



User Manual

INT-0230-S-01

DIN Rail Energy Meter for Single and Three Phase Electrical Systems

Warnings



Caution: Risk of Electric Shock

- During normal operation, voltages hazardous to life may be present at some of the terminals of this unit.
- At voltages below that specified in the Range of Use the meter may shut down. However, voltages hazardous to life may still be present at some of the terminals of this unit.
- Installation and servicing should be performed only by qualified, properly trained personnel abiding by local regulations.
- Ensure all supplies are de-energised before attempting connection or other procedures.
- Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions.
- This unit is not intended to function as part of a system providing the sole means of fault protection - good engineering practice dictates that any critical function be protected by at least two independent and diverse means.
- The unit does not have internal fuses therefore external fuses must be used for protection and safety under fault conditions.
- Never open-circuit the secondary winding of an energized current transformer.
- This product should only be operated with the CT secondary connections earthed.
- If this equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired.

1 Introduction

This document provides operating, maintenance and installation instructions. This unit measures and displays the characteristics of Single Phase Two Wire (1P2W), Three Phase Three Wire (3P3W) and Three Phase Four Wire (3P4W) networks. The measuring parameters include Voltage (V), Current (A), Frequency (Hz), Power (kW/KVA/KVAh), Power Factor (PF), Imported, Exported and Total Energy (kWh/kVAh). The unit also measures Maximum Demand Current and Power, this is measured over preset periods of up to 60 minutes. This particular model accommodates 1A or 5A Current Transformers and can be configured to work with a wide range of CTs. It also comes with a complete comms capability with built in Pulse and RS485 Modbus RTU outputs, configuration is password protected. This product can be powered from a separate auxiliary supply (AC or DC). Alternatively, it can be powered from the monitored supply by linking the voltage reference and neutral reference in to terminals 5 & 6 (Please refer to wiring diagram).

1.1 Unit Characteristics

The Integra 0230 can measure and display:

- Phase to Neutral Voltage and THD% (Total Harmonic Distortion) of all Phases
- Line Frequency
- Current, Maximum Demand Current and Current THD% of all Phases
- Power, Maximum Power Demand and Power Factor
- Imported, Exported & Total Active Energy
- Imported, Exported & Total Reactive Energy

The unit has a Password-Protected set up menu for:

- Changing the Password
- System Configuration - 1P2W, 3P3W, 3P4W.
- Demand Interval Time
- Reset for Demand Measurements
- Pulsed Output Duration

1.2 Current Transformer Primary Current

This unit requires configuring to operate with the appropriate current transformer(s), the optional secondary currents are 1A or 5A. It is programmed by inputting the ratio (CT Primary divided by the CT Secondary). It can be used on primary currents up to 6000A.

On the MID Version, you can only program the CT multiplier ONCE.

This cannot be overridden and must be returned to the factory.

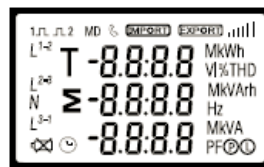
1.3 RS485 Serial – Modbus RTU

This unit is compatible with remote monitoring through RS485 Modbus RTU. Set-up screens are provided for configuring the RS485 port. Refers to section 4.8.

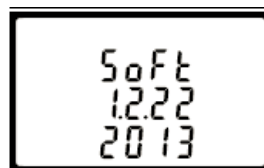
1.4 Pulsed Outputs

The Integra 0230 has Two Pulsed Outputs that can be set for active (kWh) or reactive (kVAh) energy. Terminals 11 & 12 have a fixed output of 3200imp/kWh. Terminals 9 & 10 are configurable within the setup menu.

2 Start Up Screens



The first screen lights up all display segments and can be used as a display check.



The second screen indicates the firmware installed in the unit and its build number.



The interface performs a self-test and indicates the result if the test passes.

*After a short delay, the screen will display active energy measurements.

3 Measurements

The buttons operate as follows:



Selects the Voltage and Current display screens. In Set-up Mode, this is the "Left" (press) or "Escape" (hold 3sec) button.



Select the Frequency and Power factor display screens. In Set-up Mode, this is the "Up" (press) button.



Select the Power display screens. In Set-up Mode, this is the "Down" (press) button.



Select the Energy display screens. In Set-up mode, this is the "Right" (press) or "Enter" (hold 3sec) button.

3.1 Voltage and Current

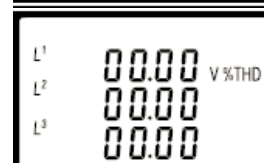
Each successive press of the button selects a new parameter.



Phase to neutral voltages.



Current on each phase.



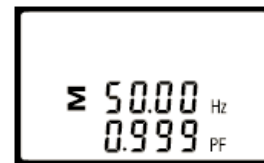
Phase to neutral voltage THD%.



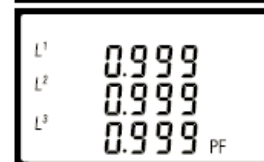
Current THD% for each phase.

3.2 Frequency and Power Factor and Demand

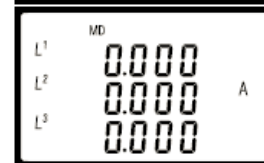
Each successive press of the button selects a new range:



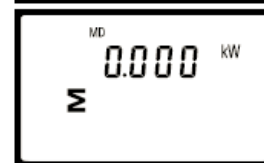
Frequency and Power Factor (total).



Power Factor of each phase.



Maximum Current Demand.



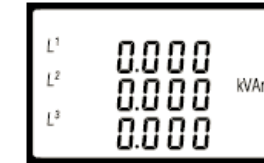
Maximum Power Demand.

3.3 Power

Each successive press of the selects a new range:



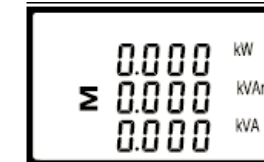
Instantaneous Active Power in kW.



Instantaneous Reactive Power in kVAh.



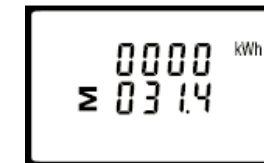
Instantaneous Volt-Amps in KVA.



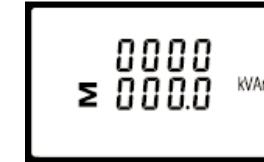
Total kW, kVAh, KVA.

3.4 Energy Measurements

Each successive press of the button selects a new range:



Total active energy in kWh.



Total reactive energy in kVAh.



Imported active energy in kWh.



Exported active energy in kWh.



Imported reactive energy in kVAh.

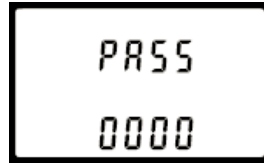


Exported reactive energy in kVAh.

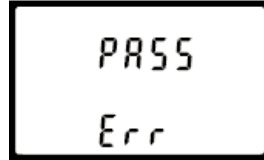
Please note the register is 9999999.9 display over two lines.

4 Set Up

To enter set up mode, hold the button for 3 seconds, until the password screen appears.



The set up is password-protected so you must enter the correct password (default '1000') before processing.



If an incorrect password is entered, the display will show: PASS Err (Error)

To exit the set up menu, hold the button for 3 seconds, the measurement screen will display.

4.1 Set up Entry Methods

Some menu items, such as Password and CT, require a four-digit number entry while others, such as supply system, require selection from a number of menu options.

4.1.1 Menu Option Selection

1. Use the and buttons to scroll through the different options of the set up menu.
2. Hold the button for 3 seconds to confirm your selection.
3. If an item flashes, then it can be adjusted by the and buttons.
4. Having selected an option from the current layer, hold the button for 3 seconds to confirm your selection.
5. On completion of setting-up, hold the button for 3 seconds, the measurement screen will then be restored.

4.1.2 Number Entry Procedure

When setting up the unit, some screens require the entering of a number. In particular, on entry to the setting up section, a password must be entered. Digits are set individually, from left to right. The procedure is as follows:

1. The current digit to be set flashes and then can be adjusted using the and buttons.
2. Press the button to move right to the next digit.
3. After setting the last digit, hold the button for 3 seconds to save your selection.

4.2 Communication

The RS485 port can be used for communication using Modbus RTU Protocol. To configure the Modbus settings, such as Address and Baud Rate, this is also done within the Password-protected set up menu.

4.2.1 RS485 Address



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to set the meter Address. Range: 001(default) to 247.



Hold the button to confirm the selection.

Use the and buttons to choose the necessary number, then press the button to move along to the next number. To save the new setting, hold the button for 3 seconds until the selection stops flashing.

4.2.2 Baud Rate



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to enter the menu option, the current selection will flash.



Use the and buttons to select the required option.

On completion of the entry procedure, hold the button to confirm the setting.

4.2.3 Parity



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to enter the menu option, the current selection will flash.



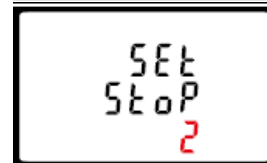
Use the and buttons to select the required option. Range: None (default), Odd or Even.

On completion of the entry procedure, hold the button for 3 seconds until the selection stops flashing.

4.2.4 Stop bits



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to enter the menu option, the current selection will flash.

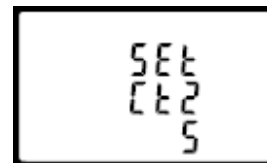


Use the and buttons to select the required option. Range: 1 (default) or 2.

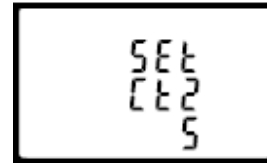
On completion of the entry procedure, hold the button for 3 seconds until the selection stops flashing.

4.3 CT Configuration

The CT options set the Secondary Current (CT2 5A or 1A) of the Current Transformer (CT) that are used with the meter.



Use the and buttons to select the menu option. The screen will show the current setting.



Secondary CT Setting:

Hold the button to set the CT secondary option: 5A (default) or 1A.



Set the CT Ratio Value:

Hold the button to enter the CT Ratio setting screen. The range is from 0001 to 9999.

The CT Ratio is the CT Primary divided by the CT Secondary. For Example: 200/5A Current Transformers - $200 \div 5 = 40$, so the CT Rate would be 0040 and the CT2 would be 5.

On the MID Version, you can only program the CT multiplier ONCE.

4.4 PT

The PT option sets the Secondary Voltage (PT2 100-500V) of the Voltage Transformer (PT) that may be connected to the meter.

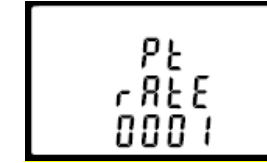


Use the and buttons to select the menu option. The screen will show the current setting. The default value is 400V.



Secondary PT Setting:

Hold the button to set the PT secondary option: 100-500V.



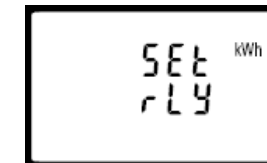
Set the PT Ratio Value:

Hold the button to enter the PT Ratio setting screen. The range is from 0001 to 9999.

The PT Ratio is the PT Primary divided by the PT Secondary. For Example: Voltage Transformer - $11000 \div 110 = 100$, so the PT Rate would be 0100 and the PT2 would be 110.

4.5 Pulsed Output

Use this section to configure the Pulsed Output Type. Units: kVArh (default); kWh.



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to enter the menu option, the current selection will flash.



Use the and buttons to select the required option. Hold the button to confirm the selection.

Hold the button for 3 seconds to exit the set up menu.

4.5.1 Pulse Rate

You can configure the number of pulses to relate to a defined amount of Total Energy.

Please note there are limitations that need to be factored in when setting the pulsed output. This is based upon the relay output only being able to pulse 2 times per second.

For example, If the CT is set to 500/5A on a Single Phase network this would generate $(500 \times 230V = 115,000 / 1000)$ 115kWh which is 31W per second. A setting of 10IMP/kWh (10 pulses per kWh) would generate 3 pulses per second. This will exceed the 2 pulse per second limitation.

Pulse settings: 1 Pulse per: 10W (0.01) / 100W (0.1) / 1000W/1kWh (1) / 10kWh (10) / 100kWh (100) / 1000kWh (1000)



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to enter the menu option, the current selection will flash.

Use the and buttons to choose the desired pulse rate. To save the new setting, hold the button for 3 seconds until the selection stops flashing.

4.5.2 Pulse Duration

The energy monitored can be active or reactive and the pulse width can be selected as 200, 100 or 60mS.



Use the and buttons to select the menu option. The screen will show the current setting.

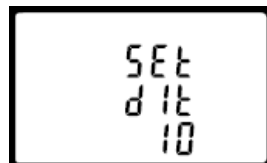


Hold the button to enter the menu option, the current selection will flash.

Use the and buttons to choose the desired pulse rate. To save the new setting, hold the button for 3 seconds until the selection stops flashing.

4.6 DIT (Demand Integration Time)

This sets the period (in minutes) in which the Current and Power readings are integrated for maximum demand measurement. The options are 0; 5; 8; 10; 15; 20; 30 or 60 minutes.



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to enter the menu option, the current selection will flash.



Use the and buttons to select the required option.

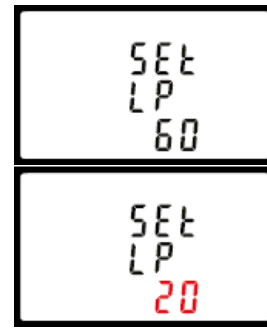


Hold the button to confirm the selection.

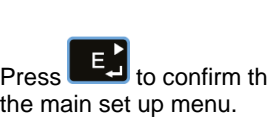
Hold the button for 3 seconds to exit the set up menu.

4.7 LP

The light period is a programmable time (in minutes) that determines how long the display backlight remains on for before this goes into standby.



From the set-up menu, use the and buttons to select the reset option.



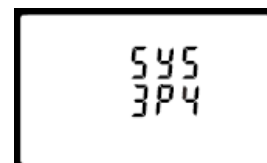
Press to enter the selection routine. The dlt will flash. The options are 0/10/30/60/120 minutes.

Press to confirm the setting and press to return to the main set up menu.

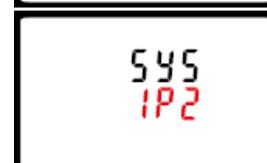
4.8 Supply System

The unit has a default setting of 3 Phase 4 Wire (3P4W).

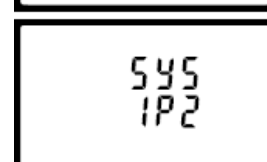
Use this section to set the type of electrical system.



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to enter the menu option, the current selection will flash.

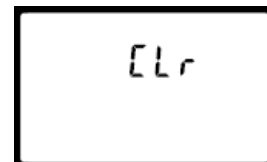


Use the and buttons to select the required option.

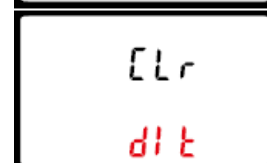
Hold the button to confirm your adjustment. Hold the button for 3 seconds to exit the set up menu.

4.9 CLR

The meter provides a function to reset the maximum demand value of current and power.



Use the and buttons to select the menu option. The screen will show the current setting.



Hold the button to enter the menu option, the current selection will flash.

Hold the button to confirm the setting and press to return to the main set up menu.

4.10 Change Password



Use the and to choose the change password option.



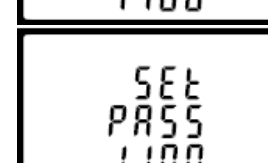
Hold the button to enter the set up menu. The first digit will start flashing.



Use and to set the first digit and press to move right. The next digit will flash.



Repeat the procedure for the remaining three digits.

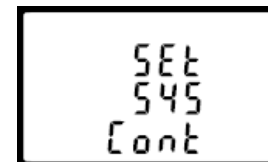


After setting the last digit, hold the button to save your selection.

Hold the button for 3 seconds to exit the set up menu.

4.11 CT Reversal

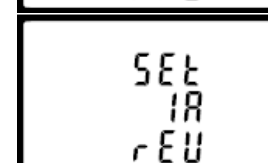
If the CT connections are incorrectly wired, they can be reversed through the "Set System Continued" menu:



Use the and buttons to select the menu option. Hold the button to view the sub-menu.



This screen will display, you can change "Forward" to "Reverse" on each individual CT connection.



Hold the button to confirm your adjustment. You can then move on to IB or IC using the and buttons.

Hold the button for 3 seconds to exit the set up menu.

5 Specifications

5.1 Measured Parameters

The unit can monitor and display the following parameters of a Single Phase Two Wire (1P2W), Three Phase Three Wire (3P3W) or Three Phase Four Wire (3P4W) system.

5.1.1 Voltage and Current

- Phase to Neutral Voltages 100-289V AC (L-N).

- Phase to Phase Voltages 173-500V AC (L-L).
- Percentage Total Voltage Harmonic Distortion (V %THD) for each Phase to Neutral (not for 3P3W supplies).
- Percentage Total Voltage Harmonic Distortion (V% THD) between Phases (3 Phase supplies only).
- Current %THD for each Phase.

5.1.2 Power factor and Frequency and Max. Demand

- Frequency in Hz
- Instantaneous power:
- Power 0-3600 MW
- Reactive power 0-3600 MVAR
- Volt-amps 0-3600 MVA
- Maximum Demand Power since last reset
- Power factor

- Maximum Neutral Demand Current, since the last reset (for Three Phase supplies only)

5.1.3 Energy Measurements

- Imported/Exported active energy 0 to 9999999.9 kWh
- Imported/Exported reactive energy 0 to 9999999.9 kVARh
- Total active energy 0 to 9999999.9 kWh
- Total reactive energy 0 to 9999999.9 kVARh

5.2 Measured Inputs

Voltage inputs through 4-way fixed connector with 2.5mm² stranded wire capacity. Single Phase Two Wire (1P2W), Three Phase Three Wire (3P3W) or Three Phase Four Wire (3P4W) unbalanced. Line frequency measured from L1 Voltage or L3 Voltage. Three current inputs (six physical terminals) with 2.5mm² stranded wire capacity for connection of external CTs. Nominal rated input current 5A or 1A AC RMS.

5.3 Accuracy

- Voltage 0.5% of range maximum
- Current 0.5% of nominal
- Frequency 0.2% of mid-frequency
- Power factor 1% of unity (0.01)
- Active power (W) ±1% of range maximum
- Reactive power (VAR) ±1% of range maximum
- Apparent power (VA) ±1% of range maximum
- Active energy (Wh) Class 1 IEC 62053-21
- Reactive energy (VARh) ±1% of range maximum
- Total harmonic distortion 1% up to 31st harmonic
- Response time to step input 1s, typical, to >99% of final reading, at 50 Hz.

5.4 Auxiliary Supply

Two-way fixed connector with 2.5mm² stranded wire capacity. 85-275V AC 50/60Hz ±10% or 120-380V DC ±20%. Consumption <2W 10VA.

5.5 Interfaces for External Monitoring

Three interfaces are provided:

- RS485 communication channel that can be programmed for Modbus RTU protocol
- Relay output indicating real-time measured energy. (configurable)
- Pulse output 3200IMP/kWh (not configurable)

The Modbus configuration (baud rate etc.) and the pulse relay output assignments (kW/kVARh) are configured through the set-up screens.

5.5.1 Pulse Output

Opto-coupler with potential free SPST-NO Contact (Contact rating 5-27V DC / Max current input: I_{min} 2mA and I_{max} 27mA DC). The pulse output can be set to generate pulses to represent kWh or kVAh.

Rate can be set to generate 1 pulse per:

- 0.01 = 10 Wh/VArh
- 0.1 = 100 Wh/VArh
- 1 = 1 kWh/kVAh
- 10 = 10 kWh/kVAh
- 100 = 100 kWh/kVAh

Pulse width 200/100/60 mS.

5.5.2 RS485 Output for Modbus RTU

For Modbus RTU, the following RS485 communication parameters can be configured from the set-up menu:

Baud rate: 2400, 4800, 9600, 19200, 38400

Parity: none (default) / odd / even

Stop bits: 1 or 2

RS485 Network Address: 3 digit number - 001-247

Modbus™ Word order Hi/Lo byte order is set automatically to normal as defined in IEEE 754. It cannot be configured from the set-up menu.

5.6 Reference Conditions of Influence Quantities

Influence Quantities are variables that affect measurement errors to a minor degree. Accuracy is verified under nominal value (within the specified tolerance) of these conditions.

- Ambient temperature 23°C ±1°C
- Input waveform 50 or 60Hz ±2%
- Input waveform Sinusoidal (distortion factor < 0.005)
- Auxiliary supply voltage Nominal ±1%
- Auxiliary supply frequency Nominal ±1%
- Auxiliary supply waveform (if AC) Sinusoidal (distortion factor < 0.05)
- Magnetic field of external origin Terrestrial flux

5.7 Environment

- Operating temperature -25°C to +55°C*
- Storage temperature -40°C to +70°C*
- Relative humidity 0 to 95%, non-condensing
- Altitude Up to 3000m
- Warm up time 1 minute
- Vibration 10Hz to 50Hz, IEC 60068-2-6, 2g
- Shock 30g in 3 planes

*Maximum operating and storage temperatures are in the context of typical daily and seasonal variation.

5.8 Mechanics

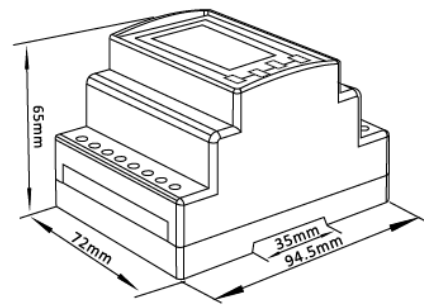
- DIN rail dimensions 72 x 94.5 mm (WxH) per DIN 43880
- Mounting DIN rail (DIN 43880)
- Sealing IP51 indoor
- Material Self-extinguishing UL 94 V-0

5.9 Declaration of Conformity

We, Tyco Electronics UK Ltd, declare under our sole responsibility as the manufacturer that the poly phase multifunction electrical energy meter "INT-0230-S-01" (Integra 0230) correspond to the production model described in the EC-

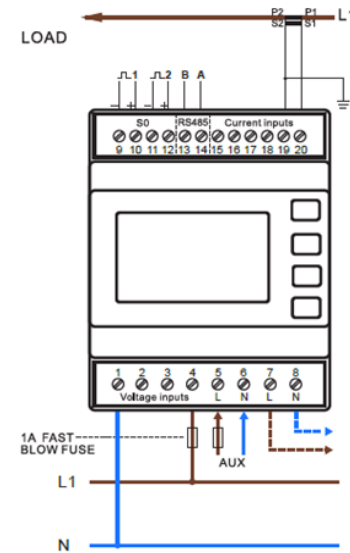
type examination certificate and to the requirements of the Directive 2004/22/EC.

6 Dimensions

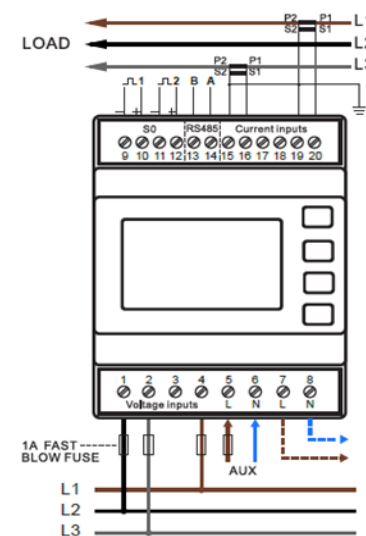


7 Installation

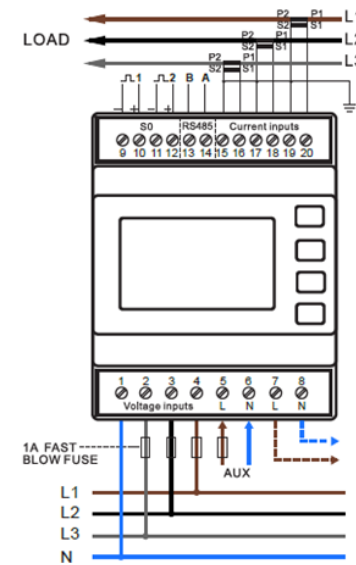
7.1 Single phase two wires



7.2 Three phase three wires



7.3 Three phase four wires



Explanation of Symbols

- Refer to manual
- Danger of electric shock
- Do not discard

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