MetaTrader 4 Expert Advisors

MetaQuotes Language 4
Expert Advisor Sample

The principles of MQL4-programs development are shown on sample of creating a simple Expert Advisor system based on the standard MACD indicator. In this Expert Advisor, we will also see examples of implementing such features as setting take profit levels with the support of trailing stop as well as the most means ensuring safe work. In our example, trading is done through opening and managing a single position.

Trading principles:

- **Long (BUY) entry** – MACD indicator is below zero, goes upwards and is crossed by the Signal Line going downwards.
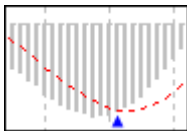
- **Short (SELL) entry** – MACD indicator is above zero, goes downwards and is crossed by the Signal Line going upwards.
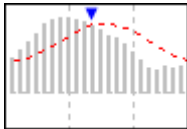
- **Long exit** – by execution of the take profit limit, by execution of the trailing stop or when MACD crosses its Signal Line (MACD is above zero, goes downwards and is crossed by the Signal Line going upwards).

- **Short exit** – by execution of the take profit limit, by execution of the trailing stop or when MACD crosses its Signal Line (MACD is below zero, goes upwards and is crossed by the Signal Line going downwards).

Important notice: to exclude insignificant changes of the MACD indicator (small 'hillocks' on the chart) from our analysis, we introduce an additional measure of controlling the size of the plotted 'hillocks' as follows: the indicator size should be at least 5 units of the minimum price (5*Point, which for USD/CHF = 0.0005 and for USD/JPY = 0.05).

MetaTrader 4 Expert Advisors

EURUSD,H1 1.2789 1.2792 1.2787 1.2791   MACD Sample

MACD(12,26,9) 0.00020 -0.00055

Created with MetaTrader, © 2002-2004 MetaQuotes Sofware Corp.

Step 1 – Writing the Expert Advisor description

Point the mouse cursor at the Expert Advisors section of the Navigator window, press the right button of the mouse, and select "Create a new Expert" command in the appearing menu. The Initializing Wisard of the Expert Advisor will ask you for entering certain data. In the appearing window, write the name (Name) of the Expert Advisor - MACD Sample, the author (Author) - indicate your name, the link (Link) - a link to your website, in the notes (Notes) - Test example of an MACD-based Expert Advisor.

Step 2 – Creating the primary structure of the programme

Source code of the test Expert Advisor will only occupy several pages, but even such volume is often difficult to grasp, especially regarding that we are not professional programmers - otherwise, we would not need this description at all, would we? :)

To get some idea of the structure of a standard Expert Advisor, let us take a look at the description given below:

1. Initializing variables

2. Initial data checks

   - check the chart, number of bars on the chart
   - check the values of external variables: Lots, S/L, T/P, T/S

3. Setting the internal variables for quick data access

MetaTrader is a property of **MetaQuotes Software Corp.**
http://www.metaquotes.net/experts/mql4

MetaTrader 4 Expert Advisors

4. Checking the trading terminal – is it void? If yes, then:

- checks: availability of funds on the account etc...
- is it possible to take a long position (BUY)?
- open a long position and exit
- is it possible to take a short position (SELL)?
- open a short position and exit

exiting the Expert Advisor...

5. Control of the positions previously opened in the cycle

- if it is a long position
- should it be closed?
- should the trailing stop be reset?
- if it is a short position
- should it be closed?
- should the trailing stop be reset?

It turns out to be quite simple, only 4 main blocks.

Now let us try to generate pieces of code step by step for each section of the structural scheme:

1. **Initializing variables**

All variables to be used in the expert program must be defined according to the syntax of MetaQuotes Language 4 first. That is why we insert the block for initializing variables at the beginning of the program

2. extern double TakeProfit = 50;
3. extern double Lots = 0.1;
4. extern double TrailingStop = 30;
5. extern double MACDOpenLevel=3;
6. extern double MACDCloseLevel=2;
7. extern double MATrendPeriod=26;

MetaQuotes Language 4 is supplemented by "external variables" term. External variables can be set from the outside without modifying the source code of the expert program. It provides additional flexibility. In our programm, the MATrendPeriod variable is defined as extern variable. We insert the definition of this variable at the beginning of the program.

extern double MATrendPeriod=26;

8. **Initial data checks**

This part of code is usually used in any expert with minor modifications because it is a virtually standard check block:

9.   // initial data checks
10.   // it is important to make sure that the expert works with a normal

```
11.        // chart and the user did not make any mistakes setting external
12.        // variables (Lots, StopLoss, TakeProfit,
13.        // TrailingStop) in our case, we check TakeProfit
14.        // on a chart of less than 100 bars
15.          if(Bars<100)
16.            {
17.              Print("bars less than 100");
18.            return(0);
19.            }
20.        if(TakeProfit<10)
21.          {
22.            Print("TakeProfit less than 10");
23.            return(0);  // check TakeProfit
24.          }
```

25. **Setting internal variables for quick access to data**

In the source code it is very often necessary to access the indicator values or handle the calculated values. To simplify the coding and speed up the access, data are put into internal variables.

```
26.        int  start()
27.         {
28.           double MacdCurrent, MacdPrevious, SignalCurrent;
29.           double SignalPrevious, MaCurrent, MaPrevious;
30.           int cnt, ticket, total;
31.        // to simplify the coding and speed up access
32.        // data are put into internal variables
33.          MacdCurrent=iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_MAIN,0);
34.          MacdPrevious=iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_MAIN,1);
35.          SignalCurrent=iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_SIGNAL,0);
36.          SignalPrevious=iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_SIGNAL,1);
37.          MaCurrent=iMA(NULL,0,MATrendPeriod,0,MODE_EMA,PRICE_CLOSE,0);
38.          MaPrevious=iMA(NULL,0,MATrendPeriod,0,MODE_EMA,PRICE_CLOSE,1);
```

Now, instead of the monstrous notation of **iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_MAIN,0)**, you can use **MacdCurrent** in the source code.

39. **Checking the trading terminal – is it empty? If it is, then:**

In our Expert Advisor, we use only those positions which are opened with market orders and do not handle the pending orders. However, to be on the safe side, let us introduce a check of the trading terminal for previously placed orders:

```
40.          total=OrdersTotal();
41.          if(total<1)
42.            {
```

- **checks: availability of funds on the account etc...**
  Before analyzing the market situation it is advisable to check the status of your account to make sure that there are free funds on it for opening a position.

```
        if(AccountFreeMargin()<(1000*Lots))
          {
           Print("We have no money. Free Margin = ", AccountFreeMargin());
           return(0);
          }
```

- **is it possible to take a long position (BUY)?**
  Condition of entry into the long position: MACD is below zero, goes upwards and is crossed by

the Signal Line going downwards. This is how we describe it in MQL 4 (note that we operate on the indicator values which were previously saved in the variables):

```
// check for long position (BUY) possibility
if(MacdCurrent<0 && MacdCurrent>SignalCurrent &&
   MacdPrevious<SignalPrevious &&
   MathAbs(MacdCurrent)>(MACDOpenLevel*Point) &&
   MaCurrent>MaPrevious)
  {
  ticket=OrderSend(Symbol(),OP_BUY,Lots,Ask,3,0,Ask+TakeProfit*Point,
                   "macd sample",16384,0,Green);
    if(ticket>0)
     {
       if(OrderSelect(ticket,SELECT_BY_TICKET,MODE_TRADES))
         Print("BUY order opened : ",OrderOpenPrice());
     }
    else Print("Error opening BUY order : ",GetLastError());
    return(0);
  }
```

Additional control over the size of the 'hillocks' being drawn was already mentioned above. MACDOpenLevel variable is a user-defined variable which may be changed without interfering with the program text, to ensure greater flexibility. In the beginning of the programme we insert a description of this variable (as well as the description of the variable used below).

- **is it possible to take a short position (SELL)?**

  Condition of entry of a short position: MACD is above zero, goes downwards and is crossed by the Signal Line going upwards. The notation is as follows:

```
// check for short position (SELL) possibility
if(MacdCurrent>0 && MacdCurrent<SignalCurrent &&
   MacdPrevious>SignalPrevious &&
   MacdCurrent>(MACDOpenLevel*Point) && MaCurrent<MaPrevious)
  {
  ticket=OrderSend(Symbol(),OP_SELL,Lots,Bid,3,0,Bid-TakeProfit*Point,
                   "macd sample",16384,0,Red);
    if(ticket>0)
     {
       if(OrderSelect(ticket,SELECT_BY_TICKET,MODE_TRADES))
         Print("SELL order opened : ",OrderOpenPrice());
     }
    else Print("Error opening SELL order : ",GetLastError());
    return(0);
  }
```

```
43.        return(0);
44.      }
```

45. **Control of the positions previously opened in the cycle**

```
46.      // it is important to enter the market correctly,
47.      // but it is more important to exit it correctly...
48.      for(cnt=0;cnt<total;cnt++)
49.        {
50.        OrderSelect(cnt, SELECT_BY_POS, MODE_TRADES);
51.        if(OrderType()<=OP_SELL &&   // check for opened position
52.           OrderSymbol()==Symbol())  // check for symbol
53.            {
```

MetaTrader 4 Expert Advisors

"cnt" – is a cycle variable that must be defined at the beginning of the program as follows:

int cnt = 0;

- if it is a long position

```
if(OrderType()==OP_BUY)  // long position is opened
  {
```

- **should it be closed?**

Condition for exiting a long position: MACD is crossed by its Signal Line, MACD being above zero, going downwards and being crossed by the Signal Line going upwards.

```
if(MacdCurrent>0 && MacdCurrent<SignalCurrent &&
MacdPrevious>SignalPrevious &&

   MacdCurrent>(MACDCloseLevel*Point))

  {

   OrderClose(OrderTicket(),OrderLots(),Bid,3,Violet); //
close position

   return(0); // exit

  }
```

- **should the trailing stop be reset?**

We set the trailing stop only in case the position already has a profit exceeding the trailing stop level in points, and in case the new level of the stop is better than the previous.

```
 // check for trailing stop
if(TrailingStop>0)
  {
   if(Bid-OrderOpenPrice()>Point*TrailingStop)
     {
      if(OrderStopLoss()<Bid-Point*TrailingStop)
        {
         OrderModify(OrderTicket(),OrderOpenPrice(),Bid-
Point*TrailingStop,
                OrderTakeProfit(),0,Green);
       return(0);
        }
     }
  }
```

We close the brace of the operator.

```
  }
```

- if it is a short position

```
        else // go to short position
          {
```

- **should it be closed?**

Condition for exiting a short position: MACD is crossed by its Signal Line, MACD being below zero, going upwards and being crossed by the Signal Line going downwards.

```
        if(MacdCurrent<0 && MacdCurrent>SignalCurrent &&
           MacdPrevious<SignalPrevious &&
  MathAbs(MacdCurrent)>(MACDCloseLevel*Point))
             {
             OrderClose(OrderTicket(),OrderLots(),Ask,3,Violet); //
  close position
             return(0); // exit
             }
```

- **should the trailing stop be reset?**

We set the trailing stop only in case the position already has a profit exceeding the trailing stop level in points, and in case the new level of the stop is better than the previous.

```
        // check for trailing stop
        if(TrailingStop>0)
          {
          if((OrderOpenPrice()-Ask)>(Point*TrailingStop))
            {
            if((OrderStopLoss()>(Ask+Point*TrailingStop)) ||
  (OrderStopLoss()==0))
              {
  OrderModify(OrderTicket(),OrderOpenPrice(),Ask+Point*TrailingStop,
              OrderTakeProfit(),0,Red);
              return(0);
              }
            }
          }
```

Closing all the curly bracket which remain open.

```
      }
    }
  }
 return(0);
}
```

So, following this step-by-step procedure, we have written our Expert Advisor...

Step 3 – Assembling the resulting code of the programme

Let's open the Expert Advisor settings (using a button or a line in the "Properties..." menu. We are offered a window in which we have to define the external settings of the working parameters:

MetaTrader 4 Expert Advisors
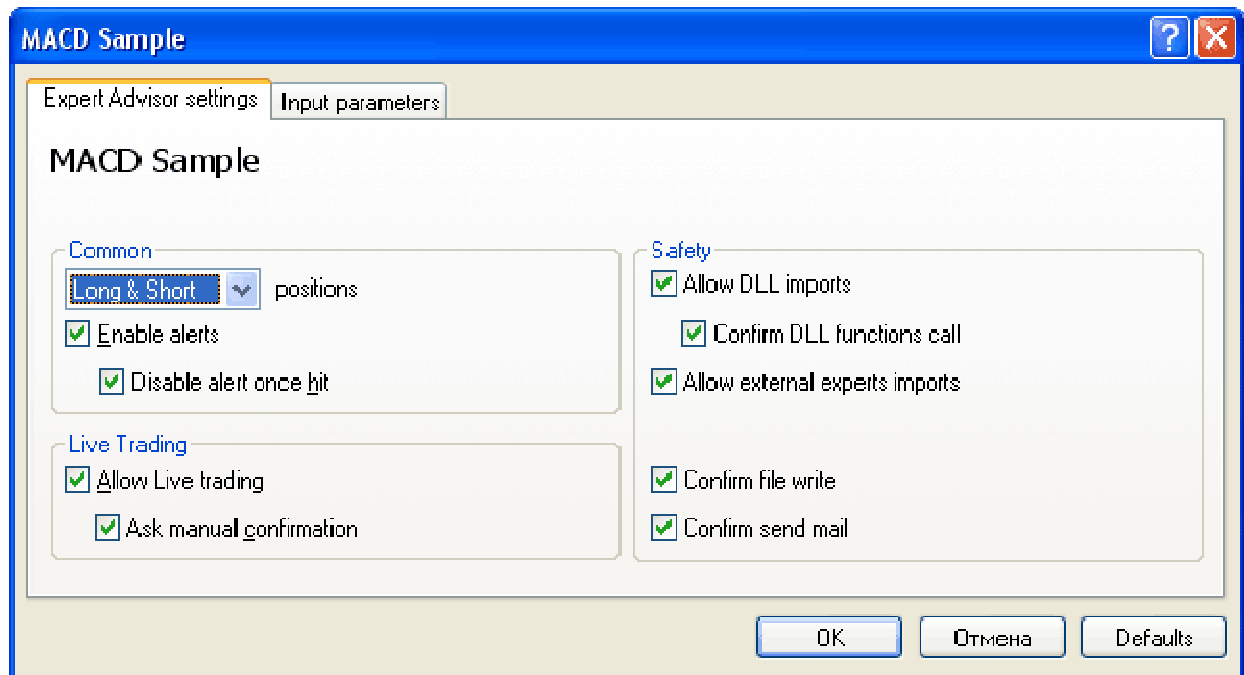
Let's assemble all the code from the previous section:

```
//+------------------------------------------------------------------+
//|                                              MACD Sample.mq4 |
//|                          Copyright й 2005, MetaQuotes Software Corp. |
//|                                        http://www.metaquotes.net/ |
//+------------------------------------------------------------------+


extern double TakeProfit = 50;

extern double Lots = 0.1;

extern double TrailingStop = 30;

extern double MACDOpenLevel=3;

extern double MACDCloseLevel=2;

extern double MATrendPeriod=26;



//+------------------------------------------------------------------+
```

MetaTrader 4 Expert Advisors

```mql4
//|                                              |
//+------------------------------------------------------------+
int start()
  {
   double MacdCurrent, MacdPrevious, SignalCurrent;
   double SignalPrevious, MaCurrent, MaPrevious;
   int cnt=0, ticket, total;
// initial data checks
// it is important to make sure that the expert works with a normal
// chart and the user did not make any mistakes setting external variables (Lots, StopLoss,
// TakeProfit, TrailingStop)
// in our case, we check TakeProfit
   if(Bars<100)
     {
      Print("bars less than 100");
      return(0);
     }
   if(TakeProfit<10)
     {
      Print("TakeProfit less than 10");
      return(0);  // check TakeProfit
     }
// to simplify the coding and speed up access
// data are put into internal variables
   MacdCurrent=iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_MAIN,0);
   MacdPrevious=iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_MAIN,1);
   SignalCurrent=iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_SIGNAL,0);
   SignalPrevious=iMACD(NULL,0,12,26,9,PRICE_CLOSE,MODE_SIGNAL,1);
```

MetaTrader 4 Expert Advisors

```
MaCurrent=iMA(NULL,0,MATrendPeriod,0,MODE_EMA,PRICE_CLOSE,0);

MaPrevious=iMA(NULL,0,MATrendPeriod,0,MODE_EMA,PRICE_CLOSE,1);


total=OrdersTotal();

if(total<1)

  {

  // no opened orders identified

  if(AccountFreeMargin()<(1000*Lots))

    {

    Print("We have no money. Free Margin = ", AccountFreeMargin());

    return(0);

    }

  // check for long position (BUY) possibility

  if(MacdCurrent<0 && MacdCurrent>SignalCurrent && MacdPrevious<SignalPrevious &&

    MathAbs(MacdCurrent)>(MACDOpenLevel*Point) && MaCurrent>MaPrevious)

    {

    ticket=OrderSend(Symbol(),OP_BUY,Lots,Ask,3,0,Ask+TakeProfit*Point,

            "macd sample",16384,0,Green);

    if(ticket>0)

      {

      if(OrderSelect(ticket,SELECT_BY_TICKET,MODE_TRADES))

        Print("BUY order opened : ",OrderOpenPrice());

      }

    else Print("Error opening BUY order : ",GetLastError());

    return(0);

    }

  // check for short position (SELL) possibility

  if(MacdCurrent>0 && MacdCurrent<SignalCurrent && MacdPrevious>SignalPrevious &&
```

```
      MacdCurrent>(MACDOpenLevel*Point) && MaCurrent>MaPrevious)

    {

    ticket=OrderSend(Symbol(),OP_SELL,Lots,Bid,3,0,Bid-TakeProfit*Point,

              "macd sample",16384,0,Red);

    if(ticket>0)

      {

       if(OrderSelect(ticket,SELECT_BY_TICKET,MODE_TRADES))

         Print("SELL order opened : ",OrderOpenPrice());

      }

    else Print("Error opening SELL order : ",GetLastError());

    return(0);

    }

  return(0);

  }

// it is important to enter the market correctly

// but it is more important to exit it correctly...

for(cnt=0;cnt<total;cnt++)

  {

   OrderSelect(cnt, SELECT_BY_POS, MODE_TRADES);

   if(OrderType()<=OP_SELL &&   // check for opened position

      OrderSymbol()==Symbol())  // check for symbol

     {

     if(OrderType()==OP_BUY)   // long position is opened

       {

       // should it be closed?

        if(MacdCurrent>0 && MacdCurrent<SignalCurrent && MacdPrevious>SignalPrevious &&

           MacdCurrent>(MACDCloseLevel*Point))

          {
```

```
        OrderClose(OrderTicket(),OrderLots(),Bid,3,Violet); // close position

      return(0); // exit

      }

    // check for trailing stop

    if(TrailingStop>0)

     {

      if(Bid-OrderOpenPrice()>Point*TrailingStop)

       {

        if(OrderStopLoss()<Bid-Point*TrailingStop)

         {

          OrderModify(OrderTicket(),OrderOpenPrice(),Bid-Point*TrailingStop,

                OrderTakeProfit(),0,Green);

          return(0);

         }

       }

     }

   }

  else // go to short position

   {

    // should it be closed?

    if(MacdCurrent<0 && MacdCurrent>SignalCurrent &&

      MacdPrevious<SignalPrevious && MathAbs(MacdCurrent)>(MACDCloseLevel*Point))

     {

      OrderClose(OrderTicket(),OrderLots(),Ask,3,Violet); // close position

      return(0); // exit

      }

    // check for trailing stop

    if(TrailingStop>0)
```

MetaTrader 4 Expert Advisors

```
                  {

            if((OrderOpenPrice()-Ask)>(Point*TrailingStop))

              {

                if((OrderStopLoss()>(Ask+Point*TrailingStop)) || (OrderStopLoss()==0))

                  {

                    OrderModify(OrderTicket(),OrderOpenPrice(),Ask+Point*TrailingStop,

                            OrderTakeProfit(),0,Red);

                    return(0);

                  }

              }

            }

          }

        }

    return(0);

    }
// the end.
```

For the final configuration of our expert advisor, just specify the values of external variables "Lots = 1", "Stop Loss (S/L) = 0" (not used), "Take Profit (T/P) = 120" (appropriate for one-hour intervals), "Trailing Stop (T/S) = 30". Of course, you can set your own values. Press "Compile" button and, if there isn't any error message (by the way, you can copy the text from the listing above into the MetaEditor), press "Save" button to save the Expert Advisor.