

# Value Units (Price Calculation)

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## Introduction

In this technology and media-driven age, the stratospheric rise of cryptocurrencies, electronic currencies which are decentralised, anonymous, and freely tradable, is not surprising. Currencies such as Bitcoin and Ethereum have demonstrated that it is possible to use the internet, now ubiquitous and fast in many countries, to make a decentralised value-transfer system which is virtually free to use and can be shared across the world at very fast speeds.

It can seem that there is an ideological gap between hard-asset investors, such as those preferring to invest in precious metals such as gold and silver, and the early adopters of electronic currencies. However, there are many similarities between these two currencies, such as the finite supply (both precious metals and most cryptocurrencies need to be mined and are limited) and durability (both of these value-storage methods retain their value almost indefinitely). The time is therefore ripe for a cryptocurrency based on precious metals, retaining the security of the latter, while adding the flexibility of an electronic currency.

Value Units, is such a currency, based on precious metals which represent the Value Basket (the book value of the cryptocurrency). However, as in any exchangeable asset, the book value is not necessarily the real value of the asset. As in stocks and other tradeables, the market determines the real value of the asset. In markets of low liquidity, the market price can be very volatile. Therefore, until the market provides the requisite liquidity, the Value Units Foundation in cooperation with its partners has created an algorithm to calculate the current price, based on emissions and trades that will not highly fluctuate based on new data. In this document, we describe the algorithm to calculate this price for a Value Unit.

## Concept and Definitions

There are two processes that can modify the market price of a Value Unit: “emissions” and “trades”.

An emission is the process which creates Value Units. A consumer would buy a certain amount of precious metals, and in exchange would receive a certain amount of Value Units. This increases the Value Basket, which contains all the precious metal stored at the moment. The value basket can also change if the price of the precious metals changes. The exact emission price is set by the Value Units Foundation.

The second way in which the market price can be modified is via a trade, allowed by the platform. The execution of a trade will influence the market price in a way determined by taking into account the time, price, and volume of the trade.

In order to encapsulate the various factors going into the market price, we first define a few terms. First, we define the three factors which underlie the entire price calculation:

**VB<sub>F</sub>**: The Value Basket Factor defines the importance of the Value Basket in the price calculation. Any value bigger than 1 makes it more important than the last calculated market price. Every number smaller than 1 makes it less important than the last calculated market price.

**TPD<sub>F</sub>**: The Traded Price Difference Factor defines the importance of the difference between the last traded price (**LTP**) and the target price that was calculated using the **VB<sub>F</sub>**.

**TTD<sub>F</sub>**: The Traded Time Difference Factor defines the importance of the difference between the last traded time (**LTT**) and the current time.

In addition, there are a few parameters appearing above, which define every trade in the market, and these are also used in the price calculation:

**LTP** The Last Traded Price defines the price at which the last market transaction was executed.

**LTT** The Last Traded Time defines the time at which the last market transaction was executed.

**LTA** The Last Traded Amount defines the amount that changed hands in the last market transaction.

Lastly, we define two terms which are used in the calculation of the Target Price (**TP**):

**LMP** The Last Market Price represents the price that was calculated after the previous trade.

**VBP** The Value Basket Price represents the price of each Value Unit based on the value of the value basket. As such, it can be defined as the total value basket value divided by the total amount of Value Units in circulation.

We now proceed to the price calculation in the next section.

## Market Price Calculation

We start by calculating the target price:

$$TP = \frac{LMP + VB_F \times VBP}{VB_F + 1} \quad (1)$$

as well as a quantity called the Price Relevance (**PR**):

$$PR = \frac{1}{(|LTP - LMP|^{TPD_F})} \quad (2)$$

The PR of a trade denoted the importance accorded to the price at which the last trade was carried out. If the price differs too much from the target price, a large  $TPD_F$  will rapidly decrease its relevance via the PR.

A similar quantity, called the Time Relevance (**TR**) of each trade is calculated using the Last Traded Time (LTT) and the current time (NOW):

$$TR = \frac{1}{(|NOW - LTT|^{TTD_F})} \quad (3)$$

Similarly to the PR, a time that differs too much from the current time will result in a high  $TTD_F$ , which will decrease its relevance, via the TR.

Finally, we can calculate the market price, in the following way:

$$LMP = \frac{\sum_i LTP_i \times LTA_i \times PR_i \times TR_i}{\sum_i LTA_i \times PR_i \times TR_i} \quad (4)$$

The equation means that every trade is multiplied by the Last Traded Amount (LTA), the Price Relevance (PR) and the Time Relevance (TR), after which the total is multiplied by the sum of these values.

## Conclusion

The above algorithm presents a price calculation based on real-world emissions and trades of Value Units. While the algorithm is of course not perfect and cannot guarantee that the actual market price will be calculated, it dampens price speculations because it takes into consideration the actual book value of the underlying assets and reduces the noise by reducing the importance of operations that are far away from the historical transactions. This makes the currency usable for transactions and value storage. In the future, with greater market stability, the algorithm should be replaced by the actual trading price of the last few hours.