

Average True Range (ATR)

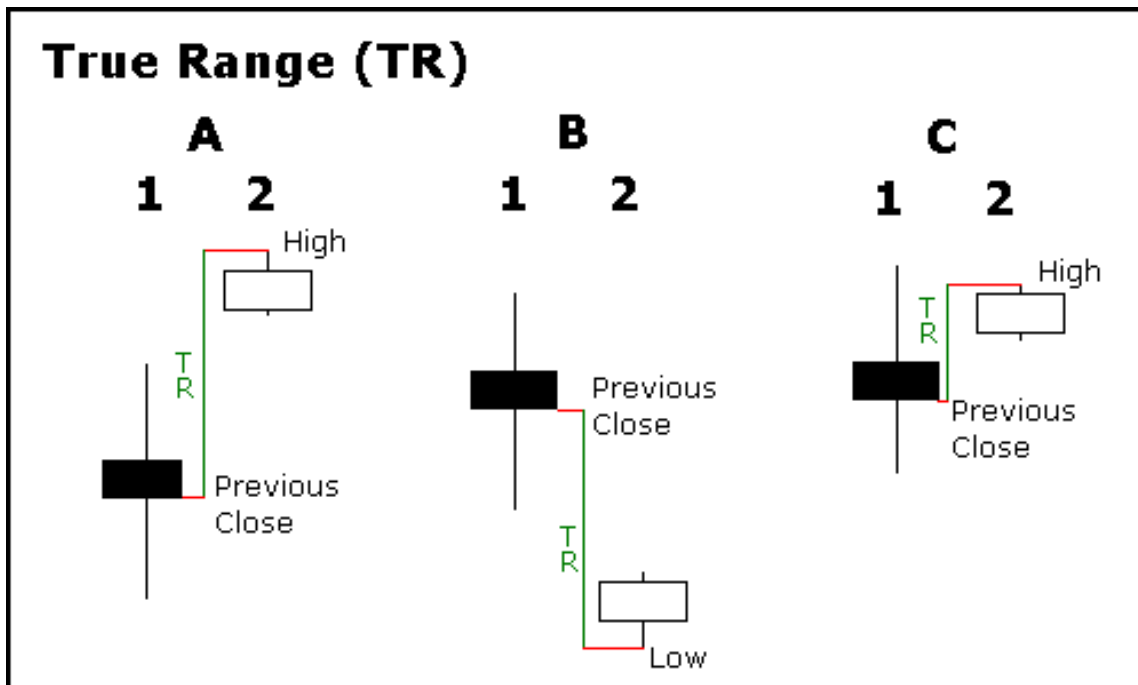
Developed by J. Welles Wilder and introduced in his book, [New Concepts in Technical Trading Systems](#) (1978), the Average True Range (ATR) indicator measures a security's [volatility](#). As such, the indicator does not provide an indication of price direction or duration, simply the degree of price movement or volatility.

As with most of his indicators, Wilder designed ATR with commodities and daily prices in mind. In 1978, commodities were frequently more volatile than stocks. However, recent Nasdaq price action may belie that notion. In addition, commodities were (and still are) often subject to [gaps](#) and limit moves. A limit move occurs when a commodity opens up or down its maximum allowed move and does not trade again until the next session. The resulting bar or candlestick would simply be a small dash. In order to accurately reflect the volatility associated with commodities, Wilder sought to account for gaps, limit moves and small high/low ranges in his calculations. A volatility formula based on only the high/low range would fail to capture the actual volatility created by the gap or limit move.

Wilder defined the true range (TR) as the greatest of the following:

- The current high less the current low.
- The absolute value of: current high less the previous close.
- The absolute value of: current low less the previous close.

If the current high/low range is large, chances are it will be used as the TR. If the current high/low range is small, it is likely that one of the other two methods would be used to calculate the TR. The last two possibilities usually arise when the previous close is greater than the current high (signaling a potential gap down and/or limit move) or the previous close is lower than the current low (signaling a potential gap up and/or limit move). To ensure positive numbers, absolute values were applied to differences.



The example above shows three potential situations when the TR would not be based on the current high/low range. Notice that all three examples have small high/low ranges and two examples show a significant gap.

- A small high/low range formed after a gap up. The TR was found by calculating the absolute value of the difference between the current high and the previous close.
- A small high/low range formed after a gap down. The TR was found by calculating the absolute value of the difference between the current low and the previous close.
- Even though the current close is within the previous high/low range, the current high/low range is quite small. In fact, it is smaller than the absolute value of the difference between the current high and the previous close, which is used

to value the TR.

Typically, the Average True Range (ATR) is based on 14 periods and can be calculated on an intraday, daily, weekly or monthly basis. For this example, the ATR will be based on daily data. Because there must be a beginning, the first TR value in a series is simply the high minus the low and the first 14-day ATR is found by averaging the daily ATR values for the last 14 days. After that, Wilder sought to smooth the data set, by incorporating the previous period's ATR value. The second and subsequent 14-day ATR value would be calculated with the following steps:

1. Multiply the previous 14-day ATR by 13.
2. Add the most recent day's TR value.
3. Divide by 14.

Date	Open	High	Low	Close	H - L	Absolute (H - PrevC)	Absolute (L - PrevC)	Daily TR	14-Day ATR
23/10/00	1	59.4375	61.0000	59.0312	59.3750			1.9688	*
24/10/00	2	59.6875	61.0000	58.3750	58.9062	2.6250	1.0000	2.6250	
25/10/00	3	58.2500	58.8438	53.6250	54.3125	5.2188	0.0624	5.2812	
26/10/00	4	54.9375	55.1250	47.4375	51.0000	7.6875	0.8125	6.8750	
27/10/00	5	52.6953	54.0625	50.5000	51.5938	3.5625	3.0625	3.5625	
30/10/00	6	51.0312	53.9688	49.7812	52.0000	4.1876	2.3750	1.8126	
31/10/00	7	52.5312	56.0000	52.5000	55.4375	3.5000	4.0000	0.5000	
01/11/00	8	54.2500	55.2188	52.6250	52.9375	2.5938	0.2187	2.8125	
02/11/00	9	53.9062	55.0312	53.2500	54.5312	1.7812	2.0937	0.3125	
03/11/00	10	54.3750	57.4922	53.7500	56.5312	3.7422	2.9610	0.7812	
06/11/00	11	56.7500	57.0938	55.2500	55.3438	1.8438	0.5626	1.2812	
07/11/00	12	54.8438	56.8125	54.3438	55.7188	2.4687	1.4687	1.0000	
08/11/00	13	55.5000	55.5625	50.0000	50.1562	5.5625	0.1563	5.7188	
09/11/00	14	48.9453	50.0625	46.8438	48.8125	3.2187	0.0937	3.3124	3.6646
10/11/00	15	46.9062	47.6875	44.4688	44.5938	3.2187	1.1250	4.3437	3.7131
13/11/00	16	42.5312	44.9062	40.6250	42.6562	4.2812	0.3124	3.9688	3.7537
14/11/00	17	44.3125	47.3750	44.1641	47.0000	3.2109	4.7188	1.5079	3.8226
15/11/00	18	47.3750	47.6250	45.1250	46.9688	2.5000	0.6250	1.8750	3.7282
16/11/00	19	45.9062	48.0156	43.2500	43.6250	4.7656	1.0468	3.7188	3.8023
17/11/00	20	44.3125	45.0391	42.6875	44.6562	2.3516	1.4141	0.9375	3.6986
20/11/00	21	43.5938	43.7500	40.7500	40.8125	3.0000	0.9062	3.9062	3.7135
21/11/00	22	41.3750	43.2500	39.9688	42.5625	3.2812	2.4375	0.8437	3.6826
22/11/00	23	41.7500	43.0000	40.0000	40.0000	3.0000	0.4375	2.5625	3.6338
24/11/00	24	41.5938	42.5000	40.7500	42.4375	1.7500	2.5000	0.7500	3.5529
27/11/00	25	44.1797	44.8750	43.3750	44.0938	1.5000	2.4375	0.9375	3.4732
28/11/00	26	44.2500	44.3125	40.0625	40.6250	4.2500	0.2187	4.0313	3.5287
29/11/00	27	40.8125	41.2188	37.6250	39.8750	3.5938	0.5938	3.0000	3.5333
30/11/00	28	38.1562	39.3750	36.5000	38.0312	2.8750	0.5000	3.3750	3.5220
01/12/00	29	39.0000	40.9375	37.5625	38.4688	3.3750	2.9063	0.4687	3.5115
04/12/00	30	38.5312	40.5938	36.9375	39.4375	3.6563	2.1250	1.5313	3.5219
05/12/00	31	41.9688	46.0000	40.8438	45.8750	5.1562	6.5625	1.4063	3.7390
06/12/00	32	46.6875	48.1250	42.5625	44.2500	5.5625	2.2500	3.3125	3.8693
07/12/00	33	43.7500	45.0000	42.5000	42.8125	2.5000	0.7500	1.7500	3.7715

*First TR value = (high - low) ** First ATR value = Simple average of first 14 TR values

In the Excel spread sheet example above, the first TR value (1.9688) equals the high minus the low. The first 14-day ATR value (3.6646) was calculated by finding the average of first 14 TR values. The second ATR value started the smoothing process by using the previous value.

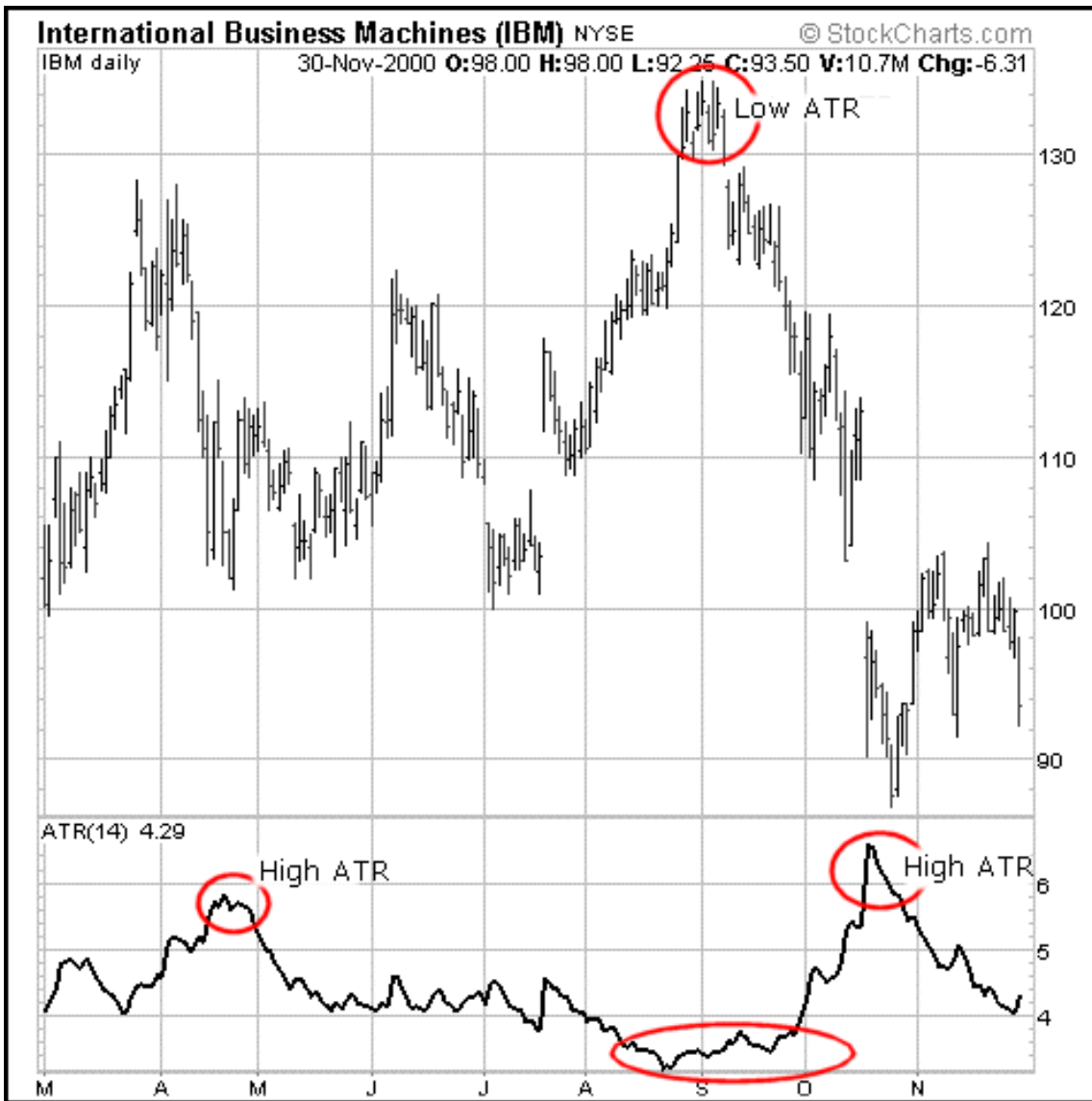


The chart above corresponds with the Excel spreadsheet calculations for Sun Microsystems from 23-Oct 2000 to 7-Dec 2000.

- Day 15: $((3.6646 \times 13) + 4.3437) / 14 = 3.7131$
- Day 16: $((3.7131 \times 13) + 4.2812) / 14 = 3.7536$

For those trying this at home, here are a few cautionary notes on calculations.

- There is always a beginning and the first calculations may not conform exactly with the formula. The first TR value is simply the high minus the low and the first ATR is a simple average of the first 14 TR values.
- Second, many indicators involve a smoothing process. In this example, the previous period's ATR is used to form the current ATR.
- This example only contains a small portion of total available price data. The size of the data set will affect the final outcome. Although the difference is not likely to be huge, a data set of 33 days will produce a different ATR value than a data set of 500 days.
- If you wish to replicate this formula, first try and duplicate the example provided using the same open/high/low/close data. Once your formulas produce answers that match the example, you can then plug in your desired open/high/low/close data.
- Due to rounding issues and decimal places, an exact match may not be possible. Also, discrepancies in the open/high/low/close data can produce different indicator values.



Example: The IBM chart provides an example of the 14-day ATR in action. Extreme levels (both high and low) can mark turning points or the beginning of a move. As a volatility-based indicator like Bollinger Bands, the ATR cannot predict direction or duration, simply activity levels. Low levels indicate quiet trading (small ranges) and high levels indicate violent trading (large ranges). A prolonged period of low ATR readings might indicate consolidation and the beginning of a continuation move or reversal. High ATR readings usually result from a sharp advance or decline and are unlikely to be sustained for extended periods.

Indicator Windows: [About Indicators](#) [Glossary](#)

Below ▼	Average True Range ▼	14		
Above ▼	Average True Range ▼	14		
Below ▼	-- None -- ▼			

[Instructions](#)

SharpChart Application: Using SharpCharts, the ATR can be set as an indicator above or below a security's price plot. The only variable necessary is the number of periods and the first box to the right can be used to make adjustments. The default setting is 14 periods and the indicator can be used on intraday, daily, weekly or monthly charts. The scale is set in absolute (not percentage) price increments based on price changes in the selected security. The lower the price is, the smaller the scale on the ATR.

Special note: Because the ATR shows volatility as an absolute level (versus percentage), low price stocks will have lower ATR levels than high price stocks. For example, a \$10 security would have a much lower ATR reading than a \$200 stock. Because of this, ATR readings can be difficult to compare across a range of securities. Even for a single security, large price movements, such as a decline from 70 to 20, can make long-term ATR comparisons problematical.

Written by Arthur Hill

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