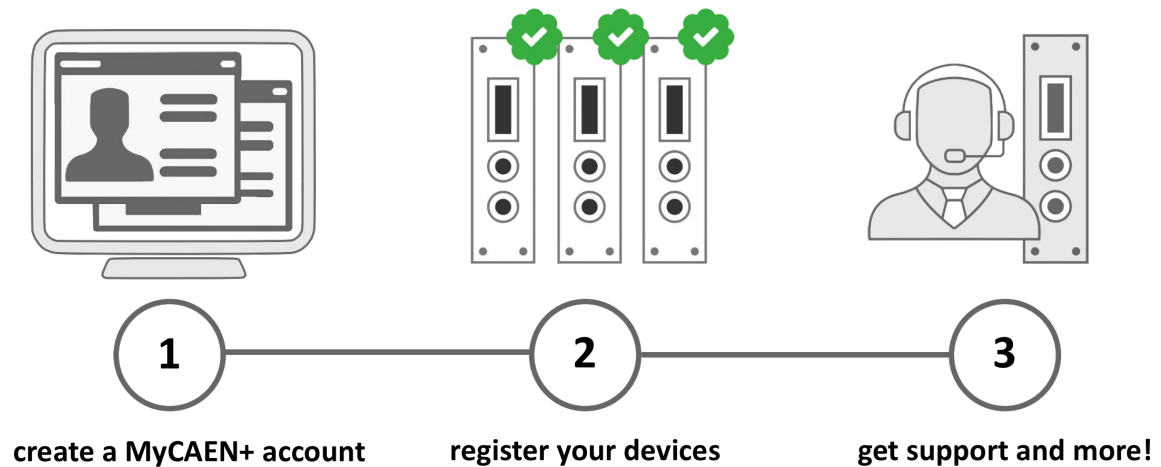# Register your device

Register your device to your **MyCAEN+** account and get access to our customer services, such as notification for new firmware or software upgrade, tracking service procedures or open a ticket for assistance. **MyCAEN+** accounts have a dedicated support service for their registered products. A set of basic information can be shared with the operator, speeding up the troubleshooting process and improving the efficiency of the support interactions.

**MyCAEN+** dashboard is designed to offer you a direct access to all our after sales services. Registration is totally free, to create an account go to https://www.caen.it/become-mycaenplus-user and fill the registration form with your data.

1

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2

**register your devices**

3

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# Purpose of this Manual

This document is the DT993 User's Manual; it contains information about the installation, the configuration and the use of the unit.

# Change Document Record

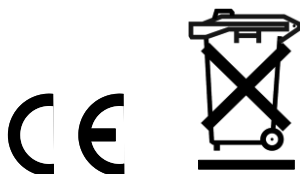| Date | Revision | Changes |
|---|---|---|
| 14 September 2017 | 0 | Preliminary |
| 27 October 2017 | 1 | Updates in § 1, 2, 3 |

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**CAEN** 🇳 Electronic Instrumentation

# 1. Module description

## Overview

The **DT993** Dual Timer is a Desktop module, housing two identical triggered pulse generators.

The module produces NIM, TTL and ECL pulses whose width ranges from 50 ns to 10 s when triggered. Output pulses are provided normal (**OUT**) and negated (**/OUT**).

Timers can be re-triggered with the end marker signal.

The coarse adjustment of the output width is provided via a 9-position rotary switch, the fine adjustment can be performed via either a 10 Turn rotary handle with lock or by providing an external voltage (**REMOTE**).

The trigger **START** can be provided via either an external signal (NIM, TTL or ECL) or manually via a front panel switch (*START/RESET* switch).

The **VETO** input (NIM, TTL or ECL TRUE level) allows to disable the START operation.

The **ENDM** output (NIM, TTL or ECL) is a short pulse produced at the end of any timing cycle.

The **RESET** input (NIM, TTL or ECL) ends the timing cycle at any time. RESET can also be provided manually via a front panel switch (*START/RESET* switch).

The module features LEMO 00 connectors for REMOTE and NIM/TTL signals and male pin couples for ECL signals. Two front panel LEDs display when the module is operating.

One switch (common to both sections) allow to select between NIM and TTL output pulses, while input levels are automatically recognised (no selection is required).

# 2. Technical specifications

## Packaging



**Fig.1: DT993 Desktop Dual Timer**

The DT993 unit is a Desktop module housed in a 262 W x 66.2 H x 171.6 L mm$^3$ (without connectors) alloy box. The kit includes:

- DT993 Desktop Dual Timer
- External AC/DC power supply with separate power cord

## Power requirements

The module is powered by the external AC/DC stabilized power supply included in the delivered kit (Switchbox Model FRA045-S12-4; see specifications)

**Note.:** Using a different power supply source, like battery or linear type, it is recommended the source to provide +12V and, at least, 2.5A; the power jack is a 2.1mm type, a suitable cable is the RS 656-3816 type (or similar).

# CAEN ⬡ Electronic Instrumentation

# Front panel



**Fig.2: DT993 front panel**

# Signals features[1]

| | |
|---|---|
| **START INPUT:** | Signal features:<br>*NIM*: Leading edge sensitive, 2.5 ns minimum FWHM on LEMO 00 type connector<br>*TTL*: Leading edge sensitive, 1.5 ns minimum FWHM on LEMO 00 type connector<br>*ECL*: Leading edge sensitive, 2.5 ns minimum FWHM on a male pin-couple<br>*START/RESET Switch[2]*: Momentary switch for single cycle operation<br>Function: Timer triggering signal |
| **VETO INPUT:** | Signal features:<br>*NIM/TTL*: TRUE level (within ±2 ns of START leading edge) on LEMO 00 type connector<br>*ECL*: TRUE level (within ±2 ns of START leading edge) on a male pin-couple<br>Function: It disables triggering |
| **RESET INPUT:** | Signal features:<br>*NIM/TTL*: Leading edge sensitive, 3 ns minimum FWHM on LEMO 00 type connector<br>*ECL*: Leading edge sensitive, 3 ns minimum FWHM on a male pin-couple<br>*START/RESET Switch[2]*: Momentary switch<br>Function: stops the timing cycle at any time. After a RESET, the module is at rest until the next START. |
| **ENDM OUTPUT:** | Signal features:<br>*NIM*: 8 ns wide on LEMO 00 type connector<br>*TTL*: 10 ns wide on LEMO 00 type connector<br>*ECL*: 8 ns wide on a male pin-couple<br>Function: It marks the end of the timing cycle |
| **OUT:** | Signal features:<br>*NIM*: 50 ns to 10 s wide, 2 ns rise/fall time, Fan-Out of 2 on LEMO 00 type connectors<br>*TTL*: 50 ns to 10 s wide, 4.5 ns rise/fall time, Fan-Out of 2 on LEMO 00 type connectors<br>*ECL*: 50 ns to 10 s wide, 2 ns rise/fall time, male pin-couple<br>Function: Output pulse |
| **/OUT:** | Signal features:<br>*NIM*: 50 ns to 10 s wide, 2 ns rise/fall time, Fan-Out of 2 on LEMO 00 type connectors<br>*TTL*: 50 ns to 10 s wide, 4.5 ns rise/fall time, Fan-Out of 2 on LEMO 00 type connectors<br>*ECL*: 2 ns to 10 s wide, 2 ns rise/fall time, male pin-couple<br>Function: Negated output pulse |
| **REMOTE:** | Signal features:<br>0 to 5 V DC input on LEMO 00 type connector (1 kΩ input impedance)<br>Function: It allows to perform the output pulse fine adjustment via an external voltage: 0 V → "short" pulse, 5 V → "long" pulse<br><br>**N.B.: REMOTE must never exceed the 5 V value to avoid damage to the input stage** |

---

[1] All ECL inputs are 110 Ω terminated, all NIM/TTL inputs are 50 Ω terminated
[2] START and RESET share the same 3-position switch: Down → RESET, Middle → NEUTRAL (stable), Up → START

# Other components

| | |
|---|---|
| **OPERATION LEDS**: | green/red LEDs |
| **LOCAL/REMOTE;** | 2-position switches |
| **START/RESET**: | 3-position switches |
| **OUTPUT LEVEL**: | 2-position switch |
| **COARSE ADJUSTMENT**: | 9-position rotary switches |
| **FINE ADJUSTMENT**: | Vishay 10 Turns dial with lock |
| **DC Input (rear panel):** | +12V DC Input PCB 2.1mm DC Power Jack |
| | ON/OFF switch    A1 switch |
| | O → power supply OFF. |
| | I → power supply ON |

## Fine adjustment dial



**Fig.3: Vishay Spectrol Dial**

Vishay 11A11B10 Dial, with brake lever (LOCK): Single counter type wheel and a graduated circular dial registering a total count of 11 turns (10 used). Single numeral in window (0 thru 10) indicates completed number of turns of the drive sleeve. Graduated circular dial indicates the percent of the partial turn of the drive sleeve. Transfer point Between 97 and 0. Increasing indication: CW direction; Decreasing indication: CCW direction.

# Technical specifications table

**Table 1: DT993 Technical Features**

| Packaging | Desktop module; 262 W x 66.2 H x 171.6 L mm³ (without connectors) alloy box |
|---|---|
| Output³ / Section | **OUT**: NIM/TTL signal with a Fan-Out of 2, ECL signal<br>**/OUT**: negated NIM/TTL signal, ECL signal |
| Output width | 50 ns ÷ 10 s (NIM, TTL and ECL levels) |
| REMOTE | 0 ÷ 5 V |
| START/OUT delay | <25 ns |
| RESET delay | ~30 ns: the timing cycle stops ~30 ns after the RESET pulse is sent |
| Rise/Fall Time | < 2 ns |
| Thermal stability⁴ | -60 ppm/°C |
| Humidity range | 0 ÷ 80% |
| Operating temperature | 0 ÷ 45°C |
| Storage temperature | -10 ÷ 70°C |
| External power supply | Switchbox FRA045-S12-4 (12 VDC, 3.75 A, 45 W); Universal Input C14 receptacle;<br>INPUT Voltage range 100-240VAC 1.2A 50-60Hz. Inrush current 40A at 115VAC / 80A at 230VAC max. Dielectric withstand Input/output 3,000VDC.<br>OUTPUT Output voltage +12V. Ripple and noise 2% p-p max. Load regulation ±5% max. No load stand by power <0.5W @ 230VAC. Efficiency >=85% for CEC requirement. Hold up time 10ms at nominal line. Protections OCP, OVP, over power & short circuit.<br>GENERAL Std output connector Dc barrel jack. Std output cable/length UL1185, #18AWG / 5 ft.<br>ENVIRONMENTAL Operating temperature 0°C to +40°C. Storage temperature –20°C to +85°C.<br>STANDARDS Safety standards IEC/UL/EN60950-1, CE, CB. EMC EN55022 (CISPR 22) class B, FCC class B. |

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[3] NIM outputs drive a 50 Ohm load (termination required), ECL outputs drive a 110 Ohm load (termination not required)

[4] Measured with a 1 μs NIM output pulse (1 ms full scale)

# 3. Operating Modes

## Installation

Prior to shipment this unit was inspected and found free of mechanical or electrical defects. Upon unpacking of the unit, inspect for any damage, which may have occurred in transport. The inspection should confirm that there is no exterior damage to the unit, such as broken knobs or connectors, and that the panels are not scratched or cracked. Keep all packing material until the inspection has been completed. If damage is detected, file a claim with carrier immediately and notify CAEN. Before installing the unit, make sure you have read thoroughly the safety rules and installation requirements, then place the package content onto your bench; you shall find the following parts:

• DT993 Desktop Dual Timer

• External AC/DC power supply with separate power cord

Connect the DT993 section OUT to the device to be triggered;

Connect the DT993 to the AC/DC power supply through the DC input rear connector;

Connect the external AC/DC power supply to Mains (AC) via the separate power cord

Power up the DT993 through the ON/OFF rear switch

---

⚠️ **CAUTION**

**ECL INPUTS ARE SUSCEPTIBLE TO DAMAGE FROM ESD
(ELECTROSTATIC DISCHARGE). TO PREVENT THE RISK OF DAMAGING,
THE USER SHOULD NEUTRALIZE ANY STATIC ELECTRIC CHARGE BUILT UP
ON THE BODY (e.g. TOUCHING AN EARTHED OBJECT) BEFORE
HANDLING THE ECL CONNECTORS**

---

## Timer triggering

The board has two sections housing one triggered pulse generator each. Each section produces an adjustable width pulse when triggered. The trigger START signal can be sent as external NIM/ECL signal on the relevant START connectors or by pulling up the START/RESET switch. Note that output pulses are not retriggerable: the START signal/switch is inactive as long as the output status is true.

# Output width adjustment

Each section has a 9-position rotary switch for performing the COARSE ADJUSTMENT. This switch allows to choose between nine width ranges:

*50 ns ÷ 1 μs*
*1 μs ÷ 10 μs*
*10 μs ÷ 0.1 ms*
*0.1 ms ÷ 1 ms*
*1 ms ÷ 10 ms*
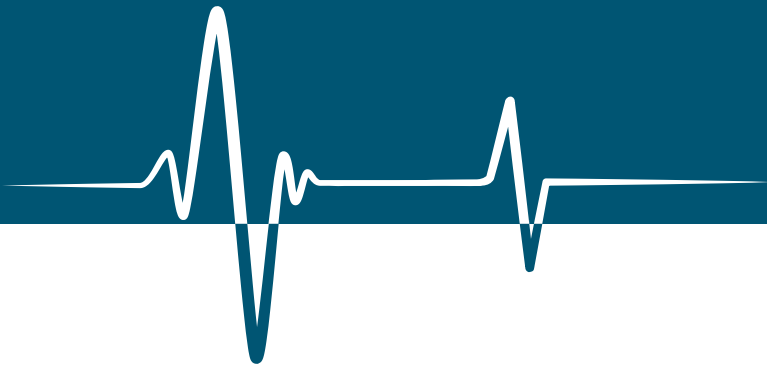*10 ms ÷ 0.1 s*
*0.1 s ÷ 1 s*
*1s ÷ 10 s*
*∞: Flip-Flop*

The 9th position (∞) lets the module work as a Flip-Flop: the output is kept active unless a Reset occurs. Once the COARSE ADJUSTMENT is set, the FINE ADJUSTMENT must be performed either by turning the relevant 10 turns dial handle (Readout shall increase with clockwise and decrease with counter clockwise Rotation; see p.7) or by supplying the REMOTE connector with a DC voltage ranging from 0 to 5 Volts: the REMOTE/LOCAL SWITCH allows to select between the two ways: DOWN → REMOTE, UP → Rotary Handle.
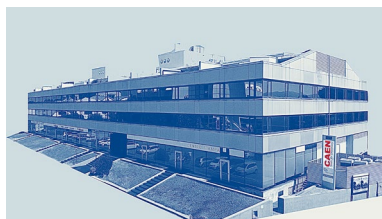
# Output level selection

One two position LEVEL switch (common to both sections) on the front panel allows to produce either NIM or TTL pulses on the LEMO 00 output connectors.
ECL output pulses are ALWAYS produced on the relevant male pins.

# LEDs operation

The front panel LEDs are OFF when no output is present; they light up following the output with widths larger than 0.5 s; they light up for a fixed time (≈0.5 s) with output pulses shorter than 0.5 s. They flash at a constant frequency (≈2 Hz) with output frequencies higher than 2 Hz. They light up red for NIM output pulses and green for TTL ones.

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