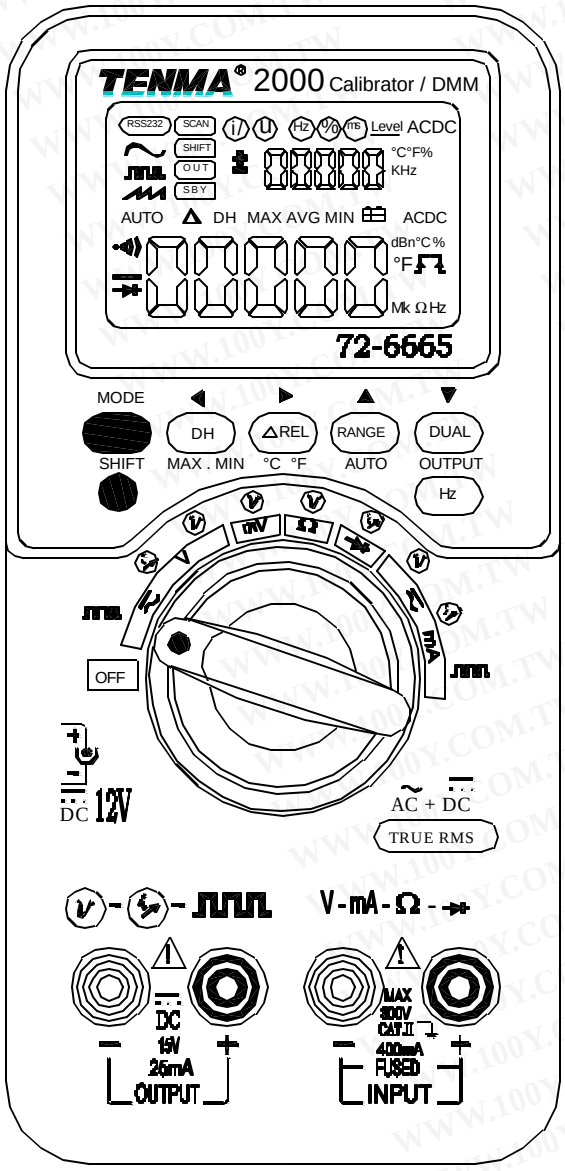
| REVISIONS | | | DOC. NO. SPC-F004 • Effective: 12/21/98 • DCP No: 680 | | | | | |
|---|---|---|---|---|---|---|---|---|
| DCP # | REV | DESCRIPTION | DRAWN | DATE | CHECKD | DATE | APPRVD | DATE |
| 430 | A | RELEASED | JWM | 11/14/00 | HYO | 11/22/00 | DJC | 11/22/00 |
| | | | | | | | | |




## Features:

1. Combination precision calibrator and True RMS DMM
2. Multifunction Calibrator provides: current, voltage, and frequency (square wave) sources
3. Constant current output for loads up to 500 ohms
4. Bipolar current (±25mA) and voltage (±1.5V, ±15V output)
5. Wide range frequency source with adjustable pulse width and duty cycle
6. 28 frequency ranges
7. Programmable memory with continuous ramp or step output
8. DMM functions: AC and DC voltage and current, AC and DC voltage and current, AC+DC True RMS, resistance, temperature, frequency, duty cycle, pulse width, diode test and continuity beeper
9. Dual 40,000 count backlit LCD
10. Optical isolated RS-232 interface
11. 1msec peak hold for glitch capture
12. Data Hold: MAX/MIN/AVG dynamic recording
13. Dimensions: 1.5"(H) x 3.5"(W) x 7.6"(L)
14. Weight 2.73lbs (1240g)
15. Includes test leads and clips, 9V battery, protective holster, 12V external battery source, carrying case and owners manual
16. Optional Accessories:
    - 120VAC to 12V Adaptor Source (72-6666)
    - RS-232 Software and Cable (72-6667)
    - 220VAC to 12V Adaptor Source (72-6668)
    - K-Type Transition Plug (72-6252)
    - K-Type Thermocouple (72-6253)



SPC-F004.DWG



TENMA®

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE FOR REFERENCE PURPOSES ONLY.

| DRAWN BY: | DATE: |
|---|---|
| JEFF MCVICKER | 11/14/00 |
| CHECKED BY: | DATE: |
| Hisham Odish | 11/22/00 |
| APPROVED BY: | DATE: |
| DANIEL CAREY | 11/22/00 |

DRAWING TITLE: PROCESS CALIBRATOR / DMM

| SIZE | DWG. NO. | ELECTRONIC FILE | REV |
|---|---|---|---|
| A | 72-6665 | 91B1602.DWG | A |

SCALE: NTS | U.O.M.: INCHES [mm] | SHEET: 1 OF 5

## AC+DC Current (True RMS: from 5% to 100% of range.)

| Range | Resolution | Accuracy 45Hz~2kHZ | Burden Voltage and Shunt | Overload Protection |
|---|---|---|---|---|
| 40mA | 10µA/1µA | ±(1.2%rdg + 10dgt) | 0.06V (1Ω) | 250V, 630mA Quick Acting Fuse |
| 400mA | 0.1mA/10µA | | 0.6V (1Ω) | |

*Crest factor <=3*

## 1ms Peak Hold Voltage

*(Specified Accuracy ±40 digits for changes >1ms duration)*

| Range | Resolution | Accuracy | Overload Protection |
|---|---|---|---|
| 40mV | 10µV/1µV | ±(2%rdg + 43dgt) | 300V AC RMS |
| 400mV | 0.1mV/10 µV | | |
| 4V | 1mV/0.1mV | | |
| 40V | 10mV/1mV | | |
| 300V | 0.1V/10mV | | |

*Input impedance: 10 megohm (1000 megohm for 40mV and 400mV)*



## Current

| Range | Resolution | Accuracy | Burden Voltage and Shunt | Overload Protection |
|---|---|---|---|---|
| 40mA | 10µA/1µA | ±(2%rdg + 43dgt) | 0.06V (1Ω) | 250V, 630mA Quick Acting Fuse |
| 400mA | 0.1mA/10µA | | 0.6V (1Ω) | |

## Resistance

| Range | Resolution | Accuracy | Maximum Test Voltage | Overload Protection |
|---|---|---|---|---|
| 400Ω | 0.1/0.01 Ω | ±(0.2%rdg + 3dgt) | 3.3V | 300V AC RMS |
| 4kΩ | 1/0.1 Ω | | 1.28V | |
| 40kΩ | 10/1 Ω | | | |
| 400kΩ | 100/10 Ω | | | |
| 4MΩ | 1/.1k Ω | | | |
| 40MΩ | 10/1k Ω | ±(1%rdg + 5dgt) | | |

*Instant Continuity: Built-in buzzer sounds when resistance is less than 10 Ohms*

## Diode Check

| Range | Resolution | Accuracy | Test Current | Test Voltage |
|---|---|---|---|---|
| Diode | 1/0.1mV | ±(1.0%rdg + 2dgt) | Approx. 1.65mA | <3.3V |

*Overload protection: 300VAC RMS*

## Audible Continuity Test

| Range | Resolution | Accuracy | Test Current | Test Voltage |
|---|---|---|---|---|
| Diode | 1/0.1mV | Built-in buzzer sounds when reading is below approx. 100mV | Approx. 1.65mA | <3.3V |

*Overload protection: 300VAC RMS*

# Input Specifications

## DC Voltage

| Range | Resolution | Accuracy | Overload Protection |
|---|---|---|---|
| 40mV | 10µV/1µV | ±(0.08%rdg + 5dgt) | 300V AC RMS |
| 400mV | 0.1mV/10µV | ±(0.03%rdg + 3dgt) for positive range. ±(0.06%rdg + 3dgt) for bipolar range | |
| 4V | 1mV/0.1mV | | |
| 40V | 10mV/1mV | | |
| 300V | 0.1V/10mV | ±(0.06%rdg + 3dgt) | |

Input impedance: 10M Ω (1000MΩ for 40mV and 400mV)

## AC Voltage (True RMS: from 5% to 100% of range.)

| Range | Resolution | Accuracy | | | Overload Protection |
|---|---|---|---|---|---|
| | | 50/60Hz | 45Hz~5kHz | 5kHz~20kHz | |
| 40mV | 10µV/1µV | ±(0.7%rdg + 5dgt) | ±(1.5%rdg + 5dgt) | ±(2%rdg + 5dgt) | 300V AC RMS |
| 400mV | 0.1mV/10µV | | | | |
| 4V | 1mV/0.1mV | | | | |
| 40V | 10mV/1mV | | | | |
| 300V | 0.1V/10mV | | 45kHz~1kHz ±(1.5%rdg + 5dgt) | No Specification | |

Input impedance: 10M Ω // less than 100pF (1000M Ω) for 40mV and 400mV
Crest factor ≤3

## AC+DC Voltage (True RMS: from 5% to 100% of range.)

| Range | Resolution | Accuracy | | | Overload Protection |
|---|---|---|---|---|---|
| | | 50/60Hz | 45Hz~5kHz | 5kHz~20kHz | |
| 40mV | 10µV/1µV | ±(0.8%rdg + 10dgt) | ±(1.6%rdg + 10dgt) | ±(2.1%rdg + 10dgt) | 300V AC RMS |
| 400mV | 0.1mV/10µV | | | | |
| 4V | 1mV/0.1mV | | | | |
| 40V | 10mV/1mV | | | | |
| 300V | 0.1V/10mV | | 45kHz~1kHz ±(1.6%rdg + 10dgt) | No Specification | |

Input impedance: 10M Ω // less than 100pF (1000M Ω) for 40mV and 400mV
Crest factor ≤3

## DC Current

| Range | Resolution | Accuracy | Burden Voltage and Shunt | Overload Protection |
|---|---|---|---|---|
| 40mA | 10µA/1µA | ±(0.06%rdg + 3dgt) | 0.06V (1Ω) | 250V, 630mA Quick Acting Fuse |
| 400mA | 0.1mA/10µA | | 0.6V (1Ω) | |

## AC Current (True RMS: from 5% to 100% of range.)

| Range | Resolution | Accuracy 45Hz~2kHZ | Burden Voltage and Shunt | Overload Protection |
|---|---|---|---|---|
| 40mA | 10µA/1µA | ±(1.0%rdg + 5dgt) | 0.06V (1Ω) | 250V, 630mA Quick Acting Fuse |
| 400mA | 0.1mA/10 µA | | 0.6V (1Ω) | |

*Crest factor <=3*

## Output Specifications

### Constant Voltage Output

| Generation Range | Resolution | Accuracy | Maximum Output Current |
|---|---|---|---|
| CV:1.5V 0 to ±1.50000V | 0.1mV | ±(0.03%rdg + 0.3mV) | Approx. ±25mA *Note 1* |
| CV:15V 0 to ±15.0000V | 1mV | ±(0.03%rdg + 3mV) | Approx. ±25mA |

*Note: 1. Loading coefficient: 0.012mV/mA for 1.5V ouput*
*2. Maximum input voltage: 25VDC*

### Constant Current Output

| Generation Range | Resolution | Accuracy | Maximum Burden Voltage |
|---|---|---|---|
| CC:25mA 0~±25.00mA | 1μA | ±(0.03%rdg + 5μA) | Approx. ±12V *Note 1* |

*Note: 1. Loading (burden voltage) coefficient: 1 mA/V*
*2. Maximum input voltage: 25VDC*

### Square Wave Output

| Output | Range | Resolution | Accuracy |
|---|---|---|---|
| Frequency | 0.5, 1, 2, 5, 10, 15, 20, 25, 30, 40, 50, 60, 75, 80, 100, 120, 150, 200, 240, 300, 400, 480, 600, 800, 1200, 1600, 2400, 4800 Hz | 0.01Hz | ±(0.005%rdg + 0.01Hz) |
| Duty Cycle *1 f ≤ 100Hz | 0.39% ~99.60% | 0.39% | ±(0.01%rdg + 0.1%) |
| Pulse Width *1 | 1/Frequency | Range/256 | ±(0.01%rdg + 0.3ms) |
| Amplitude | 5V, ±5V, 12V, ±12V | 0.1V | ±(2%rdg + 0.2V) |

*Note: 1. The positive width must be greater than 50 μs for adjusting the duty cycle or pulse width under different frequency or the accuracy and range will be different to definition.*
*2. Maximum input voltage: 25VDC*

## K-Type Temperature Test

| Range | Resolution | Accuracy | Overload Protection |
|---|---|---|---|
| -40°C ~ 1200 °C | 1/0.1°C | ±(0.3%rdg + 3 °C) | 300V AC RMS |
| -40°F ~ 2192 °F | 1/0.1°F | ±(0.3%rdg + 6 °F) | |

*The accuracy does not include the tolerance of thermocouple probe*

*The accuracy of the thermocouple probe is as shown below:*

*Temperature Rating (wire): Continuous 204 °C, Single Reading 260 °C*

*Temperature Measuring Range: -50 °C to 800 °C (Max)*

*Accuracy:*

*± 2.2 °C or ± 0.75% of reading from 0 °C~800 °C (whichever is greater)*

*± 2.2 °C or ± 2% of reading from 0 °C~-50 °C (whichever is greater)*



## Frequency for Voltage measurement

| Range | Resolution | Accuracy | Min. Input Frequency |
|---|---|---|---|
| 100Hz | .01/.001Hz | ±(0.02%rdg + 1dgt) | 1Hz |
| 1kHz | 0.1/0.01Hz | | |
| 10kHz | 1/0.1Hz | | |
| 100kHz | 10/1Hz | | |
| 200kHz | 100/10Hz | | |

*Overload protection: 300VAC RMS*

## Frequency Sensitivity and Trigger Level

| Input Range | Minimum Sensitivity (RMS Sinewave) | | Trigger Level for DC Coupling | |
|---|---|---|---|---|
| *Maximum input for specified accuracy=10xRange or 300V* | 40 Hz~20kHz | 10Hz~200kHz | <20kHz | 20kHz~200kHZ |
| 40mV | 10mV | No Spec. | 15mV | No Spec. |
| 400mV | 30mV | 40mV | 40mV | 80mV |
| 4V | 0.3V | 0.4V | 0.4V | 0.8V |
| 40V | 3V | 4V | 4V | 8V |
| 300V | 30V | 40V (≤100kHz) | 40V | 80V (≤100kHz) |

*The accuracy for duty cycle and pulse width is based on a 5V square wave input on the 4V DC range.*

*Duty Cycle 0.01 ~ 99.9% for DC coupling, 5% ~ 95% for AC coupling*

*Accuracy: Within ± (0.3% per kHz+0.3%) of full scale*

*Pulse Width 0.1ms to 1999ms*

*Accuracy: ± (0.2% rdg+3dgt) pulse width must be greater than 10 ms*

*Pulse widh range is determined by the frequency of the signal*