

RTU-1000

Relay Testing Unit



Overcurrent Relay Testing Unit RTU-1000

- Everything You need for testing protection relays and more...
- Rugged, compact, lightweight (approx. 17kg)
- Sine-wave current,
- "Soft Start", zero-crossing start-up,
- Ammeter 2A, 20A, 200A, 2000A,
- User-friendly Timer with auto-stop function, preprogrammed pulse,
- Forced ventilation with thermal protection,
- Weather and impact resistant case (IP64).

December 2008.

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1. GENERAL TERMS

Important User Information

This guide has been developed as a quick reference tool to Mikrotrend d.o.o. industrial automation controls and factory assemblies. It is not intended to replace factory user manuals or technical documentation supplied with Mikrotrend d.o.o. equipment. Because of the variety of uses for the products described in this publication, those responsible for the application and use of these products must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes, and standards. Factory provided user manuals and technical documentation should not be solely relied on for those purposes. Mikrotrend d.o.o. reserves the right to change the features or characteristics of its products at any time. Therefore, the information contained in this publication is subject to change at any time without notice.

The illustrations, charts, diagrams, and layout examples shown in technical documentation are intended solely as examples. Since there are many variables and requirements associated with any particular installation, Mikrotrend d.o.o. can not assume responsibility or liability (including intellectual property infringement liability) for actual use based upon the examples shown in this publication.

Service and Installation Conditions

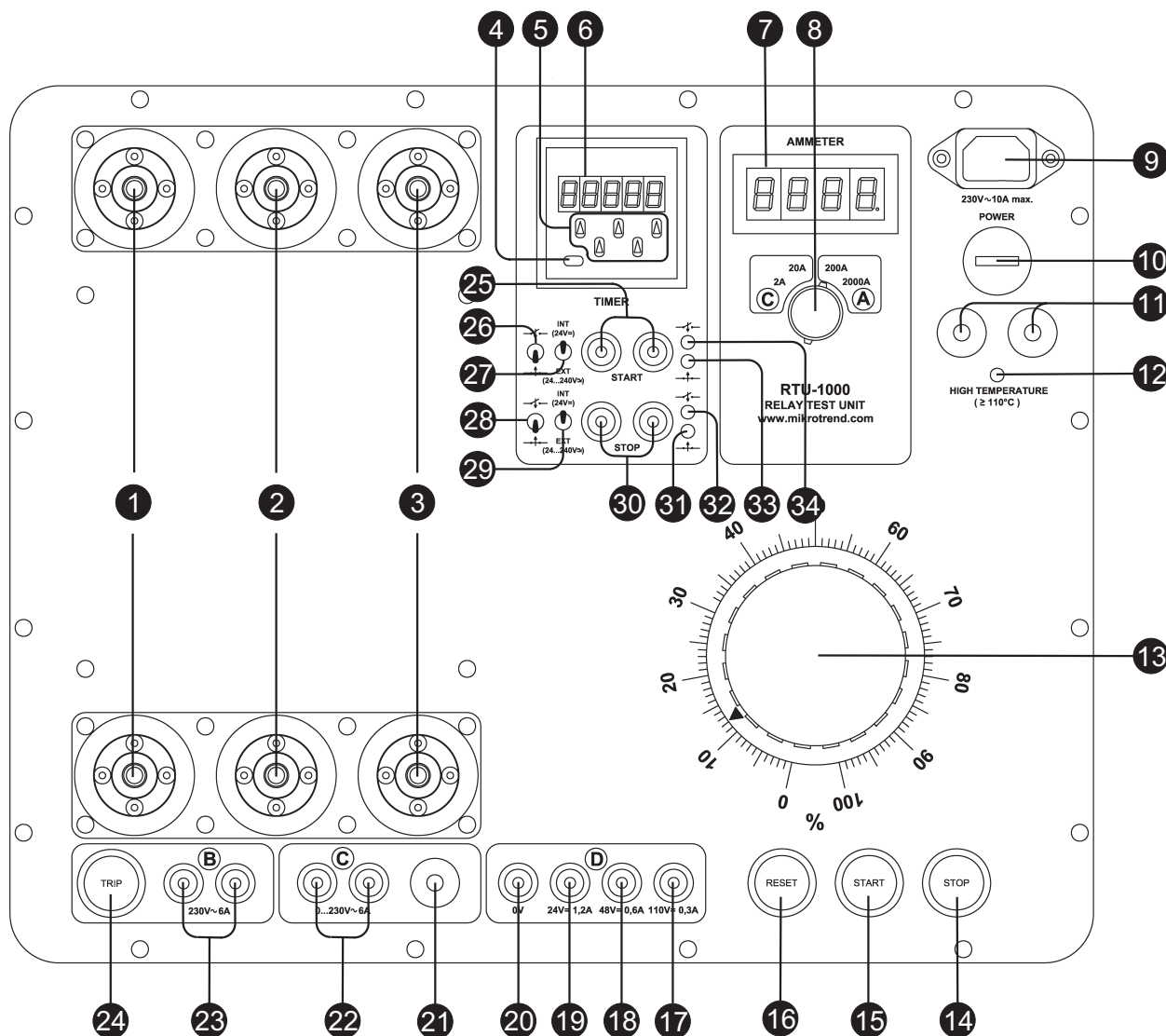
Unless otherwise noted, the products described in this publication are designed to meet usual "service and installation conditions". Open-style devices must be provided with environmental and safety protection by proper mounting in enclosures designed for specific application conditions. See explanations of the degrees of protection provided by different types of enclosures.

Performance Data

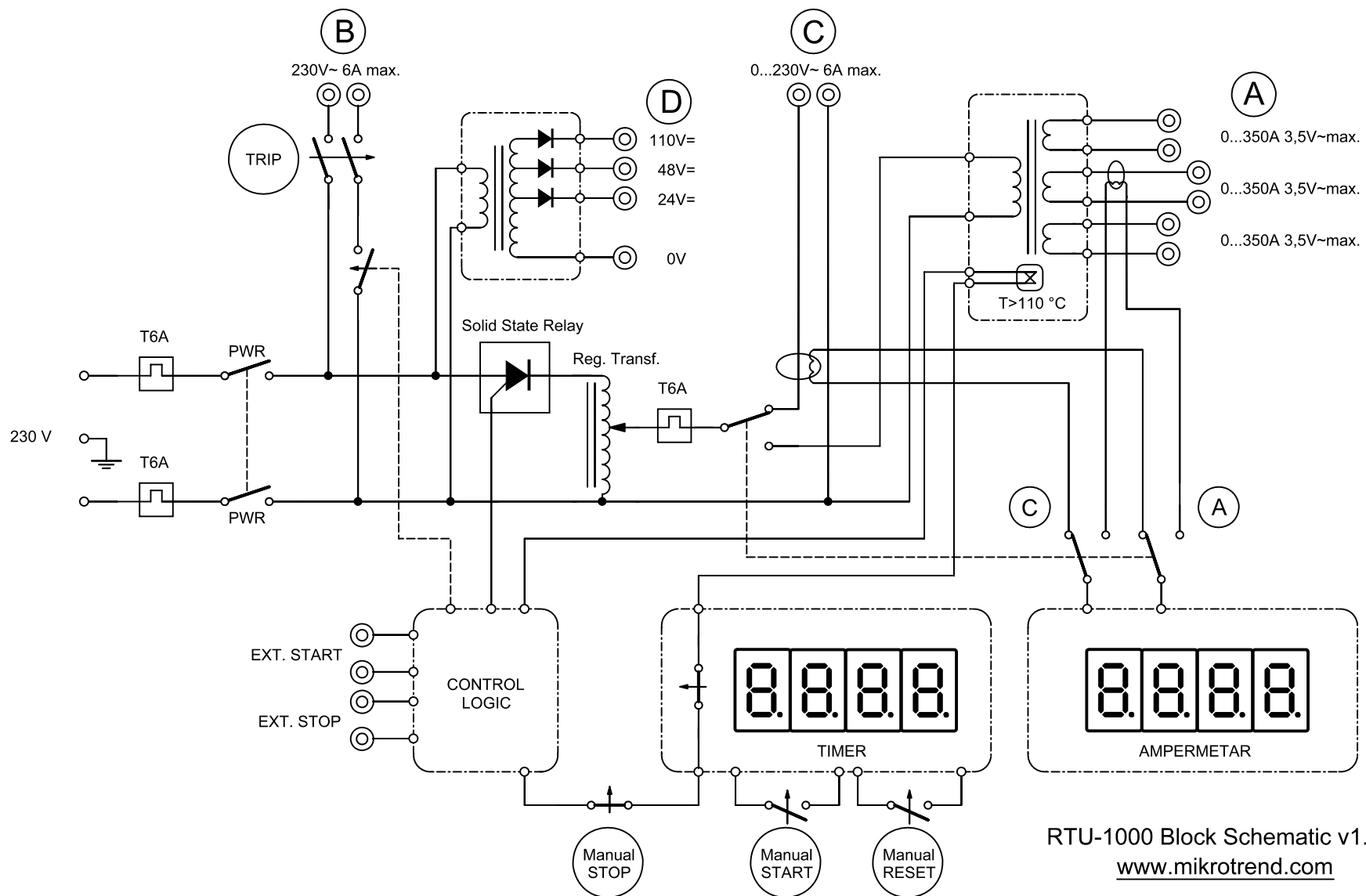
Performance data given in technical documentation is provided only as a guide for the user in determining suitability and do not constitute a performance warranty of any kind. Such data may represent the results of accelerated testing at elevated stress levels, and the user is responsible for correlating the data to actual application requirements. **ALL WARRANTIES AS TO ACTUAL PERFORMANCE, WHETHER EXPRESS OR IMPLIED, ARE EXPRESSLY DISCLAIMED.**

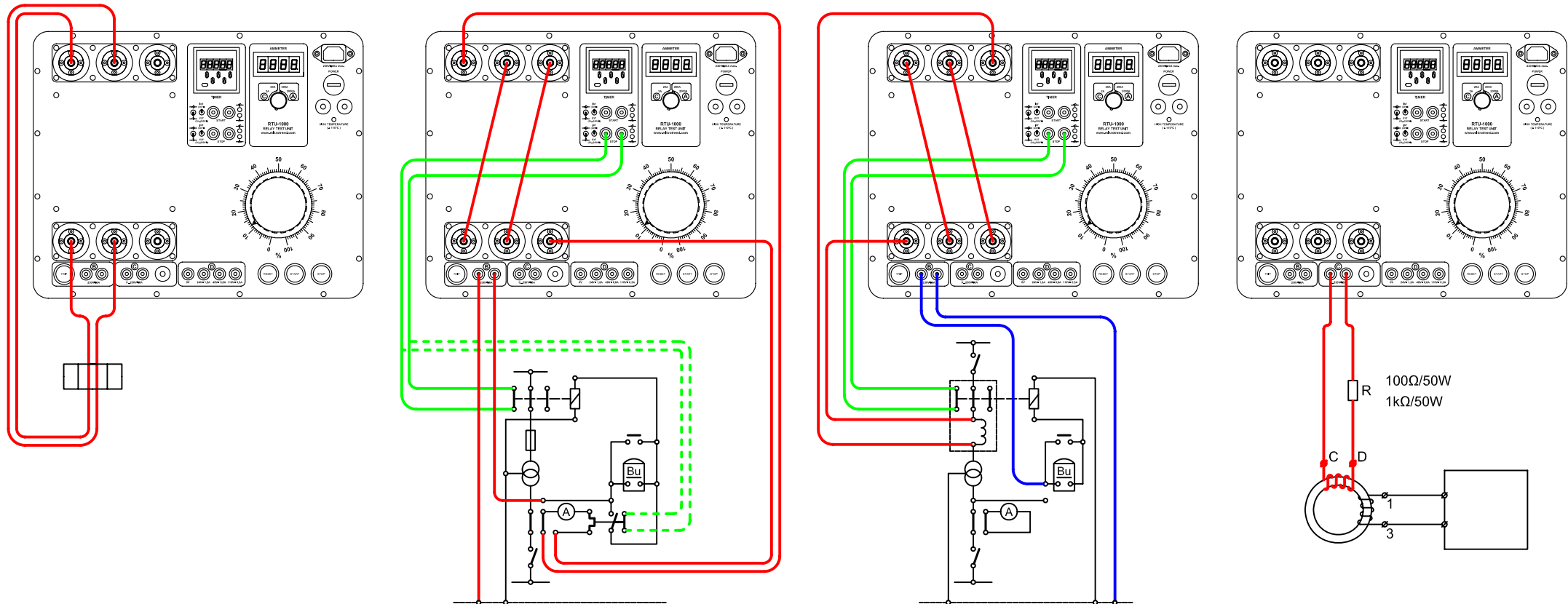
Safety Recommendations for Maintenance Personnel

All maintenance work should be done by qualified personnel familiar with the construction, operation, and hazards involved with the equipment.



- | | |
|---|--|
| 1. Output A1 | 20. Output D - output 0V |
| 2. Output A2 (Built-in Ammeter) | 21. Regulation transformer fuse (6A), automatic |
| 3. Output A3 | 22. Output C - output 0...230Vac |
| 4. Timer reset | 23. Output B - output 230Vac, timer activated |
| 5. Set time | 24. "Trip", activates output B |
| 6. Timer display (sec.) | 25. Auto-Start signal, input |
| 7. Ammeter | 26. Selector Normally Open/Normally Closed contact of Auto-Start signal |
| 8. Output (C or A) and range selector | 27. Selector INT ern/ EXT ern power for Auto-Start signal |
| 9. Mains power plug, 230Vac, 50Hz | 28. Selector Normally Open/Normally Closed contact of Auto-Stop signal |
| 10. Mains power switch | 29. Selector INT ern/ EXT ern power for Auto-Stop signal |
| 11. Mains power fuse (6A), automatic | 30. Auto-Stop signal, input |
| 12. High temperature, output A , $T > 110^{\circ}\text{C}$ | 31. Indicator: Auto-Stop signal, circuit closed |
| 13. Regulation transformer | 32. Indicator: Auto-Stop signal, circuit open |
| 14. "Stop", manual stop | 33. Indicator: Auto-Start signal, circuit closed |
| 15. "Start", manual start | 34. Indicator: Auto-Start signal, circuit open |
| 16. "Reset", timer reset | |
| 17. Output D - output 110Vdc | |
| 18. Output D - output 48Vdc | |
| 19. Output D - output 24Vdc | |





RTU-1000
www.mikrotrend.com

5. TECHNICAL SPECIFICATION

Specification:

Measured at 230Vac, 50Hz, 25°C ambient, duty cycle = 1/10

Output A: For testing Overcurrent Protective Relays, etc. Consists of 3 independent output windings which can be connected in parallel or in series:

Parallel connection:

- 0...3Vac max, 0...1000Aac max,

Serial connection:

- 0...9Vac max, 0...350Aac max,

Output B: For testing Actuators etc.

- 230Vac, 6A max., continuous,

Output C: For testing Voltmeters, Overcurrent Protective Relays (via current transformer test input) etc.

- 0...230Vac, 6A max.,

Output D: Auxillary power supply for devices under test (DUT)

- 24Vdc, 1,2A max., stabilised, continuous,

- 48Vdc, 0,6A max., stabilised, continuous,

- 110Vdc, 0,3A max., stabilised, continuous,

TIMER:

Time: 999,99sec.

Functions: Auto-Start, Auto-Stop, Manual Start, Manual Stop, Reset, Preprogrammed pulse,

Auto-Start signal: 24...240Vdc, 10mA max, Normally Open or Normally Closed, Internal or External powered,

Auto-Stop signal: 24...240Vdc, 10mA max, Normally Open or Normally Closed, Internal or External powered,

Resolution: 10msec,

Display: LED, 8mm,

AMMETER:

Range: 2A, 20A, 200A, 2000A,

Accuracy : +/-3% (23°C <80% humidity),

Resolution: 0,1A,

Display: LED, 13mm,

**DIGITAL MULTIMETER WITH CURRENT CLAMP AND IR THERMOMETER
EX810 with IR Thermometer****Range, accuracy:**

0,1...1000Aac, 2,0%,
0,1mV...600Vac, +/-1,8%,
0,1mV...600Vdc, +/-2,8%,
0,1...40MΩ, +/-1,5%,
0,001nF...40000uF, +/-3%,
0,001kHz...4kHz, +/-1,5%,
-50...270°C, +/-2°C,

Working temperature: +5...+40°C,

Storage temperature: -20...+60°C,

Battery: 9V,

GENERAL:

Power supply: 230Vac, 50Hz, 8A max.,

Fuse: T6A,

Protection: Thermal cut-out and miniature circuit breakers,

Working temperature: +5...+45°C,

Storage temperature: -40...+60°C,

Dimensions: 380×430×160mm, portable case,

Weight: approx. 17kg

ACCESSORIES:

1 x Current clamp

Connection cables:

3 x 16mm² × 2,5m, silicone insulation

2 x 16mm² × 2,5m with alligator clips, silicone insulation

2 x 2,5mm² × 3m with 4mm plug+alligator clip, silicone insulation

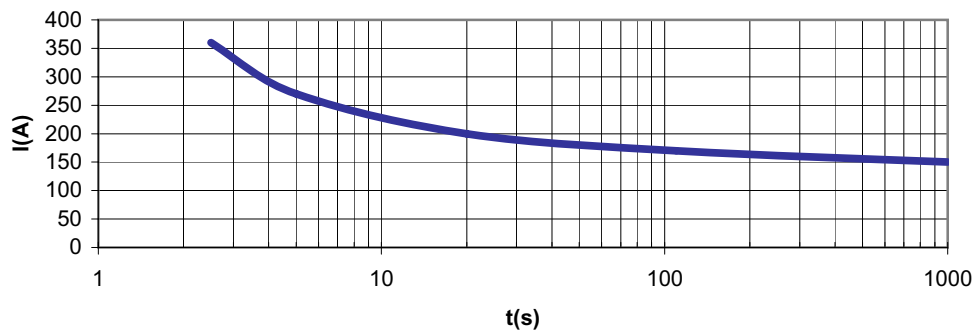
4 x 1,5mm² × 3m with 4mm plug+alligator clip, silicone insulation

Specifications are subject to change without notice.

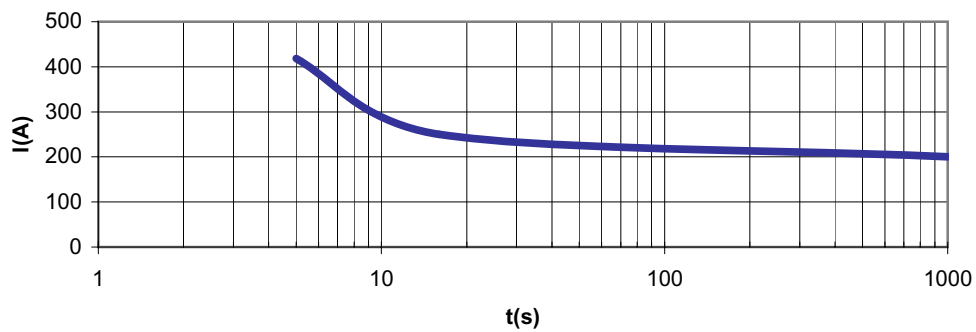
6. RTU - 1000, Output A, load curve, max. allowed values

Measured at 230Vac, 50Hz, 25°C ambient

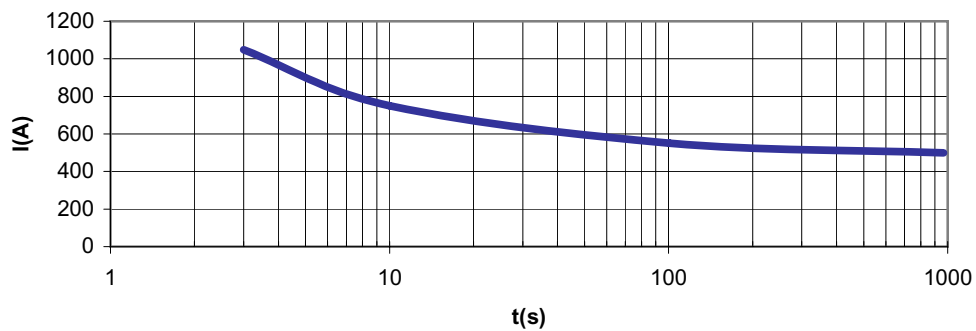
Three output windings in serial connection



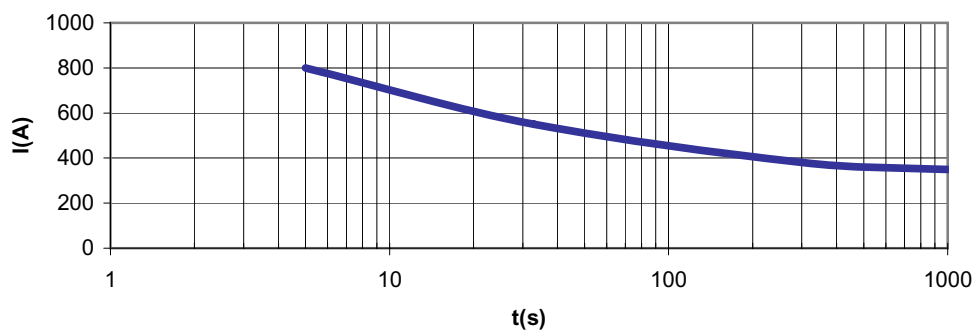
Two output windings in serial connection



Three output windings in parallel connection



Two output windings in parallel connection



Multifunktionaler Vorwahlzähler Typ 715



Ihr Nutzen

- gut ablesbare helle LED-Anzeige
- programmierbar als Impuls-, Frequenz- oder Betriebsstundenvorwahlzähler
- Spannungsversorgung 230 V AC, 115 V AC oder 11 ... 30 V DC
- Approbation

Weitere Vorzüge

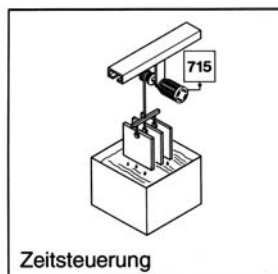
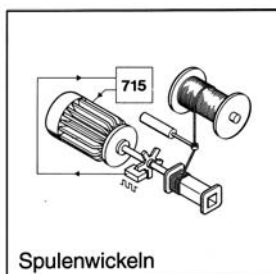
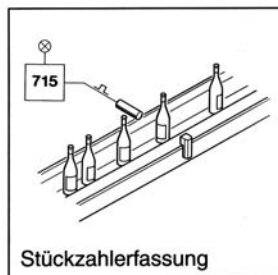
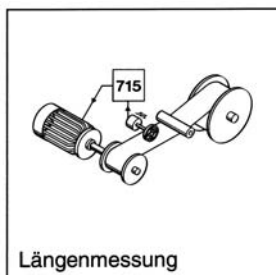
- Anzeigebereich –19999 ... 99 999 mit Vornullenunterdrückung
- einfache Vorwahleinstellung; jeder Dekade ist eine Vorwahltaste zugeordnet
- Relais oder Optokoppler-Ausgang
- Faktoreinstellung von 0,001 ... 9,999

Technische Daten

Spannungsversorgung:	11 ... 30 V DC, mit Verpolungsschutz
Stromaufnahme:	max. 100 mA, 4 VA
Anzeige:	5-stellige rote 7-Segment LED-Anzeige; 7,5 mm hoch
Polarität der Eingangssignale:	programmierbar für alle Eingänge gemeinsam
Eingangswiderstand:	ca. 10 k Ω
Zählfrequenz:	über DIL-Schalter für INP A und INP B separat einstellbar, 30 Hz, 10 kHz (7,5 kHz bei Eingangsart E4) bei automatischer Wiederholung 1 kHz ohne Zählverluste (600 Hz bei Eingangsart E4)
Mindestimpulsdauer der Steuereingänge:	5 ms
Schaltpegel der Eingänge bei:	DC-Versorgungsspannung: Low: 0 ... 0,2 x U _B [V DC] High: 0,6 x U _B ... 30 V DC AC-Versorgungsspannung: Low 0 ... 4 V DC High 12 ... 30 V DC
Impulsform:	beliebig, da Schmitt-Trigger

Ausgang Relais:	mit potentialfreiem Wechselkontakt max. 250 V AC/300 V DC Schaltstrom max. 3 A, Schaltstrom bei DC min. 30 mA Schaltleistung: max. 50 W bei DC max. 2000 VA bei AC
Optokoppler:	mit offenem Kollektor max. 30 V DC, 15 mA
Ansprechzeit der Ausgänge:	Relais: ca. 6 ms Optokoppler: ca. 1 ms
Datensicherung:	min. 10 Jahre oder 10 ⁶ Speicherzyklen
Geberspannung:	24 V DC –40 %/+15 %, 80 mA unstabilisiert bei AC-Ausführung
Umgebungstemperatur:	0 ... +50 °C, nicht betauend
Lagertemperatur:	–25 ... +70 °C
EMV:	CE-konform zur EG-Richtlinie 89/36/EWG
Normen :	EN 61000-6-4/EN 55011 Klasse B EN 61000-6-2
UL:	File-Nr.: E128604
Schutzart:	IP65 (frontseitig)
Gewicht:	ca. 240 g, (AC-Ausführung mit Relais)

Anwendungsbeispiele



Betriebsarten Impulszähler

Betriebsart	Zählbeginn	Ausgangssignal bei Zählerstand	Ausgangsart
1	0	$\geq$ Vorwahl	Dauer oder Wischsignal
2	Vorwahl	$\leq$ 0	Dauer oder Wischsignal
3	0	= Vorwahl	Wischsignal und automatische Wiederholung
4	Vorwahl	= 0	Wischsignal und automatische Wiederholung

Betriebsart-Einstellungen

1. Impulszähler

Betriebsarten siehe Tabelle

Dezimalpunkt: 0 ... 3 Dezimalstellen

Polarität: npn oder pnp

Eingangsarten:

- E1: Impuls bzw. Zähleingang und ein Eingang für Vor- oder Rückwärtsumschaltung. Wird dieser Eingang nicht beschaltet, addiert der Zähler; beschaltet subtrahiert er.
- E2: Differenzeingang mit einem Vorwärts- und einem Rückwärtseingang
- E3: Phasendiskriminatoreingang für Drehgeber mit zwei um 90° phasenverschobenen Impulsen zur automatischen Zählrichtungserkennung
- E4: Phasendiskriminatoreingang mit Impulsdoppelauswertung. Jede Impulsflanke des Zähleingangs "A" erzeugt einen Zählimpuls

Faktor: 0,001 ... 9,999

Ausgangssignale: Dauer- oder Wischsignal
einstellbar (0,01 ... 99,98 s)

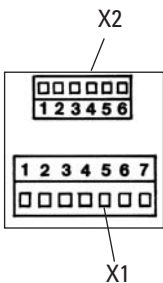
2. Frequenzzähler

- Gate: Torzeit, einstellbar von 0,001 ... 99,99 s
- Dezimalpunkt: 0 ... 3 Dezimalstellen
- Polarität: npn oder pnp
- Eingangsarten: siehe Impulszähler E1 ... E4
- Faktor: 0,001 ... 9,999
- Ausgangssignale: Dauer- oder Wischsignal
einstellbar (0,01 ... 99,98 s)

3. Zeitzähler

- Betriebsarten: siehe Impulszähler
- Zählung: s, min oder h;
Auflösung: 0,001; 0,01; 0,1 oder 1,0
- Polarität: npn oder pnp
- Ausgangssignale: Dauer- oder Wischsignal
einstellbar (0,01 ... 99,98 s)

Anschlussbelegung:



Steckerbelegung X1:

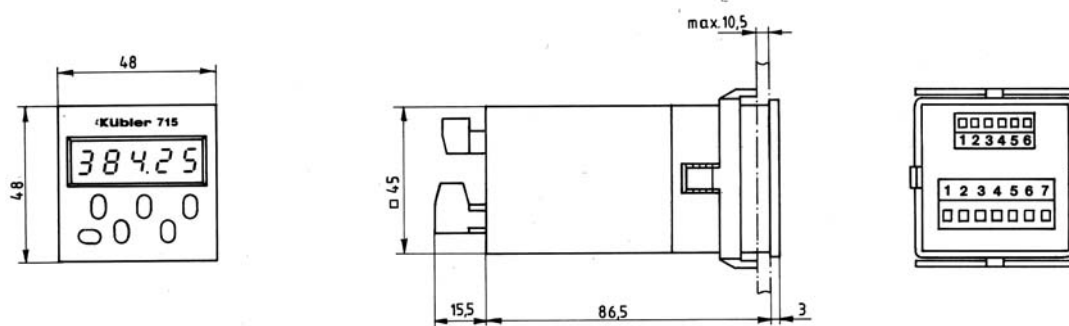
Pin	115/230 V AC-Version	11 ... 30 V DC Version
1	+24 V DC Geber- versorgungsspannung	—
2	0 V DC (GND)	—
3	Relaisausgang, gemeinsamer Kontakt (C) Optokopplerausgang Emitter	
4	Relaisausgang Schließer (NO)	
5	Relaisausgang Öffner (NC) Optokopplerausgang Kollektor	
6	115 V AC/230 V AC	11 ... 30 V DC
7	115 V AC/230 V AC	0 V DC (GND)

Steckerbelegung X2:

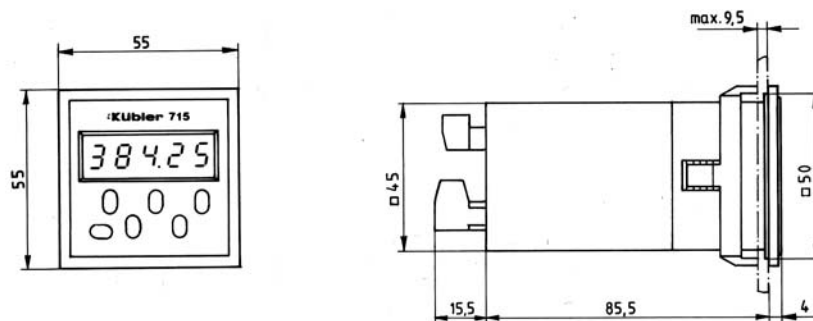
Pin	Benennung	Funktion
1	INP A	Zähleingang A
2	INP B	Zähleingang B
3	Gate	Toreingang
4	Reset	Rücksetzeingang
5	Latch	Anzeigestop-Eingang
6	Key	Tastaturverriegelungs-Eingang

Maßbilder:

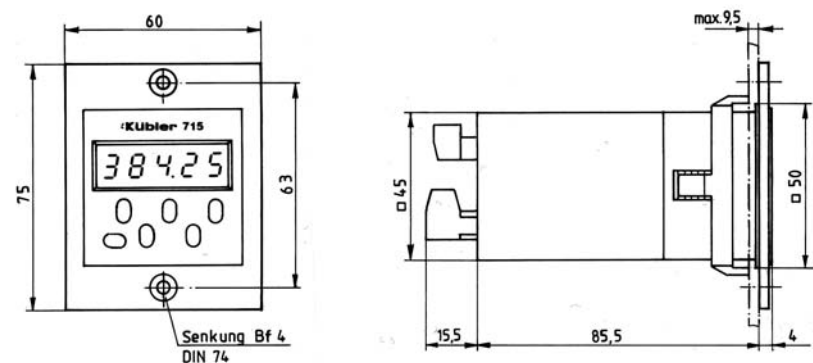
715: Einbauquerschnitt 45 x 45 mm



715: mit Frontrahmen 2
Einbauquerschnitt 50 x 50 mm



715: mit Frontrahmen 3
Einbauquerschnitt 50 x 50 mm



Lieferumfang:

- Zähler 715
- 1 Schraubklemme 7polig
- 1 Schraubklemme 6polig
- 1 Frontrahmen für Schraubbefestigung
Einbauquerschnitt 50 x 50 mm
- 1 Frontrahmen für Spannbügelbefestigung
Einbauquerschnitt 50 x 50 mm
- 1 Spannbügel
- 1 Schablone für Schaltfelausschnitt
- 1 Bedienungsanleitung

Bestellschlüssel:

6.715.01X.X00

Versorgungsspannung
0 = 230 V AC
1 = 115 V AC
3 = 11 ... 30 V DC

Ausgang
0 = Relais
1 = Optokoppler

Bedienungsanleitung 5.94.1 (Ausg. 3.97)

Elektronischer Vorwahlzähler Type 715

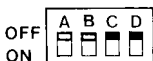
1. Beschreibung

- 5stelliger add./subtr. Vorwahlzähler mit einer Vorwahl
- gut ablesbare 7,5 mm hohe LED-Anzeige
- Zähl- und Vorwahlbereich –19999 bis 99999
- Über- oder Unterlauf ohne Zählverluste bis jeweils 1 Dekade, hierbei blinkt die Anzeige im s-Takt
- programmierbar als Impuls-, Frequenz- oder Zeit- bzw. Betriebsstundenzähler
- Relais- oder Optokopplerausgang (siehe Bestellschlüssel)
- Die Programmierung der Zählfunktionen bzw. Betriebsparameter erfolgt über die Vorwahlstasten. Bedienerführung auf dem Display während der Programmerroutine.
- programmierbar sind:
 - Betriebsart (Ausgangssignal bei Null oder Vorwahl, mit oder ohne automat. Wiederholung)
 - Dezimalpunkt
 - Polarität der Eingänge (NPN oder PNP)
 - Eingangsart und Faktor
 - Ausgangssignal als Dauer- oder Wischsignal
 - Torzeit bei Programmierung als Frequenzzähler, Auflösung in s, min oder h als Zeitzähler
- Spannungsversorgung 230 VAC, 115 VAC oder 11...30 VDC

2. Eingänge

2.1 INP A, INP B

Zähleingänge. Die max. Zähhfrequenz dieser beiden Eingänge ist über die Programmschalter C und D (an der rechten Seite des Zählergehäuses) auf 30 Hz oder 10 kHz einstellbar.



	INP A		INP B	
Mikroschalter	30 Hz	10 kHz	30 Hz	10 kHz
C	ON	OFF		
D			ON	OFF

2.2 Gate

Statischer Toreingang; keine Zählung solange dieser Eingang aktiviert ist. In der Betriebsart Zeitzähler blinkt bei nichtaktiviertem Toreingang der Dezimalpunkt zwischen der 4. und 5. Dekade (Laufanzeige bei Zeiteinheiten h, min oder 0,1 min).

2.3 Reset

Dynamischer Rücksetzeingang; er ist mit der roten Set-Taste parallel geschaltet und setzt den Zähler bei add. Zählweise auf Null, bei subtr. Zählweise auf den Vorwahlwert.

2.4 Latch

Statischer Speichereingang für Anzeigestop. Mit der Aktivierung dieses Einganges wird der momentane Zählerstand in der Anzeige solange festgehalten, bis der Speichereingang wieder frei ist. Der Zähler zählt im Hintergrund weiter.

2.5 Key

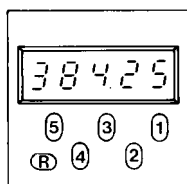
Statischer Tastaturverriegelungseingang. Solange dieser Eingang aktiviert ist, sind alle Fronttasten gesperrt.

3. Ausgang

Relaisausgang mit potentialfreiem Wechselkontakt oder Optokoppler mit offenem Emittor und Kollektor. Bei aktivem Ausgang erscheint rechts von der 1. Dekade der Dezimalpunkt. Für Sicherheitsschaltungen kann in den Betriebsarten 1 und 2 (nur bei Dauersignal) die Relais- bzw. Optokoppleransteuerung invertiert werden, d.h. die Relaispule wird bei Erreichen der Vorwahl spannungslos bzw. der Optokoppler gesperrt. Hierzu muß in den Programmerroutinen die Dauer des Ausgangssignals auf 99,99 s eingestellt werden.

4. Einstellung der Betriebsparameter

- Spannungsversorgung einschalten
- Programmschalter „A“ (an der rechten Seite des Zählergehäuses) kurzzeitig auf „ON“ stellen. Auf dem Display wird der 1. Menüpunkt angezeigt.

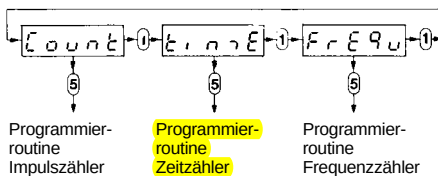


- Mit der Taste 1 die gewünschte Funktion auswählen.
- Mit der Taste 5 wird der eingestellte Wert übernommen und auf den jeweiligen nächsten Menüpunkt weitergeschaltet.
- Erneut mit der Taste 1 die gewünschte Funktion bzw. Zählerwerte (Faktor, Wisch- oder Torzeit) direkt über die Tasten 1 bis 4 eingeben.
- Nach dem letzten Menüpunkt (Dauersignal oder Wischsignal) wird mit der Taste 5 die Programmerroutine verlassen (Programmschalter „A“ auf „OFF“). Falls Schalter „A“ noch auf „ON“ geschaltet ist, wird die Programmerroutine nochmals durchlaufen.

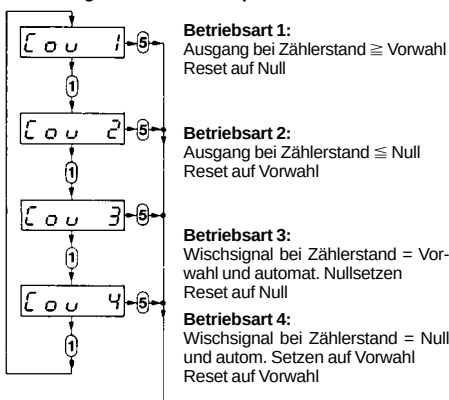
5. Einstellung der Betriebsart

5.1 Einstellung der Grundbetriebsart

Nach kurzzeitigem Umschalten des Programmschalters „A“ auf „ON“ erscheint eines der folgenden Bilder auf dem Display.



5.2.1 Programmerroutine Impulszähler



Dezimalpunkt:
nur anzeigende Funktion!
dP0 = kein Dezimalpunkt
dP1 = 0000.0
dP2 = 000.00
dP3 = 00.000

Polarität der Eingänge:
negative Polarität (NPN), nach 0 V schaltend
positive Polarität (PNP), nach +24 V schaltend

Eingangsart:
E 1: INP A = Zähleingang
INP B = Zählrichtungseingang
E 2: INP A = Zähleingang add.
INP B = Zähleingang subtr.
E 3: Phasendiskriminator
INP A = Zähleingang 0°
INP B = Zähleingang 90°
E 4: wie E 3, jedoch mit Impulsverdopplung. Jede Flanke von INP A wird gezählt

Faktor:

0,001...9,999
Einstellung über Tasten 1 bis 4
Faktor 0,000 wird nicht akzeptiert
Achtung! In den Betriebsarten 2 und 4 (Ausgangssignal bei Zählerstand = Null) muß der Vorwahlwert ganzzahlig durch den Faktor teilbar sein, andernfalls wird der Zähler bei einem Reset auf das nächstgrößere ganzzahlige Vielfache des Faktors gesetzt.

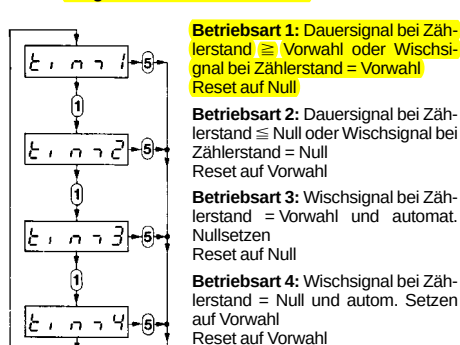
Dauer des Ausgangssignals:

00,00 = Dauersignal bei Betriebsarten 1 und 2
0,01...99,98 s = Wischsignal bei Betriebsarten 1 bis 4
Einstellung 99,99 s = Dauersignal bei Betriebsarten 1 und 2, jedoch mit invertierter Relais- oder Optokoppleransteuerung (Relaispule wird bei Erreichen der Vorwahl spannungslos bzw. Optokoppler gesperrt).

Wenn Programmschalter „A“ auf „OFF“ ist, wird jetzt die Programmerroutine verlassen und der Zähler ist funktionsbereit.

Falls Programmschalter „A“ noch auf „ON“ steht, muß die Programmerroutine nochmals durchlaufen werden.

5.2.2 Programmerroutine Zeitzähler



Betriebsart 1: Dauersignal bei Zählerstand $\geq$ Vorwahl oder Wischsignal bei Zählerstand = Vorwahl
Reset auf Null

Betriebsart 2: Dauersignal bei Zählerstand $\leq$ Null oder Wischsignal bei Zählerstand = Null
Reset auf Vorwahl

Betriebsart 3: Wischsignal bei Zählerstand = Vorwahl und automat. Nullsetzen
Reset auf Null

Betriebsart 4: Wischsignal bei Zählerstand = Null und automat. Setzen auf Vorwahl
Reset auf Vorwahl

Zeiteinheit:

Zählung in s; 0,1 s; 0,01 s oder 0,001 s*

Zählung in min; 0,1 min; 0,01 min oder 0,001 min*

Zählung in h; 0,1 h; 0,01 h oder 0,001 h*
*je nach Stellung des Dezimalpunktes

Dezimalpunkt (Auflösung)

dP0 = keine Dezimalstelle
dP1 = 0000.0
dP2 = 000.00
dP3 = 00.000

Polarität der Eingänge

negative Polarität (NPN), nach 0 V schaltend

positive Polarität (PNP), nach +24 V schaltend

Dauer des Ausgangssignals:

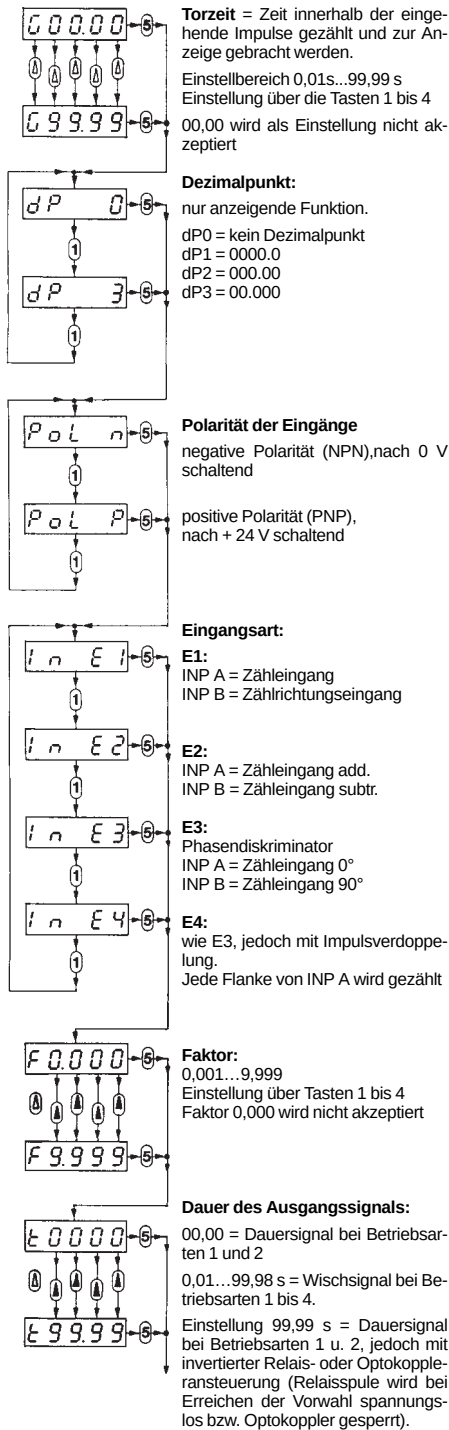
00,00 = Dauersignal bei Betriebsarten 1 und 2
0,01...99,98 s = Wischsignal bei Betriebsarten 1 bis 4

Einstellung 99,99 s = Dauersignal bei Betriebsarten 1 und 2, jedoch mit invertierter Relais- oder Optokoppleransteuerung (Relaispule wird bei Erreichen der Vorwahl spannungslos bzw. Optokoppler gesperrt).

Wenn Programmierschalter „A“ auf „OFF“ ist, wird jetzt die Programmerroutine verlassen und der Zähler ist funktionsbereit.

Falls Programmierschalter „A“ noch auf „ON“ steht, muß die Programmerroutine nochmals durchlaufen werden.

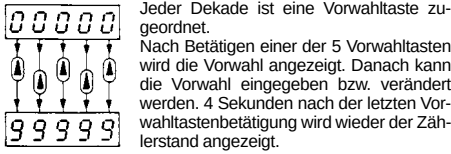
5.2.3 Programmerroutine Frequenzzähler



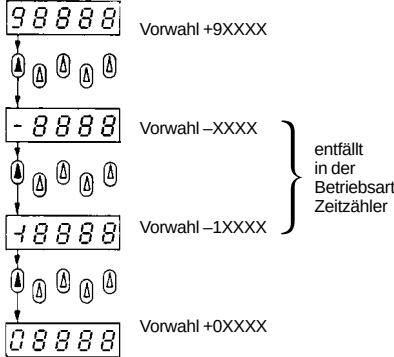
Wenn Programmierschalter „A“ auf „OFF“ ist, wird jetzt die Programmerroutine verlassen und der Zähler ist funktionsbereit.

Falls Programmierschalter „A“ noch auf „ON“ steht, muß die Programmerroutine nochmals durchlaufen werden.

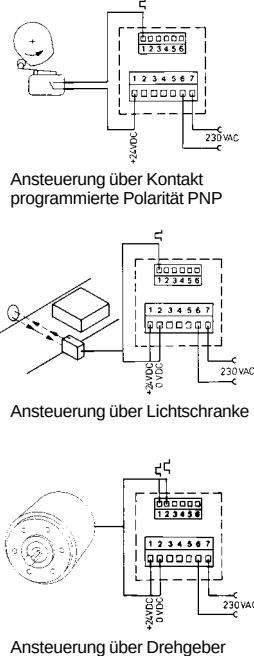
6. Vorwaleinstellung:



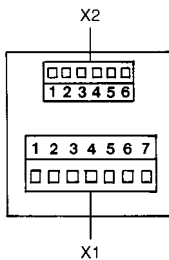
6.1 Vorwaleingabe in der 5. Dekade



7. Anschlußbeispiele:



8. Anschlußbelegung



Steckerbelegung X1

Klemme Nr.	115/230-VAC-Version	11...30 VDC-Version
1	+24 VDC Geberversorgungsspannung	—
2	0 VDC (GND)	—
3	Relaisausgang gemeinsamer Kontakt (C) Optokopplerausgang Emitter	—
4	Relaisausgang Schließer (NO)	—
5	Relaisausgang Öffner (NC) Optokopplerausgang Kollektor	—
6	115 VAC / 230 VAC	11...30 VDC Betriebsspannung
7	115 VAC / 230 VAC	0 VDC (GND)

Achtung! Bei Einstellung Dauersignal = 99,99 s (invertierte Relais- oder Optokoppleransteuerung) ändern sich die Anschlüsse der Klemmen 4 und 5.

Klemme Nr.	AC- und DC-Version
4	Relaisausgang Öffner (NC)
5	Relaisausgang Schließer (NO)

Steckerbelegung X2

Klemme Nr.	Benennung	Funktion
1	INP A	Zähleingang A
2	INP B	Zähleingang B
3	GATE	Toreingang
4	RESET	Rücksetzeingang
5	LATCH	Anzeigestop-Eingang
6	KEY	Tastaturverriegelungs-Eingang

9. Technische Daten

Spannungsversorgung:
230 VAC, 115 VAC, max. 4 VA
oder 11...30 VDC, max. 0,1 A

Anzeige:
5stellige 7-Segment-LED-Anzeige
7,5 mm hoch, rot

Polarität der Eingangssignale:
programmierbar, für alle Eingänge gemeinsam

Eingangswiderstand:
ca. 10 kOhm

Zählfrequenz:
über DIL-Schalter für INP A und INP B separat einstellbar
30 Hz
10 kHz (7,5 kHz bei Eingangsart E4)
bei automatischer Wiederholung 1 kHz ohne Zählverluste (600 Hz bei Eingangsart E4)

Mindestimpulszeit der Steuereingänge:
5 ms

Schaltpegel der Eingänge:
Bei AC-Spannungsversorgung
Log „0“: 0... 4 VDC
Log „1“: 12...30 VDC
Bei DC-Spannungsversorgung U_b
Log „0“: 0...0,2 x U_b
Log „1“: 0,6 x U_b ...30 VDC

Impulsform:
beliebig, da Schmitt-Trigger-Eingänge

Ausgang:
Relais mit potentialfreiem Wechselkontakt
Schaltspannung max. 250 VAC / 300 VDC
Schaltstrom max. 3 A
Schaltstrom bei DC min. 30 mA
Schaltleistung max. 50 W bei DC
max. 2000 VA bei AC
oder
Optokoppler mit offenem Kollektor und Emitter
Schaltleistung: 30 VDC / 15 mA
 U_{cesat} bei $I_c = 15$ mA: max. 2,0 V
 U_{cesat} bei $I_c = 5$ mA: max. 0,4 V

Ansprechzeit des Ausganges:
Relais: ca. 6 ms
Optokoppler: ca. 1 ms

Datensicherung:
min. 10 Jahre oder 10^6 Speicherzyklen

Geberspannung:
24 VDC -40%/+15%, 80 mA unstabilisiert
bei AC-Ausführung

Störfestigkeit:
EN 55011 Klasse B und prEN 50082-2
mit geschirmten Dateneingängen

Umgebungstemperatur:
0...50°C

Lagertemperatur:
-25°C...+70°C

Gewicht:
ca. 240 g (AC-Ausführung mit Relais)

Schutzart:
IP 54 von vorne

Gehäusefarbe:
schwarz

10. Bestellschlüssel

6.715.01X.X00

Spannungsversorgung
0 = 230 VAC
1 = 115 VAC
3 = 11...30 VDC

Ausgang
0 = Relais
1 = Optokoppler

1000A Clamp Meters with IR Thermometers

Clamp-on multimeter with built-in non-contact InfraRed Thermometer

Features:

- Non-contact InfraRed Temperature measurements with laser pointer
- Models with True RMS Current and Voltage measurements
- Peak hold captures inrush currents and Transients
- MultiMeter functions include AC/DC Voltage, Resistance, Capacitance, Frequency, Diode, and Continuity
- 1.7" (43mm) jaw opening for conductors up to 750MCM or two 500MCM
- 4000 count backlit dual display
- Features include Data Hold and Min/Max
- Autoranging with manual range button
- Auto Power off
- Complete with test leads, 9V battery, Type K probe (-4 to 482°F/-20 to 250°C) for EX820/EX830, and belt holster

Built-in **IR Thermometer**



Built-in IR Thermometer with laser pointer is an excellent troubleshooter for locating hot spots and overheating motors.



Model EX810

- AC Current
- Average responding

Model EX820

- AC Current
- True RMS
- Type K thermometer

Model EX830

- AC/DC Current
- True RMS
- Type K thermometer
- DC Zero



CAT III - 600V

Patent Pending

Specifications	EX810	EX820	EX830	Basic Accuracy
IR Temperature	-58 to 518°F -50 to 270°C	-58 to 518°F -50 to 270°C	-58 to 518°F -50 to 270°C	±2.0% rdg or ±4°F/±2°C
AC Current	0.1 to 1000A	0.1 to 1000A	0.1 to 1000A	2.0% (EX810) 2.5% (EX820) 2.8% (EX830)
DC Current	—	—	0.1 to 1000A	±2.8%
AC Voltage	0.1mV to 600V	0.1mV to 600V	0.1mV to 600V	±1.8% (EX810) ±1.5% (EX820, EX830)
DC Voltage	0.1mV to 600V	0.1mV to 600V	0.1mV to 600V	±2.8% (EX830)
Resistance	0.1 to 40MΩ	0.1 to 40MΩ	0.1 to 40MΩ	±1.5%
Capacitance	0.001nF to 40,000μF	0.001nF to 40,000μF	0.001nF to 40,000μF	±3.0%
Frequency	0.001kHz to 4kHz	0.001kHz to 4kHz	0.001kHz to 4kHz	±1.5%
Type K Temperature	—	-4 to 1400°F -20 to 760°C	-4 to 1400°F -20 to 760°C	±(3%rdg+9°F/5°C)
Continuity	Yes	Yes	Yes	
Inrush	Yes	Yes	Yes	
Diode	Yes	Yes	Yes	
Dimensions	10.6x4.3x2" (270x110x50mm)			
Weight:	13.6oz (386g)			

Ordering Information:

EX8101000A AC Clamp/DMM+IR Thermometer

EX810-NISTL* 1000A AC Clamp/DMM+IR Thermometer w/NIST Cert.

EX8201000A AC True RMS Clamp/DMM+IR Thermometer

EX820-NISTL* 1000A AC True RMS Clamp/DMM+IR Thermometer w/NIST Cert.

EX8301000A AC/DC True RMS Clamp/DMM+IR Thermometer

EX830-NISTL* 1000A AC/DC True RMS Clamp/DMM+IR Thermometer w/NIST Cert.

*NISTL is a Limited NIST: Product is certified to all functions except IR Thermometer

EXTECH INSTRUMENTS CORPORATION
285 Bear Hill Road, Waltham, MA 02451-1064, U.S.A.
Phone: 781-890-7440 • Fax: 781-890-7864

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05/10/05 - R1

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User's Guide

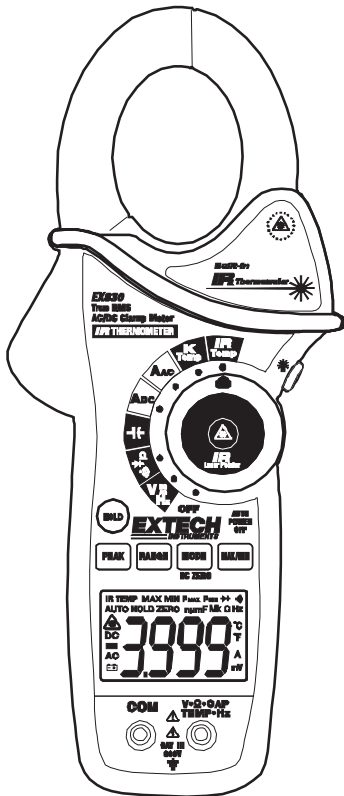
EXTECH
INSTRUMENTS

Extech 800 Series 1000 Amp Clamp Meters with IR Thermometer

EX810 AC Clamp meter

EX820 True RMS AC Clamp meter

EX830 AC/DC True RMS Clamp meter



Introduction

Congratulations on your purchase of the EX800 Series Clamp device. The series consists of the following models:

EX810	1000A AC Current Clamp meter
EX820	1000A True RMS AC Current Clamp
EX830	1000A True RMS AC/DC Current Clamp

All models measure:

- Infrared Temperature
- AC/DC Voltage
- Resistance
- Capacitance
- Frequency
- Continuity
- Diode

Model specific functions:

- EX830: DC Current, True RMS, Type K thermometer, DC Zero
- EX820: True RMS, Type K thermometer
- EX810: Average responding

The EX800 Series features:

- Auto Power OFF
- Max/Min recording
- Data Hold
- Peak Hold
- Backlit LCD display

Careful use of this meter will provide many years of reliable service.

Safety

International Safety Symbols



This symbol, adjacent to another symbol or terminal, indicates the user must refer to the manual for further information.



This symbol, adjacent to a terminal, indicates that, under normal use, hazardous voltages may be present



Double insulation

SAFETY NOTES

- Do not exceed the maximum allowable input range of any function.
- Do not apply voltage to meter when resistance function is selected.
- Set the function switch OFF when the meter is not in use.
- Remove the battery if meter is to be stored for longer than 60 days.

WARNINGS

- Set function switch to the appropriate position before measuring.
- When measuring volts do not switch to current/resistance modes.
- Do not measure current on a circuit whose voltage exceeds 600V.
- When changing ranges always disconnect the test leads from the circuit under test.

UL Note

A UL mark does not indicate that this product has been evaluated for accuracy.

CAUTIONS

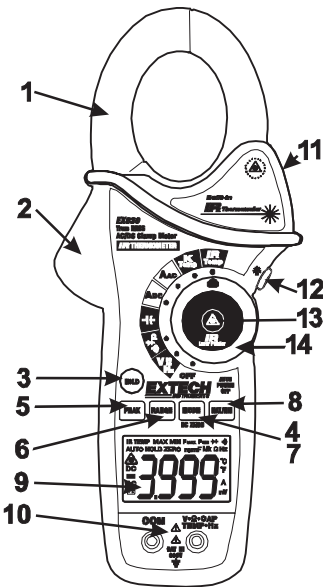
- Improper use of this meter can cause damage, shock, injury or death. Read and understand this user manual before operating the meter.
- Always remove the test leads before replacing the battery or fuses.
- Inspect the condition of the test leads and the meter itself for any damage before operating the meter. Repair or replace any damage before use.
- Use great care when making measurements if the voltages are greater than 25VAC rms or 35VDC. These voltages are considered a shock hazard.
- Always discharge capacitors and remove power from the device under test before performing Diode, Resistance or Continuity tests.
- Voltage checks on electrical outlets can be difficult and misleading because of the uncertainty of connection to the recessed electrical contacts. Other means should be used to ensure that the terminals are not "live".
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Function	Maximum Input
A AC, A DC (A DC on Model EX830 only)	1000A DC/AC
V DC, V AC	600V DC/AC
Resistance, Capacitance, Frequency, Diode Test	250V DC/AC
Type K Temperature (EX820 & EX830 only)	60V DC, 24V AC

Description

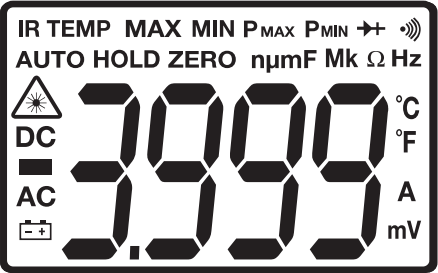
Meter Description (EX830 pictured)

- 1. Current clamp
- 2. Clamp opening trigger
- 3. Data Hold Button
- 4. Mode
- 5. Peak
- 6. Range
- 7. DCA Zero (EX830 only)
- 8. MIN/MAX
- 9. Backlit LCD Display
- 10. Test lead input jacks
- 11. IR thermometer and laser pointer (rear)
- 12. Backlight Button
- 13. Laser pointer button
- 14. Function switch



Display icons Description

HOLD	Data Hold
Minus sign	Negative reading display
0 to 3999	Measurement display digits
ZERO	DCA Zero (Model EX830 only)
P	Peak value
AUTO	Auto Range mode
DC/AC	Direct Current / Alternating Current
MAX	Max reading
MIN	Min reading
	Low battery
mV or V	Milli-volts or Volts (Voltage)
Ω	Ohms (Resistance)
A	Amperes (Current)
F	Farad (Capacitance)
Hz	Hertz (Frequency)
$^{\circ}\text{F}$ and $^{\circ}\text{C}$	Fahrenheit and Celsius units (Temperature)
n, m, μ , M, k	Unit of measure prefixes: nano, milli, micro, mega, and kilo
	Continuity test
	Diode test
	Laser pointer



Specifications

Function	Range & Resolution	Accuracy (% of reading + digits)		
		EX810	EX820	EX830
AC Current 50/60 Hz True RMS on EX820 & EX830	400.0 AAC	$\pm (2.8\% + 8d)$	$\pm (2.5\% + 8d)$	$\pm (2.5\% + 8d)$
	1000 AAC	$\pm (3.0\% + 8d)$	$\pm (2.8\% + 5d)$	$\pm (2.8\% + 5d)$
DC Current EX830 only	400.0 ADC	-----	-----	$\pm (2.5\% + 5d)$
	1000 ADC	-----	-----	$\pm (2.8\% + 5d)$
AC Voltage 50/60Hz True RMS on EX820 & EX830	400.0 mVAC	$\pm (1.5\% + 10d)$	$\pm (1.0\% + 10d)$	$\pm (1.0\% + 10d)$
	4.000 VAC	$\pm (1.8\% + 8d)$	$\pm (1.5\% + 5d)$	$\pm (1.5\% + 5d)$
	40.00 VAC			
	400.0 VAC			
	600 VAC	$\pm (2.5\% + 8d)$	$\pm (2.0\% + 5d)$	$\pm (2.0\% + 5d)$
DC Voltage	400.0 mVDC	$\pm (0.8\% + 2d)$	$\pm (0.8\% + 2d)$	$\pm (0.8\% + 2d)$
	4.000 VDC	$\pm (1.5\% + 2d)$	$\pm (1.5\% + 2d)$	$\pm (1.5\% + 2d)$
	40.00 VDC			
	400.0 VDC			
	600 VDC	$\pm (2.0\% + 2d)$	$\pm (2.0\% + 2d)$	$\pm (2.0\% + 2d)$
Resistance	400.0 Ω	$\pm (1.0\% + 4d)$	$\pm (1.0\% + 4d)$	$\pm (1.0\% + 4d)$
	4.000k Ω	$\pm (1.5\% + 2d)$	$\pm (1.5\% + 2d)$	$\pm (1.5\% + 2d)$
	40.000k Ω			
	400.0k Ω			
	4.000M Ω	$\pm (2.5\% + 3d)$	$\pm (2.5\% + 3d)$	$\pm (2.5\% + 3d)$
	40.00M Ω	$\pm (3.5\% + 5d)$	$\pm (3.5\% + 5d)$	$\pm (3.5\% + 5d)$
Capacitance	4.000nF	$\pm (5.0\% + 30d)$	$\pm (5.0\% + 30d)$	$\pm (5.0\% + 30d)$
	40.00nF	$\pm (5.0\% + 20d)$	$\pm (5.0\% + 20d)$	$\pm (5.0\% + 20d)$
	400.0nF	$\pm (3.0\% + 5d)$	$\pm (3.0\% + 5d)$	$\pm (3.0\% + 5d)$
	4.000 μ F			
	40.00 μ F			
	400.0 μ F	$\pm (4.0\% + 10d)$	$\pm (4.0\% + 10d)$	$\pm (4.0\% + 10d)$
	4.000mF	$\pm (10\% + 10d)$	$\pm (10\% + 10d)$	$\pm (10\% + 10d)$
	40.00mF	unspecified	unspecified	unspecified
Frequency	4.000kHz	$\pm (1.5\% + 2d)$	$\pm (1.5\% + 2d)$	$\pm (1.5\% + 2d)$
	Sensitivity: 100V (<50Hz); 50V (50 to 400Hz); 5V (401Hz to 4000Hz)			

Function	Range and Resolution	Accuracy (% of reading + digits)		
		EX810	EX820	EX830
Temperature (type-K)	-4 to 1400°F	NA	± (3%rdg + 9°F)	± (3%rdg + 9°F)
	-20 to 760°C	NA	± (3%rdg + 5°C)	± (3%rdg + 5°C)
Temp (IR)	-58 to -4°F	± 9 °F	± 9 °F	± 9 °F
	-4 to 518°F	±2.0% reading or ± 4°F whichever is >	±2.0% reading or ± 4°F whichever is >	±2.0% reading or ± 4°F whichever is >
	-50 to -20°C	±5°C	±5°C	±5°C
	-20 to 270°C	±2.0% reading or ±2°C whichever is >	±2.0% reading or ±2°C whichever is >	±2.0% reading or ±2°C whichever is >

General Specifications

Clamp jaw opening	1.7" (43mm) approx.
Display	3-3/4 digits (4000 counts) backlit LCD
Continuity check	Threshold 40Ω; Test current < 0.5mA
Diode test	Test current of 0.3mA typical; Open circuit voltage < 3VDC typical
Low Battery indication	Battery symbol is displayed
Over-range indication	'OL' display
Measurement rate	2 readings per second, nominal
PEAK	Captures peaks >1ms
Thermocouple sensor	Type K thermocouple required
IR Spectral response	6 to 16μm
IR Emissivity	0.95 fixed
IR distance ratio	8:1
Input Impedance	10MΩ (VDC and VAC)
AC bandwidth	50 to 400Hz (AAC and VAC)
AC response	True rms (AAC and VAC) on EX820 & EX830
Crest Factor	3.0 in 40A and 400A ranges, 1.4 in 1000A range (50/60Hz and 5% to 100% of range)
Operating Temperature	41°F to 104°F (5°C to 40°C)
Storage Temperature	-4°F to 140°F (-20°C to 60°C)
Operating Humidity	Max 80% up to 87°F (31°C) decreasing linearly to 50% at 104°F(40°C)
Storage Humidity	<80%
Operating Altitude	7000ft. (2000meters) maximum.
Battery	One (1) 9V Battery (NEDA 1604)
Auto power OFF	After approx. 25 minutes
Dimensions & Weight	10.6x4.3x2" (270x110x50mm); 13.6 oz. (386g)
Safety	For indoor use and in accordance with the requirements for double insulation to IEC1010-1 (2001): EN61010-1 (2001) Overvoltage Category III 600V and Category II 1000V, Pollution Degree 2.

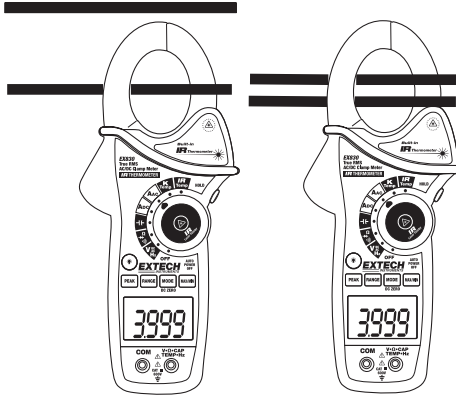
Operation

NOTES: Read and understand all **Warning** and **Caution** statements in this operation manual prior to using this meter. Set the function select switch to the OFF position when the meter is not in use.

AC/DC Current Measurements (DC Current on Model EX830 only)

WARNING: Ensure that the test leads are disconnected from the meter before making current clamp measurements.

1. Set the Function switch to the **Aac** or **Adc** range
2. Press the trigger to open jaw. Fully enclose only one conductor. For optimum results, center the conductor in the jaw.
3. The clamp meter LCD will display the reading.



Correct

Incorrect

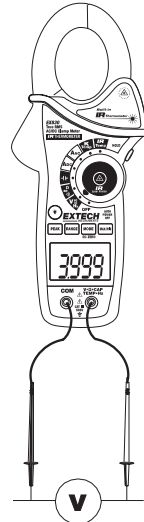
DCA ZERO (EX830 only)

The DC Zero feature removes offset values and improves accuracy for DC current measurements. To perform a zero, select ADC and with no conductor in the jaw:

1. Press the **DC ZERO** button to zero the display. "ZERO" will appear in the display. The offset value is now stored and removed from all measurements.
2. To view the stored value, press the **DC ZERO** button. "ZERO" will flash and the stored value will be displayed.
3. To exit this mode, press and Hold the **ZERO** button until "ZERO" is no longer in the display.

AC/DC Voltage Measurements

1. Insert the black test lead into the negative **COM** terminal and the red test lead into the positive **V** terminal.
2. Set the function switch to the **Vac** or **Vdc** position.
3. Use the **MODE** button to select AC or DC Voltage (EX830 only).
4. Connect the test leads in parallel to the circuit under test.
5. Read the voltage measurement on the LCD display.



Resistance Measurements

Note: Remove power before making resistance measurements

1. Insert the black test lead into the negative **COM** terminal and the red test lead into the **Ω** positive terminal.
2. Set the function switch to the **Ω** position.
3. Touch the test probe tips across the circuit or component under test.
4. Read the resistance on the LCD display.



Capacitance Measurements

WARNING: To avoid electric shock, discharge the capacitor under test before measuring. If “dISC” appears in the display, remove and discharge the capacitor.

1. Set the function switch to the $\text{--}\text{C}\text{--}$ capacitance position.
2. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the **CAP** positive jack.
3. Press MODE to zero any stray capacitance.
4. Touch the test probe tips across the part under test.
5. Read the capacitance value in the display.
6. The display will indicate the proper decimal point and value.

Note: For very large values of capacitance measurement time can be several minutes before the final reading stabilizes.



Frequency Measurements

1. Set the function switch to the V Hz Position.
2. Press and hold the MODE button to select the Frequency (Hz) function. “k Hz” will appear in the display.
3. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the **Hz** positive jack.
4. Touch the test probe tips across the part under test.
5. Read the Frequency value on the display.
6. The display will indicate the proper decimal point and value.
7. Press and hold the MODE button again to return to the voltage mode



Type K Temperature Measurements

(Models EX820 and EX830 only)

1. Set the function switch to the **K Temp** position.
2. Insert the Temperature Probe into the negative **COM** and the positive **TEMP** jacks, observing polarity.
3. Touch the Temperature Probe tip to the device under test. Continue to touch the part under test with the probe until the reading stabilizes.
4. Read the temperature on the display. The digital reading will indicate the proper decimal point and value.

WARNING: To avoid electric shock, be sure the thermocouple probe has been removed before changing to another measurement function.

Note: An open input or a temperature overrange the meter will display "OL" and beep.

Note: See the "Temperature Units" paragraph to select °F or °C



Continuity Measurements

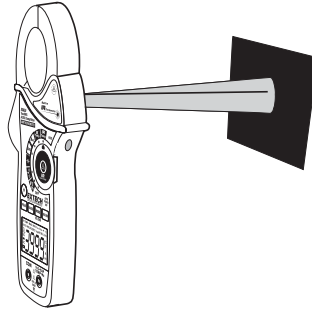
1. Insert the black test lead into the negative **COM** terminal and the red test lead into the **Ω** positive terminal.
2. Set the function switch to the **••••** position.
3. Use the **MODE** button to select continuity **••••**. The display icons will change when the **MODE** button is pressed.
4. Touch the test probe tips across the circuit or component under test.
5. If the resistance is < 40Ω, a tone will sound.

Diode Test

1. Insert the black test lead banana plug into the negative **COM** jack and the red test lead banana plug into the **→+** positive jack
2. Turn the function switch to **→+** position. Use the **MODE** button to select the diode function if necessary (diode symbol will appear on the LCD when in Diode test mode)
3. Touch the test probe tips to the diode or semiconductor junction under test. Note the meter reading
4. Reverse the test lead polarity by reversing the red and black leads. Note this reading
5. The diode or junction can be evaluated as follows:
 - If one reading displays a value (typically 0.400V to 0.900V) and the other reading displays **OL**, the diode is good.
 - If both readings display **OL** the device is open.
 - If both readings are very small or '0', the device is shorted.

Non-Contact InfraRed Temperature Measurements

1. Set the function switch to the **IR Temp** position.
2. Aim the infrared sensor (rear of the meter) at the surface to be measured.
3. Press the  button in the center of the rotary function switch to turn on the laser pointer and identify the surface spot to be measured.
4. The area of the surface to be measured must be larger than the spot size as determined by the distance to spot size specification.
5. Read the temperature in the display.



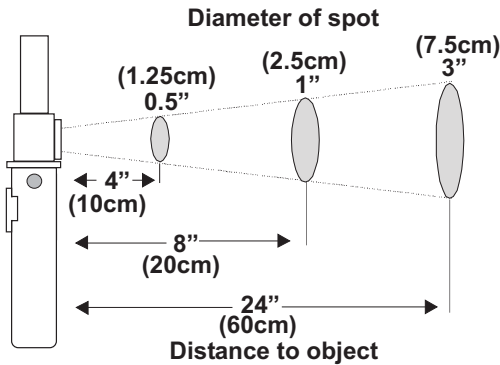
Note: See the "Temperature Units" paragraph to select °F or °C

WARNING: Do not directly view or direct the laser pointer at an eye. Low power visible lasers do not normally present a hazard, but may present some potential for hazard if viewed directly for extended periods of time.



IR Spot to Distance Diagram

The 8:1 spot to distance ratio determines the size of the measured surface area with respect to the distance the meter is held away from the surface.



IR Measurement Notes

1. The object under test should be larger than the spot (target) size calculated by the field of view diagram.
2. If the surface of the object under test is covered with frost, oil, grime, etc., clean before taking measurements.
3. If an object's surface is highly reflective, apply masking tape or flat black paint to the surface before measuring.
4. The meter may not make accurate measurements through transparent surfaces such as glass.
5. Steam, dust, smoke, etc. can obscure measurements.
6. To find a hot spot, aim the meter outside the area of interest then scan across (in an up and down motion) until the hot spot is located.

Data Hold

To freeze the LCD reading, press the **HOLD** button. While data hold is active, the **HOLD** icon appears on the LCD. Press the **HOLD** button again to return to normal operation.

Peak Hold

The Peak Hold function captures the peak AC or DC voltage or current. The meter can capture negative or positive peaks as fast as 1 millisecond in duration.

1. Turn the function switch to the A or V position.
2. Use the **MODE** button to select AC or DC (ADC EX830 only).
3. Allow time for the display to stabilize.
4. Press and Hold the **PEAK** button until "**CAL**" appears in the display. This procedure will zero the range selected.
5. Press the **PEAK** button, **Pmax** will display.
6. The display will update each time a higher positive peak occurs.
7. Press the **PEAK** button again, **Pmin** will display. The display will now update and indicate the lowest negative peak.
8. To return to normal operation, press and hold the **PEAK** button until the **Pmin** or **Pmax** indicator switches off.

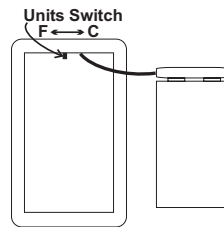
Note: If the Function switch position is changed after a calibration the Peak Hold calibration must be repeated for the new function selected.

MAX/MIN

1. Press the **MAX/MIN** key to activate the MAX/MIN recording mode. The display icon "**MAX**" will appear. The meter will display and hold the maximum reading and will update only when a new "max" occurs.
2. Press the **MAX/MIN** key and "**MIN**" will appear. The display icon "**MIN**" will appear. The meter will display and hold the minimum reading and will update only when a new "min" occurs.
3. Press the **MAX/MIN** key and a blinking "**MAX MIN**" will appear. The meter will display the present reading, but will continue to update and store the max and min readings.
4. To exit MAX/MIN mode press and hold the **MAX/MIN** key for 2 seconds.

Temperature Units (F / C)

The temperature units selection switch is located in the battery compartment. To change the units, remove the battery door, lift out the battery and set the switch for the desired units.



LCD Backlight Button

The LCD is equipped with backlighting for easier viewing, especially in dimly lit areas. Press the backlight button to turn the backlight on. Press again to turn the backlight off.

Automatic Power OFF

In order to conserve battery life, the meter will automatically turn off after approximately 25 minutes. To turn the meter on again, turn the function switch to the OFF position and then to the desired function position.

Maintenance

WARNING: To avoid electrical shock, disconnect the meter from any circuit, remove the test leads from the input terminals, and turn OFF the meter before opening the case. Do not operate the meter with an open case.

Cleaning and Storage

Periodically wipe the case with a damp cloth and mild detergent; do not use abrasives or solvents. If the meter is not to be used for 60 days or more, remove the battery and store it separately.

Battery Replacement

1. Remove the Phillips head screw that secures the rear battery door
2. Open the battery compartment
3. Replace the 9V battery
4. Secure the battery compartment

Temperature Probe Replacement

The replacement bead wire probe (with banana plug connectors) is Part Number TP873.

Note: To use a Type K thermocouple probe that is terminated by a subminiature (flat blade) connector, a subminiature-to-banana plug adaptor (Part Number TP879) is required.

Warranty

EXTECH INSTRUMENTS CORPORATION warrants this instrument to be free of defects in parts and workmanship for one year from date of shipment (a six month limited warranty applies to sensors and cables). If it should become necessary to return the instrument for service during or beyond the warranty period, contact the Customer Service Department at (781) 890-7440 ext. 210 for authorization or visit our website www.extech.com for contact information. A Return Authorization (RA) number must be issued before any product is returned to Extech. The sender is responsible for shipping charges, freight, insurance and proper packaging to prevent damage in transit. This warranty does not apply to defects resulting from action of the user such as misuse, improper wiring, operation outside of specification, improper maintenance or repair, or unauthorized modification. Extech specifically disclaims any implied warranties or merchantability or fitness for a specific purpose and will not be liable for any direct, indirect, incidental or consequential damages. Extech's total liability is limited to repair or replacement of the product. The warranty set forth above is inclusive and no other warranty, whether written or oral, is expressed or implied.

Calibration and Repair Services

Extech offers repair and calibration services for the products we sell. Extech also provides NIST certification for most products. Call the Customer Service Department for information on calibration services available for this product. Extech recommends that annual calibrations be performed to verify meter performance and accuracy.



Support line (781) 890-7440

Technical support: Extension 200; E-mail: support@extech.com

Repair & Returns: Extension 210; E-mail: repair@extech.com

Product specifications subject to change without notice

For the latest version of this User's Guide, Software updates, and other up-to-the-minute product information, visit our website: www.extech.com

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