature coefficient, and linearity. At temperature of 23°C ±5°C and relative humidity of 70% or less.

Relative accuracy: A value indicating overall accuracy except for the external standard traceability.

1-day stability: At temperature of 23°C ±1°C

Temperature coefficient 1: At temperature of 23°C ±10°C

Temperature coefficient 2: At temperature of 0°C to 13°C, 33°C to 50°C

Voltage source accuracy (The 10mV to 1000mV ranges are divided output.):

Range	Overall accuracy			
	1 year	180 days	90 days	1 day
	± (% of setting+V)			
10mV	0.0070+2.3μV	0.0065+2.3μV	0.0060+2.3μV	0.0055+0.7μV
100mV	0.0055+2.5μV	0.0050+2.5μV	0.0045+2.5μV	0.0040+0.8μV
1000mV	0.0045+8μV	0.0040+8μV	0.0035+8μV	0.0030+6μV
1V	0.0035+12μV	0.0030+12μV	0.0025+11μV	0.0020+10μV
10V	0.0035+70μV	0.0030+70μV	0.0025+70μV	0.0020+60μV
100V	0.0035+700μV	0.0030+700μV	0.0025+700μV	0.0020+600μV
1000V	0.0040+7mV	0.0035+7mV	0.0030+7mV	0.0025+6mV

Range	Relative accuracy			
	1 year	180 days	90 days	1 day
	± (% of setting+V)			
10mV	0.0030+2μV	0.0025+2μV	0.0020+2μV	0.0010+0.5μV
100mV	0.0030+2μV	0.0025+2μV	0.0020+2μV	0.0010+0.5μV
1000mV	0.0030+6μV	0.0025+6μV	0.0020+6μV	0.0010+4μV
1V	0.0025+9μV	0.0020+9μV	0.0015+8μV	0.0005+6μV
10V	0.0025+50μV	0.0020+50μV	0.0015+50μV	0.0005+40μV
100V	0.0025+500μV	0.0020+500μV	0.0015+500μV	0.0005+400μV
1000V	0.0025+5mV	0.0020+5mV	0.0015+5mV	0.0008+4mV

Range	1-day stability (23°C ±1°C)	Temperature coefficient 1	Temperature coefficient 2
	± (% of setting+V)	± (% of setting+V) /°C	± (% of setting+V) /°C
10mV	0.0007+0.3μV	0.0004+0.01μV	0.0005+0.03μV
100mV	0.0007+0.3μV	0.0004+0.07μV	0.0005+0.08μV
1000mV	0.0007+2μV	0.0004+0.6μV	0.0005+0.8μV
1V	0.0005+3μV	0.0002+1μV	0.0004+1.5μV
10V	0.0005+20μV	0.0002+6μV	0.0004+8μV
100V	0.0005+200μV	0.0002+60μV	0.0004+80μV
1000V	0.0005+2mV	0.0003+600μV	0.0005+800μV

Current source accuracy:

Range	Overall accuracy			
	1 year	180 days	90 days	1 day
	± (% of setting+A)			
1mA	0.0070+9nA	0.0065+9nA	0.0060+9nA	0.0055+9nA
10mA	0.0055+90nA	0.0050+90nA	0.0045+90nA	0.0040+90nA
100mA	0.0055+900nA	0.0050+900nA	0.0045+900nA	0.0040+900nA

Range	Relative accuracy			
	1 year	180 days	90 days	1 day
	± (% of setting+A)			
1mA	0.0035+6nA	0.0030+6nA	0.0025+6nA	0.0015+5nA
10mA	0.0030+60nA	0.0025+60nA	0.0020+60nA	0.0010+50nA
100mA	0.0030+600nA	0.0025+600nA	0.0020+600nA	0.0010+500nA

Range	1-day stability (23°C ±1°C)	Temperature coefficient 1	Temperature coefficient 2
	± (% of setting+A)	± (% of setting+A) /°C	± (% of setting+A) /°C
1mA	0.0012+2nA	0.0006+0.7nA	0.0008+0.8nA
10mA	0.0007+20nA	0.0004+7nA	0.0005+8nA
100mA	0.0007+200nA	0.0004+70nA	0.0005+80nA

Source linearity:
At temperature of 23°C ±10°C, relative humidity of 70% or less and constant power and load
For the current range, with a compliance voltage of ±10V or less
(The 10mV to 1000mV ranges are divided output.)

Range	Linearity
10mV	±0.03μV
100mV	±0.3μV
1000mV	±4μV
1V	±3μV
10V	±30μV
100V	±400μV
1000V	±5mV
1mA	±3nA
10mA	±30nA
100mA	±500nA

Load regulation/output resistance: In 2-wire connection
(The 10mV to 1000mV ranges are divided output.)

	Range	Load regulation (Load condition)	Output resistance	Maximum output
Voltage source	10mV	–	180Ω±0.5%	–
	100mV		198Ω±0.5%	
	1000mV		200Ω±0.5%	
	1V	±0.0008% (10Ω or higher)	100mΩ or less	Output current ±120mA
	10V	±0.0002% (100Ω or higher)	100mΩ or less	
	100V	±0.0002% (1kΩ or higher)	100mΩ or less	
	1000V	±0.0002% (100kΩ or higher)	100mΩ or less	Output current ±12mA
Current source	1mA	±0.0002% (10kΩ or higher)	5GΩ or higher*1	Compliance voltage: ±120V*2
	10mA	±0.0002% (1kΩ or less)	5GΩ or higher*1	
	100mA	±0.0002% (100Ω or less)	1GΩ or higher	

*1 : 1GΩ or higher when the compliance voltage exceeds 120V
*2 : Up to ±1200V for the 1mA and 10mA ranges of the OPT6166+20

Output noise: Voltage source: within the range from no-load to maximum load
Current source: at load resistance of 1kΩ
(The 10mV to 1000mV ranges are divided output.)

	Range	Low frequency noise		High frequency noise
		0.1Hz to 10Hz (rms)	10Hz to 10kHz (rms)	DC to 20MHz (p-p)
Voltage source	10mV	0.2μV	20μV	1mV
	100mV	0.5μV	20μV	1mV
	1000mV	1μV	20μV	1mV
	1V	2μV	100μV	3mV
	10V	10μV	100μV	3mV
	100V	100μV	100μV	3mV
	1000V	1mV	1mV	10mV
Current source	1mA	5nA	50nA	2μA (10μA)*3
	10mA	20nA	200nA	2μA (10μA)*3
	100mA	200nA	500nA	10μA

*3 : The values in parentheses are for the 1mA and 10mA ranges of the OPT6166+20

Settling time:
Time to settle to the final value ±0.001% when varying from zero to the full scale.
(For the 100mA range, time to settle to the final value ±0.0015%)
(The 10mV to 1000mV ranges are divided output.)

	Range	Settling time	Load condition
Voltage source	10mV	1sec or less	—
	100mV		
	1000mV		
	1V		
	10V		
	100V		
	1000V	10sec or less*4	
Current source	1mA	1sec or less	100kΩ or less
	10mA		10kΩ or less
	100mA		1kΩ or less

*4 : Time to settle to the final value ±0.05% in the 1000V range is within 3s.

For the OPT6166+20, time to settle to the final value ±0.005% in the 1mA and 10mA ranges is within 5s (at load of 1MΩ or less and 100kΩ or less respectively).

Line regulation : ±0.0003% of range or less for 100VAC change of 10%
Maximum load capacitance: Maximum value that does not oscillate in voltage source

Range	Maximum load capacitance
10mV to 10V	1000μF
100V	10μF
1000V	1μF

Maximum load inductance: Maximum value that does not oscillate in current source
Current source: 1mH

CMRR: At unbalanced impedance of 1kΩ between -OUTPUT/-SENSE terminal and GUARD terminal

Voltage output	DC	140dB or more
	50/60Hz ±1%	80dB or more
Current output	DC	140dB or more
	50/60Hz ±1%	80dB or more

Voltage/current limiter:

	Setting range	Resolution	Setting accuracy
Voltage limiter	10V to 1250V	1V	±3% of setting ±5V*5
Current limiter	1mA to 125mA	1mA	±3% of setting ±0.8mA

*Available except for the divider voltage ranges (10mV, 100mV and 1000mV)
*5 : 1V is added for current source.

Thermal electromotive force

Thermal electromotive force source range :

Thermocouple	Source range	Setting resolution
T (CC)	-220.0℃ to +400.0℃	0.1℃
J (IC)	-210.0℃ to +1200.0℃	0.1℃
E (CRC)	-220.0℃ to +1000.0℃	0.1℃
K (CA)	-220.0℃ to +1372.0℃	0.1℃
S (PR10)	-10.0℃ to +1768.0℃	0.1℃
R (PR13)	-10.0℃ to +1768.0℃	0.1℃
B (PR30)	+280.0℃ to +1820.0℃	0.1℃
N	-220.0℃ to +1300.0℃	0.1℃

Reference junction temperature (cold junction compensation) setting range:
-270°C to +120°C except for the following:
Thermocouple type J: less than -210°C is deemed to be -210°C
Thermocouple type S: less than -50°C is deemed to be -50°C
Thermocouple type R: less than -50°C is deemed to be -50°C
Thermocouple type B: less than 0°C is deemed to be 0°C
Standard setting: JIS C1602-1995 or JIS C1602-1981
For type N, JIS C1602-1995 is applied.

Thermal electromotive force overall accuracy: At temperature of 23°C ±5°C and relative humidity of 70% or less for one year

Thermocouple	Source temperature – Reference junction temperature	Accuracy	
		Range	± (% of setting+℃)
T (CC)	-220.0℃ to +400.0℃	-220.0℃ to -190.1℃	0.012+0.2℃
		-190.0℃ to -70.1℃	0.009+0.2℃
		-70.0℃ to +50.0℃	0.006+0.1℃
		+50.1℃ to +400.0℃	0.005+0.1℃
J (IC)	-210.0℃ to +1200.0℃	-210.0℃ to -170.1℃	0.006+0.1℃
		-170.0℃ to -100.1℃	0.008+0.1℃
		-100.0℃ to +1200.0℃	0.011+0.2℃
E (CRC)	-220.0℃ to +1000.0℃	-220.0℃ to -190.1℃	0.012+0.2℃
		-190.0℃ to -80.1℃	0.009+0.1℃
		-80.0℃ to +1000.0℃	0.006+0.1℃
K (CA)	-220.0℃ to +1372.0℃	-220.0℃ to -190.1℃	0.012+0.3℃
		-190.0℃ to -130.1℃	0.010+0.2℃
		-130.0℃ to -80.1℃	0.006+0.1℃
		-80.0℃ to +1240.0℃	0.006+0.1℃
		+1240.1℃ to +1372.0℃	0.007+0.1℃
S (PR10)	-10.0℃ to +1768.0℃	-10.0℃ to +50.0℃	0.006+0.5℃
		+50.1℃ to +200.0℃	0.006+0.4℃
		+200.1℃ to +1768.0℃	0.006+0.3℃
R (PR13)	-10.0℃ to +1768.0℃	-10.0℃ to +40.0℃	0.006+0.5℃
		+40.1℃ to +160.0℃	0.006+0.4℃
		+160.1℃ to +1768.0℃	0.006+0.3℃
B (PR30)	+280.0℃ to +1820.0℃	+280.0℃ to +500.0℃	0.004+0.9℃
		+500.1℃ to +650.0℃	0.004+0.7℃
		+650.1℃ to +950.0℃	0.004+0.5℃
		+950.1℃ to +1550.0℃	0.004+0.4℃
		+1550.1℃ to +1820.0℃	0.004+0.3℃
N	-220.0℃ to +1300.0℃	-220.0℃ to -210.1℃	0.015+0.4℃
		-210.0℃ to -180.1℃	0.013+0.3℃
		-180.0℃ to -30.1℃	0.009+0.2℃
		-30.0℃ to +1300.0℃	0.006+0.1℃

Source Function

Program function:
Recall Specifies an arbitrary memory number.
Scan Scans memory numbers one by one by trigger input.
Increments memory numbers at step time intervals.
Scan operation
Hold Scans memory numbers one by one by trigger input.
Single Scans from the first number to the last number.
Repeat Scans repeatedly from the first number to the last number.
Maximum memory: 1000 data
Step time: Setting range 1s to 99s
Setting resolution 1s
Limiter: Current limiter
Voltage limiter
Output system: Floating, bipolar
Output terminal: Front/rear, biding post
+OUTPUT, +SENSE,
-OUTPUT, -SENSE,
DIVIDED OUTPUT HI,
DIVIDED OUTPUT LO
GUARD, GND
For thermal electromotive force sourcing, the DIVIDED OUTPUT terminals are used.

Maximum input between:
(+OUTPUT, +SENSE) and (-OUTPUT, -SENSE) 1200V output max
(OUTPUT) and (SENSE) 0.5V peak max
(DIVIDED OUTPUT HI) and (LO) 2V peak max
(-OUTPUT, -SENSE, DIVIDED OUTPUT LO) and (GUARD) 50V peak max
(GUARD) and (chassis) 50V peak max
Maximum remote sensing voltage between:
[+OUTPUT] and [+SENSE] ±0.1V peak max
[-OUTPUT] and [–SENSE] ±0.1V peak max
*The voltage between [±OUTPUT] and [±SENSE] must be 0.1V or less including voltage drop due to cable resistance.
(Approx. 10ppm error at 0.1V)

GPIB interface : Compliant with IEEE-488.2-1987
Interface function SH1, AH1, T6, L3, SR1, RL1, PP0, DC1, DT1, C0, E2
Connector Amphenol 24 pin
USB interface : USB 2.0 Full-speed
Connector Type B
BCD parallel interface (factory option):
Remote programming
Output level, polarity, range, Operate, V/I mode, divider output, voltage limit, current limit, remote operate input, operate flag output, limit flag output
Connector Amphenol 50 pin
External control signal : TRIGGER IN
INTERLOCK
Connectorn BNC

General Specifications

Operating environment conditions: Ambient temperature 0℃ to +50℃
Relative humidity 85% or below, no condensation
Storage environment conditions: Ambient temperature -25°C to +70°C,
Relative humidity 85% or below, no condensation
Warming up time : 60 minutes or longer (until the specified accuracy is reached.)
Display: Dot matrix vacuum fluorescent display
Power supply: AC power 100V/120V/220V/and240V (User selectable)

Option No.	Standard	OPT. 32	OPT. 42	OPT. 44
Power Voltage	100V	120V	220V	240V

Specify the option number when ordering.
When changing the power voltage, use only a power cable and rated fuse approved for the respective country.

Line frequency: 50Hz/60Hz
Power consumption: 90VA or less
Dimensions: Approx. 424 (width) × 132 (height) × 450 (depth) mm
Mass: 17kg or less
Safety: Compliant with IEC61010-1 Ed.3
EMI: Compliant with EN61326 classA

Supplied accessory

Part number	Name
A01402	Power cable (JIS 2m)

Options

	Option number
Compliance voltage 1200V (1mA and 10mA ranges) (factory option)	OPT6166+20
BCD parallel interface (factory option)	OPT6166+04

Optional accessories

Part number	Name
CC022003	Rack mount set (JIS 3U)
CC024003	Rack mount set (EIA 3U)
CC028003	Front handle set (3U)
A02615	Slide rail set

- Please read through the operation manual carefully before using the products.
- All specifications are subject to change without notice.

ADCMT®

ADC CORPORATION

E-mail : kcc@adcmt.com URL : http://www.adcmt-e.com

Head Office
Shoei Bldg, 3-6-12, Kyobashi, Chuou-ku,
Tokyo 104-0031, Japan
Phone: +81-3-6272-4433 Fax: +81-3-6272-4437

Higashimatsuyama Office (R&D Center)
77-1, Miyako, Namegawa-machi, Hiki-gun,
Saitama 355-0812, Japan
Phone: +81-493-56-4433 Fax: +81-493-56-4281

 Printed in Japan 6166-NP1E Jan. '11 AMS