1 YEAR WARRANTY

OMEGA®

User's Guide

Shop online at omega.com®

e-mail: info@omega.com
For latest product manuals: omegamanual.info

ISO 9001 CERTIFIED CORPORATE QUALITY — STAMFORD, CT

ISO 9001 CERTIFIED CORPORATE QUALITY — MANCHESTER, UK

MADE IN TAIWAN

CL427
Documenting Multifunction Calibrator and Arbitrary Function Generator

OMEGA®

OMEGAnet® Online Service omega.com	Internet e-mail info@omega.com

Servicing North America:

U.S.A.: Omega Engineering, Inc., One Omega Drive, P.O. Box 4047
ISO 9001 Certified Stamford, CT 06907-0047
Toll-Free: 1-800-826-6342 Tel: (203) 359-1660
FAX: (203) 359-7700 e-mail: info@omega.com

Canada: 976 Bergar
Laval (Quebec), H7L 5A1 Canada
Toll-Free: 1-800-826-6342 TEL: (514) 856-6928
FAX: (514) 856-6886 e-mail: info@omega.ca

For immediate technical or application assistance:

U.S.A. and Canada: Sales Service: 1-800-826-6342/1-800-TC-OMEGA®
Customer Service: 1-800-622-2378/1-800-622-BEST®
Engineering Service: 1-800-872-9436/1-800-USA-WHEN®

Mexico
Latin America En Español: 001 (203) 359-7803 FAX: 001 (203) 359-7807
info@omega.com.mx e-mail: espanol@omega.com

Servicing Europe:

Benelux: Managed by the United Kingdom Office
Toll-Free: 0800 099 3344 TEL: +31 20 347 21 21
FAX: +31 20 643 46 43 e-mail: sales@omegaeng.nl

Czech Republic: Frystatska 184
733 01 Karviná, Czech Republic
Toll-Free: 0800-1-66342 TEL: +420-59-6311899
FAX: +420-59-6311114 e-mail: info@omegashop.cz

France: Managed by the United Kingdom Office
Toll-Free: 0800 466 342 TEL: +33 (0) 161 37 29 00
FAX: +33 (0) 130 57 54 27 e-mail: sales@omega.fr

Germany/ Austria: Daimlerstrasse 26
D-75392 Deckenpfronn, Germany
Toll-Free: 0800 6397678 TEL: +49 (0) 7056 9398-0
FAX: +49 (0) 7056 9398-29 e-mail: info@omega.de

United Kingdom: OMEGA Engineering Ltd.
ISO 9001 Certified One Omega Drive, River Bend Technology Centre, Northbank
Irlam, Manchester M44 5BD United Kingdom
Toll-Free: 0800-488-488 TEL: +44 (0) 161 777-6611
FAX: +44 (0) 161 777-6622 e-mail: sales@omega.co.uk

Documenting Multifunction Calibrator
and Arbitrary Function Generator

CL427

OMEGA®

Table of Contents

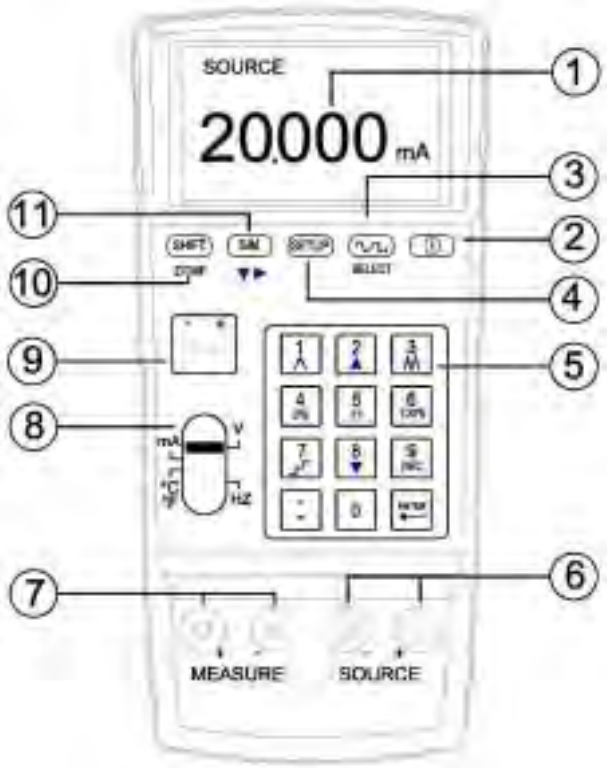
Features:

1. **Unique mapping function** let you calibrate temperature (300°C) or voltage (220V) directly (instead of 4 to 20mA indirectly).
2. CL427 is a **multifunction calibrator** and an **arbitrary function generator**.
3. **Source**: mA (4 to 20mA), V (0 to 15V, 0 to 70mV), Hz, sine wave, square wave, triangular wave, truncated sine wave, user programmable waveform and temperature for 11 types of thermocouples.
4. **Measure:** Current (mA), Voltage (V, mV) and temperature in ℃ or ℉.
5. **Programmable cold junction compensation** allows users to fine tune temperature output and measurement.
6. Programmable 0% and 100% value for easy **25% step function**.
7. **Output error warning** when output is shorted or open.
8. **Short circuit protection** for voltage output.
9. **Clear and easy user interface** (Numerical key pad, sliding switch and dot matrix LCM with backlight).
10. Voltage, frequency, PWM duty-cycle (square wave and triangular wave), and offset are programmable in the **Hz function**.
11. **Frequency range (0.3Hz to 20KHz)** covers application of audio band (speaker, MP3, MD etc.)
12. **DTMF** (Dual Tone Multi-Frequency) can perform professional testing for telephone line and audio product (MP3 or MD).
13. **Auto-step and auto-ramp functions** can quickly perform linear test.
14. **PC** can program calibrator through USB port.
15. CL427 can perform **data logging** with programmable sampling time (0-255 seconds) and memory of 4000 records.
16. **Rechargeable Lithium battery** (1600mAH) with built-in charging circuit.
17. **Calibration results** (source and measure) can be **saved in memory** (2000 records). Then users download them to a PC for documentation. No needs to transcribe calibration data manually.
18. To **distinguish calibration data** at different locations, data can be saved under different file names.

Applications:

1. **Calibration of 4 to 20mA** transmitters and panel meters.
2. **Temperature calibration** of panel meters or instruments for 11 types of thermocouples.
3. **Calibration of valve opening** by changing duty cycle of a PWM signal.
4. **Generation** of selected test **frequency and waveform** for electronic device.
5. **Pre-stored** 1/3 octave audition, white noise, and pink noise for MP3, MD, speaker and audio driver tests.
6. **Audio Frequency Synthesizer**: Programmable frequency and phase synthesis of single tone, DTMF(Double Tone, Multi-Frequency) for audio products such as MP3, MD and telephone line.
7. **Function generation** for transistor DC bias characteristics test, amplifier overload and transient characteristics.
8. **Function generation** for vibration testing.
9. **Calibration of a chart recorder** with different waveforms (sine, square, or triangular wave).
10. Simulation of **PLC.**

I. PANEL DESCRIPTION



1. **LCM** display.
2. **ON/OFF** button.
3. **SELECT** button for selecting waveforms (in the Hz function).
4. **SETUP** button.
5. Numerical key pads; or buttons for special functions (e.g. REC, 0%, 100%).
6. Output terminals (for **SOURCE**).
7. Input terminals (for **MEASUR**E).
8. **Sliding switch** (for various functions).
9. Temperature input/output terminals.
10. **SHIFT** button for using secondary functions on the numerical key pads: **DTMF** and Frequency switching.
11. **S/M** button (for selecting SOURCE or MEASURE).

II. OPERATION

1. Voltage Source

1a. -3V ~ 15V

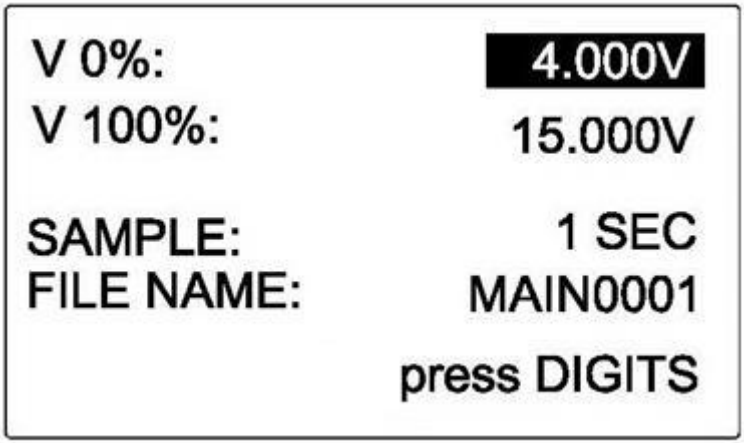
(1) Turn on the power, and move the sliding switch to V.
(2) Press S/M button to select SOURCE (output) mode.
(Press SETUP once to store it as default mode when power is turned on.)
(3) Type in a voltage value (including decimal point); then press ENTER.
(4) Connect Test leads or Alligator clips to SOURCE terminals (red to red, and black to black).
(5) Then connect Test leads or Alligator clips to the object for calibration.
(6) To perform voltage scanning, refer to “Scanning for Source” chapter.
(7) To perform data logging function, refer to “Data logging” chapter.

Remark: 1. Users are allowed to type in max. 5 digits.
2. Type in a voltage value (including decimal point), press ENTER, then CL427 will output this voltage value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in “0.” first.

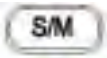
Warning: 1. Do not make an input with voltage potential or connect any charged circuitry to SOURCE (terminals) to prevent from damaging CL427.
2. When there is a short circuit or overload at the output terminals, CL427 can not output the correct voltage. Please remove connecting leads and check when there is a symbol of OUTPUT ERROR.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

1b. How to set up

(1) Press SETUP to enter SETUP function.
(2) V 0%: set up the "starting" voltage for scanning.
(refer to SCANNING chapter).
(3) V 100%: set up the "ending" voltage for scanning.
(refer to SCANNING chapter).
(4) SAMPLE: set up the "sampling time" for data logging.
(refer to DATA LOGGING chapter).
(5) FILE NAME: data can be saved under different file names. Here users can set up a "file name". (refer to DATA LOGGING chapter)



1c. Details for set up



(1) Press  button to select the item you'd like to setup.
(2) When the selected item is in reverse video, type in a value.
(3) FILE NAME: Type in a name by corresponding to ASCII codes (refer to Appendix 1). For example, for the letter "A" users should type in "65".
(4) The data under the same file name will be put together.

2. Current Source

2a. -4mA ~ 24mA

(1) Turn on the power. Sliding switch turned to mA.
(2) Press S/M button to select SOURCE (output) mode.

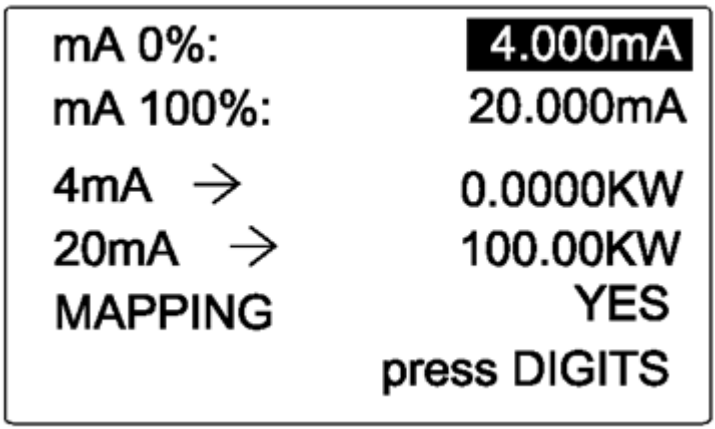
(Press SETUP once to store it as default mode when power is turned on.)
(3) Type in a current value (including decimal point); then press ENTER.
(4) Connect Test leads or Alligator clips to SOURCE terminals
(red to red, and black to black).
(5) Then connect Test leads or Alligator clips to the object for calibration.
(6) Current scanning function: refer to “Scanning for Source” chapter.
(7) Data logging function: refer to “Data logging” chapter.

Remark: 1. Users are allowed to type in max. 5 digits.
2. Type in a current value (including decimal point), press ENTER, then CL427 will output this current value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in “0.” first.

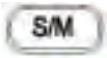
Warning: 1. Do not make an input or connect any charged installment to SOURCE (terminals) to prevent from damaging CL427l.
2. When there is an output open circuit or overload, CL427 can not output the correct current. Please remove connecting leads and check when there is a symbol of OUTPUT ERROR.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

2b. How to set up

(1) Press SETUP to enter SETUP function.
(2) mA 0%: set up the "starting" current for scanning.
(refer to SCANNING chapter).
(3) mA 100%: set up the "ending" current for scanning.
(refer to SCANNING chapter).
(4) 4mA→: set up the mapping unit for 4mA.
(5) 20mA→: set up the mapping unit for 20mA.
(6) MAPPING: here users can decide if they want MAPPING function.



2c. Details for set up



(1) Press  button to select the item you'd like to setup.
(2) When the selected item is in reverse video, type in a value.
(3) When setting up the mapping unit for 4mA or 20mA, type in the unit by corresponding to ASCII codes (refer to Appendix 1). For example, for "KW" users should type in "75" and "87".
(4) MAPPING: "YES" means the mapping function is enabled;
"NO" means the mapping function is disabled.

2d. MAPPING Function

(1) In the SETUP display when users choose YES for MAPPING, the MAPPING function is enabled

(2) The display unit will be the same as the one set up by users. For example, for the unit “KW” users should type in “75” and “87”.

(3) (If in the SETUP display, users set up 0KW for 4mA and 100KW for 20mA) When users type in 100 and then press ENTER, the display will show: **100.0KW** (the main display) and **20.000mA** (which means the original output of iCal is 20.000mA).

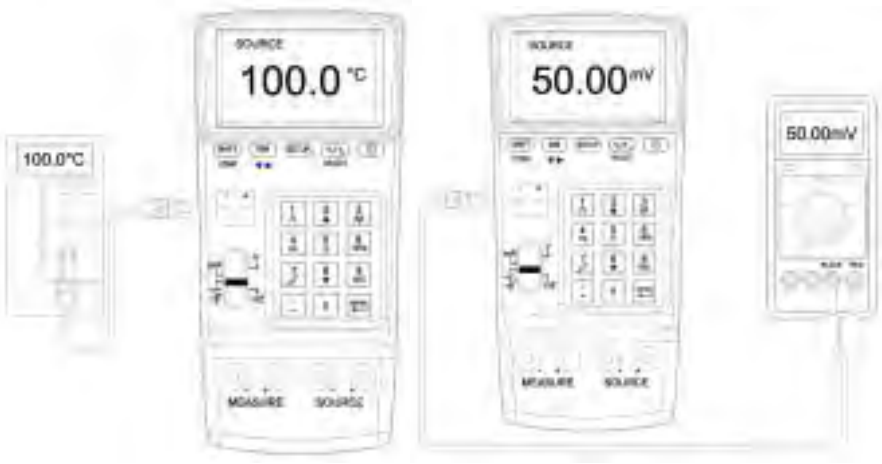
(4) When users perform scanning function, the display show 0~100KW instead of 4mA ~ 20mA.

3. TEMPERATURE SOURCE (THERMOCOUPLES, ℃&℉)

3a. TC Simulating Thermocouple Signals

(for Types K, J, E, T, R, S, N, L, U, B, C, and mV Output)

(1) Turn on the power. Sliding switch turned to ℃ ℉ mV.
(2) Select a TC TYPE in the SETUP display.
(3) Type in a temperature value (including decimal point); then press ENTER.
(4) Connect Thermocouple to TC/mV terminals.
(5) Then connect the other end of Thermocouple to the object for calibration.



Remark: 1. Users are allowed to type in max. 5 digits.
2. Type in a temperature value (including decimal point), press ENTER, then iCal will output this temperature value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in "0." first.

Warning: 1. Do not make an input or connect any charged installment to TC terminals to prevent from damaging CL427.
2. When there is an output short circuit or overload, CL427 can not output the correct temperature. Please remove connecting leads and check when there is a symbol of OUTPUT ERROR.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

3b. How to set up

(1) Press SETUP to enter SETUP function.

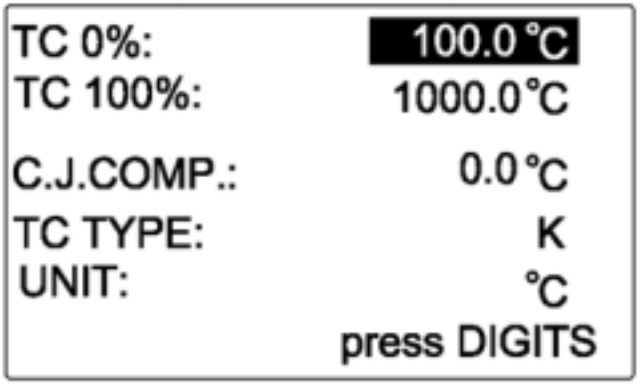
(2) TC 0%: set up the “starting” temperature for scanning.
(refer to SCANNING chapter).

(3) TC 100%: set up the “ending” temperature for scanning.
(refer to SCANNING chapter).

(4) C. J. COMP.: set up the Cold Junction Compensation.

(5) TC TYPE: set up the thermocouple type.

(6) UNIT: here users can choose ℃ or ℉.



3c. Details for set up

(1) Press S/M ▼ ► button to select the item you’d like to setup.

(2) When the selected item is in reverse video, type in a value.

(3) C. J. COMP.: Users can type in the temperature for Cold Junction Compensation. (The default is 0.0℃, users can make compensation from -5℃ to +5℃ in accordance with the ideal output values.)

(4) When “TC TYPE” is in reverse video, users can press SELECT button to choose the thermocouple type they want.

(5) When “UNIT” is in reverse video, users can press SELECT button to choose ℃ or ℉.

4. Frequency (Hz) Output

4a. 0.1Vpp ~ 20Vpp , 0.3Hz ~ 20KHz , offset: -5V ~ +5V

(1) Turn on the power. Sliding switch turned to Hz.

(Press SETUP once to store it as default mode when power is turned on.)

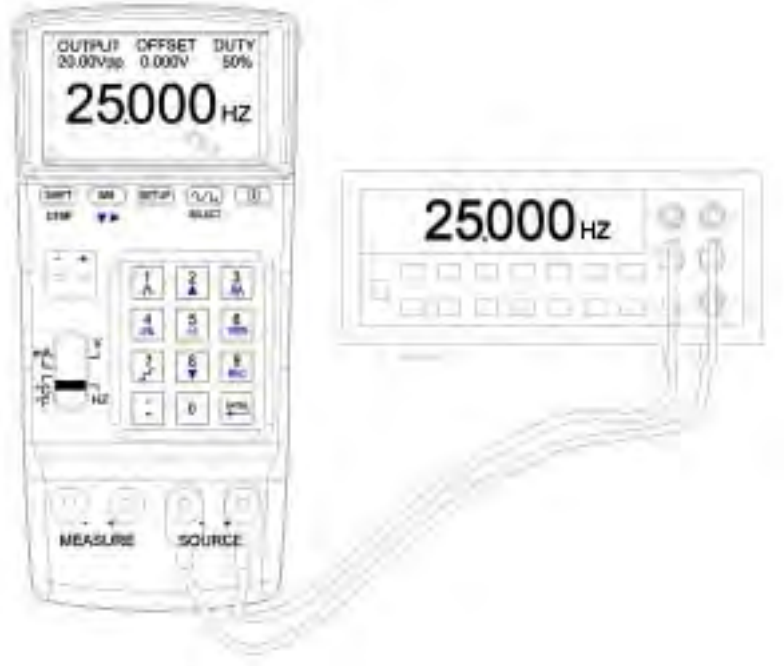
(2) Press SELECT button to select the type of waveform (Sine wave, Square wave, Triangular wave, Truncated sine wave, and User programmable waveform).

(3) Press S/M button to switch among “Voltage Peak to Peak (Vpp)”, “OFFSET”, “DUTY” and “Hz”.

(4) Then type in a value (including decimal point) and press ENTER.

(5) Connect Test leads or Alligator clips to SOURCE terminals (red to red, and black to black).

(6) Connect Test leads or Alligator clips to the object for calibration.



Remark: 1. Users are allowed to type in max. 5 digits.
2. Type in each parameter (including decimal point), press ENTER, then CL427 will output the parameter values.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in "0." first.

Warning: 1. Do not make an input or connect any charged installment to SOURCE (terminals) to prevent from damaging CL427.
2. When there is an output short circuit or overload, can not output the CL427 correct frequency.
3. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

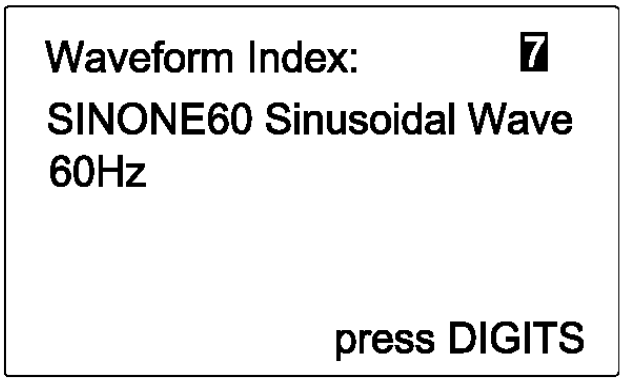
4b. How to set up

(1) Press SETUP to enter SETUP function.

(2) Waveform Index: give a number for a "user programmable waveform".

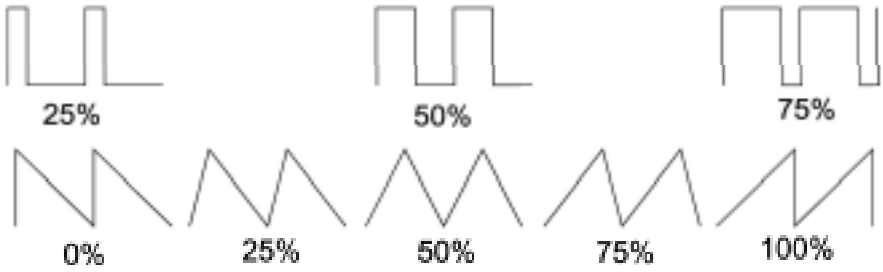
(3) Press SETUP again to enter the main display of Hz range.

(4) Press SELECT button to select the "user programmable waveform". Then, CL427 will output this selected "user programmable waveform" (e.g. number 7 waveform – named SINONE60 Sinusoidal Wave 60Hz).

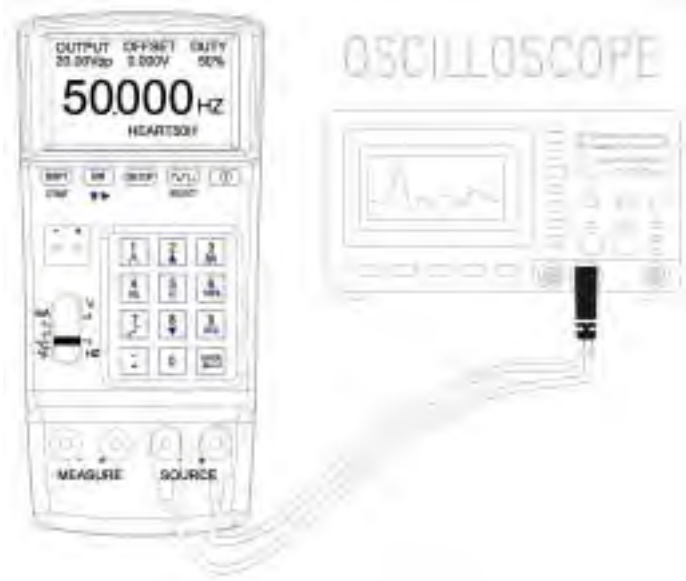


4c. Details for fine-tuning items

(1) Hz: set up the output frequency.
(2) OUTPUT: set up the output voltage (Peak to Peak).
(3) OFFSET: set up the output DC bias accurate position. Fine tune this item can output TTL or modulate PWM signal.
(4) DUTY: for a square wave, users can decide the band width of the positive wave. For a triangular wave, users can set up the saw-toothed shape.



(5) Set up the waveform: users can select among sine wave, square wave, triangular wave, truncated sine wave, and user programmable waveform.
(6) User programmable waveform: first users have to compile a waveform in PC and then send it to CL427 (the details please refer to Software Manual).



5. DTMF (Dual Tone Multi-Frequency)

5a. 5Vpp~20Vpp, 0.3Hz~20KHz, offset: -5V~+5V, %: 0~100%, phase: 0~360°

(1) Turn on the power. Sliding switch turned to Hz.

(Press SETUP once to store it as default mode when power is turned on.)

(2) Press SHIFT DTMF button to enter DTMF mode.

(3) Press S/M ▼ ► button to set up all the parameters of F1 and F2.

(4) Then type in a value (including decimal point) and press ENTER.

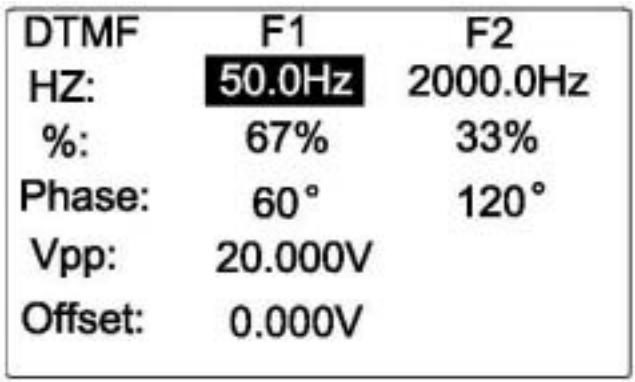
(5) Connect Test leads or Alligator clips to SOURCE terminals (red to red, and black to black).

(6) Connect Test leads or Alligator clips to the object for calibration.

Remark: 1. Users are allowed to type in max. 5 digits. **2.** Type in each parameter (including decimal point), press ENTER, then CL427 will output the parameter values. **3.** When the output value is <0, please type in a negative sign first. **4.** When the output value is <1 and >0, please type in “0.” first.
Warning: 1. Do not make an input or connect any charged installment to SOURCE (terminals) to prevent from damaging CL427. **2.** When there is an output short circuit or overload, CL427 can not output the correct frequency/waveform. **3.** Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

5b. How to set up

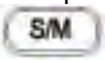
(1) Hz: set up the output frequency of F1 and F2.
(2) %: set up the output % of F1 and F2.
(3) Phase: set up the outset phase angle of F1 and F2.
(4) Vpp: set up the output Peak to Peak voltage.
(5) Offset: set up the output DC bias accurate position.



6. Voltage Input (Measure)

6a. -3V ~ 24V

(1) Turn on the power. Sliding switch turned to V.



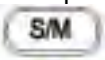
(2) Press ▼► button to select MEASURE (input) mode.
(3) Connect Test leads or Alligator clips to MEASURE terminals (red to red, and black to black).
(4) Then connect the other ends of Test leads or Alligator clips to the object for measurement.
(5) The display of CL427 will show the measurement result.
(6) Data logging function: refer to “Data logging” chapter.

Remark: **1.** The measurement result is 5-digit (including decimal point and negative sign).
Warning: 1. Do not measure over 30V for MEASURE (terminals) to prevent from damaging CL427. **2.** Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

7. Current Input (Measure)

7a. -4mA ~ 24mA

(1) Turn on the power. Sliding switch turned to mA.

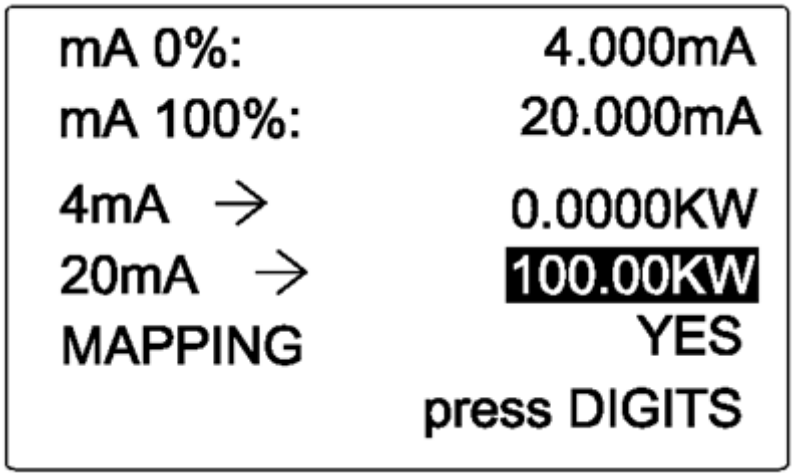


(2) Press ▼► button to select MEASURE (input) mode.
(3) Connect Test leads or Alligator clips to MEASURE terminals (red to red, and black to black).
(4) Then connect the other ends of Test leads or Alligator clips to the object for measurement.
(5) The display of CL427 will show the measurement result.
(6) Data logging function: refer to “Data logging” chapter.

Remark: 1. The measurement result is 5-digit (including decimal point and negative sign).
Warning: 1. Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

7b. How to set up

(1) Press SETUP to enter SETUP function.
(2) 4mA→: set up the mapping unit for 4mA.
(3) 20mA→: set up the mapping unit for 20mA.
(4) MAPPING: here users can decide if they want MAPPING function.



7c. Details for set up

S/M

(1) Press ▼► button to select the item you'd like to setup.
(2) When the selected item is in reverse video, type in a value.
(3) When setting up the mapping unit for 4mA or 20mA, type in the unit by corresponding to ASCII codes (refer to Appendix 1). For example, for "KW" users should type in "75" and "87".
(4) MAPPING: "YES" means the mapping function is enabled;
"NO" means the mapping function is disabled.

7d. MAPPING Function

(1) In the SETUP display when users choose YES for MAPPING, the MAPPING function is enabled

(2) The display unit will be the same as the one set up by users. For example, for the unit “KW” users should type in “75” and “87”.

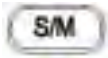
(3) (If in the SETUP display, users set up 0KW for 4mA and 100KW for 20mA) When users type in 100 and then press ENTER, the display will show: **100.0KW** (the main display) and **20.000mA** (which means the original output of iCal is 20.000mA).

8. Temperature Input (Measure)

8a. TC Simulating Thermocouple Signals

(for Types K, J, E, T, R, S, N, L, U, B, C, and mV Input)

(1) Turn on the power. Sliding switch turned to ℃ ℉ mV.



(2) Press ▼ ▶ button to select MEASURE (input) mode.
(3) Select a TC TYPE in the SETUP display.
(4) Connect Thermocouple to TC/mV terminals.
(5) Then connect the other end of Thermocouple to the object for measurement.
(6) The display of CL427 will show the temperature of the tested object.

Remark: 1. The measurement result is 5-digit (including decimal point and negative sign).
Warning: 1. The Input TC terminals is for measuring mV, do not measure over 30V for MEASURE (terminals) to prevent from damaging CL427. **2.** Perform one function at a time and make connection to the specific terminals only. Remove all other connections to the unused terminals. Always connect to only one of SOURCE , MEASURE , or TC alone.

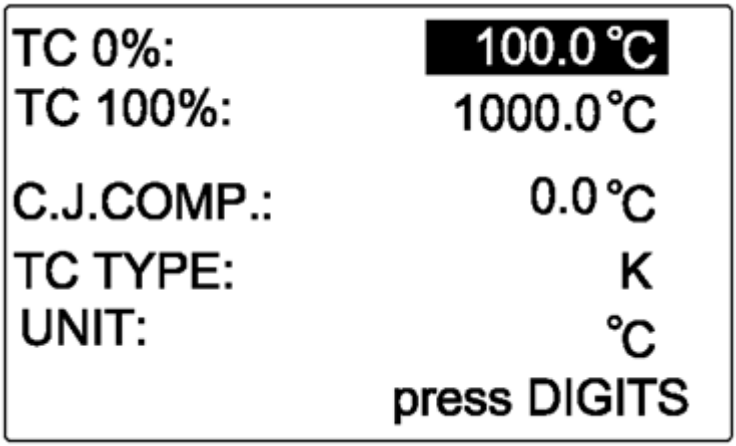
8b. How to set up

(1) Press SETUP to enter SETUP function.

(2) C. J. COMP.: set up the Cold Junction Compensation.

(3) TC TYPE: set up the thermocouple type.

(4) UNIT: here users can choose ℃ or ℉.



8c. Details for set up

(1) Press S/M ▼ ► button to select the item you'd like to setup.

(2) When the selected item is in reverse video, type in a value.

(3) C. J. COMP.: Users can type in the temperature for Cold Junction Compensation. (The default is 0.0℃, users can make compensation from -5℃ to +5℃ in accordance with the ideal output values.)

(4) When "TC TYPE" is in reverse video, users can press SELECT button to choose the thermocouple type they want.

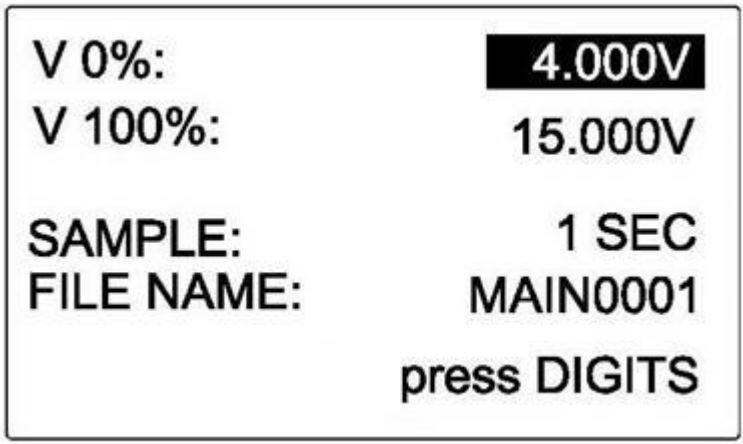
(5) When "UNIT" is in reverse video, users can press SELECT button to choose ℃ or ℉.

III. SCANNING FOR SOURCE

1. Voltage Scanning for SOURCE

1a. How to setup:

(1) Press SETUP button to enter SETUP function.
(2) V 0%: set up the “starting” voltage for scanning.
(3) V 100%: set up the “ending” voltage for scanning.



Remark:
1. Users are allowed to type in max. 5 digits.
2. Type in a voltage value (including decimal point), press ENTER, then CL427 will output this voltage value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in “0.” first.

1b. Functions of Voltage Scanning for SOURCE

Press SHIFT / DTMF , then the lower left of LCM will display various functions (see the descriptions on below).

SHIFT +	Functions
1	**Ramp scanning** 1% 2%.... 100% 99%....2% 1%
2	**Manual Multi-step scanning (increase progressively)** Press this button once +25% till it reaches 100%
3	**Fast ramp scanning** 4% 8%....100% 96%....8% 4%
4 0%	Return to the **"starting" point** of scanning 0%
5 H	Press it during scanning period to **HOLD** the scanning
6 100%	Return to the **"ending" point** of scanning 100%
7	**Auto Multi-step scanning (increase and decrease progressively)** 0% 25% 50% 75% 100%....
8	**Manual Multi-step scanning (decrease progressively)** Press this button once -25% till it reaches 0%.

1c. Example of Connecting Leads (for Rapid and Multi-step Scanning)

Connecting Leads for Fast ramp

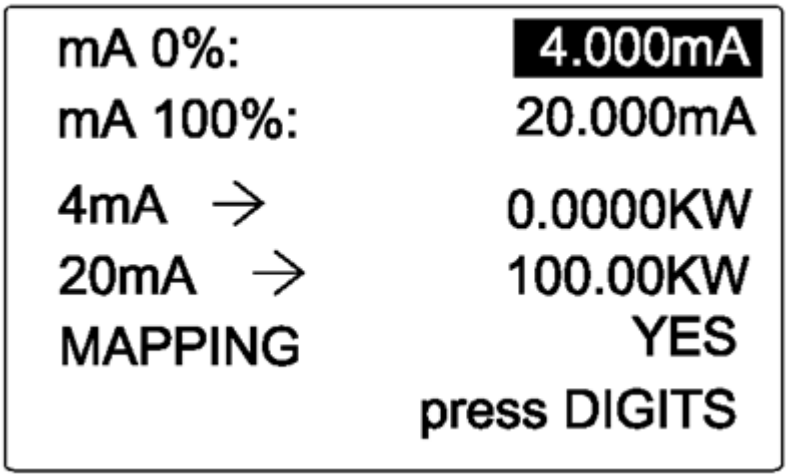
Connecting Leads for Multi-step Scanning

2. Current Scanning for SOURCE

2a. How to setup:

(1) Press 

button to enter SETUP function.
(2) mA 0%: set up the “starting” current for scanning.
(3) mA 100%: set up the “ending” current for scanning.



Remark:
1. Users are allowed to type in max. 5 digits.
2. Type in a voltage value (including decimal point), press ENTER, then CL427 will output this current value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in “0.” first.

2b. Functions of Current Scanning for SOURCE

Press SHIFT / DTMF , then the lower left of LCM will display various functions (see the descriptions on below).

SHIFT +	Functions
1	**Ramp** 1% 2%.... 100% 99%....2% 1%
2	**Manual Multi-step scanning (increase progressively)** Press this button once +25% till it reaches 100%
3	**Fast ramp** 4% 8%....100% 96%....8% 4%
4 0%	Return to the **"starting" point** of scanning 0%
5 H	Press it during scanning period to **HOLD** the scanning
6 100%	Return to the **"ending" point** of scanning 100%
7	**Auto Multi-step scanning (increase and decrease progressively)** 0% 25% 50% 75% 100%....
8	**Manual Multi-step scanning (decrease progressively)** Press this button once -25% till it reaches 0%.

2c. Example of Connecting Leads (for Rapid and Multi-step Scanning)

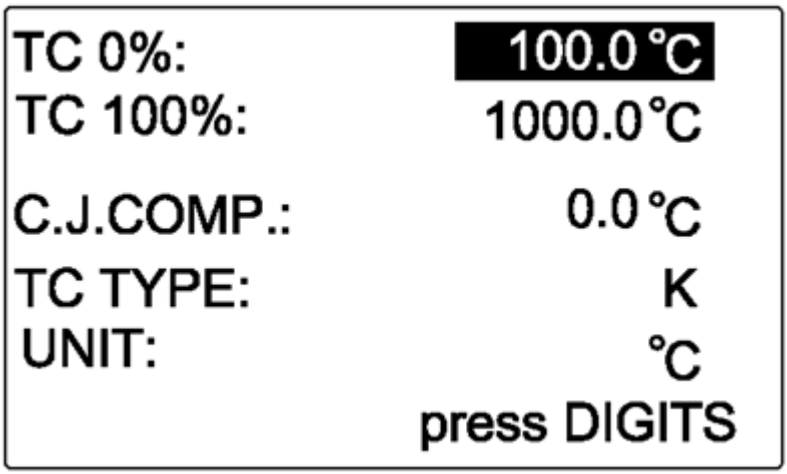
Connecting Leads for Fast ramp

Connecting Leads for Multi-step Scanning

3. Temperature Scanning for SOURCE

3a. How to setup:

(1) Press SETUP button to enter SETUP function.
(2) TC 0%: set up the “starting” temperature for scanning.
(3) TC 100%: set up the “ending” temperature for scanning.



Remark:
1. Users are allowed to type in max. 5 digits.
2. Type in a temperature value (including decimal point), press ENTER, then CL427 will output this temperature value.
3. When the output value is <0, please type in a negative sign first.
4. When the output value is <1 and >0, please type in “0.” first.

3b. Functions of Temperature Scanning for SOURCE

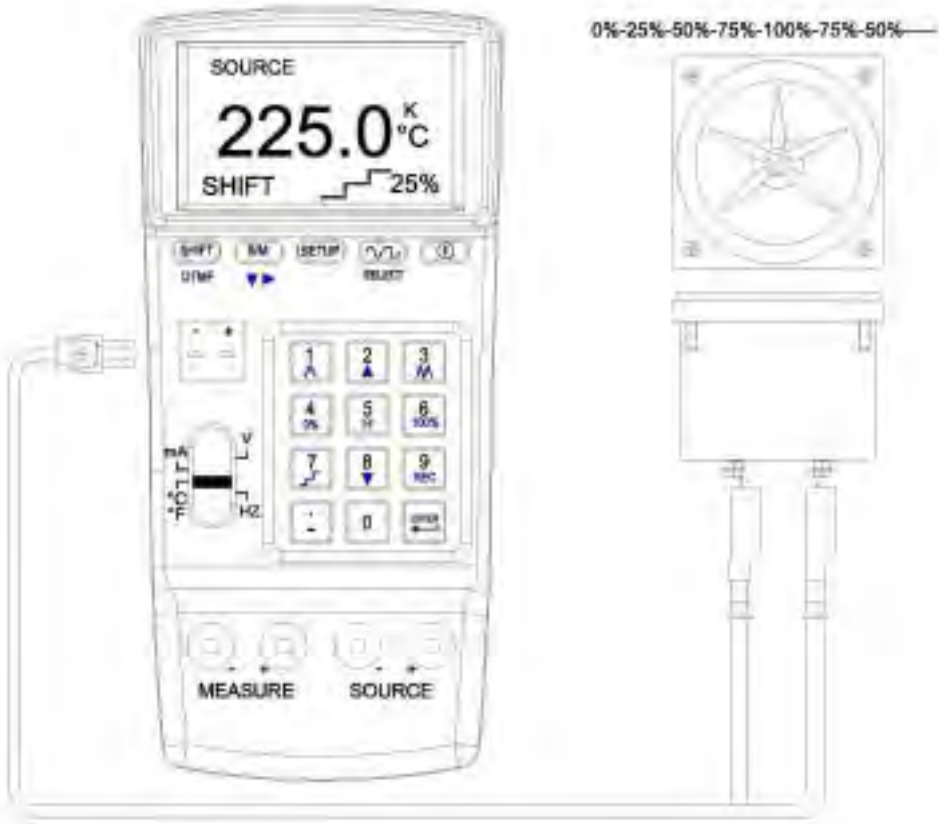
Press 

, then the lower left of LCM will display various functions (see the descriptions on below).

SHIFT +	Functions
	**Ramp** 1% 2%.... 100% 99%....2% 1%
	**Manual Multi-step scanning (increase progressively)** Press this button once +25% till it reaches 100%
	**Fast ramp** 4% 8%....100% 96%....8% 4%
	Return to the **"starting" point** of scanning 0%
	Press it during scanning period to **HOLD** the scanning
	Return to the **"ending" point** of scanning 100%
	**Auto Multi-step scanning (increase and decrease progressively)** 0% 25% 50% 75% 100%....
	**Manual Multi-step scanning (decrease progressively)** Press this button once -25% till it reaches 0%.

3c. Example of Connecting Leads (for Ramp and Multi-step Scanning)

Connecting Leads for Fast ramp



Connecting Leads for Multi-step Scanning

IV. DATA LOGGING

1. The way of logging

The data logging function is available for all the ranges except Hz.

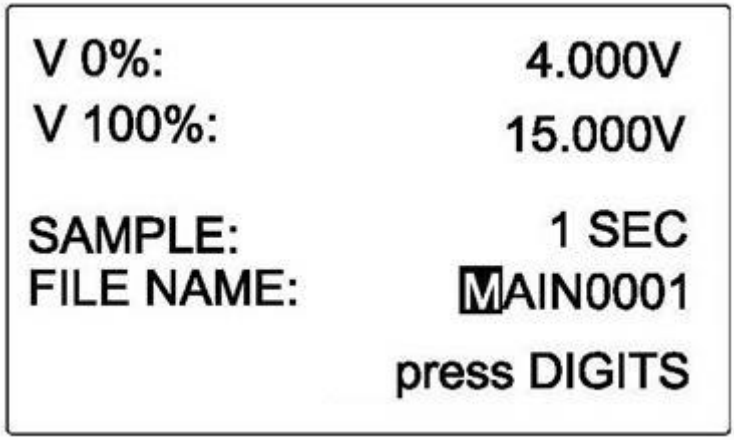
1a. How to set up

(1) Only under V range, users can set up SAMPLE and FILE NAME.
And the setups under V range will be applied to other ranges (mA, …).

(2) Press SETUP to enter SETUP function.

(3) SAMPLE: set up the "sampling time" for data logging.

(4) FILE NAME: data can be saved under different file names. Here users can set up a "file name". (However, this function is available only when the SAMPLE is set up as "0".)



1b. Data logging for V, mA, Temperature (℃ & ℉)

(1) The data logging can be preformed under both modes (SOURCE and MEASURE). But the data can not be logged under different ranges or under different modes. (When the SAMPLE is set up as "0", many single logged data under the same file name can be put together).

(2) To perform data logging, press SHIFT DTMF and then "SHIFT" will show on the left bottom of the display. Press 9 REC button to start data logging.

(3) To stop data logging, please repeat the above procedures.
To continue data logging, users just have to repeat it again.

(4) When users want to logged data for a different mode (SOURCE or MEASURE), they have to clear memory first (and save the data before clearing the memory if necessary, please refer to Software Manual).

1c. Save data in FILE NAME

This data logging can be performed under any ranges (V, mA, ℃ & ℉) and any modes (SOURCE and MEASURE). And the logged data can be saved in the FILES NAME(s) decided by users.

(1) SAMPLE (rate) has to be 0 if users would like to use the function of saving data in FILE NAMEs..

(2) To perform data logging, press 

and then "SHIFT" will show on the left bottom of the display. Press 

button to start data logging.

(3) Data logging for various data can be performed under any ranges or any modes. Users just have to follow the above procedures to continue data logging and saving.

2. Single-point Data Logging

2a. Data Logging Set Up

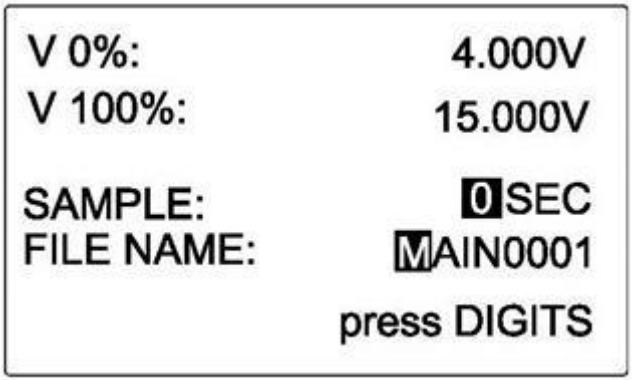
(1) Only under V range, users can set up SAMPLE and FILE NAME. And the setups under V range will be applied to other ranges (mA, …).

(2) Press 

to enter SETUP function.

(3) SAMPLE: set up the "sampling time" as "0".

(4) FILE NAME: data can be saved under different file names. Here users can set up a "file name" (by referring to ASCII codes).



2b. Start Data Logging

(1) Under any ranges/modes except Hz range, press SHIFT DTMF and then "SHIFT" will show on the left bottom of the display. Press 9 REC button to start logging single-point data under specified FILE NAME.
(2) Under all the ranges/modes, single-point data under the same FILE NAME can be logged together.
(3) To continue data logging under each range, users just have to repeat the above step 1.

3. Multi-point Data Logging

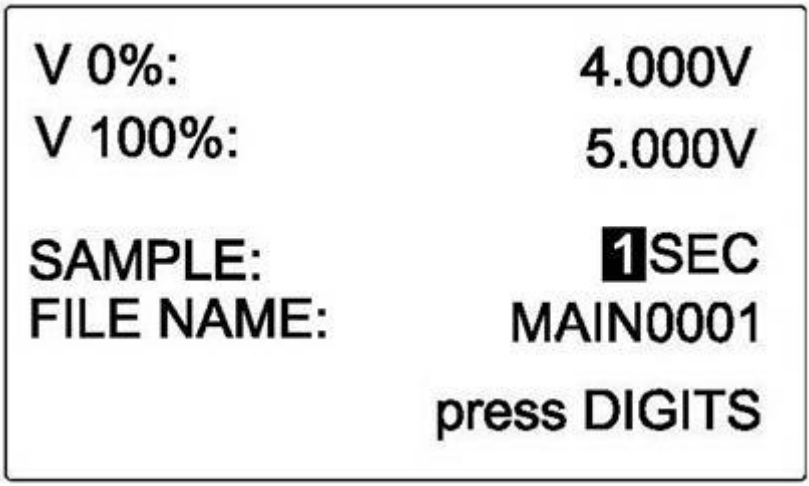
3a. Data Logging Set Up

(1) Only under V range, users can set up SAMPLE and FILE NAME.
And the setups under V range will be applied to other ranges (mA, …).

(2) Press SETUP to enter SETUP function.

(3) SAMPLE: set up the "sampling time" (from 1~255 sec.).

(4) FILE NAME: for multi-point data logging, data can not be saved under different file names. Here users do not have to set up a "file name".



3b. Start Data Logging

(1) Under any ranges/modes except Hz range, press SHIFT DTMF and then "SHIFT" will show on the left bottom of the display. Press 9 REC button to start logging multi-point data per the sampling time set us by users.
(2) To stop data logging, please repeat the above procedure.
(3) All the data can not logged under different ranges or different modes. If users have to log data for a different mode or range, they have to download data or clear memory first.

4. Delete Data & Download Data

(1) Delete Data: Turn off the power first. Press 9 REC and ⏻ buttons at the same time, there will be 2 beep sounds. Then the memory is cleared.

(2) Download Data: First install the software (provided along with CL427) to PC, then users can download data (refer to software manual).

V. REMOTE PC (CONTROLLING CL427)

1. The baud rate between PC and CL427 is 460800 Bps.
2. Please refer to below list for corresponding iCal buttons to the (remote) PC buttons.

iCal buttons	PC buttons	ASCII
	0	0x30
	1	0x31
	2	0x32
	3	0x33
	4	0x34
	5	0x35
	6	0x36
	7	0x37
	8	0x38
	9	0x39
	◦	0x2E
	ENTER	0x0D
	F	0x46
	U	0x55
	S	0x53
	I	0x49

VI. BATTERY RECHARGING

1. Inside CL427 there is a rechargeable lithium battery.

2. After turning on the power of CL427, the display will show the remaining power percentage of the rechargeable battery.

3. When the remaining power percentage of the rechargeable battery is less than 10%, we suggest users to recharge the battery by using the AC adaptor provided along with CL427.

4. To do the battery recharging, users just need to:
   (1) put the AC adaptor into the socket;
   (2) connect the AC adaptor to DC terminal of CL427;
   (3) and turn on CL427.

VII. ELECTRICAL SPECIFICATIONS

(23+/- 5℃, 10 minutes after turning on the power)

mA (source) (Vopen > 15V)

Range	Resolution	Accuracy of Reading
-4mA to -0.005mA	1uA	+/-0.03% +/- 5dgts
0.005mA to 4mA	1uA	+/-0.03% +/- 5dgts
4mA to 20mA	1uA	+/-0.03% +/-3dgts
20mA to 24mA	1uA	+/-0.03% +/-5dgts

V (source) (maximum load 1mA, short circuit protection < 100mA)

Range	Resolution	Accuracy of Reading
-3V to -0.005V	0.001V	+/-0.03% +/-5dgts
0.005V to 10V	0.001V	+/-0.03% +/-5dgts
10V to 15V	0.001V	+/-0.03% +/-5dgts

mA (measure)

Range	Resolution	Accuracy of Reading
-4mA to -0.005mA	1uA	+/-0.03% +/- 5dgts
0.005mA to 4mA	1uA	+/-0.03% +/- 5dgts
4mA to 20mA	1uA	+/-0.03% +/-3dgts
20mA to 24mA	1uA	+/-0.03% +/-5dgts

If reading of mA (measure) is less than 5 digits, it is displayed as 0.

V (measure)

Range	Resolution	Accuracy of Reading
-3V to -0.005V	0.001V	+/-0.03% +/-5dgts
0.005V to 10V	0.001V	+/-0.03% +/-5dgts
10V to 24V	0.001V	+/-0.03% +/-5dgts

If reading of V (measure) is less than 5 digits, it is displayed as 0.

Frequency (source, 10 Vpp, 0V offset, square wave, duty cycle = 50%)

Range (Hz)	Input Resolution	Accuracy
0.3 to 99.999	0.1Hz	0.002Hz
10.00 to 999.99	0.1Hz	0.02Hz
1000.0 to 9999.9	0.1Hz	0.2Hz
10000 to 20000	1Hz	2Hz

Temperature, Thermocouples (source and measure, 0.1◦C & 0.1◦F Resolution, Internal Cold Junction Compensation, thermocouple accuracy not included, 3 minutes after plugging in thermocouples.)

	°C		°F	
	Range	Accuracy	Range	Accuracy
K	-200 to -150	2.0	-382 to -238	3.6
	-150 to 0	1.2	-238 to 32	2.1
	0 to 1000	0.8	32 to 1832	1.4
	1000 to 1370	1.2	1832 to 2498	2.1
J	-200 to -150	2.0	-382 to -238	3.6
	-150 to 0	1.0	-238 to 32	1.8
	0 to 1050	0.7	32 to 1922	1.2
E	-200 to -150	1.5	-382 to -238	2.7
	-150 to 0	0.9	-238 to 32	1.6
	0 to 850	0.7	32 to 1562	1.2
T	-200 to -150	1.5	-382 to -238	2.7
	-150 to 0	1.2	-238 to 32	2.1
	0 to 400	0.8	32 to 752	1.4
R	0 to 500	1.8	32 to 932	3.2
	500 to 1760	1.5	932 to 3200	2.7
S	0 to 500	1.8	32 to 932	3.2
	500 to 1760	1.5	932 to 3200	2.7
N	-200 to 0	1.5	-328 to 32	2.7
	0 to 1300	0.9	32 to 2372	1.6
L	-200 to 0	0.9	-328 to 32	1.6
	0 to 900	0.7	32 to 1652	1.2
U	-200 to 0	1.1	-328 to 32	1.9
	0 to 600	0.7	32 to 1112	1.2
B	600 to 800	2.2	1112 to 1472	3.9
	800 to 1000	1.8	1472 to 1832	3.2
	1000 to 1820	1.4	1832 to 3308	2.5
C	0 to 1800	1.0	32 to 3272	1.8
	1800 to 2310	1.5	3272 to 4190	2.7
mV	-10mV to 70mV	0.05mV	-10mV to 70mV	0.05mV

Voltage Peak to Peak for Sine Wave

(Vpp, 0.3~20KHz, 50% duty cycle, sine wave, 0V offset)

Range(V)	Resolution	Accuracy of Reading
0.1 to 20V	0.001V	5% +/- 0.3V

Voltage Peak to Peak for Non-Sine Wave (Vpp, 0.3~20KHz, 0V offset)

Range(V)	Resolution	Accuracy of Reading
0.1 to 20V	0.001V	6% +/- 0.4V

Voltage Peak to Peak

(Vpp, 0.3~20KHz, 50% duty cycle, square wave, 0V offset)

Range(V)	Resolution	Accuracy of Reading
1 to 20V	0.001V	6% +/- 0.4V

Voltage of Offset (Maximum Vpp < 20V)

Range	Resolution	Accuracy of Reading
-5V to 5V	0.001V	5% +/-0.5V +/-5%xVpp

Duty Cycle (%, square wave, 10 Vpp, 0.3~20KHz)

Range	Resolution	Rise Time of Vpp	Fall Time of Vpp
0 to 100%	1%	10μS max, 5μS typical	15μS max, 7.5μS typical

DTMF (Hz)

Range (Hz)	Resolution	Accuracy of Reading
0.3 to 99.999	0.1Hz	0.002Hz
10.00 to 999.99	0.1Hz	0.02Hz
1000.0 to 9999.9	0.1Hz	0.2Hz
10000 to 20000	1Hz	2Hz

DTMF (%)

Range (%)	Resolution	Accuracy of Reading
0% ~ 100%	1%	5%

DTMF (Phase Angle)

Range (°)	Resolution	Accuracy of Reading
0 ~ 360	1°	100**μS**+1°

DTMF (**Vpp**, F1=F2, <1 KHz, %1=%2, Phase1=Phase2)

Range	Resolution	Accuracy of Reading
5V ~ 20V	0.001V	10% +/-0.6V

DTMF (**Offset**, F1=F2, <1 KHz, %1=%2, Phase1=Phase2)

Range	Resolution	Accuracy of Reading
-5V ~ 5V	0.001V	10% +/-0.6V +/-5%xVpp

VIII. GENERAL SPECIFICATIONS

AC Adaptor:	AC 110V, 60Hz input; or AC 220V, 50/60Hz input. DC 15V / 0.5A output,
Dimension:	214.0(L) x 98.7(W) x 56.0(H) mm 8.4" (L) x 3.9" (W) x 2.2" (H)
Weight:	650g / 22.9oz (Batteries included)
Operation Environment:	0℃ ~ 50℃, 85% RH
Storage Environment:	-20℃ ~ 60℃, 75% RH
Accessories:	Carrying case x 1 User manual x 1 AC adaptor x 1 USB cable x 1 Software CD x 1 Software manual x 1 K-type thermocouple (dual plugs) x 1 Alligator clips x 2 (black and red) Test leads x 2 (black and red) Rechargeable lithium battery (11.1V/ 1600mAh) x 1

（Appendix 1）ASCII code list

Decimal System	ASCII	Decimal System	ASCII
32		62	>
33	!	63	?
34	"	64	@
35	#	65	A
36	$	66	B
37	%	67	C
38	&	68	D
39	'	69	E
40	(	70	F
41	)	71	G
42	*	72	H
43	+	73	I
44	,	74	J
45	-	75	K
46	.	76	L
47	/	77	M
48	0	78	N
49	1	79	O
50	2	80	P
51	3	81	Q
52	4	82	R
53	5	83	S
54	6	84	T
55	7	85	U
56	8	86	V
57	9	87	W
58	:	88	X
59	;	89	Y
60	<	90	Z
61	=	91	[

Decimal System	ASCII	Decimal System	ASCII
92	\	127	°
93	]	128	凸
94	^	129	μ
95	_	130	🔔
96	`	131	⬆
97	a	132	⬇
98	b	133	⬅
99	c	134	➡
100	d	135	▲
101	e	136	▼
102	f	137	◀
103	g	138	▶
104	h	139	Λ
105	i	140	△
106	j	141	千
107	k	142	万
108	l	143	元
109	m	144	丹
110	n	145	X
111	o	146	
112	p	147	
113	q	148	
114	r	149	?
115	s	150	∞
116	t	151	Є
117	u	152	⋂
118	v	153	±
119	w	154	≧
120	x	155	≦
121	y	156	α
122	z	157	β
123	{	158	γ
124	|	159	δ
125	}	160	ε
126	~	161	ζ

Decimal System	ASCII		
162	η		
163	Θ		
164	¯		
165	Κ		
166	λ		
167	μ		
168	ν		
169	ζ		
170	◯		
171	π		
172	ρ		
173	σ		
174	τ		
175	υ		
176	Φ		
177	χ		
178	ψ		
179	ω		
180	Γ		
181	Σ		
182	Φ		
183	Ω		

WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **13 months** from date of purchase. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **one (1) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective, it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of having been damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. Purchase Order number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. Purchase Order number to cover the COST of the repair,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

OMEGA is a registered trademark of OMEGA ENGINEERING, INC.

Where Do I Find Everything I Need for Process Measurement and Control? OMEGA...Of Course!

Shop online at omega.com℠

TEMPERATURE

- Thermocouple, RTD & Thermistor Probes, Connectors, Panels & Assemblies
- Wire: Thermocouple, RTD & Thermistor
- Calibrators & Ice Point References
- Recorders, Controllers & Process Monitors
- Infrared Pyrometers

PRESSURE, STRAIN AND FORCE

- Transducers & Strain Gages
- Load Cells & Pressure Gages
- Displacement Transducers
- Instrumentation & Accessories

FLOW/LEVEL

- Rotameters, Gas Mass Flowmeters & Flow Computers
- Air Velocity Indicators
- Turbine/Paddlewheel Systems
- Totalizers & Batch Controllers

pH/CONDUCTIVITY

- pH Electrodes, Testers & Accessories
- Benchtop/Laboratory Meters
- Controllers, Calibrators, Simulators & Pumps
- Industrial pH & Conductivity Equipment

DATA ACQUISITION

- Data Acquisition & Engineering Software
- Communications-Based Acquisition Systems
- Plug-in Cards for Apple, IBM & Compatibles
- Data Logging Systems
- Recorders, Printers & Plotters

HEATERS

- Heating Cable
- Cartridge & Strip Heaters
- Immersion & Band Heaters
- Flexible Heaters
- Laboratory Heaters

ENVIRONMENTAL MONITORING AND CONTROL

- Metering & Control Instrumentation
- Refractometers
- Pumps & Tubing
- Air, Soil & Water Monitors
- Industrial Water & Wastewater Treatment
- pH, Conductivity & Dissolved Oxygen Instruments

M5160/0712