

Notes on using this document – either use the Navigation pane on left – or the control key and the required section in the table of contents below (and the control and home keys to return to the top)

See also the Datastream functions help

<http://product.datastream.com/navigator/AdvanceHelpFiles/Functions/WebHelp/HFUNC.htm>

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A-Z of Datastream expressions for popular indicators, adjustments and calculations

Advance-Decline ratio and line

The Advance-Decline Ratio divides the number of stocks that closed higher than the previous day (advances) by the number of stocks that closed lower than the previous day (declines).

If datatypes RS (Number of Rises) and FS (Number of Falls) are available for an index, then the ratio can be calculated as follows, for example:

`TOTMKUK(RS)/TOTMKUK(FS)*1.000`

However, if RS and FS are unavailable for a particular index, the best solution would be to calculate a User Created Index (UCI) from the index constituent list - as RS and FS can be selected as datatypes to be calculated.

The related concept of the Advance-Decline Line is a measure of broad market strength, and the line tends to peak well ahead of the more widely followed market indices and averages. It is calculated as the cumulative difference between the advancing and declining stocks each day.

- When the AD line is positive (line moves up), more stocks are advancing than declining.
- When the AD line is negative (line moves down), more stocks are declining than advancing.

For example:

`CSUM#(TOTMKUK(RS))-CSUM#(TOTMKUK(FS))`

Again, if RS and FS are not directly available (e.g. for the S&P 500 index) a solution is to calculate a UCI and select these two datatypes from the choices to be calculated.

Annualized growth rate / compound annual growth rate (CAGR)

The GRFL# function is normally used to calculate the annualised growth rate, also known as the Compound Annual Growth Rate (CAGR) between two values/dates, using a trend line between the first and last value. GRLS# is also available, which calculates the annualised growth rate using a least squares trend line - but is less commonly used.

$$CAGR = \left(\frac{\text{Ending Value}}{\text{Starting Value}} \right)^{\left(\frac{1}{\text{number of years}} \right)} - 1$$

For example, GRFL#(FTSE100,1M) calculates the annualised 1 month compound growth rate for the FTSE 100 index, and GRFL#(UKGDP...D,1Q) calculates the annualised quarterly compound growth rate for UK GDP.

Arms Ease of Movement Index

The Arms Ease of Movement Index emphasizes days in which the stock moves easily and minimizes the days in which the stock finds it difficult to move. The indicator is used frequently with equivolume charts to identify market formations. A buy signal is generated when the index crosses above zero; a sell signal is generated when it crosses below zero. When the index hovers around zero, there are small price movements and/or high volume i.e. the price does not move easily.

057E "ARMS EASE OF MOVEMENT INDEX"

$((X(\text{PH})+X(\text{PL}))/2)-((\text{LAG}\#(X(\text{PH}),1\text{D})+\text{LAG}\#(X(\text{PL}),1\text{D}))/2))/(X(\text{VO}))(X(\text{PH})-X(\text{PL}))$

The general formula for the calculation is:

$$\text{Midpoint Move} = \left(\frac{\text{high}-\text{low}}{2} \right) - \left(\frac{\text{high}_{-1}-\text{low}_{-1}}{2} \right)$$

$$\text{Box Ratio} = \left(\frac{\text{volume}/10,000}{\text{high}-\text{low}} \right)$$

$$\text{Ease of Movement Index} = \frac{\text{Midpoint Move}}{\text{Box Ratio}}$$

Beta

The most common measure of historical beta uses a rolling 5 year time period of monthly frequency logarithmic changes - this is available as global expression 897E "DS HISTORICAL BETA LOCAL INDEX" and this method uses a benchmark Local Index (LI) for the respective stock.

REGB#(LN#(X(LI)/LAG#(X(LI),1M)),LN#(X/LAG#(X,1M)),60M)

Alternatively, a similar global expression 851E "DS HISTORICAL BETA (5 YEARS)" is available, where X is an index of your choice, and Y is the stock. This can be used in a monthly frequency time series request as 851E(FTSE100,VOD) for example.

REGB#(LN#(X/LAG#(X,1M)),LN#(Y/LAG#(Y,1M)),60M)

The expression can be adapted for different time periods and frequencies if preferred - for example, 845E "DS HISTORICAL BETA (2 YEARS)" uses two years (104 weeks) of weekly frequency observations:

```
REGB#(LN#(X/LAG#(X,1W)),LN#(Y/LAG#(Y,1W)),104W)
```

And the following uses 1 year (252 trading days) of daily frequency observations:

```
REGB#(LN#(X/LAG#(X,1D)),LN#(Y/LAG#(Y,1D)),252D)
```

Further alternatives and examples are also available in the Expression Picker, folder Datastream > Risk and Volatility > Beta Calculations.

Bollinger bands

Bollinger Bands provide a relative definition of high and low in the sense that prices are considered high at the upper band and low at the lower band. They consist of 3 lines drawn in relation to an instrument's price - the middle band usually being a simple moving average while the upper and lower bands are usually 2 standard deviations either side.

Values can be calculated using the following global expressions for example, which use a 20 day moving time period:

```
113E "UPPER BOLLINGER BAND"
```

```
MAV#(X,20D)+(2*SDN#(X,20D))
```

```
114E "LOWER BOLLINGER BAND"
```

```
MAV#(X,20D)-(2*SDN#(X,20D))
```

An example is available in Datastream Charting - see the following section of the Library:

Datastream > Sample Charts > Technical Charts > Example Templates > Bollinger Bands & MACD.

This template is also available in the Chart Studies app in EIKON, and the Studies page from the EQUITY menu in Datastream Professional. See the Datastream > Equities > Technical folder.

Buy-and-hold abnormal returns (BHAR)

The term BHAR is taken from Event Study literature and is generally defined as the difference between actual and expected returns, under a buy-and-hold long investment strategy.

The global expression 481E is a (static) long term performance measure, which measures the excess compounded percentage return for a financial instrument, relative to a reference or benchmark instrument between two given dates. For both instruments, all dividends are assumed to be reinvested over time.

Take two dates A and Z, with A>Z. The measure is defined as:

```
481E "BHAR STATIC"
```

```
(VAL#(X(RI),A)/VAL#(X(RI),Z)-VAL#(Y(RI),A)/VAL#(Y(RI),Z))*100
```

The following measure is a continuous version of the BHAR measure; the parameter Z is the date for which the measure is supposed to be "started" and have the value 0:

```
482E "BHAR CONTINUOUS"
```

```
REB#(X(RI),Z)-REB#(Y(RI),Z)
```

Examples:

481E(MKS,FTSE100,-5Y,0D) calculates the static BHAR for the Marks & Spencer equity relative to the benchmark index FTSE 100, over the latest 5 year time period.

482E(MKS,FTSE100,31/12/99) calculates continuously the performance in terms of compounded returns for an investment made at end of December 1999 in the Marks & Spencer equity relative to the FTSE 100.

Chaikin money flow

The 20-day period (for example) Chaikin Money Flow for an equity, which uses the daily closing price along with datatypes PH (Intraday Price High), PL (Intraday Price Low) and VO (Volume traded) can be written as:

$SUM\#((X-X(PL))-(X(PH)-X)/(X(PH)-X(PL)))*X(VO),20D)/SUM\#(X(VO),20D)$

Coppock indicator

The Coppock Indicator was developed by Edwin Coppock, a US investment advisor. It is a momentum oscillator that was designed for long term investors to begin accumulation at the beginning of a bull market. The Coppock Indicator signals the beginning of a bull market when it crosses above the zero line. This signal is usually after the first leg of a bull market is underway, thus it's highly reliable.

It is available under the following global expression:

052E "COPPOCK INDICATOR"

$WAV\#(PCH\#(FTSE100,14M)+PCH\#(FTSE100,11M),10M)$

Correlation

Correlation indicates the extent to which two variables move in the same direction, i.e. increase or decrease. The highest value for correlation is 1 (positive correlation), meaning that they always move in the same direction, either both upwards or both downwards; the minimum value is minus 1 (inverse correlation), indicating that whenever one variable increases in value, the other decreases in value.

Correlation can be calculated using the CORR# function - see the "Statistical" folder of the Function definition help pages.

In the following global expression, X is the equity and X(LI) is used to automatically select the appropriate local benchmark index for the equity, and logarithmic monthly changes over a rolling 5 year period (60 months) are used for the calculation.

841E "HISTORICAL CORRELATION 5 YEAR"

$CORR\#(LN\#(X(LI)/LAG\#(X(LI),1M)),LN\#(X/LAG\#(X,1M)),60M)$

Related correlation examples are also available in the Expression Picker, folder Datastream > Correlation and Regression.

There is also a specialised correlation tool available in Datastream Charting, for identifying the correlation between lines, and the lag/lead period that displays the strongest correlation.

Correlation coefficient significance

This tests whether the value of a correlation coefficient between two random variables (which must be between -1 and 1) is statistically significant from zero. This can be tested using the t-distributed statistic:

This tests whether the value of a correlation coefficient between two random variables (which must be between -1 and 1) is statistically significant from zero. This can be tested using the t-distributed statistic:

$$t = r \times \frac{\sqrt{n-2}}{\sqrt{1-r^2}}$$

having $n-2$ degrees of freedom, where n is the number of observations (given some assumptions about the bivariate probability distribution).

An assumption, which is sufficient for this result, is that the two data series constitute a random sample from a bivariate normal distribution – more details are available in standard statistical textbooks or online etc.

Generally values over 3 are regarded as very significant (to confirm precisely, consult a statistical table showing the value against number of observations, available in standard textbooks or web sites)

Decumulated values

Some economics series are published by sources on a cumulative basis - i.e. for each observation period, the latest value is added to the sum of the previous values.

These cumulative series are marked with the abbreviation (CMLV) in Navigator - for example the quarterly China economics series CHPERDISA "PER CAPITA DISPOSABLE INCOME, URBAN HOUSEHOLDS (CMLV)".

If you would like to retrieve decumulated values instead of the cumulative sum, there are two global expressions available - depending on whether the series is monthly or quarterly.

310E "DECUMULATIVE QUARTER"

$X * IF\#(DUMMYQT1, GT, ZERO) + NA\#(X - LAG\#(X, 1Q)) * IF\#(DUMMYQT1, EQ, ZERO)$

311E "DECUMULATIVE MONTH"

$X * IF\#(DUMMYJAN, GT, ZERO) + NA\#(X - LAG\#(X, 1M)) * IF\#(DUMMYJAN, EQ, ZERO)$

So for example, 310E(CHPERDISA) returns the decumulated quarterly values for this series.

Example charts which illustrate the use of these expressions are available in the Datastream Charting Library, folder:

Datastream > Charting Features > Analytics > Functions and Expressions

Earnings yield

Earnings Yield is simply the reciprocal of the P/E ratio (datatype PE, which is available for equities and most equity indices), so this can be calculated in decimal form as $1/X(PE)$ or in percentage form as $100/X(PE)$

So for example the Earnings Yield for the FTSE All Share can be calculated in % form as $100/FTALLSH(PE)$

Enterprise value

Enterprise Value is a popular measure of a company's total value, calculated as the sum of:

Market Value of Equity + Debt - Cash (i.e. Net Debt) + Preferred Shares + Minority Interest

It is available as an annual frequency financial statement item under Worldscope datatype WC18100, or on a last 12 months basis under Datastream Worldscope datatype DWEV, which also takes interim financial statements into account.

Alternatively, there are a number of Global Expressions available, which use daily frequency Market Value of Equity data in order to calculate more timely latest values, and higher frequency history.

See the following folder in the Expression Picker, which includes expression based on standard MV values along with others which use datatype MVC (Market Value - Consolidated, for dual listed companies), and others which use interim Worldscope values rather than annual.

Datastream > Fundamentals > Enterprise Value

Also see the following folder, which offers expressions for calculating I/B/E/S estimate valuation ratios with Enterprise Value as the numerator:

Datastream > Ratios > Estimates Ratios

In addition, EV valuation ratio templates are available in Datastream Charting - see the following section of the Library:

Templates > Datastream > Equities > Valuation

These templates are also available in the Chart Studies app in EIKON. See the Datastream > Equities > Valuation folder.

Exponential weighted average

This type of average calculation achieves a smoothing effect on historical values by applying a weighting factor. It can be calculated using the EWA# function - see the "Average" folder of the [Functions help and definitions](#) pages for further information and examples.

Whereas the MAV# (Moving Average) function gives equal weight to each data point, the EWA# function gives different relative weights to latest values vs. earlier values, as determined by the weighting factor.

The weighting factor must be between 0 and 1; the lower the weighting, the greater the smoothing effect. The factor can be calculated from a given time period using the formula:

Weighting Factor = $2 / (\text{days} + 1)$

So e.g. for a 26 day exponential weighted average, the weighting factor would be calculated as:

$2 / 27 = 0.074$

A popular technical analysis application of this indicator (MACD) is to calculate the difference between a 12 day ($2/13=0.154$) and 26 day ($2/27=0.074$) EWA:

$\text{EWA\#}(X,0.154)-\text{EWA\#}(X,0.074)$. This is the global expression 053E.

The output value from this expression provides a dynamic indication of a change in trend. When the value moves from negative to positive, i.e. the shorter-term moving average (the first EWA# function, for 12 days) rises above the longer-term moving average (the second EWA# function, for 26 days), it is seen as a bullish indication. Conversely, a change from positive to negative indicates a bearish outlook.

Graham & Dodd PE

In order to reduce the impact of the cyclical nature of profits, Graham and Dodd argued that PE ratios should compare stock prices to earnings that have been averaged over not less than five years, and preferably seven to ten years.

For example, to use a ten-year moving average of historical earnings for a stock or an index, the expression for the PE ratio is the following, which is available as a Global Expression.

038E "GRAHAM & DODD PE RATIO 10Y"

$X/\text{MAV\#}(X/X(\text{PE}),10Y)$

Adjustment for inflation can also be made, by dividing the price by the relevant consumer price index. This is commonly known as the Cyclically Adjusted PE (CAPE), or equivalently the Shiller PE (after the economist Robert Shiller). For the US the Shiller PE is USSPRPER.

Herfindahl index

Also known as Herfindahl–Hirschman Index (HHI), this indicator is a measure of the competition between firms within an industry, and is calculated as the cross-sectional sum of the respective squared market share of each firm within that industry.

Net Sales or Revenues (Worldscope datatypes WC01001 or DWSL) could be used as the measure of market share for example, and the LIST# function can be used with an industry constituent list to calculate the cross-sectional sum.

It must be calculated in two stages, as multiple LIST# functions cannot currently be combined in a single expression. Also note that the LIST# function can only be used in time series requests, not static requests. For further information about the LIST# function, see the "Statistical" folder of the Function help and definition pages.

For example, using the constituent list for the Datastream index of US Internet companies LINTNTUS:

```
LIST#(LINTNTUS,X(DWSL),SUM)
```

gives the industry sum of net revenues in thousands of US dollars, e.g. 176560971.0

Then:

```
LIST#(LINTNTUS,POW#(X(DWSL)/176560971.0,2)*1.000,SUM)
```

calculates the Herfindahl measure, 0.34 in this example i.e. 34% (at the time of writing).

Implied volatility

Implied volatility is available for instruments which have traded options. It shows the market expectation of annualised volatility over the life of the option contract, as opposed to standard historical volatility of returns.

Search 'volatility' within the Options category of the Datatypes section of Navigator, to view the available datatypes.

For example:

```
ESXC.SERIESC(VI)
```

The implied volatility of the FTSE100 index, based on call options and the near-term contract.

K and D Stochastics

The stochastic oscillator is a technical analysis oscillator (or two oscillators) showing the latest closing price in relation to the trading range of the past N days.

Two oscillator lines are calculated, called %K and %D, each ranging from 0 to 100. %K is the closing price within the past N-days time period, and ranges from 0 when the latest close is a new N-day low, up to 100 for a new N-day high. %D is a simple moving average of %K. The "N" value can be varied - in our global expressions below we have used 5 days (5D) for %K, and 3 weeks (3W) for the %D moving average.

$$\%K = \frac{\text{close}_{\text{today}} - \text{lowest low}_{N \text{ days}}}{\text{highest high}_{N \text{ days}} - \text{lowest low}_{N \text{ days}}} \times 100$$

There is also a concept of "fast" and "slow" stochastics for this indicator. The "slow" concept applies an additional moving average (e.g. 3 weeks again, in our global expressions below) compared to the "fast" concept, and is hence regarded as being less sensitive to changes in the price, and less likely generate transaction signals.

Levels near the extremes 100 and 0, for either %K or %D, indicate strength or weakness (respectively) with prices making or approaching new N-day highs or lows. Levels above 80 and below 20 can therefore be interpreted as overbought or oversold. The %D indicator acts as a trigger or signal line for %K. A buy signal is given when %K crosses up through %D, or a sell signal when it crosses down through %D.

071E "STOCHASTICS %K (FAST)"

```
((X-MIN#(X(PL),5D))/(MAX#(X(PH),5D)-MIN#(X(PL),5D)))*100
```

055E "STOCHASTICS %K (SLOW)"

$MAV\#(((X-MIN\#(X(PL),5D))/(MAX\#(X(PH),5D)-MIN\#(X(PL),5D))*100),3W)$

072E "STOCHASTICS %D (FAST)"

$MAV\#(((X-MIN\#(X(PL),5D))/(MAX\#(X(PH),5D)-MIN\#(X(PL),5D))*100),3W)$

056E "STOCHASTICS %D (SLOW)"

$MAV\#(MAV\#(((X-MIN\#(X(PL),5D))/(MAX\#(X(PH),5D)-MIN\#(X(PL),5D))*100),3W),3W)$

See the following folder in the Expression Picker, where these expressions and other Technical Analysis indicators can be found:

Datastream > Technical Indicators

In addition, Stochastics examples are available in Datastream Charting - see the following sections of the Library:

Charts > Datastream > Sample Charts > Technical Charts

and

Templates > Datastream > Equities > Technical

Similarly, a template is available in the Chart Studies app in EIKON. See the Datastream > Equities > Technical folder.

MACD

The Moving Average Convergence/Divergence indicator (MACD) is calculated by subtracting the value of a longer term (normally 26 days) exponential weighted average from a shorter term (normally 12 days) exponential weighted average.

A trigger (or signal) line is then typically calculated using a 9 day exponential weighted average of the MACD.

The basic MACD trading rule is to sell when the MACD falls below its trigger line, or conversely buy when it rises above.

053E "MACD"

$EWA\#(X,0.154)-EWA\#(X,0.074)$

054E "MACD - TRIGGER"

$EWA\#(053E,0.20)$

For further information on the EWA# function, see the entry for Exponential Weighted Average.

The above global expressions can be found in the following folder of the Expression Picker, along with a variety of other Technical Analysis indicators:

Datastream > Technical Indicators

In addition, MACD examples are available in Datastream Charting - see the following sections of the Library:

Charts > Datastream > Sample Charts > Technical Charts

and

Templates > Datastream > Equities > Technical

Similarly, a template is available in the Chart Studies app in EIKON, and the Studies page from the EQUITY menu in Datastream Professional. See the Datastream > Equities > Technical folder.

Maximum Drawdown and the Underwater measure

Underwater measure - this calculates the return/loss from selling on a particular date, after buying at the highest peak during the time period. This can be calculated, in a time series chart or request, as $(X/\text{MAXG}\#(X)-1)*100.00$ at for example daily data frequency.

Maximum Drawdown calculates the maximum loss that would be suffered from an investment when buying at the highest peak during a particular time period, and selling at the lowest subsequent trough in the same time period (i.e. the investment is bought before it is sold). The expression at daily data frequency could be $\text{MIN}\#((X/\text{MAXG}\#(X)-1)*100.00)$

On balance volume

On Balance Volume is a momentum indicator that measures positive and negative volume flow. If today's close is greater than yesterday's close, then today's volume is added to yesterday's OBV; vice-versa if today's close is less than yesterday's close. A rise in this indicator can be seen as confirmation that the price is in an uptrend.

058E "ON BALANCE VOLUME (DAILY)"

$\text{CSUM}\#((\text{ACH}\#(X,1D))/\text{ABS}\#(\text{ACH}\#(X,1D))*X(\text{VO}))$

Oscillator

The Oscillator indicator is applicable to series where high/low/opening/close prices are available.

The formula is:

$(X(\text{PH})-X(\text{PL})+X-X(\text{PO}))/((X(\text{PH})-X(\text{PL}))^2)$

The oscillator value varies between 0 and 1 and is a measurement of sensitivity. A value above 0.8 is generally regarded as bullish and below 0.2 as bearish.

PEG ratio

The basic formula is

Price/Earnings Ratio / Annualised Earnings Growth (%)

e.g. if P/E = 20 and annualised earnings growth = 16 % then PEG Ratio = 1.25

A lower ratio is "better" (cheaper) and a higher ratio is "worse" (expensive). The P/E ratio used in the calculation may be projected or trailing, and the annualised earnings growth rate may also be projected or trailing. This latter variable is normally measured over a range of either 1 or 5 years.

PEG is a widely employed indicator of a stock's possible true value. Similar to P/E ratios, a lower PEG Ratio indicates that the stock may be undervalued. It is sometimes preferred over the standard price/earnings ratio because it also accounts for growth.

A PEG ratio of 1 is sometimes said to represent a fair trade-off between the values of cost and the values of growth, indicating that a stock is reasonably valued given the expected growth.

435E "PEG RATIO" (using FY1 and FY2 consensus I/B/E/S estimates of EPS)

$X/(X(\text{EPS2})-X(\text{EPS1}))/100$

436E "PEG RATIO" (using 5 year historical growth of Worldscope earnings per share item WC05201)

$X(\text{PE})/((\text{POW}\#(X(\text{WC05201})/\text{LAG}\#(X(\text{WC05201}),5Y),0.2)-1)*100)$

460E "PEG RATIO HISTORIC" (using 5 year growth of historical EPS)

X(PE)/GRFL#(X(EPS),5Y)

Performance relative to benchmark

Performance is normally calculated as the % change, using the PCH# function. To calculate performance relative to a particular benchmark, the following expression can be used - in this case a rolling 1 month performance relative to the S&P 500 index, for example:

PCH#(X/S&PCOMP,1M)

Alternatively, rather than directly specifying an index, you can choose to automatically select the Local Index for the stock, depending on the market it trades within:

PCH#(X/X(LI),1M)

Some users prefer to use differences instead of ratios: PCH#(X,1M)-PCH#(X(LI),1M).

To identify the index being referenced by LI for a particular stock, use datatypes LI#NAME and/or LI#MNEM in a Static Request to return the name and mnemonic of the index, respectively.

Other benchmarks can also be automatically referenced, via a set of similar datatypes instead of LI:

MI Datastream Market Index

FII Datastream Industry Index

FEI Datastream Super Sector Index

FSI Datastream Sector Index

SEI Datastream Subsector Index

DSI Datastream Sector (level 6) index

TRI1L Thomson Reuters Economic Sector Index

TRI2L Thomson Reuters Business Sector Index

TRI3L Thomson Reuters Industry Group Index

TRI4L Thomson Reuters Industry Index

R square

Also known as the Coefficient of Determination, R^2 (R squared) is a statistic often used as a measure of fit of a linear regression. It is popularly described as the proportion of the variation in the dependent variable (around its mean value) that can be explained by the linear regression.

In a bivariate regression, the statistic is calculated as the square of the correlation coefficient and it ranges from 0 to 1. A value close to one indicates that data fit the calculated model closely; a value close to zero indicates that data do not fit the model well.

For example, when the 30 day rolling correlation between a stock and its benchmark is calculated as:

CORR#(PCH#(FTALLSH,1D),PCH#(MKS,1D),30D)

Then R^2 is calculated as:

POW#(CORR#(PCH#(FTALLSH,1D),PCH#(MKS,1D),30D),2)

Rebasing

Rebasing adjusts time series values to begin at a new starting value, typically 100.

The REB# function rebases an individual series; the REBE# function rebases expressions. For more details and examples of these functions, see the Rebase page within the "Display" folder of the Function help and definitions pages.

For example:

REB#(VOD,-1M) rebases the Vodafone price to 100, starting on a date 1 month in the past.

REBE#(VOD/FTSE100,-1M) similarly rebases Vodafone performance relative to the FTSE 100 benchmark.

To "rebase" a series to zero rather than 100 to calculate performance, use the PCHV# function instead - see the "Growth rates & changes in value" section of the Function help and definitions pages mentioned above.

For example:

PCHV#(VOD)

rebases Vodafone to zero, starting on the earliest date displayed in a chart or time series request.

To rebase a series to a starting value of your choice, use the VAL# function (see the "Display" folder of the Functions help and definitions). For example, to rebase Vodafone to 50 on a date 3 months in the past, use the expression:

VOD/VAL#(VOD,-3M)*50

Also note that Datastream Charting contains Rebase settings which do not require the use of functions such as the above - click the Left Axis on a chart to open the settings, and choose from "To First", "To 100" or "To Zero".

Regression standard error and t-value

The beta coefficient can be estimated using global expression 897E for example (see the Beta entry in this document).

897E "DS HISTORICAL BETA LOCAL INDEX"

REGB#(LN#(X(LI)/LAG#(X(LI),1M)),LN#(X/LAG#(X,1M)),60M)

The following expressions for standard deviation and t-value assume that there are no missing values among the 60 monthly observations. The standard error of the REGB coefficient is then given by the formula:

POW#((1-POW#(841E(X),2))*MOM#(LN#(X/LAG#(X,1M)),60M,2)*60/58,0.5)

divided by:

SDN1#(LN#(X(LI)/LAG#(X(LI),1M)),60M)*POW#(59,0.5)

The POW# factor at the end of the second part of the expression above is the square root of the number of observations (60) minus 1.

The overall calculation is available as global expression 096E "STANDARD ERROR OF REGB".

The t value is the REGB value divided by the standard error:

097E "T VALUE OF REGB COEFFICIENT"

841E(X)/POW#(1-POW#(841E(X),2),0.5)*POW#(58,0.5)

Relative strength index

A technical momentum indicator that compares the magnitude of recent gains to recent losses, in an attempt to determine overbought and oversold conditions of an asset. It is calculated using the following formula:

$$RSI = 100 - 100 / (1 + RS)$$

Where RS = average of N days' up closes / average of N days' down closes. N is specified as a time parameter in the RSI# function, e.g. N = 14D. See the "Technical" folder of the Function definition help pages for more information on this function.

Using the FTSE 100 index as an example, over a 14 day time period:

$$RSI\#(FTSE100,14D)$$

The RSI ranges from 0 to 100. An asset is deemed to be overbought once the RSI approaches the 70 level, meaning that it may be getting overvalued and is a good candidate for a pullback. Likewise, if the RSI approaches 30, it is an indication that the asset may be getting oversold and therefore likely to become undervalued.

A further example is available in Datastream Charting - see the following sections of the Library:

Charts > Datastream > Sample Charts > Technical Charts

and

Templates > Datastream > Equities > Technical

Similarly, a template is available in the Chart Studies app in EIKON.

Revisions ratio I/B/E/S

This represents the net revisions made by brokers contributing to I/B/E/S consensus estimates.

There are a number of global expressions available within the following section of the Expression Picker:

Datastream > Ratios > Estimates Ratios

For example:

138E "REVISIONS RATIO (STOCK # ESTs)"

$((X(F1UP)-X(F1DN))/X(F1NE))*100$

429E "REVISIONS RATIO (INDEX # ESTs)"

$((X(A12UPE)-X(A12DNE))/X(A12NE))*100$

469E "REVISIONS RATIO (INDEX # COs)"

$((X(A12UPC)-X(A12DNC))/X(A12NC))*100$

497E "REVISIONS RATIO (INDEX E U/D)"

$DPL\#(X(A12UPE)/X(A12DNE),2)$

Risk premium

The equity risk premium is defined as the total annualised return on equities minus the total annualised return on a safe government backed instrument such as treasury bills or government bonds (generally short term). Normally a long time period is used e.g. the last 10 years

There are 4 Datastream global expressions available to measure the risk premium as follows. They use the GRFL# function, which calculates the annualised rate of growth.

180E "RISK PREMIUM UK MEASURE"

GRFL#(TOTMKUK(RI),10Y)-GRFL#(AUKGVG1(RI),10Y)

181E "RISK PREMIUM US MEASURE"

GRFL#(TOTMKUS(RI),10Y)-GRFL#(AUSGVG1(RI),10Y)

182E "RISK PREMIUM JAPAN MEASURE"

GRFL#(TOTMKJP(RI),10Y)-GRFL#(AJPGVG1(RI),10Y)

183E "RISK PREMIUM GERMAN MEASURE"

GRFL#(TOTMKBD(RI),10Y)-GRFL#(ABDGVG1(RI),10Y)

Equity risk premiums for other markets can be calculated by using the appropriate equity total return index and bond total return index. Some users prefer to use short term government treasury bill yields, or similar, instead of government bond redemption yields.

NB: The equity risk premium should generally be a positive number, as it represents the extra risk of holding equities compared with 'safe' government bonds, which are conventionally considered to be 'risk free' instruments. However if a time period is chosen which includes a significant bear market period(s), for example 1999 to 2008, the reading will almost certainly be negative. If a measure of what is to be expected or was expected is wanted it is suggested that in general measurements should be taken from a relatively low point to a relatively high point, in order to represent 'normal' market conditions.

Sharpe ratio

This is the total return divided by volatility, i.e. the rate of return per unit of risk. The theory is that in general, in order to obtain a higher return you have to take on additional risk (i.e. extra volatility).

So the higher the Sharpe ratio, the better - i.e. you get a higher return for a given level of risk.

A number of global expressions are available here. A popular expression is 445E which is based on a 3 year period using weekly data:

445E "SHARPE RATIO, 3 YEARS WKLY"

GRFL#(X(RI),-156W,)/(SDN1#(PCH#(X(RI),1W),156W)*7.211)

Here the numerator is the annualised total return, and the denominator is annualised volatility

The generalised form of the ratio is:

330E "SHARPE RATIO, GENERAL"

MAV#(PCH#(X,A)-PCH#(Y,A),Z)/SDN1#(PCH#(X,A)-PCH#(Y,A),Z)

where X is the stock/instrument (e.g. @MSFT), Y is a benchmark (e.g. S&PCOMP), A is the return measurement interval (e.g. 1D) and Z the time period for the moving average (e.g. 3M). This example be entered in a Time Series request or chart as:

330E(@MSFT,S&PCOMP,3M,1D)

Shiller PE ratio or CAPE

Named after the economist Robert Shiller, the Shiller PE - also known as Cyclically Adjusted Price Earnings (CAPE) - is an extension of the Graham & Dodd PE - the difference being that Shiller PE adjusts for inflation.

Shiller PE traditionally relates specifically to the S&P 500 index for the US market - historical values are available back to 1950 under mnemonic USSPRPER. The measure can also be calculated and/or adapted for other markets however, using Datastream expressions.

For the US market, mnemonics USCONPRCF (US CPI) and S&PCOMP are used in the Datastream global expressions 532E and 533E below. At the time of writing, freely available S&PCOMP(PE) data coverage ends in October 2012 due to S&P licencing restrictions, which impacts expression 532E. However the Datastream calculated datatype DSPE is available as an alternative to the PE datatype, and this is used as an alternative in 533E, since data are available up to present day.

532E "SHILLER PE RATIO"

$(S\&P\text{COMP}/USCONPRCF)/(MAV\#((S\&P\text{COMP}/S\&P\text{COMP}(PE))/USCONPRCF,10Y))$

533E "SHILLER PE RATIO (DSPE)"

$(S\&P\text{COMP}/USCONPRCF)/(MAV\#((S\&P\text{COMP}/S\&P\text{COMP}(DSPE))/USCONPRCF,10Y))$

You can adapt these standard expressions for other markets, using the relevant market index and CPI series.

For example, for the European Union region you could replace USCONPRCF with an alternative such as EHESAW52F (HICP ALL-ITEMS), sourced from Eurostat, and DJEURST(PE) i.e. the EURO STOXX index PE as the equity market measure:

$(DJEURST/EHESAW52F)/(MAV\#((DJEURST/DJEURST(PE))/EHESAW52F,10Y,I))$

Tobin's Q

Named after the economist James Tobin, this indicator is based on his hypothesis that the total value of a company should be approximately equal to its replacement costs. The Q ratio is calculated as the market (or enterprise) value of a company divided by the replacement value of its assets.

A low Q (between 0 and 1) indicates that the company's cost to replace assets is greater than the value of its stock; this implies that the stock is undervalued. Conversely, a high Q (greater than 1) indicates that the company's stock is more expensive than the replacement cost of its assets; this in turn implies that the stock is overvalued. This measure of stock valuation is the driving factor behind investment decisions in Tobin's model.

There are a number of variations in the specific calculation of company value and asset replacement value in the financial literature; below are two possible approaches which are available as global expressions:

168E "TOBIN'S Q"

$(X(MVC)*1000.000+PAD\#(X(WC03451)\sim PCUR,C)+PAD\#(X(WC03251)\sim PCUR,C)+PAD\#(X(WC03051)\sim PCUR,C))/PAD\#(X(WC02999)\sim PCUR,C)$

170E "TOBIN'S Q VER. 2"

$X(DWEV)/X(DWTA)*1.000$

Turaku index

This is a market breadth indicator, calculated as the average number of gainers (advances) over a 25 day period, divided by the average number of losers (declines) over the same period, multiplied by 100.

The Toraku index specifically refers to stocks on the Tokyo Stock Exchange, but the same methodology could be applied for other markets too, by replacing TOKYOSE with an alternative index mnemonic (dependent on the RS and FS datatypes being available - if they are not, a User Created Index could be calculated instead).

$(MAV\#(TOKYOSE(RS),25D,R)/MAV\#(TOKYOSE(FS),25D,R))*100.00$

Also see the related entry on the Advance Decline Ratio and Line.

Volatility

Volatility is a statistical measure defined as the annualised standard deviation of log price changes, and measures the range of variation over time.

There are several global expressions available on Datastream for commonly used time periods and frequencies - they can be found in the following section of the Expression Picker:

Datastream > Risk and Volatility > Volatility

These include the below expressions, for example:

840E "HISTORICAL VOLATILITY 30 DAYS"

$POW\#(250,0.5)*SDN\#(LN\#(X/LAG\#(X,1D)),30D)*1.000$

431E "HISTORICAL VOLATILITY 1 YEAR"

$POW\#(250,0.5)*SDN\#(LN\#(X/LAG\#(X,1D)),250D)*1.0000$

191E "HISTORICAL VOLATILITY 3 YEARS"

$POW\#(52,0.5)*SDN\#(LN\#(X/LAG\#(X,1W)),156W)*1.0000$

400E "HISTORICAL VOLATILITY 5 YEARS"

$POW\#(12,0.5)*SDN\#(LN\#(X/LAG\#(X,1M)),60M)*1.0000$

Note that for longer time periods, the frequency of observations is usually dropped - so in the above expressions, the 30D (day) time period for the volatility calculation uses daily frequency price changes (1D); the 3 year time period (156 weeks) uses weekly frequency price changes (1W); and the 5 year time period (60 months) uses monthly frequency price changes (1M).

Each of the expressions uses the POW# (Power) function to calculate the annualising factor, which for volatility is the square root of the number of observations in a year. Daily frequency expressions use the annualising factor POW#(250,0.5) as there are assumed to be 250 trading days in a year; weekly frequency values use POW#(52,0.5) as there are 52 weeks in a year, and monthly frequency values use POW#(12,0.5) as there are 12 months in a year.

The SDN# is the function for measuring standard deviation; LN# is the Natural Log function used to calculate the price change between the latest close (X) and the previous (i.e. lagged) value via LAG#.

Frequency and time periods can be varied according to your preferences within the general format of the global expressions above. For example, to measure volatility over a 100 day period, 840E could be altered to:

$POW\#(250,0.5)*SDN\#(LN\#(X/LAG\#(X,1D)),100D)$

Using one of the above expressions with any financial instrument, the resulting data represents the annualised 1 standard deviation range of the movement. For example, a volatility reading of 0.12 means that the 1 standard deviation range is +/- 12%.

Note: in the above examples, the function SDN# is used, known as the 'population' standard deviation. An alternative is the function SDN1#, known as the 'sample' standard deviation, and this gives a very slightly larger answer because the number of observations divisor is n-1 instead of n observations.

Also see the related entry for Implied Volatility.

Volume weighted average price (VWAP)

Volume Weighted Average Price (VWAP) is calculated by dividing the total volume of shares traded for a stock on a particular day, into the total value of shares traded for the stock on that day. It is available under equity datatype VWAP.

The calculation uses data from the Datastream primary exchange for the stock – see the EXNAME equity datatype to check which exchange this is.

$VWAP = \text{Sum of (Volume * Price)} / \text{Sum of Volume}$

In the above formula, "sum" refers to the aggregate of the day's transactions on the primary exchange.

Note that for Italian stocks VWAP represents the Prezzo Ufficiale price.

Weighted average cost of capital (WACC)

WACC, expressed as a percentage, is a calculation of a company's cost of capital, that weights each category of capital (equity and debt) proportionately. Investors interpret it as the rate of interest that the company must pay on its overall borrowings; the company can use the figure as an opportunity cost estimate in determining whether future projects are worthwhile undertaking.

The calculation requires a number of inputs, defined as:

Stock: X

Risk Premium: Y

Risk Free Rate: Z

Corporate Tax Rate: A

Beta: e.g. 897E

Total Debt: PAD#(X(WC03255),C)

Market Value of Equity: X(MV)~ACUR

Then:

557E "WACC"

$((897E(X)*Y+Z)*X(MV)\sim ACUR+(1-A/100)*(Z+1)*PAD\#(X(WC03255),C)/1000)/(X(MV)\sim ACUR+PAD\#(X(WC03255),C)/1000)$

Note: the first part of this formula is the cost of raising equity, which is essentially the risk free interest rate plus the equity risk premium (defined as market risk premium multiplied by Beta - see the entry for Beta above; the second part of the formula is the cost of borrowing money, where the interest rate for a blue chip company is here assumed to be 1% above the risk free rate (i.e. Z+1), and interest payments are tax deductible - for lower rated companies, a figure higher than 1 should be used accordingly to reflect a higher cost of borrowing. The two parts are weighted by their respective market values of equity and debt.

X, Y, Z, A can be selected as for example:

X = GSK (GlaxoSmithKline)

Y = 180E for UK risk premium - see the entry on Risk premium above for more explanation.

Z = BMUK10Y(RY) for the UK 10 year government bond yield as the risk free rate.

A = 20% UK corporate tax rate as of 2015.

And the expression is then used in this case as:

557E(GSK,180E,BMUK10Y(RY),20)

Williams %R

Williams %R is a momentum indicator that works much like the Stochastic Oscillator, see entry above. It is especially popular for measuring overbought and oversold levels. The scale ranges from 0 to -100, with readings from 0 to -20 considered overbought, and readings from -80 to -100 considered oversold.

William %R, sometimes referred to as %R, shows the relationship of the close relative to the high-low range over a set period of time. The nearer the close is to the top of the range, the nearer to zero (higher) the indicator will be. The nearer the close is to the bottom of the range, the nearer to -100 (lower) the indicator will be. If the close equals the high of the high-low range, then the indicator will show 0 (the highest reading). If the close equals the low of the high-low range, then the result will be -100 (the lowest reading).

$$\%R = \frac{\text{highest high over } x \text{ periods} - \text{close}}{\text{highest high over } x \text{ periods} - \text{lowest low over } x \text{ periods}} \times -100$$

Typically, Williams %R is calculated using 14 periods and can be used on intraday, daily, weekly or monthly data. The time frame and number of periods will likely vary according to desired sensitivity and the characteristics of the individual security.

531E "WILLIAMS % R 14 DAYS"

(MAX#(X(PH),14D)-X(P))/(MAX#(X(PH),14D)-MIN#(X(PL),14D))*(-100)

Williams variable accumulation

This indicator is calculated as the cumulative sum over time of the formula:

$$\frac{\text{closing price} - \text{opening price}}{\text{price high} - \text{price low}} \times \text{volume}$$

Williams' Variable Accumulation Distribution provides a measure of volume, weighted by price momentum. It calculates the current period's volume, multiplied by the difference between the close and open, divided by the period's range. A close above the open will result in values greater than zero. A close below the open will result in values less than zero. If the close and open are always within the high/low range, then Williams' Variable Accumulation Distribution will range in value between the current period's volume and the negative of the current period's volume.

507E "WILLIAMS VARIABLE ACCUMULATION"

CSUM#((X-X(PO))/(X(PH)-X(PL))*X(VO))

Z-score (Altman)

This is a ratio devised by Robert Altman to describe the financial health of a company, and its likelihood of financial distress. Altman Z-Score works best with manufacturing companies; it is not so well suited to financial or property companies.

Given:

TA - Total Assets

TL - Total Liabilities

WC - Working Capital (i.e. stocks and debtors less short term creditors)

RE - Accumulated Retained Earnings (the profit and loss account reserve)

EBIT - Earnings Before Interest and Tax

S - Sales

MV - Market Value of equity

And:

X1 = WC/TA : This measures liquid assets in relation to the firm's size. Altman, interestingly, mentions that the most widely used current and acid ratios were not as good predictors as this measure.

X2 = RE/TA : This is a measure of cumulative profitability that reflects the firm's age as well as earning power. Many studies have shown failure rates to be closely related to the age of the business.

X3 = EBIT/TA : This is a measure of operating efficiency separated from any leverage effects. It recognizes operating earnings as a key to long-run viability.

X4 = MC/TL : This ratio adds a market dimension. Academic studies of stock markets suggest that security price changes may foreshadow upcoming problems.

X5 = S/TA : This is a standard turnover measure. Unfortunately, it varies greatly from one industry to another.

Then the Z-score for **manufacturing** companies is defined as:

$$Z = (1.2 * X1) + (1.4 * X2) + (3.3 * X3) + (0.6 * X4) + (1.0 * X5)$$

Z < 1.8 indicates a bankruptcy candidate, Z > 3 indicates strong health.

For **non-manufacturing** companies, X5 varies significantly by industry. It is likely to be higher for merchandising and service firms than for manufacturers, since the former are typically less capital intensive. Consequently, non-manufacturers would have significantly higher asset turnover and Z scores. The model is thus likely to underpredict certain sorts of bankruptcy. To correct for this potential defect, Altman recommends the following formula:

$$Z = (6.56 * X1) + (3.26 * X2) + (6.72 * X3) + (1.05 * X4)$$

Z < 1.1 indicates a bankruptcy candidate, Z > 2.6 indicates financial health.

Two global expressions are available in the Expression Picker, folder:

Datastream > Fundamentals > Altman Z-Score:

374E "ALTMAN Z-SCORE MANUFACTURING"

HIDE#(PAD#((X(WC03151)*1.2+X(WC03495)*1.4+X(WC18191)*3.3+X(WC01001))/(X(WC02999)-X(WC02649))+X(WC08001)/X(WC03351)*0.6,C))

375E "ALTMAN Z-SCORE NON-MANUFACTURING"

HIDE#(PAD#((X(WC03151)*6.56+X(WC03495)*3.26+X(WC18191)*6.72)/(X(WC02999)-X(WC02649))+X(WC03501)/X(WC03351)*1.05,C))

Note -

Total Tangible Assets are used: WC02999 (Total Assets) less WC02649 (Total Intangible Other Assets Net).

Both forms of the Altman Z Score are available in Datastream Charting - see the following sections of the Library:

Templates > Datastream > Fundamentals > Altman Z-Score

Similarly, a template is available in the Chart Studies app in EIKON.

Z-score (Statistical)

This is a statistical measurement used for normalizing data. A Z-score of 0 indicates the value is equal to the mean value over the given time period; a Z-score that is positive or negative indicates that the value is above or below the mean (respectively) and by how many standard deviations.

A generalised global expression is available, for calculating the Z-Score over a rolling time period:

300E "ROLLING NORMALIZATION"

$(X-MAV\#(X,Y))/SDN1\#(X,Y)$

Where:

X = any time series instrument, e.g. FTSE100

Y = time period, e.g. 30D (30 days)

This example would be entered in a Time Series request or chart as:

300E(FTSE100,30D)

Alternatively, the following can be used, which uses the start and end date of the Time Series request or chart as the respective start and end points of the Average and (sample) Standard Deviation components of the Z-Score calculation:

315E "NORMALIZATION"

$(X-AVG\#(X))/SDN1\#(X)$

For example:

315E(FTSE100)

Other helpful hints for Datastream expressions and functions

Percentage of stocks trading above/below a high/low or moving average

A common question is around how to calculate the percentage of stocks within an index that are trading above/below a moving average, or above/below a 52 week high/low, for example.

The LIST# function can be used to achieve this.

The following calculates the % of stocks within the Nikkei 225 index* that hit a new 52 week high each day:

```
LIST#(LJAPDOWA,(IF#(MAX#(LJAPDOWA,52W)-LAG#(MAX#(LJAPDOWA,52W),1D),GT,ZERO))*100,AVG)
```

Conversely, the following calculates the % that hit a new 52 week low each day:

```
LIST#(LJAPDOWA,(IF#(MIN#(LJAPDOWA,52W)-LAG#(MIN#(LJAPDOWA,52W),1D),LT,ZERO))*100,AVG)
```

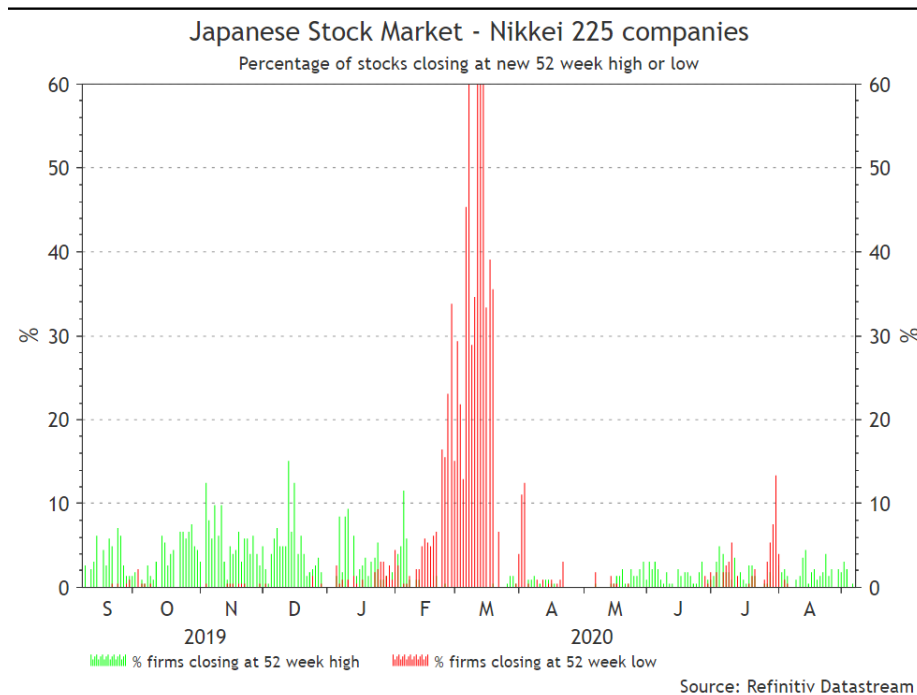
The LJAPDOWA list and 52W (week) time period could be switched to alternatives if preferred.

Similarly, the same type of expression can be used to calculate the % of constituents trading above the 50 day moving average, for example:

```
LIST#(LJAPDOWA,(IF#(LJAPDOWA-MAV#(LJAPDOWA,50D),GT,ZERO))*100,AVG)
```

The following example chart is available in the Datastream Charting Library - in the following folder:

Chart Functionality Examples > Analytics > Functions and Expressions



*Note - the constituent list mnemonic used in the LIST# expression is fixed and does not allow for index constituents changing over time. In this example, LJAPDOWA is the latest (as of the date of the request) Nikkei 225 constituent list - and this is used for the calculation of all time series values, so caution should be exercised if requesting a long time series of values, spanning more than a year for example. Historical constituent lists are generally available for indices however, by suffixing the month (end) and year to the mnemonic - e.g. suffixing 1214 to LJAPDOWA (i.e. LJAPDOWA1214) specifies the December 2014 month end list. So the LIST# expression could be run in time period sections, using the respective historical constituent list for each section, if greater accuracy is required.

Some of the IF# expressions used in the expressions above contains the operator LT. Missing values are treated as small negative values so the IF# equals 1 for missing values. If that behaviour isn't wanted the expression should be reformulated to use GT instead.

Dummy time series for use in expressions

A wide variety of 'dummy' time series are available, which are often very useful as components of calculations when constructing complex and/or conditional expressions.

For example, they could be used in the following types of application:

- USCONPRCF/DUMMYMQ3 displays only the third month of each quarter for the US consumer price index.
- UKCONPRCF/DUMMYJAN displays only the January figures for the UK consumer price index.
- Growth rates can be produced by using the exponential time trends, for example:
- POW#(,0.4066) displays a monthly series which grows at an annual rate of 5%.
- The factor 0.4066 in the above case is determined by the expression $LN\#(1+growth\ rate/100)/(number\ of\ periods\ in\ year/100)$, so $LN\#(1.05)/0.12 = 0.4066$
- Similarly POW#(UKTIMEQE,2.383) is a quarterly series growing at 10% annual rate, where $LN\#(1.1)/0.04 = 2.383$
- Negative time trends:
- (588-UKTIMETM) is a monthly (linear) time trend starting at 587 in January 1951, counting down to zero in December 1999.
- 7.099327/UKTIMEQE starts at 7.099327 in the first quarter of 1951 and declines (exponentially) by EXP 0.01 each quarter to 1 in the fourth quarter of 1999.
- POW#(7.09933/UKTIMEQE,1.814) displays a quarterly series which declines at an annual rate of 7%

The factor $1.814 = LN\#(100/(100-7))/0.04$ i.e. 7 is the negative growth rate and 0.04 is the number of time periods in year divided by 100

The following trend time series are available:

CALNDAY increases by 1 each calendar day (starting 1 January 1990)

DUMMYDY increases by 1 each weekday (starting 1 January 1970)

UKTIMETM increases by 1 each month (starting January 1951)

UKTIMETQ increases by 1 each quarter (starting Q1 1951)

UKTIMETY increases by 1 each year (starting 1951)

UKTIMEME increases exponentially by EXP0.01 each month (starting January 1956)

UKTIMEQE increases exponentially by EXP0.01 each quarter (starting Q1 1951)

UKTIMEYE increases exponentially by EXP0.01 each year (starting 1956)

Annual frequency series

DUMMYYRE yearly end alignment series value = 1 (starting 1950)

DUMMYYRM yearly mid alignment series value = 1 (starting 1950)

Quarterly frequency series

DUMMYQTE quarterly end alignment series value = 1 (starting 1950)
DUMMYQTM quarterly mid alignment series value =1 (starting 1950)
DUMMYQT1 quarterly series containing value 1 in each 1st quarter; starting Q1 1951
DUMMYQT2 quarterly series containing value 1 in each 2nd quarter; starting Q2 1951
DUMMYQT3 quarterly series containing value 1 in each 3rd quarter; starting Q3 1951
DUMMYQT4 quarterly series containing value 1 in each 4th quarter; starting Q1 1951
DUMMYQTR2 quarterly series containing value 1 in each 2nd quarter; starting Q1 1950
DUMMYQTR3 quarterly series containing value 1 in each 3rd quarter
DUMMYQTR4 quarterly series containing value 1 in each 4th quarter

Monthly frequency series

DUMMYCAL monthly series showing number of calendar days in the month
DUMMYNAS monthly series where every value = 0
MONTHLY2 monthly series where value = 1 for January, 2 for February, 3 for March etc.
DUMMYMTE monthly end alignment series where every value = 1
DUMMYMTM monthly mid alignment series where every value = 1
DUMMYJAN monthly series where January =1, zero otherwise
Similarly: DUMMYFEB DUMMYMAR DUMMYAPR DUMMYMAY DUMMYJUN DUMMYJUL DUMMYAUG DUMMYSEP
DUMMYOCT DUMMYNOV DUMMYDEC

DUMMYMQ1 first month of each quarter=1, zero otherwise
DUMMYMQ2 second month of each quarter=1, zero otherwise
DUMMYMQ3 third month of each quarter=1, zero otherwise
DUMMYMQ1N monthly series where January/April/July/October=1, n/a otherwise
DUMMYMQ2N monthly series where February/May/August/November=1, n/a otherwise
DUMMYMQ3N monthly series where March/June/September/December=1, n/a otherwise

Daily frequency series

DUMMY01 daily series where value=1 at end of month, zero otherwise, starting 26 December 1986
DUMMYDD daily series where value=1 every day, starting 28 January 1980
DUMMYMD daily series where value=1 on Mondays, starting January 1950
DUMMYTU daily series where value=1 on Tuesdays, starting January 1950
DUMMYWD daily series where value=1 on Wednesdays, starting January 1950

DUMMYTH daily series where value=1 on Thursdays, starting January 1950

DUMMYFR daily series where value=1 on Fridays, starting January 1950

DUMMDY1 daily series which counts up from 1 and resets each year, starting 1 January

Holidays

A list mnemonic HOLIDAYS exists, which contains a list of stored series codes that can be used to indicate the dates that market holidays* fell on within each respective market, when used in a Time Series request. Non-holiday dates are returned as zero; holidays are returned as null values. So for example, the code C:VACS shows which dates were market holidays in Canada, when downloaded in a Time Series request.

To retrieve the list of Holiday series for each market, enter HOLIDAYS as the series in a Static request, along with datatypes MNEM and GEOGN to return the mnemonic and country name respectively.

This is useful in particular when analysing history for instruments that trade infrequently - and you are looking to distinguish between dates when they didn't trade because of a market holiday, versus dates when the market was open but the stock still didn't trade.

You can also incorporate these Holiday series into expressions - for example the following uses CMS# (Calendar Month Sum) and IF# to count the number of Canadian holidays that occurred during each month.

CMS#(IF#(C:VACS,NNA,ZERO))

For further explanation and examples of using the CMS# and IF# functions, see the Calendar and Logical folders respectively of the [Functions Help and Definitions](#) pages.

*Defined as dates on which the primary stock exchange was closed, due to public holiday or unusual circumstances such as temporary trading suspensions or extreme weather events.

Type	MNEMONIC	GEOGRAPHIC DESCR.
89658C	AD:VAC	ABU DHABI
672274	AG:VAC	ARGENTINA
300011	A:VACS	AUSTRALIA
881581	O:VACS	AUSTRIA
87753R	BA:VAC	BAHRAIN
87224N	BN:VAC	BANGLADESH
885728	B:VACS	BELGIUM
26175E	BR:VAC	BRAZIL
87146Q	BL:VAC	BULGARIA
300013	C:VACS	CANADA
26177F	CL:VAC	CHILE
32331N	CN:VAC	CHINA
68925N	CB:VAC	COLOMBIA
26177J	CR:VAC	CROATIA
77863P	CP:VAC	CYPRUS
26177K	CZ:VAC	CZECH REPUBLIC
672000	DK:VAC	DENMARK
87753N	DI:VAC	DUBAI

IF# function and conditional tests

This function is used to test a specific condition within a series or expression. It returns a True/ False value.

The format is:

IF#(Series or expression, operator,return value)

Where the operators are:

EQ Equal zero

NE Not equal zero

GT Greater than zero

GE Greater or equal zero

LT Less than zero

LE Less than or equal zero

NA Equal to NA

NNA Not equal to NA

And the return value is:

ZERO true=1, false=0

ONE true=1, false=-1

In order to achieve more flexibility with the output from these conditional tests, it is possible to combine a number of IF# expressions together.

For example, the following expression returns -1 when EPS is zero, and actual EPS otherwise:

IF#(X(EPS),NE,ONE)*X(EPS)+(IF#(X(EPS),EQ,ZERO)*IF#(X(EPS),NE,ONE))

Note that missing values are treated as small negative values so the following always returns 1 (for true) if X is missing value and Y is any value

IF#(X-Y,LT,ZERO)

Index calculation from percentage change series

There is the global expression 099E = 100+(EXP#(CSUM#(LN#(1+X/100.00)))-1)*100. For example 099E(BARC(MSGRD)).

That means that the index start at 100 at one observation prior to the request stat date. An alternative expression which starts at 100 on the request stat date is

REBE#(CPRD#(1+X/100)). For example: REBE#(CPRD#(1+(BARC(MSGRD)/100)))

Inflation (removal of)

To remove ('deflate') the effect of inflation from a series, for example to remove the effect of US inflation from the Dow Jones Industrials index (DJINDUS), you could use the expression:

(DJINDUS/CSR#(USCONPRCF))*VAL#(CSR#(USCONPRCF),VLO)

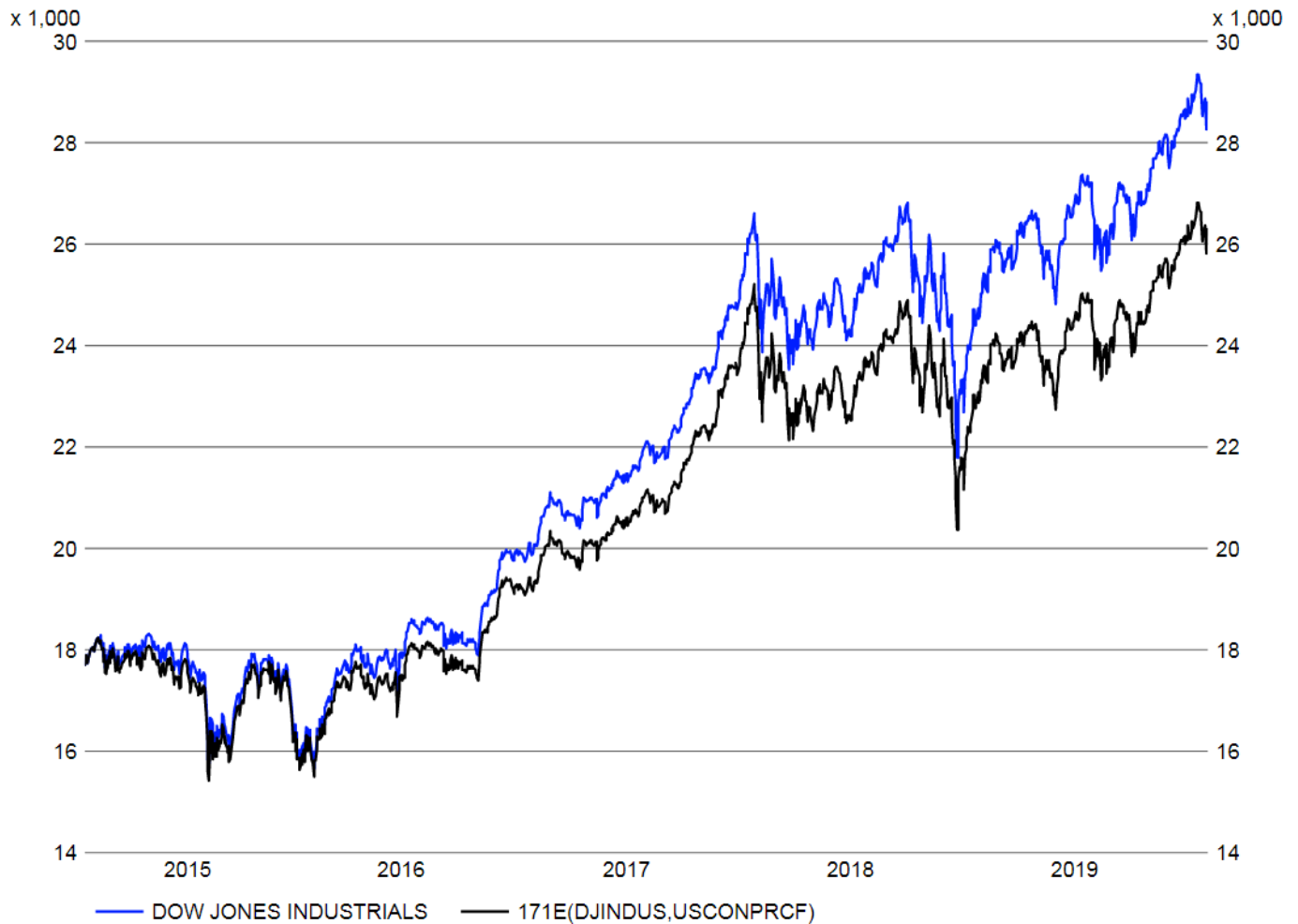
This uses the USCONPRCF series for US CPI, with the CSR# (Continuous Series) function to transform the monthly CPI series into daily frequency values, and the VAL#(...,VLO) function to select the CPI value at the start date of the chart, in order to perform the rebase of values.

This is available generically as a global expression:

171E "INFLATION ADJUSTMENT"

(X/CSR#(Y))*VAL#(CSR#(Y),VLO)

171E(DJINDUS,USCONPRCF) is then equivalent to the above example.



Source: Refinitiv Datastream

Limits for expressions and AFO/DFO requests

Expression lengths using direct entry (i.e. when not using a saved, short expression code)

In DFO you can type in an expression with a maximum length of 100 characters (time series request) or 45 characters (static request).

In Datastream Charting you can type in expressions with a maximum of 100 characters, except for Static Scatter charts, which only accept 45 characters.

In Datastream Advance/AFO you can type in an expression with a maximum length of 78 characters (time series request) or 45 characters (static request).

DFO and Datastream Charting expression builder

An expression saved as a short code (E###) can contain a maximum of 160 characters.

Tips:

- You can combine expressions to get around the character limits e.g. expression C = expression A + expression B, each of which could have up to 160 characters.
- You can use up to four symbolic variables (X,Y,Z,A) in your saved expression to make it shorter.
- **Note:**
- When you save the expression, it is validated and if it contains symbolic variables, then a value has to be supplied for those variables and the expression is expanded to its full length. For any single expression this cannot exceed 160 characters.
- Expressions which contain other expression codes, and/or use symbolic variables, will get expanded to their full length when the request is processed by the central system. When the expression is expanded, it will be bounded by brackets to ensure mathematical compliance. In practice this means that an expression stored with 160 characters will be expanded as 162 characters.
- The maximum expanded length (including any combined or nested expressions and any series codes/mnemonics replacing symbolic variables) is 400 characters.

Datastream Advance/AFO expression builder

As above, except the following differences:

- An expression saved as a short code (E###) can contain a maximum of only 78 characters.
- If it contains symbolic variables, then the fully expanded version (with sample series mnemonics replacing the symbolic variables) for any single expression cannot exceed 100 characters.
- When the fully expanded expression is bounded by brackets to ensure mathematical compliance, an expression stored with 78 characters will be expanded as 80 characters.

Other expression limits

A single expression can contain a maximum of:

- 20 functions
- 19 operators (20 operands) e.g. X+Y contains one operator (+) and two operands (X and Y)

Numeric constants can have a maximum of 8 digits.

Expressions containing currency conversion to Japanese Yen via the tilde function must use JY or JPY instead of Y otherwise it is considered as a symbolic variable.

When saving a new expression, the following characters are permitted in the name of the expression:

ABCDEFGHIJKLMNOPQRSTUVWXYZ

abcdefghijklmnopqrstuvwxyz

0123456789

\$.<(&!£*)-/%_>?:#@=\',^"

Other DFO and AFO limits

In DFO requests, the character limit for a formula is 8192.

In AFO requests, the character limit for each field is 256.

When uploading lists (L#, TR#) in either AFO or DFO, there is a limit of 5000 instruments.

When uploading a User Created Time Series (UCTS) in AFO/DFO, there is a limit of 7400 datapoints.

When uploading a User Created Index (UCI), there is a limit of 2000 instruments. However, it is possible to create a UCI using other UCI codes as constituents - e.g. X%UCI001 and X%UCI002 could be created containing 2000 instruments each, then

X%UCI003 could be created using X%UCI001 and X%UCI002 as its constituents. Note - when using this method, they must all be saved on an Auto calculation basis, not Trial.

In DFO, there are limits that come into play due to the size of the array being returned by a single request – e.g. a Time Series for List request for 20 years of daily values and a list of 2000 series would return 1.3 million values, and this may cause memory exceptions (this will depend on the version of Office and specification of the PC) – the recommendation is that no more than 300,000 values should be requested in a single request. There is also a timeout of 4 minutes for a single request that may be encountered if several datatypes are requested in a Static request for a large list. In these cases, requests should be broken down to return smaller sets of values.

LIST# expressions

The LIST# function enables you to perform analysis on lists of series, using operators to count or calculate average, sum, maximum, minimum or standard deviation.

The basic format is:

LIST#(List mnemonic,Expression,List-operator)

Where the List-operator must be one of the following:

- CT count of series in list
- CTGT count of series in list where the value of the expression is greater than zero
- CTGE count of series in list where the value of the expression is greater than or equal to zero
- CTLT count of series in list where the value of the expression is less than zero
- CTLE count of series in list where the value of the expression is less than or equal to zero
- AVG the average value of the expression for each series in the list
- SUM the sum value of the expression for each series in the list
- MIN the smallest value in the list for the expression
- MAX the largest value in the list for the expression
- SDN the 'population' standard deviation (division by n constituents)
- SDN1 the 'sample' standard deviation (division by n-1 constituents)

LIST# expressions can be combined in the following ways

LIST#(List mnemonic,Expression,List-operator) Arithmetic-operator LIST#(List mnemonic,Expression,List-operator)
Arithmetic-operator **Expression**

The Arithmetic-operator is one of +, -, * and /.

Such combined expressions cannot use lists containing more than 1000 series.

Examples:

LIST#(LFRAC40,ACH#(X,1D),CTLT)

This calculates the number of fallers each day in the French CAC40 index

LIST#(LDAXINDX,X(PE),AVG)

This calculates the simple arithmetic average PE for the German DAX index

LIST#(LFTSEMIB,X(MV),SUM)

This calculates the market value for the Italian FTSE MIB index

LIST#(LFTSE100,REB#(X,1/1/03),AVG)

This recalculates the FTSE100 index to a base of 1/1/2003=100 with each equity having an equal initial weighting. With time the weights will follow the development of the relative prices.

LIST#(LFTSE100,X-MAV#(X,200D),CTGT)

This counts the number of equities in the FTSE100 list which are above their 200 day moving average

LIST#(LFTSE100,X-MAV#(X,200D),CTGT)

This counts the number of equities in the list, which are within 10% of their (5 year) maximum value

LIST#(LFTSE100,X(PEFD12),CTGT)/LIST#(LFTSE100,111E((1/(X(PEFD12))),0),SUM)

This calculates an equally weighted 12M forward PE using only stocks having positive PEFD12.

LIST#(LFTSE100,REB#(X),AVG)-REB#(FTSE100)

This calculates an initially equally weighted price index using the latest constituents of the FTSE100 and subtracts the benchmark price index

Note:

While you can nest any Datastream functions within the LIST# function, LIST# itself cannot be nested within any other Datastream function. Therefore: LIST#(LFTSE100,PCH#(X,1D),AVG) is possible, but MAV#(LIST#(LFTSE100,X(PE),AVG),3M) is not.

Unpadding values or switching off carry forward

Many time series instruments on Datastream have 'padding' applied by default, meaning that on days where no value is available (null), due to a market holiday for example, the value from the previous day is carried over. This prevents there being a break in the line when charting the values, for example.

If you prefer to switch off this padding behaviour so that you only see 'real' values with no padded values, it is possible to do this by applying a suffix to the datatype being displayed:

#S as the suffix on the datatype unpadding *all* values in the time series.

#T unpadding values only *after* the latest real value - all values earlier than the latest real value are left padded.

In order to apply these suffixes, it is necessary to understand which datatype is being used - you may be explicitly defining a datatype in your request, or you may be using a datatype implicitly, by default.

For example, VOD(RI) explicitly specifies the RI (Return Index) datatype for Vodafone - to switch off padding of RI values, use either VOD(RI)*VOD(PI#S)/VOD(PI#S) or VOD(RI#T) according to preference. It is not recommended to use VOD(RI#S) since the calculation for that datatype isn't right. Whereas, VOD on its own does not explicitly define a datatype - here the Price (datatype P) is implicitly used by default, and in order to switch off padding of the price, VOD(P#S) or VOD(P#T) must be used - VOD#S is not valid syntax.

In order to check/discover which datatype is the default for a particular instrument, use the DEF (Default) datatype in a static request - as illustrated below for three example instruments. P (Price) is the default for most equities and PI (Price Index) is the default for most equity indices, but RI (Return Index) may be the default for other equity indices such as the Brazil Bovespa, for instance.

Note: Conversely, if you would like to *switch on* padding for a time series that does not have padding applied by default, use the PAD# function - for more information, see the "Display" folder of the [Functions Help and Definitions pages](#).

C	D	E	F	G	H	I	J	K	L
		Type	NAME	DEFAULT DATATYPE					
		VOD	VODAFONE GROUP	P					
		FTSE100	FTSE 100	PI					
		BRBOVES	BRAZIL BOVESPA	RI					
	Name	VODAFONE GROU	FTSE 100 - PRICE INDEX	BRAZIL BOVESPA - TOT RETURN IND					
	Code	VOD	FTSE100	BRBOVES					
	19/12/2014	225	6545.27	49650.98					
	22/12/2014	225.2	6576.74	50120.86					
	23/12/2014	224.7	6598.18	50889.81					
	24/12/2014	225	6609.93	50889.81					
	25/12/2014	225	6609.93	50889.81					
	26/12/2014	225	6609.93	50144.63					
	29/12/2014	224.8	6633.51	50593.82					
	30/12/2014	221.05	6547	50007.41					
	31/12/2014	222.65	6566.09	50007.41					
	01/01/2015	222.65	6566.09	50007.41					
	02/01/2015	221.9	6547.8	48512.22					
	Name	VODAFONE GROU	FTSE 100 - PRICE INDEX	BRAZIL BOVESPA - TOT RETURN IND - BRAZIL BOVESPA - TOT RETURN IND					
	Code	VOD(P#S)	FTSE100(PI#S)	BRBOVES(RI#S)					
	19/12/2014	225	6545.27	49650.98					
	22/12/2014	225.2	6576.74	50120.86					
	23/12/2014	224.7	6598.18	50889.81					
	24/12/2014	225	6609.93	N/A					
	25/12/2014	N/A	N/A	N/A					
	26/12/2014	N/A	N/A	50144.63					
	29/12/2014	224.8	6633.51	50593.82					
	30/12/2014	221.05	6547	50007.41					
	31/12/2014	222.65	6566.09	N/A					
	01/01/2015	N/A	N/A	N/A					
	02/01/2015	221.9	6547.8	48512.22					

Risk free interest rates

A risk free interest rate is the internal rate of return that can be obtained by investing in a financial instrument without (or with very limited) credit risk.

Normally this will relate to a short term investment in a financial instrument backed by the government. These money market securities are assumed to bear no credit risk and have a limited re-investment risk, when the investment is rolled over for another short term period.

The (annualised) yield on 3-month treasury bills is often used for analysis involving risk free rates, or alternatively a long term rate, such as the 10 year government bond yield, is commonly used too.

For currencies where no liquid treasury bill market exists (or the market is subject to institutional distortions), interbank rates such as LIBOR or EURIBOR rates could also be considered. These do, however, bear a minimal credit risk inherent to the banks active in the market.

Currencies with liquid repo-markets where the general collateral is a risk free long-term government bond offer another alternative for an interest rate which comes closest to 'risk-free', but are not available for as many currencies as interbank rates.

Some examples of short term Risk Free Rates for various markets are:

Country	Mnemonic	Description
ARGENTINA	AGIBPES	7 day interbank rate
AUSTRALIA	ADBR090	Dealer bill 90 day rate
BRAZIL	BRSELIC	Overnight financing rate
CANADA	CDN3MTB	3 month treasury bills
DENMARK	DNREPOR	Short term repo rate
EUROZONE	EIBOR3M	3 month interbank rate
KOREA (SOUTH)	KOCD91D	91 day certificate of deposit
MALAYSIA	MYTBB04	68-91 days treasury bill
MEXICO	MXCSM28	28 day 'cetes' certificates
NORWAY	NWIBK3M	3 month interbank rate
RUSSIA	RSIBK90	90 day interbank rate
SWITZERLAND	SWLOMBD	Central bank lombard rate
TAIWAN	TAMM90D	90 day money market rate
UK	UKTBTND	3 month treasury bill
USA	FRTBS3M	3 month treasury bill

Units, scale and currency

Converting to a different currency

Values can be converted to alternative currencies on Datastream using the following syntax:

X(DT)~CC

Where:

- **X** can be replaced with a specific series mnemonic (e.g. @AAPL for Apple) when using this expression in the Series/List field of a Time Series request or in a chart; or it can be left as the symbolic variable X, when using the expression on the Datatypes/Expression line of a request, in order to convert several series all at once.
- **DT** is the datatype to be converted
- **CC** is the currency code to convert to. ISO currency codes (such as USD, EUR and JPY for example) are accepted as currency codes, or Datastream currency codes can equivalently be used instead.

These currency conversions use spot exchange rates sourced from WMR, fixed at 16:00 UK time each day.

For example, to convert a selection of stock prices (datatype P) to euro in a time series request, use X(P)~EUR on the datatypes line, so that X is symbolic and is replaced by each stock mnemonic in turn:

Name	TESCO (~E)	AMAZON.COM (~E)	CHARLES VOGELE (~E)
Code	TSCO(P)~EUR	@AMZN(P)~EUR	S:VCH(P)~EUR
11/12/2013	3.89	277.1414	8.637
12/12/2013	3.86	277.2034	8.215
13/12/2013	3.84	279.8443	8.177
16/12/2013	3.92	282.8162	8.355
17/12/2013	3.84	282.2264	8.444
18/12/2013	3.8		
19/12/2013	3.88		
20/12/2013	3.97		
23/12/2013	4		
24/12/2013	4.03		
25/12/2013	4.03		
26/12/2013	4.04		
27/12/2013	4.07		
30/12/2013	4.02		
31/12/2013	4.02		
01/01/2014	4.02		
02/01/2014	3.97		
03/01/2014	3.99		
06/01/2014	4		
07/01/2014	4		

Time Series Request

Request Details

Series/List: TSCO,@AMZN,S:VCH

Datatypes/Expressions: X(P)~EUR

Start Date: -2Y

Frequency: Daily

Currency conversions can also be selected using the \$ button in the request window above, and via the flyout in Datastream Charting as below.



Decimal places

It is possible to override the default number of decimal places that values are returned at - when this is required in Excel workflows for example.

- Use the DPL# (Decimal Place) function to increase/decrease the decimal places.

For example, the expression PCH#(VOD/FTSE100,1M) - which calculates the 1 month % change in the Vodafone price relative to the FTSE 100 benchmark - returns values at 2 decimal places by default. If you would prefer to display values at 4 decimal places, you can nest this within DPL# as follows:

`DPL#(PCH#(VOD/FTSE100,1M),4)`

Conversely, if you prefer to display values as integers, you can instead specify zero decimal places:

`DPL#(PCH#(VOD/FTSE100,1M),0)`

- Alternatively, you can simply multiply by 1.000 where the number of zeros after the decimal point indicates the number of decimal places you require, in this case 3:

`PCH#(VOD/FTSE100,1M)*1.000`

How to determine the units/scale for a datatype

There are a number of different ways to view the units / scale of the figures you are looking at.

- In a Static request you can use the suffix #U on the datatype. As some examples, for MV (Market Value), MV#U returns "1000000", meaning Millions, and for NOSH (Number of Shares) and WC01001 (Sales or Revenues), NOSH#U and WC01001#U return "1000", meaning Thousands.

C	D	E	F	G	H	I
	Type	NAME	MARKET VALUE	NUMBER OF SHARES	WORLDSCOPE	
	MKS	MARKS & SPENCER GROUP	1000000	1000	1000	

- Similarly, for economics series, you can use the ESUNT (Economics Series Units) and ESMAG (Economics Series Magnitude) datatypes - in the below example, the ESMAG output of 1000000000 indicates a scale of Billions, and the output of 1 indicates actual values.

Note - if you would prefer to display economics series in actual values, use the time series datatype ESA - for example USGDP...D(ESA) returns actual USD values, rather than billions of USD.

C	D	E	F	G
	Type	NAME	EC. SERIES QUOT. UNT	EC. SERIE MAGNITUDE
	USGDP...D	US GDP (AR) CONA	USD BIL	1000000000
	UKCONPRCF	UK CPI INDEX 00 : ALL ITEMS- ESTIMATED PRE-97 2005=100 NADJ	INDEX	1
	ESUN%TOTR	ES UNEMPLOYMENT RATE NADJ	PERCENTAGE	1

- Alternatively, look at the spotlight section for the series in Navigator - for economics data in particular, the units and scale are displayed along with other summary metadata.

The screenshot shows the Datastream Navigator interface. On the left, there's a search bar with 'us gdp' and a 'Search' button. Below it, a 'Refine Search' sidebar shows filters for Category (Economics), Market (United States, Arabian Peninsula, Switzerland), Source (Economist Intelligence Unit, BEA, World Bank WDI), and Frequency (Annual, Quarterly, Monthly). The main area displays 'Results for us gdp (filtered)' with a table of search results. The top result is 'GDP (AR)' with symbol 'USGDP...D'. Below this, a detailed view for 'United States, National Product Account, Gross Domestic Product, Overall, Total' is shown. It includes a line chart of GDP from 1975 to 2015. To the right of the chart, a metadata table lists: Mnemonic: USGDP...D, RIC: aUSGDP/CA, EcoWin Code: ewus801006, Latest Value: 16417.8 (Billions U.S. Dollar, 2009 CHND PRICES), Timespan: Q1 1950 - Q3 2015, Quarterly, Last Updated Date: 24/11/2015, Next Date of Release: 22/12/2015, Conversion Method: Average, Market: United States, Source: BEA - Bureau of Economic Analysis, U.S. Department of Commerce, Adjustment: Constant prices, seasonally adjusted.

Volume definitions

The precise definition of Turnover by Volume figures retrieved using the VO equity datatype vary according to individual exchanges. The below list provides further information - all single counted volumes are assumed to be 'sell side only'.

Argentina - Single counted

Australia - Single counted

Austria - Single counted

Bangladesh - Single counted

Belgium - Single counted

Brazil - Single counted

Bulgaria - Single counted

Canada - Single counted

Chile - Single counted

China - Single counted

Colombia - Single counted

Cyprus - Single counted

Czech Republic - Single counted

Denmark - Single counted

Ecuador - Single counted

Egypt - Single counted

Estonia - Single counted

Finland - Single counted

France - Single counted. Official adjusted volumes stored the following morning.

Germany - Single counted

Greece - Single counted

Hong Kong - Single counted

Hungary - Single counted

Iceland - Data not held, hence no definition

India - Single counted

Indonesia - Single counted

Ireland - Single counted

Israel - Single counted

Italy - Single counted

Jamaica - Data not held by Datastream, hence no definition

Japan - Single counted

Jordan - Data not held, hence no definition

Kenya - Single counted

Korea - Single counted

Lithuania - Single counted

Luxembourg - The Stock Exchange does not publish volume data

Malaysia - Single counted

Mauritius - Data not held by Datastream, hence no definition

Mexico - Single counted
Morocco - Single counted
Netherlands - Single counted
New Zealand - Single counted
Nigeria - Data not held by Datastream, hence no definition
Norway - Single counted
Pakistan - Single counted
Peru - Single counted
Philippines - Single counted
Poland - Single counted
Portugal - Single counted
Russia - Single counted
Saudi Arabia - Data not held by Datastream, hence no definition
Singapore - Single counted
Slovakia - Data not held by Datastream, hence no definition
South Africa - Single counted. Also Volume by Value (VA).
Spain - Single counted
Sri Lanka - Single counted
Sweden - Single counted
Switzerland - Single counted
Taiwan - Single counted
Thailand - Single counted
Tunisia - Data not held by Datastream, hence no definition.
Turkey - Single counted
United Kingdom - VO = Single counted. The following volume-related datatypes are also single counted: AB, AN, AV, CB, CN, CV, DB, DN, DV, JB, JN, JB
United States - Single counted
Venezuela - Single counted
Zimbabwe - Single counted

DFO and Datastream Charting workflow tips

See the DFO help for more details on the formula options

https://product.datastream.com/WebHelp/DFO/3.0/DSGRID_formula_format.htm

7 day week data retrieval in DFO

Values on Datastream are stored and retrieved on a 5 day week basis (Monday to Friday) as standard. However it is possible to retrieve values on a 7 day week basis if preferred, using the below frequency parameters in DFO 3.0 formulas. The 7DME and 7DMEPAD options are designed for Middle East markets.

At the time of writing, these frequency parameters are not yet available to select using the menu options within the DFO Time Series Request window, but an update to the DFO 3.0 interface to include these options is planned for 2016. In the meantime, they are available to be used by editing DFO 3.0 formulas directly in the formula bar of the worksheet* after running a standard 5 day week request.

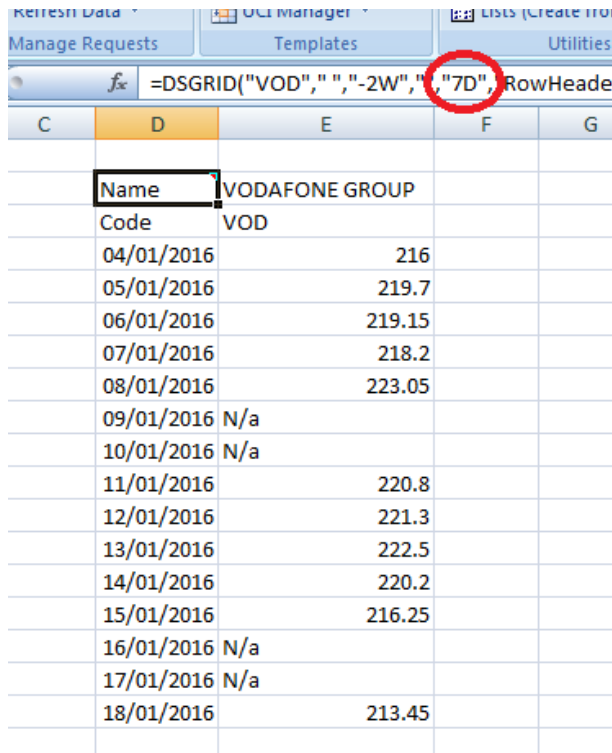
7D - Displays null value for Saturday and Sunday dates

7DPAD - As above for 7D, but with Friday values padded across Saturday and Sunday dates

7DME - Displays null value for Friday and Saturday dates, with Friday values moved to Sundays

7DMEPAD - As above for 7DME, but with Thursday values padded across Friday and Saturday dates

*NB - if you manually edit the formula to include one of these new frequency parameters and then subsequently edit the DFO formula using the Edit Request button on the DFO ribbon, this setting will be overwritten. Once the new parameters are fully introduced into the interface however, this will not apply.



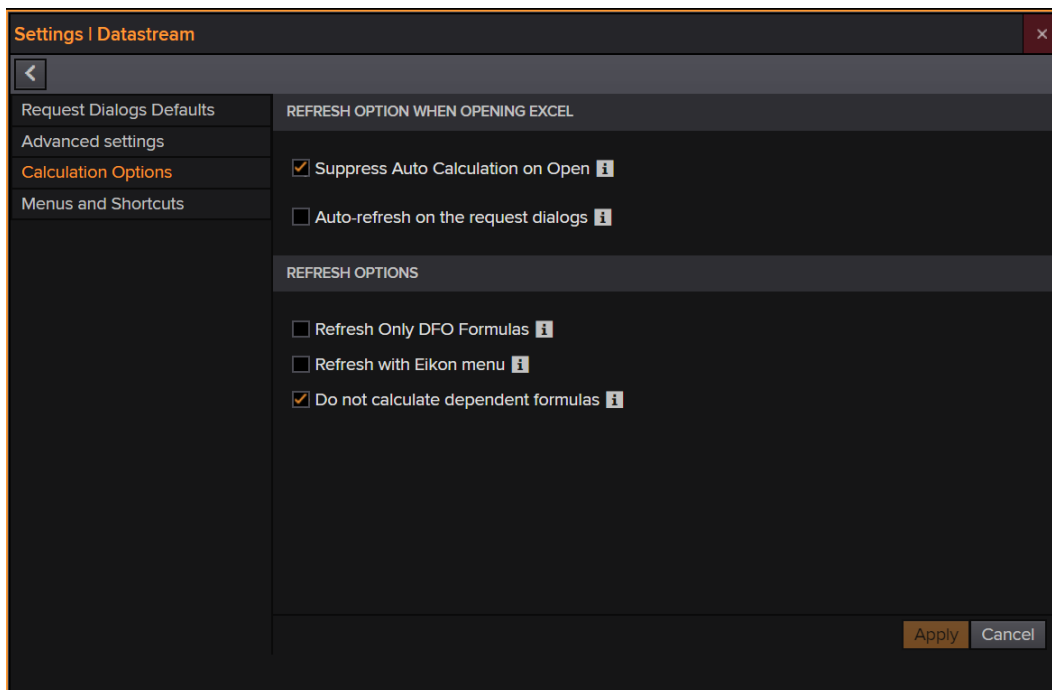
Name	Code	04/01/2016	05/01/2016	06/01/2016	07/01/2016	08/01/2016	09/01/2016	10/01/2016	11/01/2016	12/01/2016	13/01/2016	14/01/2016	15/01/2016	16/01/2016	17/01/2016	18/01/2016
VODAFONE GROUP	VOD	216	219.7	219.15	218.2	223.05	N/a	N/a	220.8	221.3	222.5	220.2	216.25	N/a	N/a	213.45

AFO to DFO conversion tips & troubleshooting

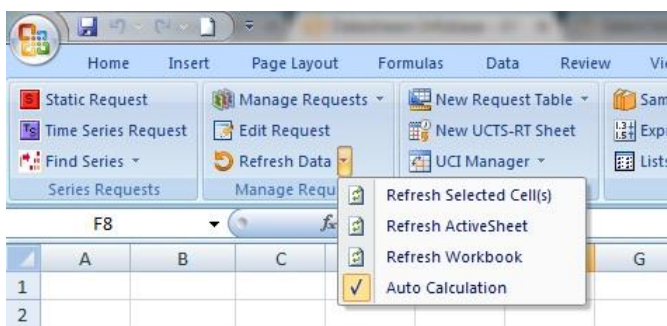
If large lists (e.g. more than 2000 constituents) are used in DFO time series requests and a timeout is encountered, an alternative method of backend retrieval can be used which should improve performance in these particular scenarios. To use this alternative method, prefix the constituent list code with an asterisk - so for example *LMSSAWFD rather than LMSSAWFD. Please note however that this alternative method is:

- not necessary or recommended for use in standard requests which do not timeout - indeed it may result in slower retrieval speeds in smaller and/or less complex requests
- only applicable for static requests, not time series requests
- not applicable for the WTIDX (constituent weights) datatype

By default, DFO formulas are set to Auto-Calculate (refresh) when the Excel workbook they are contained within is opened. This can sometimes be inconvenient when opening large files, as the user must wait for the formulas to refresh before the file can be used. The Auto Calculation option can be suppressed however, if preferred, via the Options button on the DFO ribbon as below.



When a new workbook is opened, DFO formulas are set to Auto-Calculate (refresh) whenever any other cells or formulas within the worksheet are edited/refreshed. This setting can be overridden via the drop down menu on the Refresh button of the DFO ribbon.



There are some differences between AFO and DFO in the way that requests are sent to our servers from the Request Table – AFO sends the request sequentially whereas DFO sends them in a parallel. The sequencing option switches the DFO requests back to sequential – and this may help prevent timeouts, as there are less requests being sent simultaneously.

On Open Process Table Display Details
 Compatible options with AFO
 Pre-Request Macro:
 On Completion Macro: **Enable Sequencing**
 On Completion: Refresh Charts
 Refresh Chart Templates

Process Table Add to Index Help Find Series

Press Ctrl + R to Process Table

Update		Request Type				Format	Series Lookup	Datatype/Expressions			Start Date	End Date		
Y	YN	N	S	TS	TSL	L	CH	Select Format	Find Series		Datatypes	fx	Latest Value (Static)	Latest Value (TS)

In DFO Request Tables, if there is no value available in the output of a request, a blank cell is displayed by default, whereas in AFO the default null value output was "NA". This presence of blank cells rather than NA null values can sometimes lead to #VALUES errors in Excel. It is possible to customize the null value output in DFO however, either via the Request Table setting, or via the Options button on the DFO ribbon:

Process Table Display Details Support R1C1 Reference Style
 Compatible options with AFO Display Destination as an Excel formula
 Macro: Enable Sequencing Suppress Comments
 : Refresh Charts Use as "not available" string
 Refresh Chart Templates

Datatype/Expressions	Start Date	End Date	Freq	Data Destination
Datatypes	Latest Value (Static)	Latest Value (TS)	Daily	

Settings | Datastream

Request Dialogs Defaults

Advanced settings Start Date

Calculation Options Frequency

Menus and Shortcuts

NAVIGATOR PREFERENCE

Navigator Symbol Preference as RIC

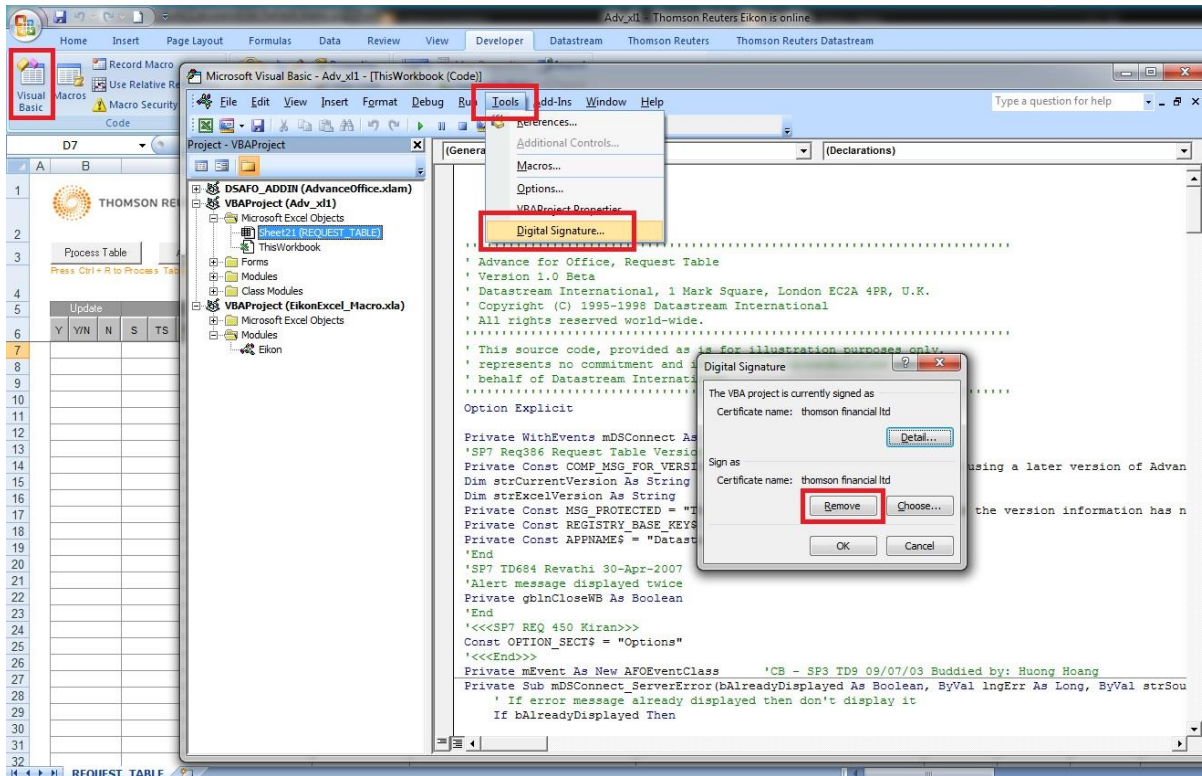
NOT AVAILABLE STRING

Not Available String

=TODAY() is an example of a [volatile Excel function](#), meaning that its value (in this case, today's date) can change over time, without any of its arguments changing. This can sometimes cause problems with requests looping or hanging within workbooks containing DFO formulas, particularly in large files. We recommend using the Eikon function =RtTODAY() instead, to resolve this problem.

If any AFO Index files containing pre- or post-conversion customized macros encounter problems with the macros not being triggered after converting to DFO Index files, and macros have already been enabled and trusted in Excel Options > Trust Centre, the cause may be due to the macro(s) being Digitally Signed - and removing the Digital Signature should resolve the problem in this case. To do this, from the Developer ribbon* go to Visual Basic > Tools > Digital Signature > Remove.

*Note that if the Developer ribbon is not displayed in Excel, it can be enabled by clicking the Office button in the top left of the Excel window > Excel Options > Popular > Show Developer tab in the ribbon.



Additional DSGRID parameters

Note – this parameters will be cleared if the Edit option is used on the Datastream ribbon

There are some additional parameters that can be added to DSGRID formulas to access additional functionality (see <http://product.datastream.com/WebHelp/DFO/3.0/DatastreamforOffice.htm> for the standard set)

The Not Available String can be overridden using - NotAvailableString=N/A; NotAvailableString=Blank, etc

The number of datatypes to send to the servers in each bundle for a static request can be set, where timeouts are occurring – where N is the number (use M:N in the Request Table Request format option) - MaxConfigSnapshotRequests=N

In Eikon 4.053 (and later), the output of a static request can be sorted on up to two datatypes/functions/expressions using new sort parameters - SORTA=datatype/expression for ascending and SORTD=datatype/expression for descending – with the following conditions -

1. Colheader = true is required with any of the SORT options (or rowheader=true if transpose = true)
2. A maximum of two SORT options can be used – the sorting order is based on the order the SORT parameters are placed in the request.
3. SORTA/SORTD functionality is limited to 20 datatypes/expressions and 1000 series.
4. "Not Available" values will be place at the end irrespective of the SORT option being used.
5. These sort parameters will be cleared if the “Edit Request” menu option is used.
6. SA (ascending) and SD (descending) parameters can be used in the format cells in the Request Table in the form of a semi colon separator (;) after the other format parameters. The sort parameter is then followed by a colon (:) and the datatype/expression – for example C;SD:PCH#(X,1Y) – where C is the column header and SD:PCH#(X,1Y) the sort option (where PCH#(X,1Y) is entered in the datatype/expression cell).

For example

=@DSGRID("LFTSE100", "NAME;mnem;X(FEI#NAME);PCH#(X/X(FEI),1Y);PCH#(X,1Y)", "Latest Value", "", "", "SORTD=X(FEI#NAME);SORTD=MV;ColHeader=true", "")

Date alignment for economics series

The default date alignment for an economics series is related to the characteristics of the data and how the figures are published by the original source: series for which an average or sum is calculated when requested at a lower frequency (e.g. a monthly series requested at quarterly frequency) normally have values aligned to the mid-period dates by default, whereas series for which the end-period value is displayed when requested at a lower frequency (such as UKRESERVA – UK GOVERNMENT GROSS RESERVE ASSETS in the example below) have values aligned to the end-period dates by default. Most economics series have values aligned to the mid-period dates.

It is possible to override the default date alignment of economics series however, using the ALI# (Alignment) function. This is of particular use in Excel worksheets – if you have set up multiple time series requests for economics series in your sheet, you may wish to use this function to help match dates with each other.

Note: When running a time series request containing multiple economics series mnemonics, the dates returned are determined by the series *placed first in the request*. So if the first series is mid-period aligned (either by default or via the ALI# function), then the dates returned will be mid-period - regardless of the alignment characteristics of any other series placed subsequently within the same request.

Series Requests		Manage Requests		Templates		Utilities		Charts				
H2 =DSGRID("ALI#{UKGDP...D,VAL}", "", "-2Y", "", "D", "RowHeader=true;ColHeader=true;Code=true;Di												
	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		Name	UK UK GOVERNMENT	Name	UK GDP AT MARKET	Name	UK GDP AT MARKET PRICES (CVM) CONA					
3		Code	UKRESERVA	Code	UKGDP...D	Code	ALI#{UKGDP...D,VAL}					
4		31/12/2013	106247.3	15/11/2013	429922	31/12/2013	429922					
5		31/03/2014	110883.9	15/02/2014	432555	31/03/2014	432555					
6		30/06/2014	111781.5	15/05/2014	436598	30/06/2014	436598					
7		30/09/2014	107248.2	15/08/2014	439374	30/09/2014	439374					
8		31/12/2014	107216.4	15/11/2014	442671	31/12/2014	442671					
9		31/03/2015	122383.2	15/02/2015	444297	31/03/2015	444297					
10		30/06/2015	122936.5	15/05/2015	447199	30/06/2015	447199					
11		30/09/2015	129699.9	15/08/2015	449282	30/09/2015	449282					
12		31/12/2015	N/A	15/11/2015	N/A	31/12/2015	N/A					
13												
14												

The middle of the period for monthly series is the 15th day of the month; for quarterly series it is 15 February/May/August/November; for yearly series it is 30 June.

The end of the period for monthly series is the last weekday of the month; for quarterly series it is the last weekday of the calendar quarter; for yearly series it is 31 December.

General format: ALI#{Expression,Parameter}

Where Parameter is:

MID Values are aligned to the mid-period dates

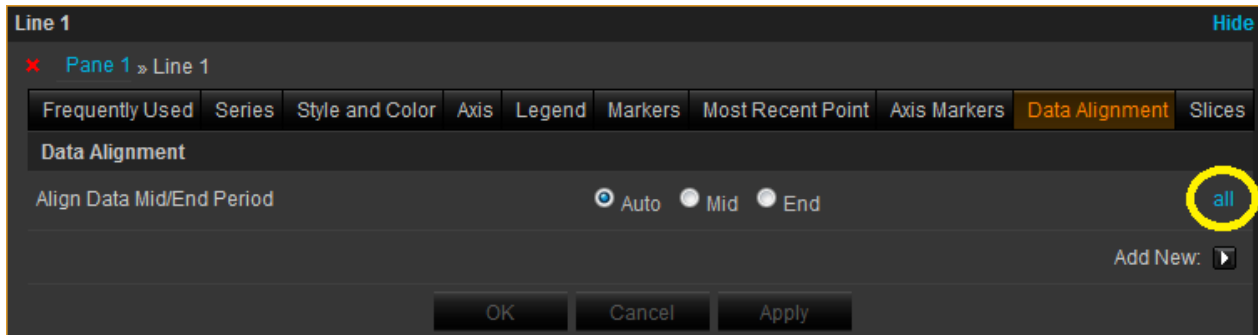
VAL Values are aligned to the end-period dates

Date Alignment in Datastream Charting

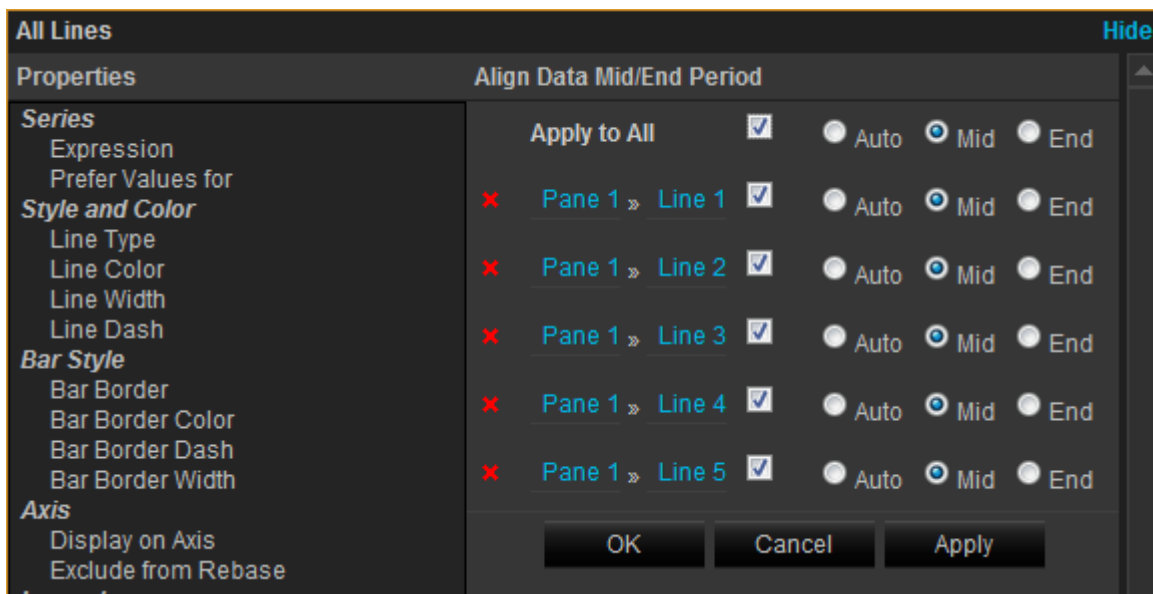
The ALI# function can also be used in Datastream Charting, however there is an alternative feature which allows you to adjust the alignment of a line without needing to use ALI# – this setting is accessed on the Data Alignment tab of the Line Settings window.

This feature is particularly useful for stacked bar charts – to ensure that all bars stack on top of each other correctly when the default alignment is not the same for all lines.

The Auto setting displays values according to the default alignment of the series; the Mid setting is equivalent to ALI#(X,MID) and the End setting is equivalent to ALI#(X,VAL).



You can quickly set the alignment of all lines on the chart by clicking the 'all' link on the right-hand side. Note that this 'all' link is available for all other line settings in Datastream Charting too.



Drawing a custom trend line from an equation

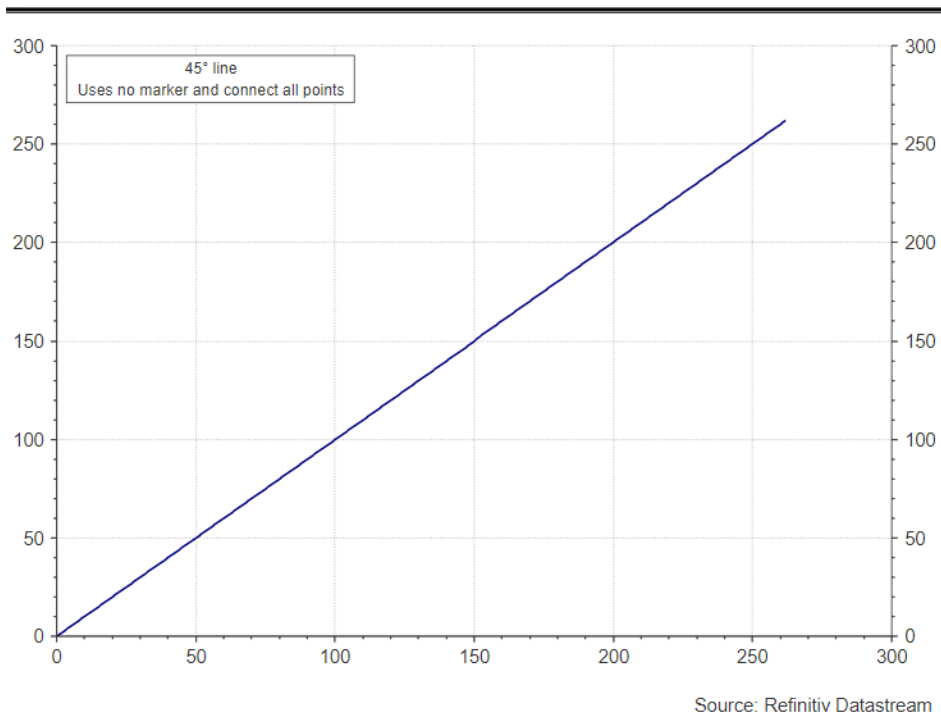
It is possible to draw custom trend lines in a chart according to equations for lines, such as the $y=mx+c$ equation for a straight line, using a time scatter chart and a 'dummy' time series DUMMYDY which counts up by 1 each day.

A simple 45° line following the line equation $y=x$ can be drawn using the below for example. A constant (c), i.e. the Y axis intercept, could be added by appending e.g. +5 to the end of the Y axis expression.

X axis: DUMMYDY-VAL#(DUMMYDY,VLO)

Y axis: DUMMYDY-VAL#(DUMMYDY,VLO)

Settings in the chart below include start date -1Y and daily display frequency

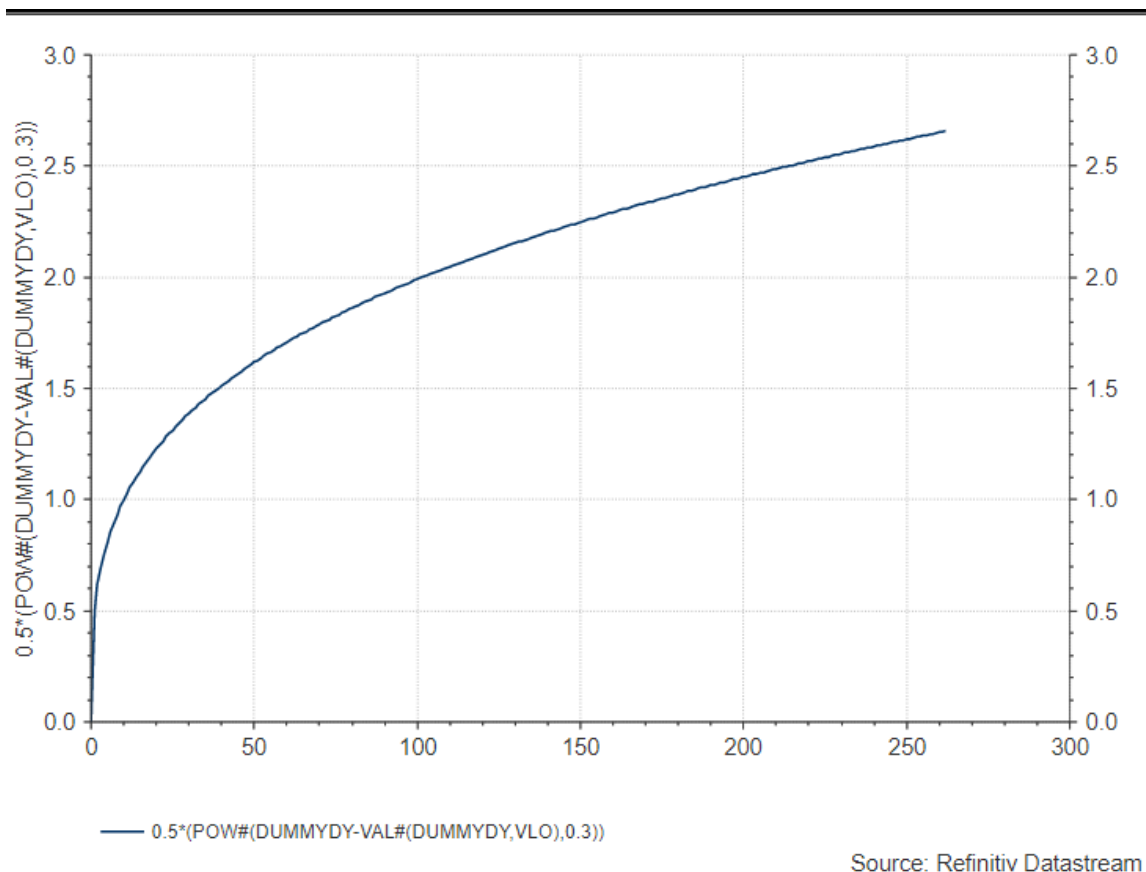


The below chart draws a curved trend line from the line equation $y = 0.5x^{0.3}$, using the expressions;

X axis: DUMMYDY-VAL#(DUMMYDY,VLO)

Y axis: $0.5*(POW\#(DUMMYDY-VAL\#(DUMMYDY,VLO),0.3))$

The settings used are the same as in the chart above except for the Y axis expression.



Half-year frequency

There is no direct setting in Datastream to retrieve a series at Half Year frequency, however the OFFSET function in Excel could be considered as a possible alternative.

In the below example, the JPABLALB series is retrieved at default frequency using a standard DFO Time Series request, then this formula is used in every cell from H3 to H10:

`=OFFSET(C3,(ROW()-3)*2,0,1,1)`

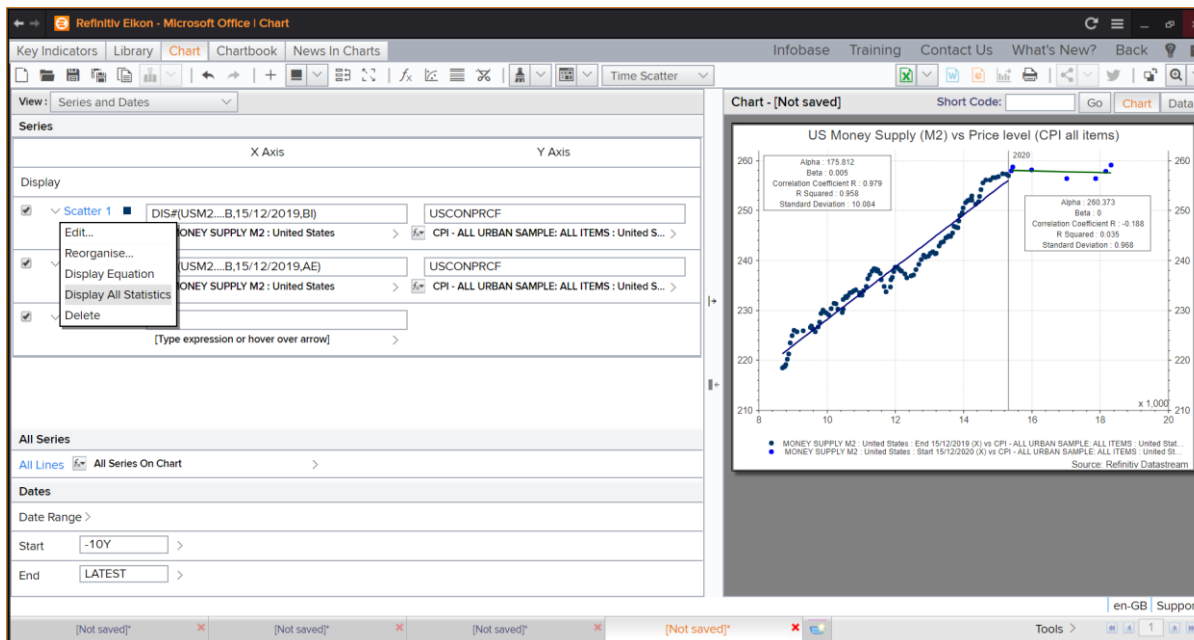
And similarly, this formula is used in every cell from I3 to I10:

`=OFFSET(C3,(ROW()-3)*2,1,1,1)`

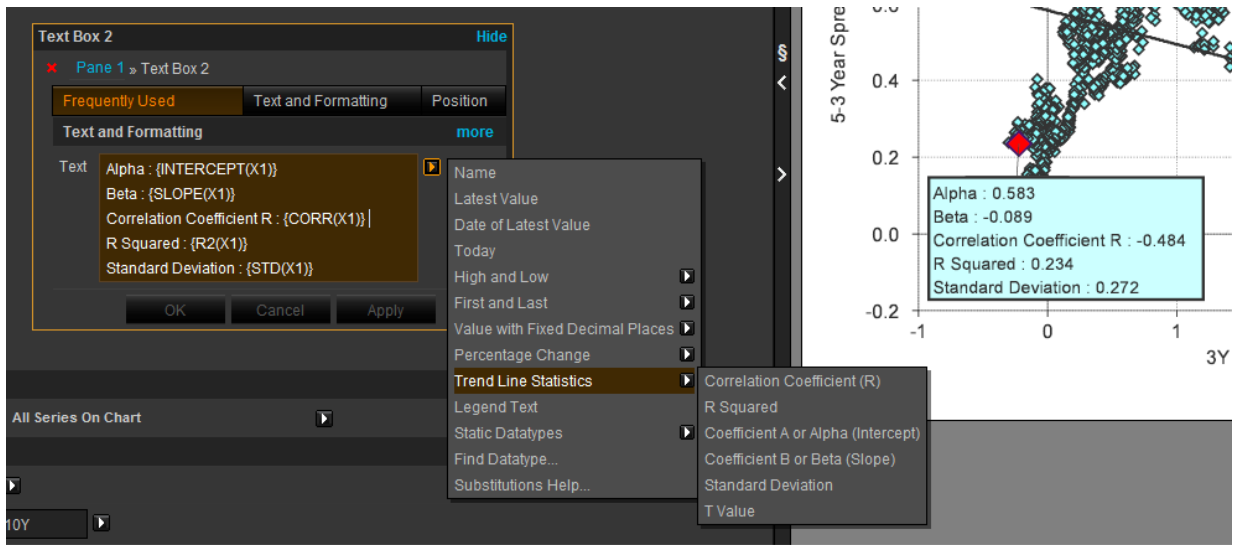
Manage Requests		Templates		Utilities		Charts	
=OFFSET(\$C\$3,(ROW()-3)*2,1,1,1)							
C	D	E	F	G	H	I	J
Name	JP TOTAL CREDIT - ALL BANKS CURN			Name	JP TOTAL CREDIT - ALL BANKS CURN		
Code	JPABLALB			Code	JPABLALB		
31/03/2011	4747870			31/03/2011	4747870		
30/06/2011	N/A			30/09/2011	4866230		
30/09/2011	4866230			30/03/2012	4876710		
30/12/2011	N/A			28/09/2012	5088710		
30/03/2012	4876710			29/03/2013	5145860		
29/06/2012	N/A			30/09/2013	5302380		
28/09/2012	5088710			31/03/2014	5398360		
31/12/2012	N/A			30/09/2014	5567460		
29/03/2013	5145860						
28/06/2013	N/A						
30/09/2013	5302380						
31/12/2013	N/A						
31/03/2014	5398360						
30/06/2014	N/A						
30/09/2014	5567460						
31/12/2014	N/A						

Line of best fit / trend line

A line of best fit can be added to a Scatter chart by selecting from the options in the Statistics section in the scatter's settings window. Parallel Standard Deviation bands can also be added here, if desired.



Summary Statistics can also be added using point-and-click Annotation settings in a Text Box for example:



Trend Lines can also be added to standard time series line charts, using the fly-out menu as below. This is a shortcut to apply the relevant global expression, in this case:

080E "LINEAR TREND LINE"

REGV#(CSUM#(1),X)



Not displaying dates where the values are #NA in DFO 3.0

Datastream by default will display all dates for a period in a Time Series request – so for example the 5 days in the week (Monday to Friday). However, it is now possible to not display dates where the corresponding values are 'not available', if preferred, using the below frequency parameters in DFO 3.0 formulas.

Description	Example	Comments
Daily – no dates for #N/As	DN	Dates not displayed where all series are #N/A for that date
Weekly - no dates for #N/As	WN	Dates not displayed where all series are #N/A for that date
Monthly - no dates for #N/As	MN	Dates not displayed where all series are #N/A for that date
Quarterly - no dates for #N/As	QN	Dates not displayed where all series are #N/A for that date

At the time of writing, these frequency parameters are not yet available to select using the menu options within the DFO Time Series Request window. In the meantime, they are available to be used by editing DFO 3.0 formulas directly in the formula bar of the worksheet after running a standard request.

So for example – if the national holiday dates at the end of the year are not required – you can use the formula below –

```
=DSGRID("BARC","P#S","2016-12-22","2017-01-06","DN","RowHeader=true;ColHeader=true;Heading=true;Code=true;DispSeriesDescription=false;YearlyTSFormat=false;QuarterlyTSFormat=false","")
```

To display the series without the national holiday dates (Monday 26th Dec, Tuesday 27th Dec and Monday 2nd Jan) – see values below –

Start	22/12/2016
End	06/01/2017
Frequency	D
Name	BARCLAYS (#S) - BARCLAYS (#S)
Code	BARC(P#S)
Thu 22/12/2016	227
Fri 23/12/2016	224.95
Wed 28/12/2016	224.75
Thu 29/12/2016	222.35
Fri 30/12/2016	223.45
Tue 03/01/2017	231.9
Wed 04/01/2017	235
Thu 05/01/2017	232.55
Fri 06/01/2017	235.25

Removing capitalization in AFO/DFO output

Text output from Datastream is returned in capital letters. If you would prefer to alter the format to Proper case where only the first letter of each word is capitalized, use the Excel =PROPER function to achieve this.

D3		fx =PROPER(C3)	
A	B	C	D
1			
2	Type	NAME	
3	506391	ABERDEEN ASSET MAN.	Aberdeen Asset Man.
4	29549F	ADMIRAL GROUP	Admiral Group
5	903076	ANGLO AMERICAN	Anglo American
6	926288	ANTOFAGASTA	Antofagasta
7	679297	ARM HOLDINGS	Arm Holdings
8	906045	ASHTEAD GROUP	Ashtead Group
9	900825	ASSOCIATED BRIT.FOODS	Associated Brit.Foods
10	319608	ASTRAZENECA	Astrazeneca

Using SEDOL and CUSIP identifiers

It is possible to use SEDOL and CUSIP identifiers as input for Datastream requests, but the codes must be prefixed in order for them to be recognised - this is in order to avoid conflicts with other types of input code.

SEDOL identifiers, particularly those which are alphanumeric, must be prefixed with "UK" (regardless of market) and CUSIP identifiers must be prefixed with "U".

So for example:

The SEDOL for Visa 'A' is B2PZN04 - therefore to use this on Datastream, the input code should be entered in a request as UKB2PZN04

Manage Requests		Templates		Utilities		Charts	
fx =DSGRID("UKB2PZN04","NAME;MNEM;DSCD","Latest Value","", "", "RowHeader=true;ColHeader=true")							
D	E	F	G	H	I	J	K
	Type	NAME	MNEMONIC	DATASTREAM CODE			
	UKB2PZN04	VISA 'A'	U:V	51683M			

The CUSIP for Apple is 037833100, therefore the input code should be U037833100

Manage Requests		Templates		Utilities		Charts	
fx =DSGRID("U037833100","NAME;MNEM;DSCD","Latest Value","", "", "RowHeader=true;ColHeader=true")							
D	E	F	G	H	I	J	K
	Type	NAME	MNEMONIC	DATASTREAM CODE			
	U037833100	APPLE	@AAPL	992816			

A quick way to apply this "U" or "UK" prefix for a list of identifiers is to use a simple Excel formula, as below - i.e. ="U"&... for a CUSIP or ="UK"&... for a SEDOL.

Note that Excel removes any leading zeros from numbers entered in a cell, by default - and CUSIP and SEDOL identifiers often do begin with zero. It is best therefore when working with these identifiers to either format the cells to Text rather than General before entering/pasting the identifiers into the worksheet, or use the TEXT("00000000") Excel function as below, to ensure that the CUSIP identifier is always 9 digits long. Similarly, TEXT("0000000") can be used to ensure that a SEDOL identifier is always 7 digits long.

In this example, the DFO request in cell G2 references the list of prefixed codes created in column E.

Manage Requests		Templates		Utilities		Charts	
fx ="U"&TEXT(D4,"000000000")							
B	C	D	E	F	G	H	I
					Type	MNEMONIC	DATASTREAM CODE
	3M	88579Y101	U88579Y101		U88579Y101	U:MMM	902172
	AMERICAN EXPRESS	25816109	U025816109		U025816109	U:AXP	906156
	APPLE	37833100	U037833100		U037833100	@AAPL	992816
	BOEING	97023105	U097023105		U097023105	U:BA	904818
	CATERPILLAR	149123101	U149123101		U149123101	U:CAT	902224

Using the DS.SYMBOLLOOKUP datatype to find the best matching Datastream series from a series description

The DS.SYMBOLLOOKUP datatype returns the best 5 matching series for a description entered in the series field. For example - =DSGRID("BARCLAYS", "DS.SYMBOLLOOKUP", "Latest Value", "", "", "RowHeader=true;ColHeader=true")

will return the following -

Type	DS.SYMBOLLOOKUP
BARC	Barclays
BW:BAR	Barclays Bank of Botswana
U:VXX	Barclays Ipath Standard and Poor's 500 VIX Short Term Futures Eastern
U:GSP	Barclays Bank Ipath Linked GSCI Total Return Index 12/06/36
U:VQT	Barclays Bank Eastern + Standard and Poor's Veqtor Eastern EXP 08/09/20

– with the matches based on the same search engine as used in the series suggest/type ahead in the Datastream for Office and Datastream Charting interfaces.

We are working on extending this so that you can specify the data category of the series to return – and the number of results to return

Using VBA commands to customize your sheets and inhouse time series uploads - Datastream For Office (DFO) 3.0

Refresh methods

Public methods in the underlying API are available to refresh formula using VBA macros - this includes methods to refresh selected formula/active worksheet/active workbook -

```
Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.RefreshSelection
```

```
Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.RefreshActiveSheet
```

```
Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.RefreshWorkbook
```

If the selected range contains DSGRID and TF(Deal Analytics) formulas, it will refresh both the formulas, but not other TF formulas.

Note: The Request Table rather than these commands should be used (using VBA if required) where there is a requirement to update DFO requests in a loop. This is to ensure that any macro processing after running a DFO request completes before the next interaction of the loop.

Methods to display Navigator with a specified category

A public method to display the navigator interface and return the selected series to the cell that has the focus

```
Application.COMAddIns("DFOAddInExcel2010").Object.Navigator("Series", "category Id", "Row_wise")
```

A public method to display the navigator interface and return the selected datatype to the cell that has the focus.

```
Call Application.COMAddIns("DFOAddInExcel2010").Object.Navigator("Datatype", "", "Column_wise")
```

The following are the category Ids –

EQUITY = 0	CONST LISTS = 1
EQUITY INDICES = 3	UNIT TRUST = 4
INVST TRUST = 5	COMMODITY = 6
EXNG RATE = 7	INT RATE = 8
BOND INDEX = 9	WARRANT = 11
ECONOMIC = 12	BONDS = 13
OPTIONS = 14	FUTURES = 15

There are the following orientation options -

Column_wise - displays several select series/datatypes in a column

Row_wise - displays several select series/datatypes in a row

The isRIC parameter should be set to TRUE to return the RIC, and FALSE to return the Datastream code/mnemonic (and should be FALSE for datatypes).

For example:-

```
RequestType = "Series"
CategoryID = "1"
Orientation = "COLUMN_WISE"
isRic = "FALSE"
ThisWorkbook.Sheets("Data").Range("A2").Select
Call Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.Navigator(RequestType, CategoryID, Orientation, isRic)
```

Methods to control the User Created Time Series (UCTS) template sheet

A public method to reset the template sheet removing all the dates, the header block and the values - *btnReset_Click*

A public method to upload all the series in the template - *CustomUpload*

A public method to set the date range in the template – *CustomSetDateRange*

Methods to save expressions

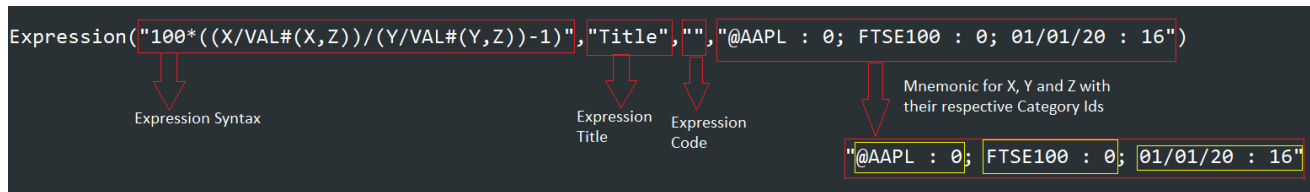
A public method to save an expression – where a set of expressions are saved – the LIST# function can then be used to create an aggregate (so not constrained by the 20 operand limit in functions) – Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.Expression("Expression Syntax", "Expression Title", "Expression Code", "Mnemonic with Category")

where

```
Expression Syntax - String
Expression Title - String
Expression Code - String
Mnemonic with Category String
Where Mnemonic1 : CategoryId1 ; Mnemonic2 : CategoryId
: (colon) Separator for mnemonic and Category Id
; (semi-colon) Separator for pair of mnemonic and Category Id
```

Categories are the same as Navigator command (above)

For example



The above expression will return the following:

1. **An Expression Code** - if no Expression Code is sent with the request **OR** a newly expression code is supplied along with the request (newly means which is not mapped to any other expressions in the server).
2. **Expression Updated Successfully** - if an already saved expression Code is used to save another expression
3. **Expression ("Expression") failed to save** - if any error in saving or any parameter is supplied wrongly.

VBA Call	Return Value	Reason
Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.Expression("MAV#(@AAPL,1Y)", "Sample Title", "", "")	E4NT (An Auto-Generated expression Code)	Because no expression code was supplied in the request.
Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.Expression("AVG#(@AAPL,1Y)", "Sample Title 2", "E1TT", "")	(Supplied with the request) E1TT	Because a new expression code (which has not been used for any other expression) is supplied with the request.
Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.Expression("MAV#(X,1Y)", "Sample Title", "E4NT", "@MSFT:0")	Expression Updated Successfully	Because the expression code has been used before - the sample series and category is supplied as this is a symbolic expression
Application.COMAddIns("PowerlinkCOMAddIn.COMAddIn").Object.Expression("MAV#(X,1Y)", "Sample Title", "E4NT", "X")	Expression MAV#(X,1Y) failed to save	Because category and sample series were not supplied in the last parameter