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# EtherCAT Connection Guide

## With Trio MC4N

### Introduction

This document shows how to use Trio EtherCAT host software *Motion Perfect* to connect and control an Applied Motion Products SSxx-EC-D StepSERVO Drive and Motor via an EtherCAT network connection. By following the steps below, you will be able to use *Motion Perfect* to control the position, velocity and torque of an Applied Motion Products motor using an SSxx-EC-D drive.

For more advanced motion control functions, please contact Trio.

### Applies to

- Trio MC4N-ECAT EtherCAT master controller.
- SSxx-EC-D StepSERVO Drives and compatible StepSERVO Motors (e.g. HT23-SS2DGB).

### Date

June, 2016

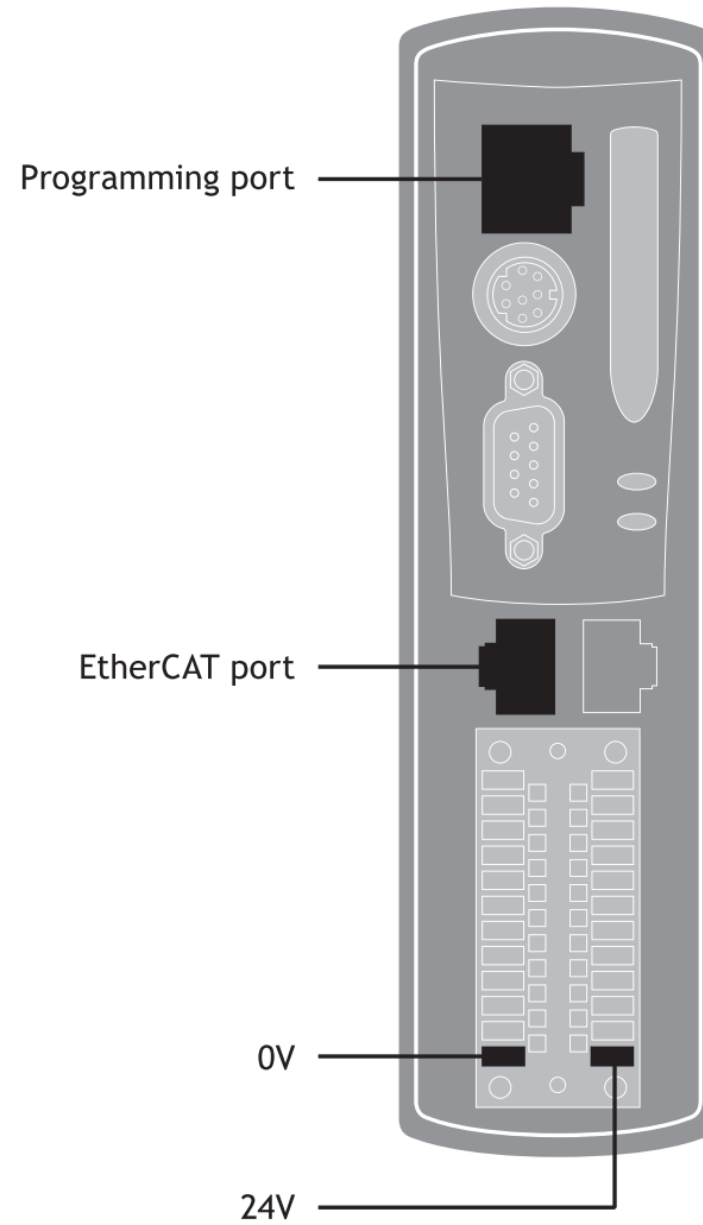
### Connection Guide

Step 1 Download EC\_EXTEND.TXT configuration file for SSxx-EC-D drive from Applied Motion Products website ([www.applied-motion.com](http://www.applied-motion.com)).

Step 2 Install Trio *Motion Perfect* software.

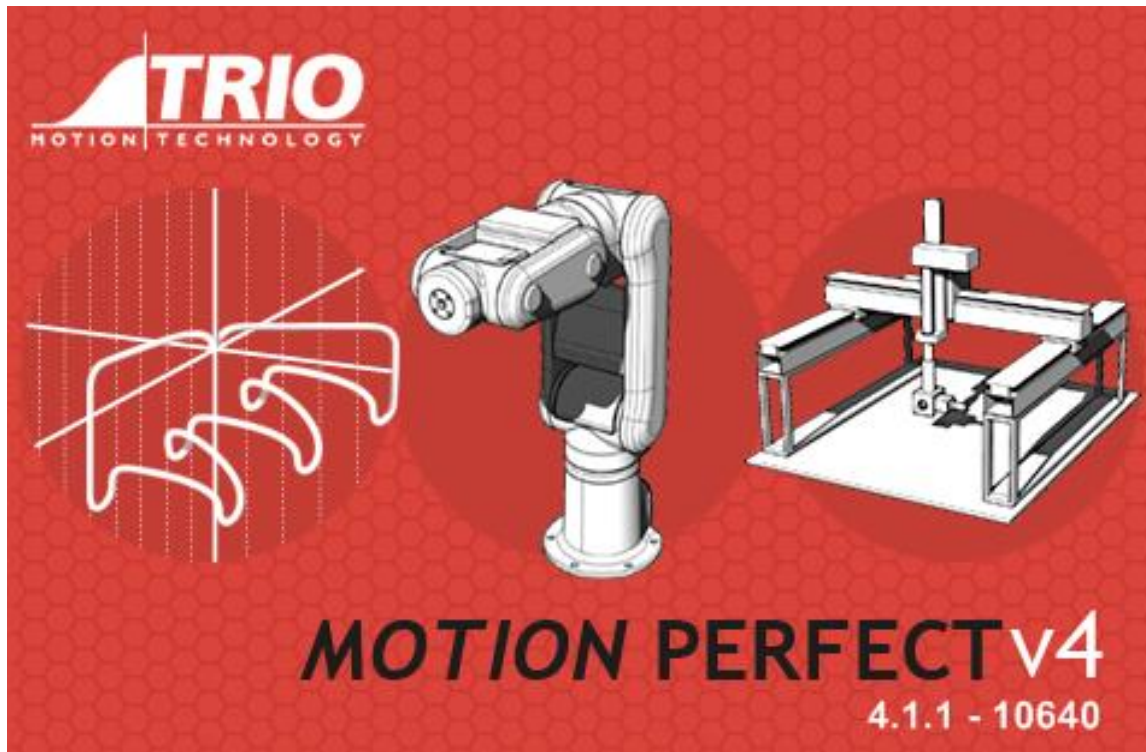
Step 3 Connect Ethernet cable from PC to the Trio controller MC4N's Programming port.

Step 4 Connect another Ethernet cable from MC4N's EtherCAT port to the drive's "EtherCAT LINK IN" RJ45 port.



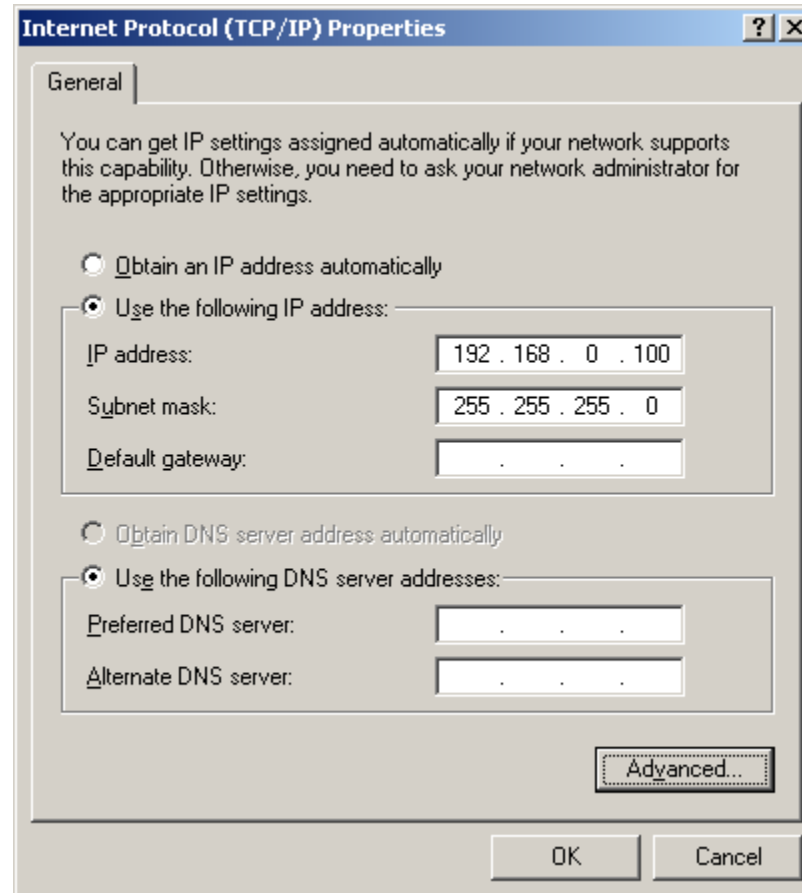
Step 5 Apply power to SSxx-EC-D drive. Apply power to MC4N controller.

Step 6 Set the IP address for your PC and run the *Motion Perfect* software.



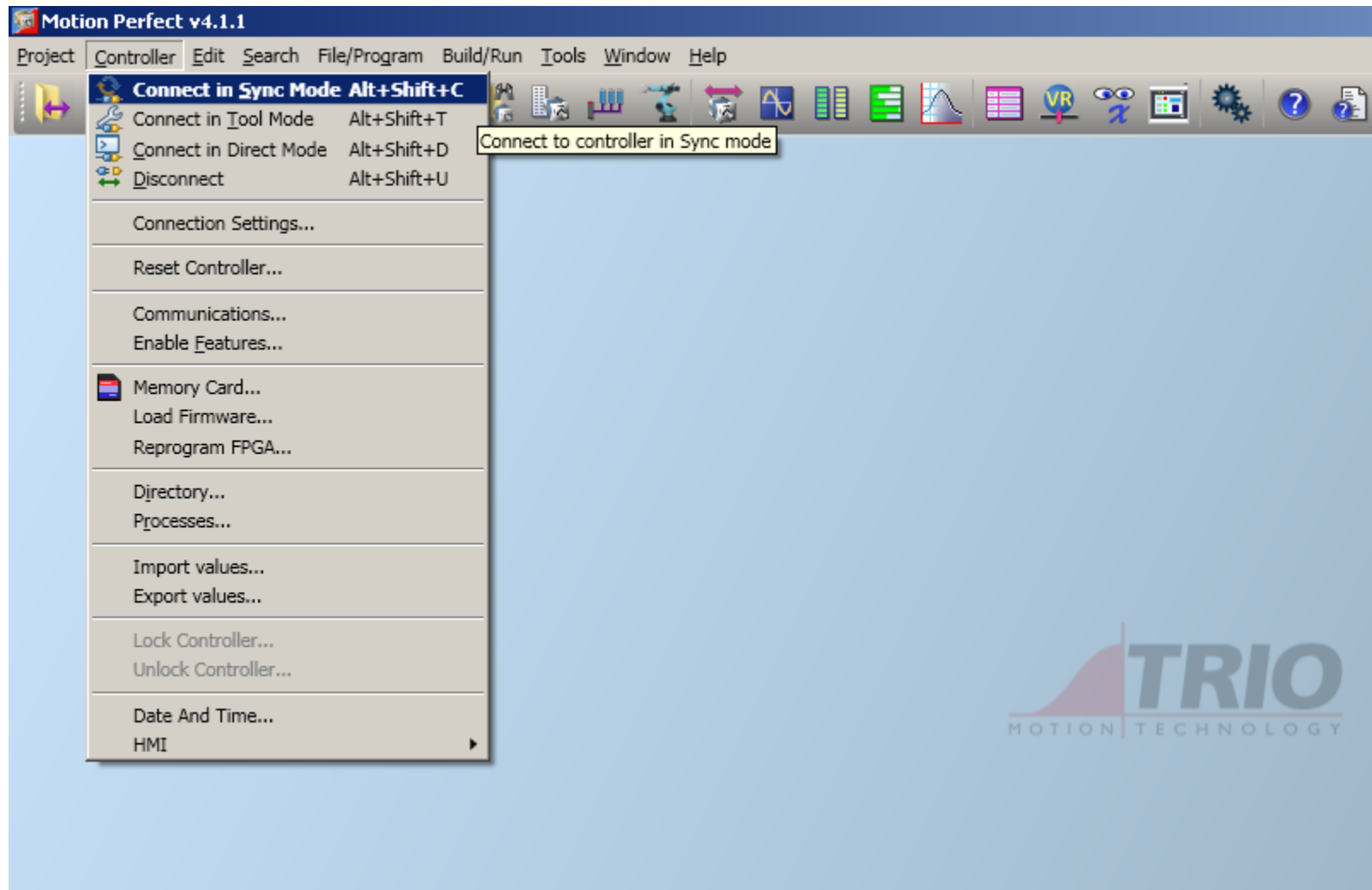
## IP Setting

The IP address of an MC4N controller is usually 192.168.0.X and the subnet mask is 255.255.255.0. You need to set the PC's IP address in the same subnet as the controller. For example, set the PC's IP address to 192.168.0.100 and the subnet mask to 255.255.255.0.



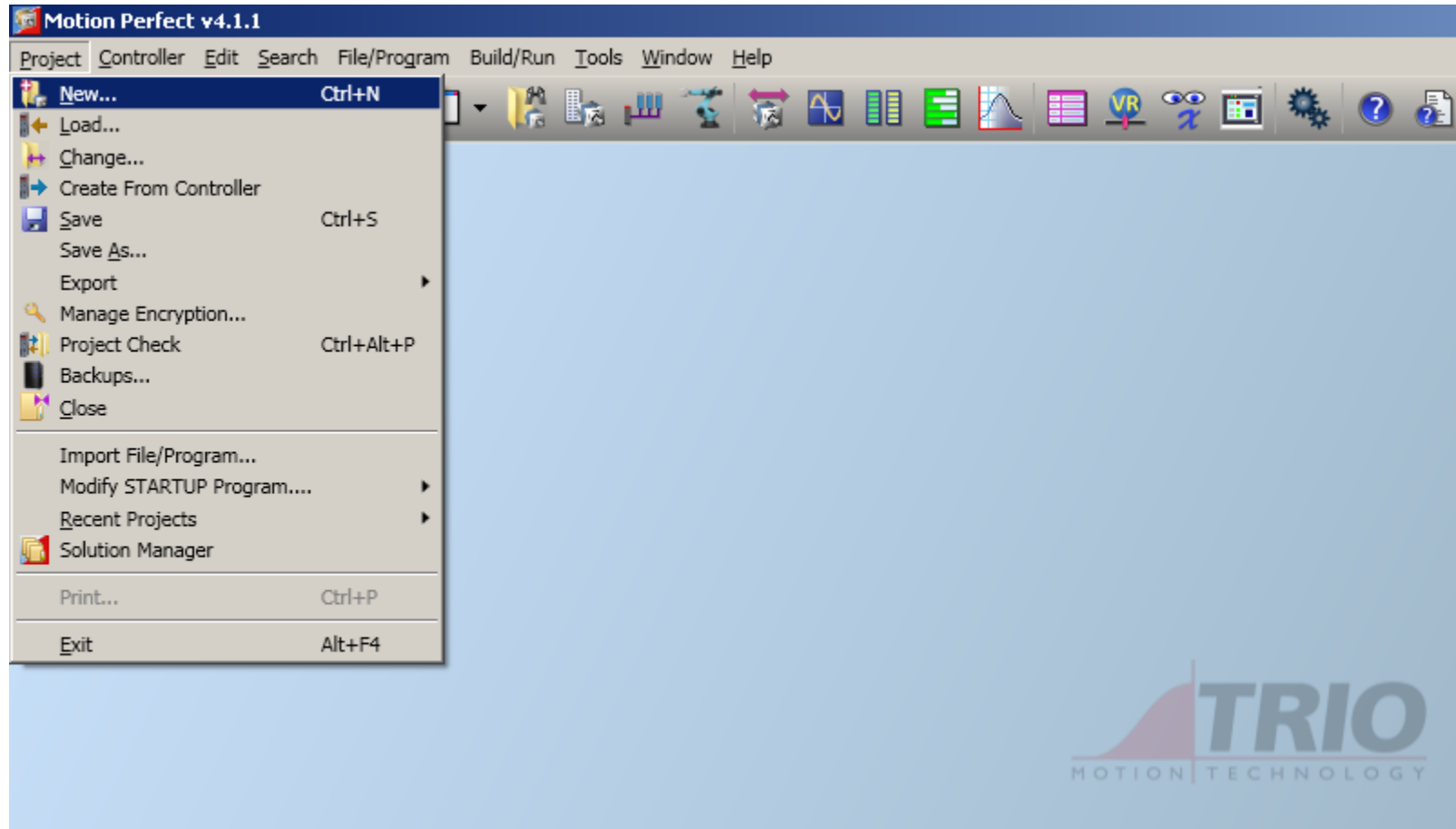
## Connect to controller in Sync mode

Click on **Connect in Sync Mode** under **Controller**.



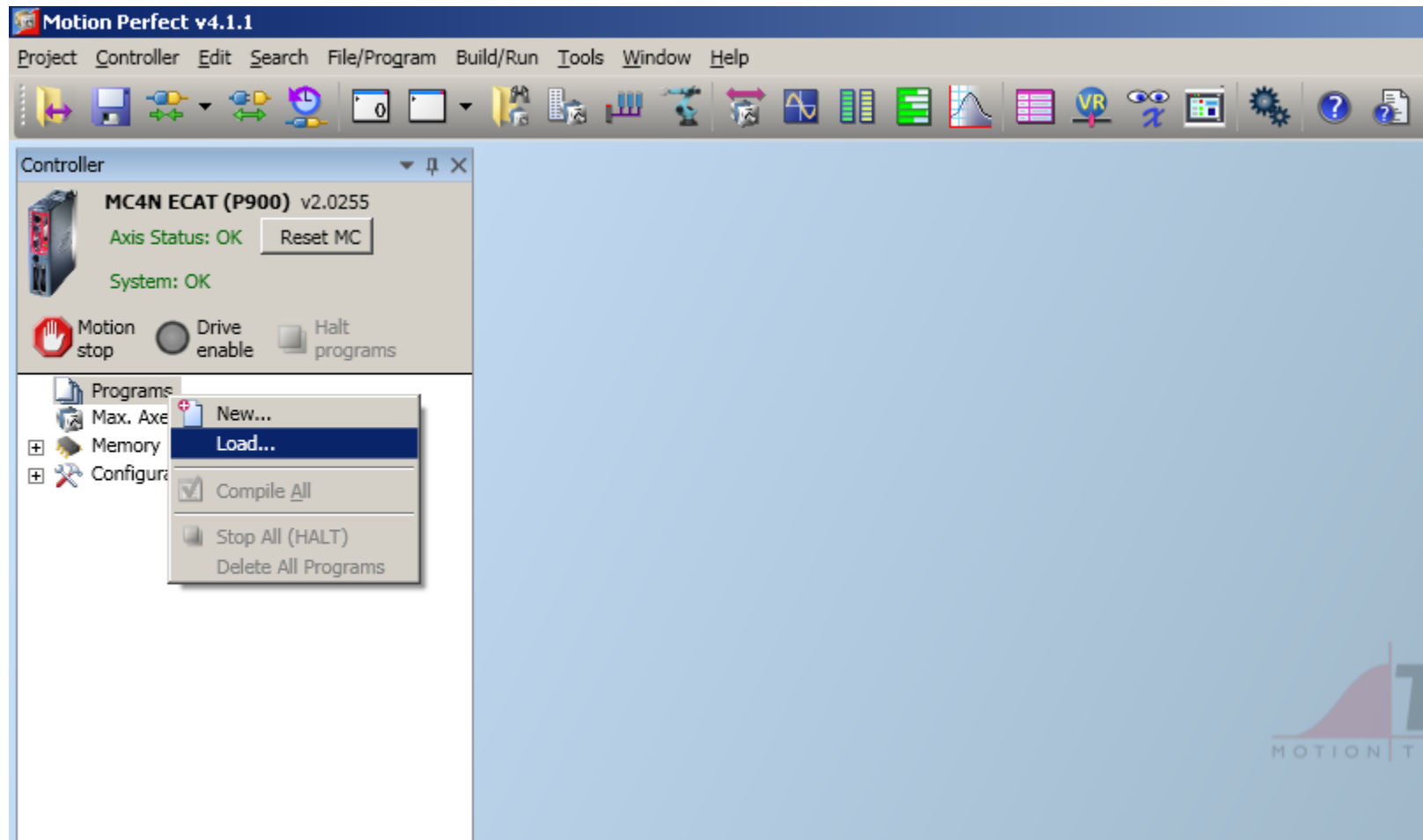
## Build a new project file

Click on **New** under **Project**.

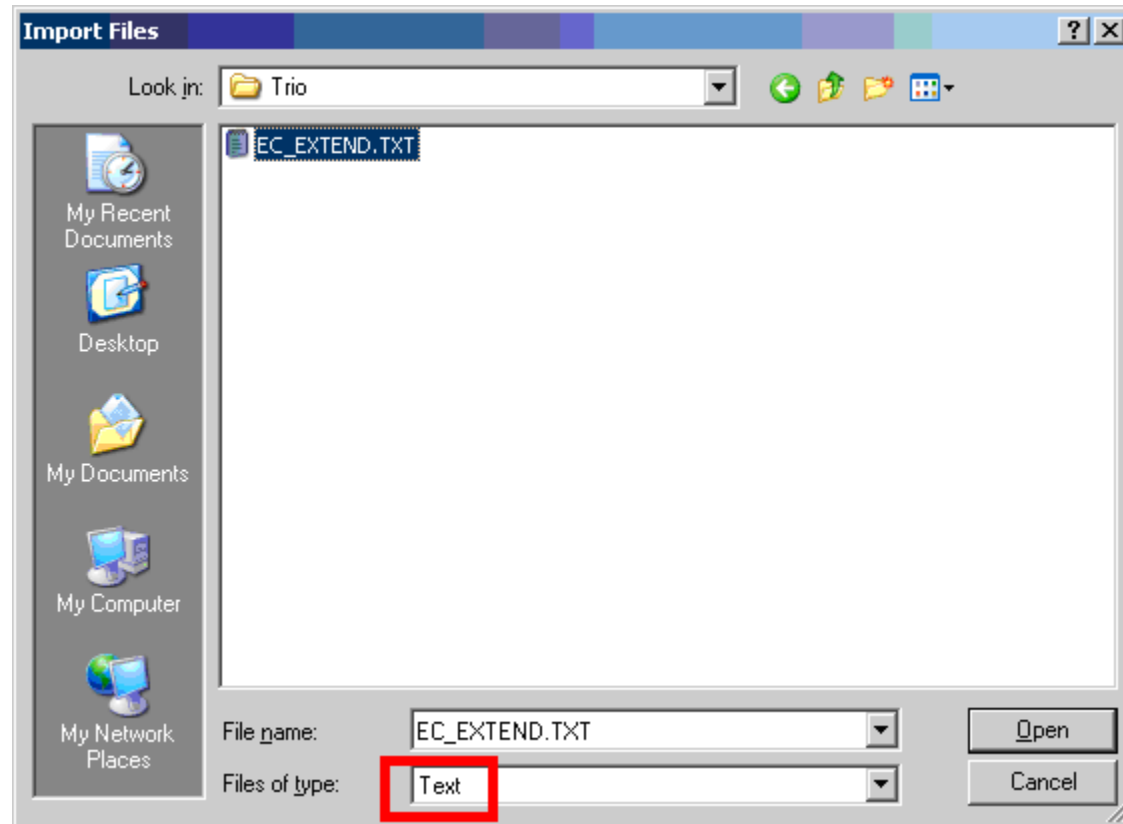


## Load the “EC\_EXTEND.TXT” file

Right-click on **Programs** and click **Load**.



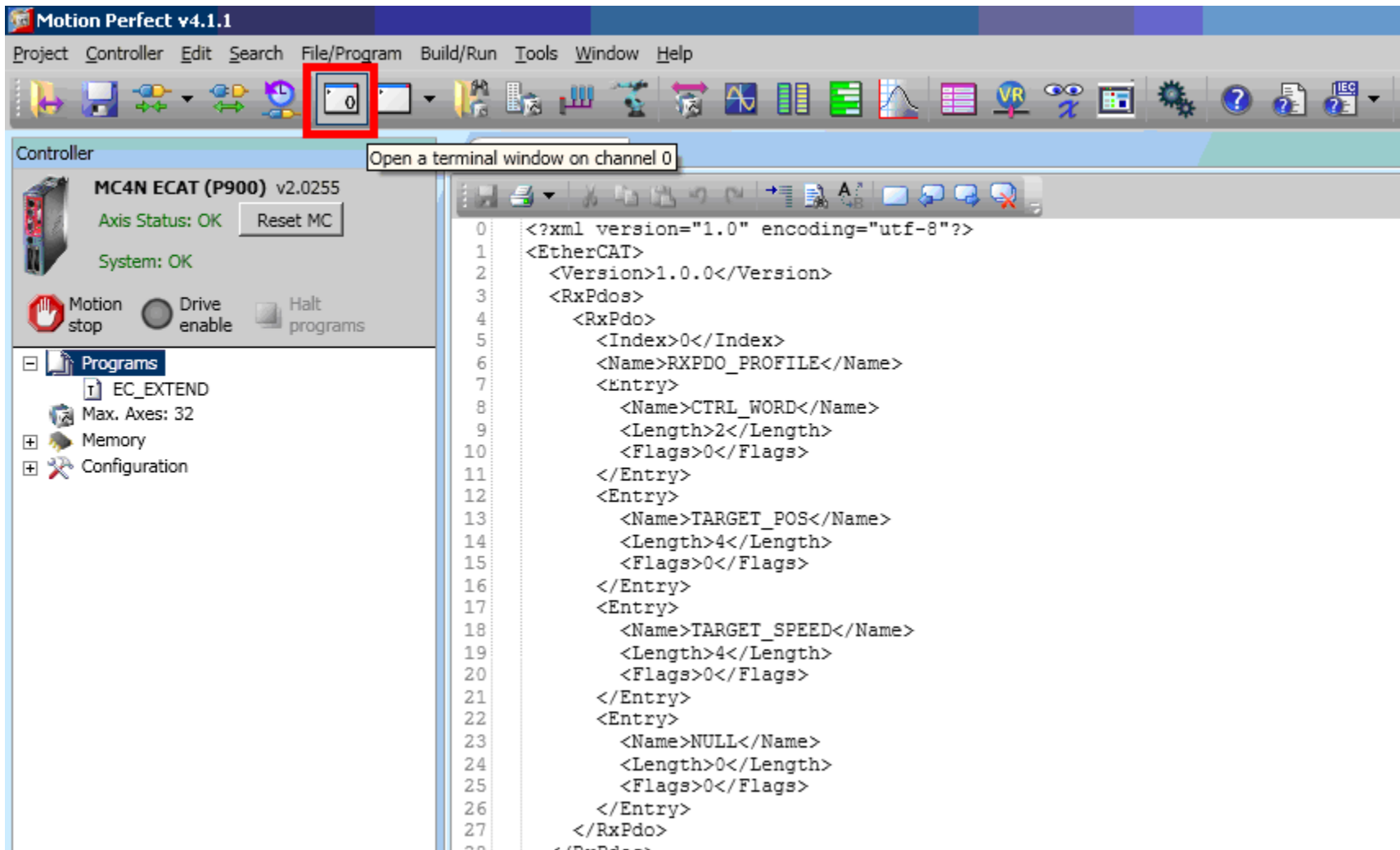
Select the **EC\_EXTEND.TXT** file with file type Text and Click Open.





## Open a terminal window

Click [Open a terminal window on channel 0](#) in the tool bar.

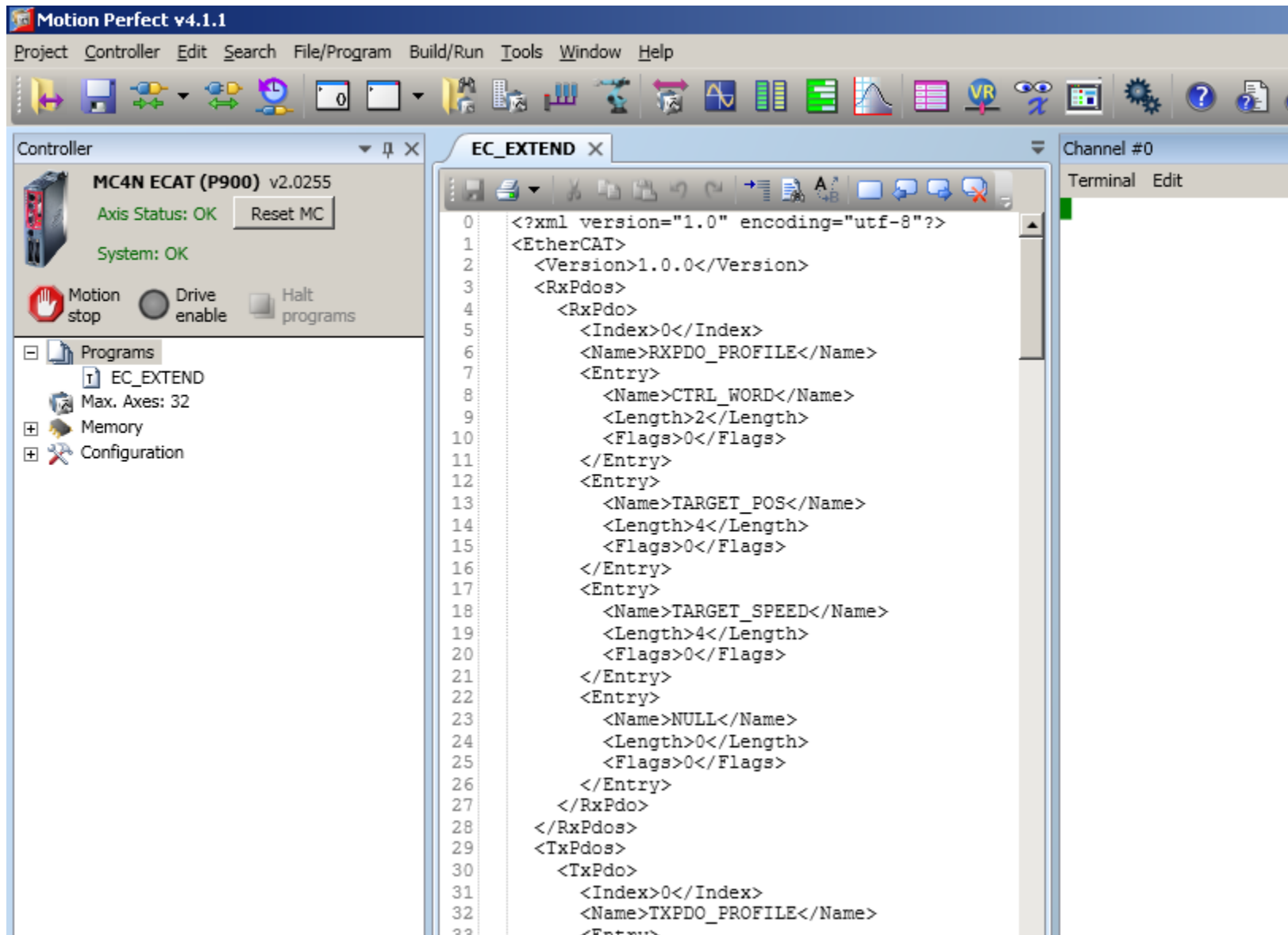


The screenshot shows the Motion Perfect v4.1.1 software interface. The main window displays the Controller section for an MC4N ECAT (P900) v2.0255. The status is 'Axis Status: OK' and 'System: OK'. There are buttons for 'Motion stop', 'Drive enable', and 'Halt programs'. A 'Programs' list on the left includes 'EC\_EXTEND', 'Max. Axes: 32', 'Memory', and 'Configuration'. The toolbar at the top contains various icons, with the 'Open a terminal window on channel 0' icon (a terminal window with '0' inside) highlighted by a red box. A tooltip above this icon reads 'Open a terminal window on channel 0'. The terminal window is open, displaying XML data for the EtherCAT configuration:

```

0  <?xml version="1.0" encoding="utf-8"?>
1  <EtherCAT>
2    <Version>1.0.0</Version>
3    <RxPdos>
4      <RxPdo>
5        <Index>0</Index>
6        <Name>RXPDO_PROFILE</Name>
7        <Entry>
8          <Name>CTRL_WORD</Name>
9          <Length>2</Length>
10         <Flags>0</Flags>
11        </Entry>
12        <Entry>
13          <Name>TARGET_POS</Name>
14          <Length>4</Length>
15          <Flags>0</Flags>
16        </Entry>
17        <Entry>
18          <Name>TARGET_SPEED</Name>
19          <Length>4</Length>
20          <Flags>0</Flags>
21        </Entry>
22        <Entry>
23          <Name>NULL</Name>
24          <Length>0</Length>
25          <Flags>0</Flags>
26        </Entry>
27      </RxPdo>
28    </RxPdos>

```



The screenshot shows the Motion Perfect v4.1.1 software interface. The main window displays the XML configuration for the EtherCAT controller, titled "EC\_EXTEND". The XML content is as follows:

```

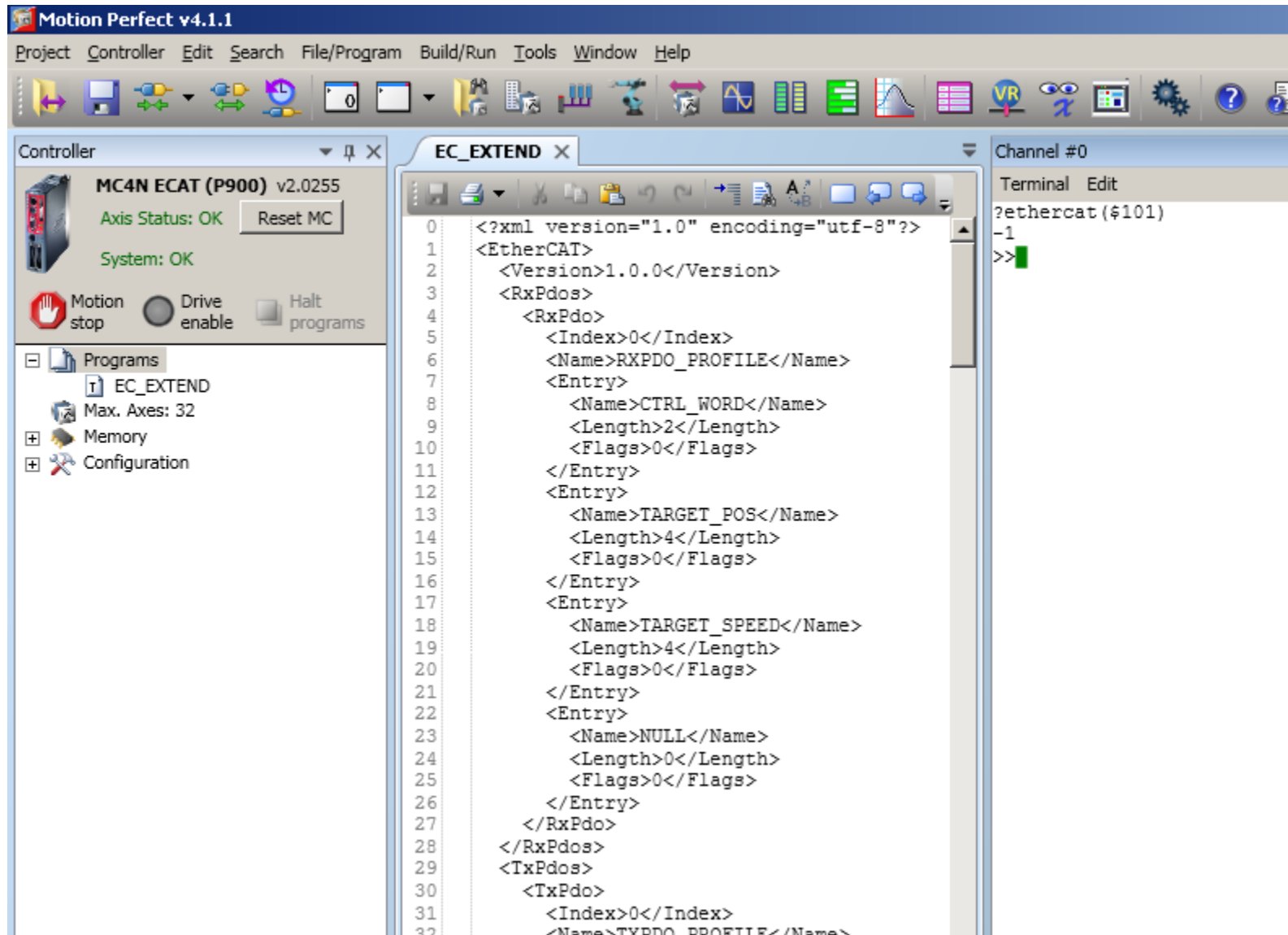
0  <?xml version="1.0" encoding="utf-8"?>
1  <EtherCAT>
2    <Version>1.0.0</Version>
3    <RxPdos>
4      <RxPdo>
5        <Index>0</Index>
6        <Name>RXPDO_PROFILE</Name>
7        <Entry>
8          <Name>CTRL_WORD</Name>
9          <Length>2</Length>
10         <Flags>0</Flags>
11        </Entry>
12        <Entry>
13          <Name>TARGET_POS</Name>
14          <Length>4</Length>
15          <Flags>0</Flags>
16        </Entry>
17        <Entry>
18          <Name>TARGET_SPEED</Name>
19          <Length>4</Length>
20          <Flags>0</Flags>
21        </Entry>
22        <Entry>
23          <Name>NULL</Name>
24          <Length>0</Length>
25          <Flags>0</Flags>
26        </Entry>
27      </RxPdo>
28    </RxPdos>
29    <TxPdos>
30      <TxPdo>
31        <Index>0</Index>
32        <Name>TXPDO_PROFILE</Name>
33        <Entry>

```

The interface also shows a "Controller" panel on the left with the following information:

- MC4N ECAT (P900) v2.0255
- Axis Status: OK
- System: OK
- Motion stop (stop icon)
- Drive enable (enable icon)
- Halt programs (halt icon)
- Programs: EC\_EXTEND
- Max. Axes: 32
- Memory
- Configuration

Type `?ethercat($101)` in the terminal window. If the `EC_EXTEND.TXT` file is correct it will respond `-1`.



The screenshot shows the Motion Perfect v4.1.1 software interface. The main window displays the `EC_EXTEND.TXT` file content, which is an XML configuration for EtherCAT. The terminal window on the right shows the command `?ethercat($101)` being entered, and the response `-1` is displayed, indicating that the configuration is correct.

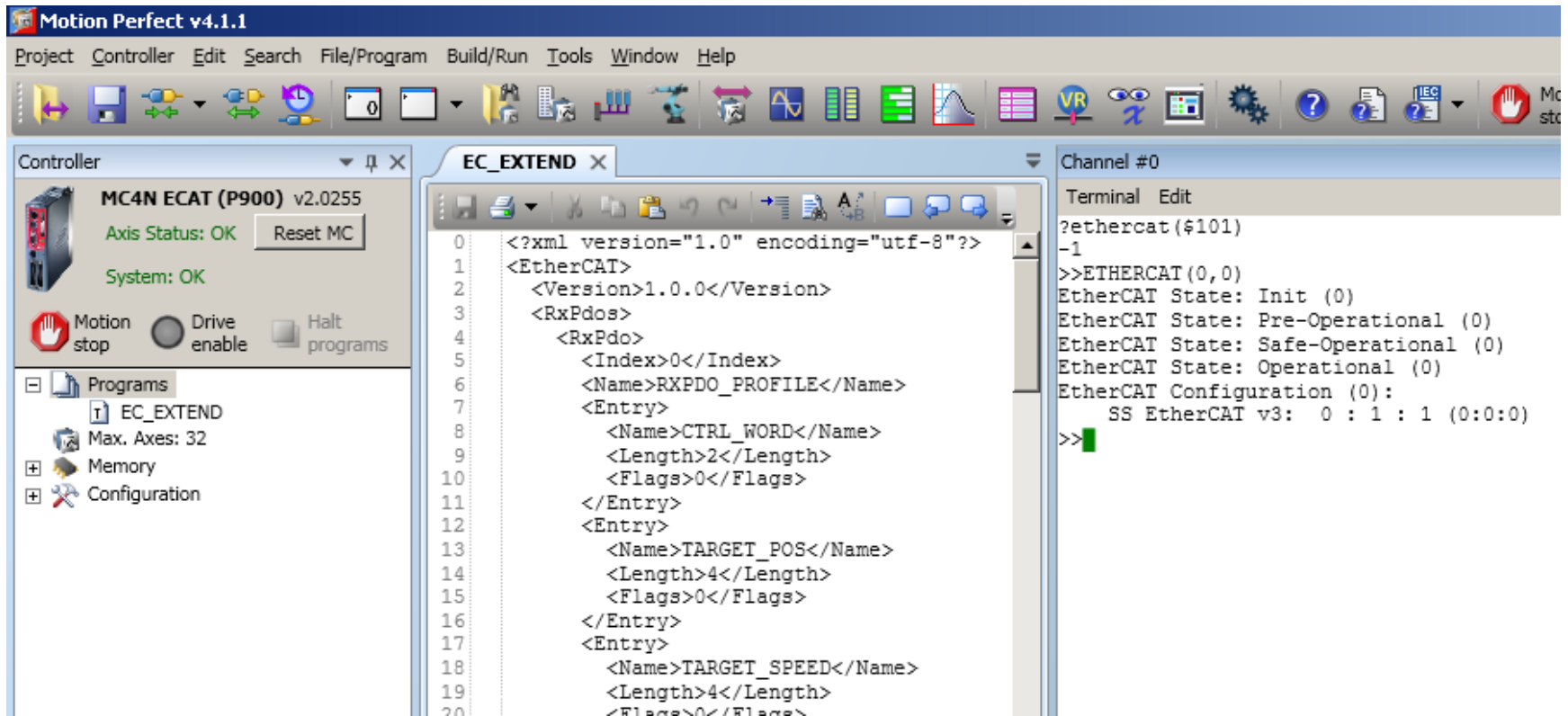
```

0  <?xml version="1.0" encoding="utf-8"?>
1  <EtherCAT>
2    <Version>1.0.0</Version>
3    <RxPdos>
4      <RxPdo>
5        <Index>0</Index>
6        <Name>RXPDO_PROFILE</Name>
7        <Entry>
8          <Name>CTRL_WORD</Name>
9          <Length>2</Length>
10         <Flags>0</Flags>
11        </Entry>
12        <Entry>
13          <Name>TARGET_POS</Name>
14          <Length>4</Length>
15          <Flags>0</Flags>
16        </Entry>
17        <Entry>
18          <Name>TARGET_SPEED</Name>
19          <Length>4</Length>
20          <Flags>0</Flags>
21        </Entry>
22        <Entry>
23          <Name>NULL</Name>
24          <Length>0</Length>
25          <Flags>0</Flags>
26        </Entry>
27      </RxPdo>
28    </RxPdos>
29    <TxPdos>
30      <TxPdo>
31        <Index>0</Index>
32        <Name>TXPDO_PROFILE</Name>

```

Terminal Edit  
?ethercat(\$101)  
-1  
>>

Type **ethercat(0,0)** in the terminal window and the drive will switch to operational status.



The screenshot displays the Motion Perfect v4.1.1 software interface. On the left, the 'Controller' panel shows 'MC4N ECAT (P900) v2.0255' with 'Axis Status: OK' and 'System: OK'. Below this are buttons for 'Motion stop', 'Drive enable', and 'Halt programs'. A 'Programs' list on the left includes 'EC\_EXTEND', 'Max. Axes: 32', 'Memory', and 'Configuration'. The central 'EC\_EXTEND' window shows an XML configuration for EtherCAT parameters:

```

0 <?xml version="1.0" encoding="utf-8"?>
1 <EtherCAT>
2   <Version>1.0.0</Version>
3   <RxPdos>
4     <RxPdo>
5       <Index>0</Index>
6       <Name>RXPDO_PROFILE</Name>
7       <Entry>
8         <Name>CTRL_WORD</Name>
9         <Length>2</Length>
10        <Flags>0</Flags>
11      </Entry>
12    </Entry>
13    <Entry>
14      <Name>TARGET_POS</Name>
15      <Length>4</Length>
16      <Flags>0</Flags>
17    </Entry>
18    <Entry>
19      <Name>TARGET_SPEED</Name>
20      <Length>4</Length>
21      <Flags>0</Flags>

```

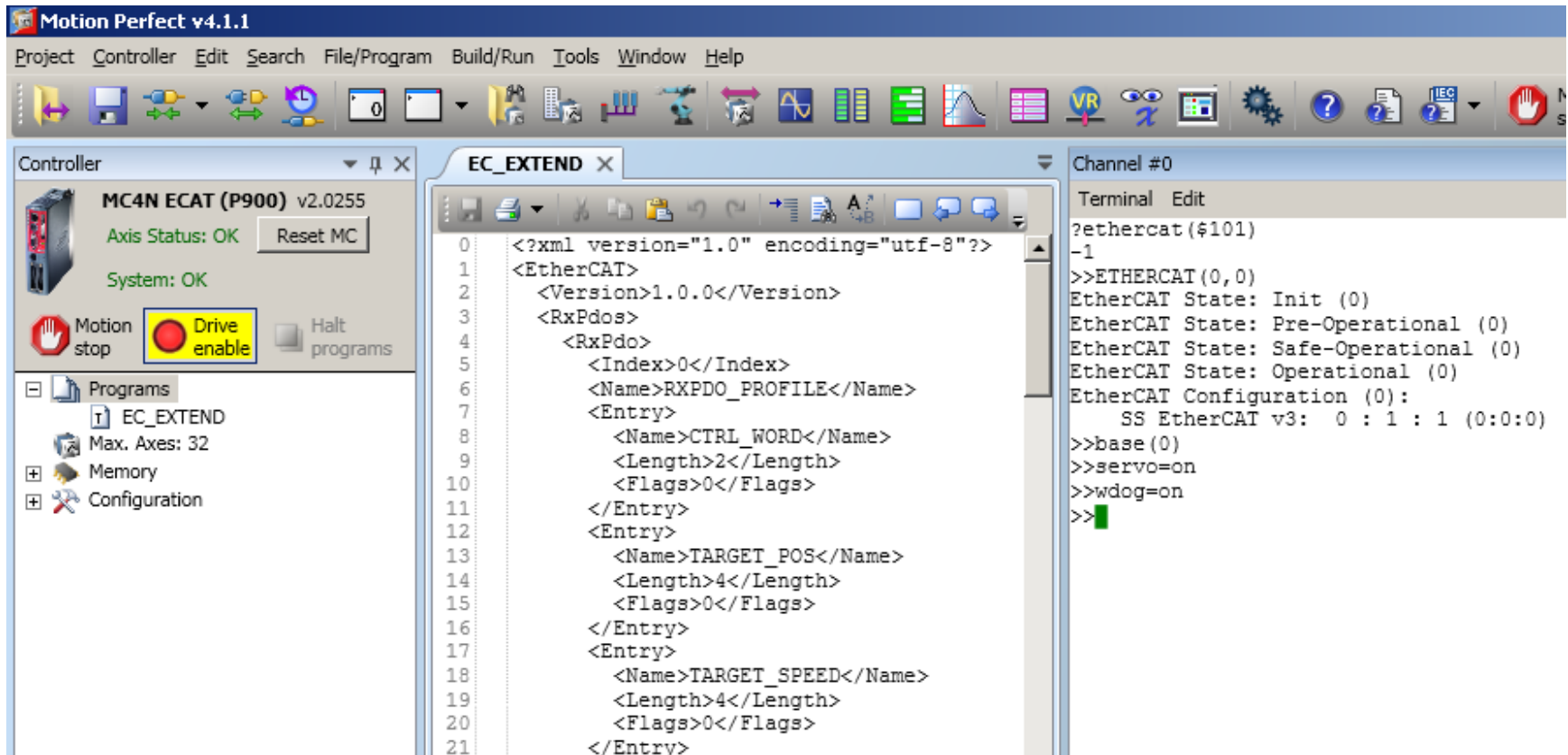
On the right, the 'Channel #0' terminal window shows the following output:

```

?ethercat($101)
-1
>>ETHERCAT (0,0)
EtherCAT State: Init (0)
EtherCAT State: Pre-Operational (0)
EtherCAT State: Safe-Operational (0)
EtherCAT State: Operational (0)
EtherCAT Configuration (0):
      SS EtherCAT v3: 0 : 1 : 1 (0:0:0)
>>

```

Type **base(0)**, **servo=on** and **wdog=on** in the terminal window and the drive will be enabled.



The screenshot displays the Motion Perfect v4.1.1 software interface. On the left, the Controller panel shows 'MC4N ECAT (P900) v2.0255' with 'Axis Status: OK' and 'System: OK'. The 'Drive enable' button is highlighted in yellow. The main window shows the 'EC\_EXTEND' XML configuration file with the following content:

```

0  <?xml version="1.0" encoding="utf-8"?>
1  <EtherCAT>
2    <Version>1.0.0</Version>
3    <RxPdos>
4      <RxPdo>
5        <Index>0</Index>
6        <Name>RXPDO_PROFILE</Name>
7        <Entry>
8          <Name>CTRL_WORD</Name>
9          <Length>2</Length>
10         <Flags>0</Flags>
11        </Entry>
12        <Entry>
13          <Name>TARGET_POS</Name>
14          <Length>4</Length>
15          <Flags>0</Flags>
16        </Entry>
17        <Entry>
18          <Name>TARGET_SPEED</Name>
19          <Length>4</Length>
20          <Flags>0</Flags>
21        </Entry>

```

On the right, the Terminal Edit window shows the following output:

```

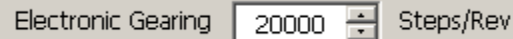
?ethercat($101)
-1
>>ETHERCAT(0,0)
EtherCAT State: Init (0)
EtherCAT State: Pre-Operational (0)
EtherCAT State: Safe-Operational (0)
EtherCAT State: Operational (0)
EtherCAT Configuration (0):
  SS EtherCAT v3: 0 : 1 : 1 (0:0:0)
>>base(0)
>>servo=on
>>wdog=on
>>

```

## Sample move

Type in commands in the terminal window as follows:

UNITS=20000 // set units to the same value as the drive's Electronic Gearing setting in the *Step-Servo Quick Tuner* software



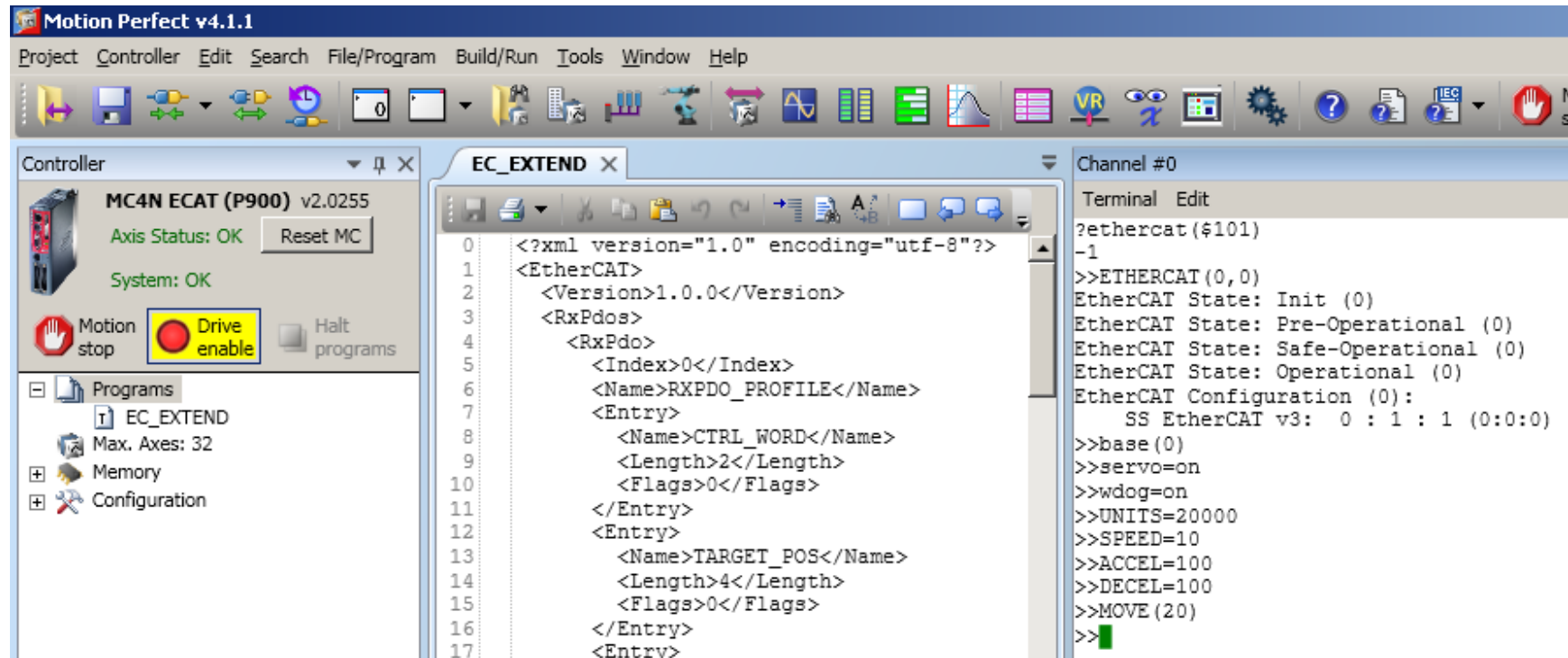
Electronic Gearing 20000 Steps/Rev

SPEED=10 // set motor speed to 10 rev/sec

ACCEL=100 // set motor acceleration to 100 rev/sec<sup>2</sup>

DECEL=100 // set motor deceleration to 100 rev/sec<sup>2</sup>

MOVE(20) // move the motor 20 revolutions



**Motion Perfect v4.1.1**

Project Controller Edit Search File/Program Build/Run Tools Window Help

Controller: MC4N ECAT (P900) v2.0255  
 Axis Status: OK  
 System: OK  
 Motion stop Drive enable Halt programs

Programs: EC\_EXTEND, Max. Axes: 32, Memory, Configuration

EC\_EXTEND

```

0  <?xml version="1.0" encoding="utf-8"?>
1  <EtherCAT>
2    <Version>1.0.0</Version>
3    <RxPdos>
4      <RxPdo>
5        <Index>0</Index>
6        <Name>RXPDO_PROFILE</Name>
7        <Entry>
8          <Name>CTRL_WORD</Name>
9          <Length>2</Length>
10         <Flags>0</Flags>
11        </Entry>
12        <Entry>
13          <Name>TARGET_POS</Name>
14          <Length>4</Length>
15          <Flags>0</Flags>
16        </Entry>
17        <Entry>

```

Channel #0

Terminal Edit

```

?ethercat($101)
-1
>>ETHERCAT (0,0)
EtherCAT State: Init (0)
EtherCAT State: Pre-Operational (0)
EtherCAT State: Safe-Operational (0)
EtherCAT State: Operational (0)
EtherCAT Configuration (0):
  SS EtherCAT v3: 0 : 1 : 1 (0:0:0)
>>base (0)
>>servo=on
>>wdog=on
>>UNITS=20000
>>SPEED=10
>>ACCEL=100
>>DECEL=100
>>MOVE (20)
>>

```