



## Description and datasheet

# Gold plated copper lugs for precision dc voltage measurements



### 1. Introduction

Finding copper lugs to make cables for high precision dc voltage measurements has always been difficult. Good-looking available lugs usually show large thermal voltage coefficients. Therefore, we developed and produce our own low thermal voltage lugs.

### 2. Design

The design of the lugs (see Picture 1) has mainly taken into account two major requirements: 1) low thermal voltages when used with commercially available cables and binding posts found on precision instruments and standards; 2) mechanical robustness at the crimping area (most of the time the cable will break at this place under intensive use). Low thermal voltage soldering is difficult to find and/or toxic (because it uses Cadmium), crimping is, thus, the method of choice here. A slightly U formed strip, to which the cable can be attached using heat shrink sleeve, enhances mechanical robustness at the crimping area. This strip also makes it easier to insert the lug in a binding post. If the strip is not desirable it can be easily cut using a saw or cutting pliers. In addition, the lug can be bent inward or outward (see Picture 2) allowing easy access to narrowly positioned binding posts.

We use oxygen free, high-conductance (OFHC) 1 mm thick copper plates. CuTe would have been even better from the thermoelectrical point of view. However, it seems not to be available in foil. After embossing, the lugs are thick gold electroplated without the usual nickel sublayer. The gold layer allows for good electrical contact (no oxidation), long life and heavy duty. In the last production step, the crimping and fixing strips of the lugs are bent (see Picture 1).



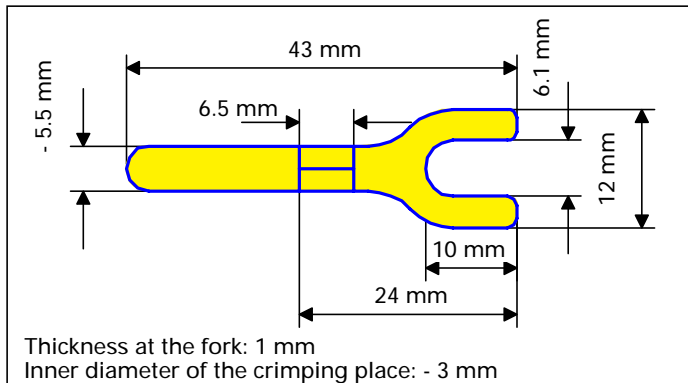
**Picture 1:** from the left: raw copper lug, finished gold plated lug, lug mounted on a cable



**Picture 2:** Inward and outward bending of the lug to make connections easier.

### 3. Technical data

#### Dimensions and weight:



The lugs will fit into 4 mm laboratory binding posts

The inner diameter corresponds to the largest cable diameter that can be used (around 7 mm<sup>2</sup>). However, crimping may be a problem with such a large cable diameter.

Weight: ≈ 3 g per piece

#### Material:

Oxygen Free High-Conductance (OFHC) 1 mm thick copper foil

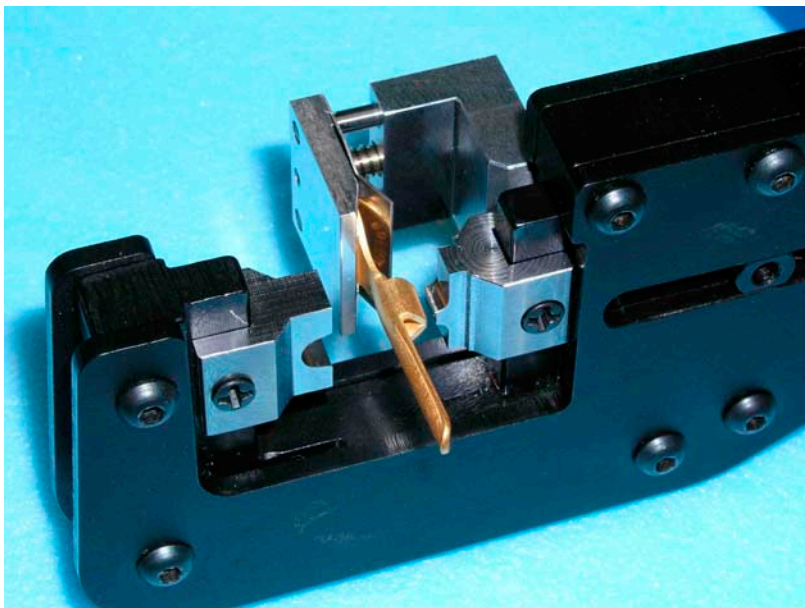
Gold electroplating: gold thickness is around 6 μm.

#### 4. Availability

Production has started in 2003 with a first batch of 2000 pieces. The lugs will be packaged in batches of 20, 50 and 100 pieces. Depending on the interest, a maximum of 50 units per order is available for immediate delivery (by the end of March 2003). Larger amounts will be delivered later (typically before September 2003).

A hand crimping tool is also available (see at [www.wdttools.ch/english/ps.htm](http://www.wdttools.ch/english/ps.htm) the 190942 *Parallel Handcrimping Tool*). A set of crimping dies has been specially designed at METAS for the copper lugs with a very handy guide to precisely position the lug for crimping (see Picture 3). For the proper use of the copper lugs, we strongly recommend to purchase the crimping tool with special guide and dies too.

Some more information on the METAS guide and dies can be found in the *Assembly instructions* of these parts.



**Picture 3:** View of the hand crimping tool head with the METAS special crimping dies and a copper lug mounted in the guide.

## 5. Pricing

Gold plated copper lugs		
Ref.	Description	Price in CHF
L20	Gold plated copper lug, set of 20	240.–
L50	Gold plated copper lug, set of 50	600.–
L100	Gold plated copper lug, set of 100	1200.–
C *	Crimping tool <u>without</u> crimping dies	440.–
Dn	Original set of crimping dies	200.–
Dsp	Very handy set of crimping dies with guide developed at METAS	750.–

Prices do not include shipping costs and local value added taxes.

\* For a usable crimping tool, you will need either C and Dn, or C and Dsp.



The Federal Office of Metrology (METAS) maintains the national calibration standards of Switzerland, ensures their international recognition and disseminates them with sufficient accuracy to Switzerland's research, economy and society. METAS takes the necessary steps to ensure that the measurements required for the protection and safety of the population and the environment are made correctly and in compliance with the applicable laws and regulations.

### Contact

Alessandro Mortara **Federal Office of Metrology METAS**  
Lindenweg 50, CH-3003 Bern-Wabern  
phone +41 31 32 33 328  
alessandro.mortara@metas.ch  
www.metas.ch

February 2007