Using Pololu 3pi Robot Library with Flowcode

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TABLE OF CONTENTS

1. Overview

Flowcode™ 4 is one of the world's most advanced graphical programming languages for microcontrollers. The great advantage of Flowcode™ is that it allows those with little to no programming experience to create complex electronic systems in minutes. Flowcode™ is available in more than twenty languages and currently supports the PICmicro, AVR and ARM series of microcontrollers.

The Pololu 3pi robot is a complete, high-performance mobile platform featuring two micro metal gearmotors, five reflectance sensors, an 8×2 character LCD, a buzzer, and three user pushbuttons, all connected to a C-programmable ATmega328 microcontroller. Capable of speeds exceeding 3 feet per second, 3pi is a great first robot for ambitious beginners and a perfect second robot for those looking to move up from non-programmable or slower beginner robots.

This document explains how to program Pololu 3pi robot with Flowcode programming language.

2. Software Setup

2.1 You should have Flowcode™ for AVR Version 4. You can order one of available versions from BiPOM web:

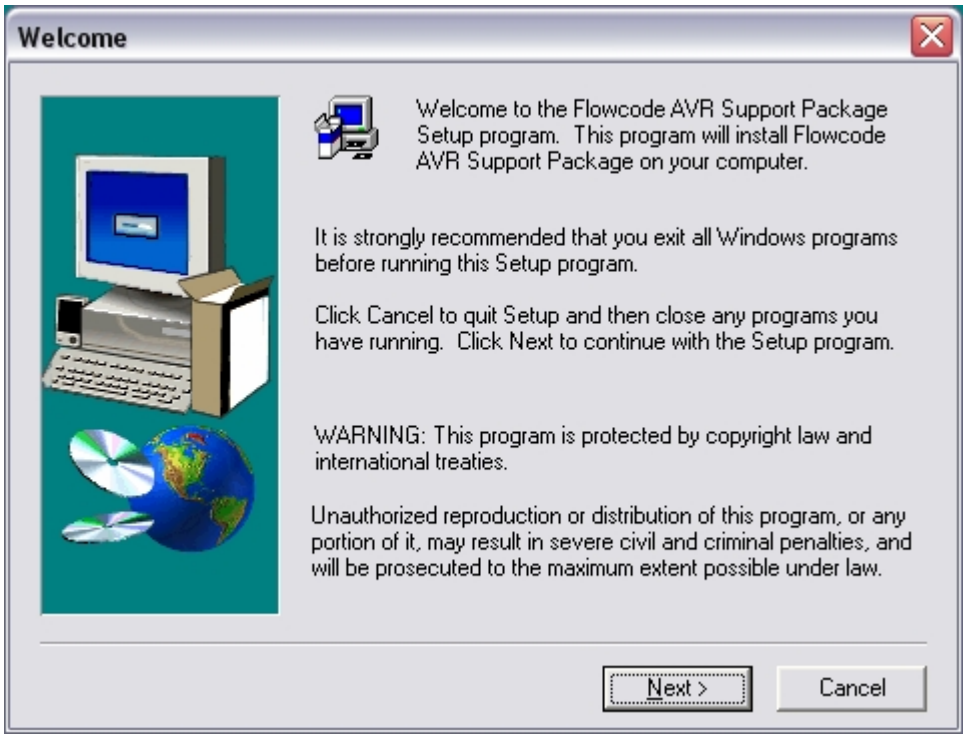
www.bipom.com/products/us/3313879.html

At first you should install Flowcode™ for AVR Version 4 on your PC.

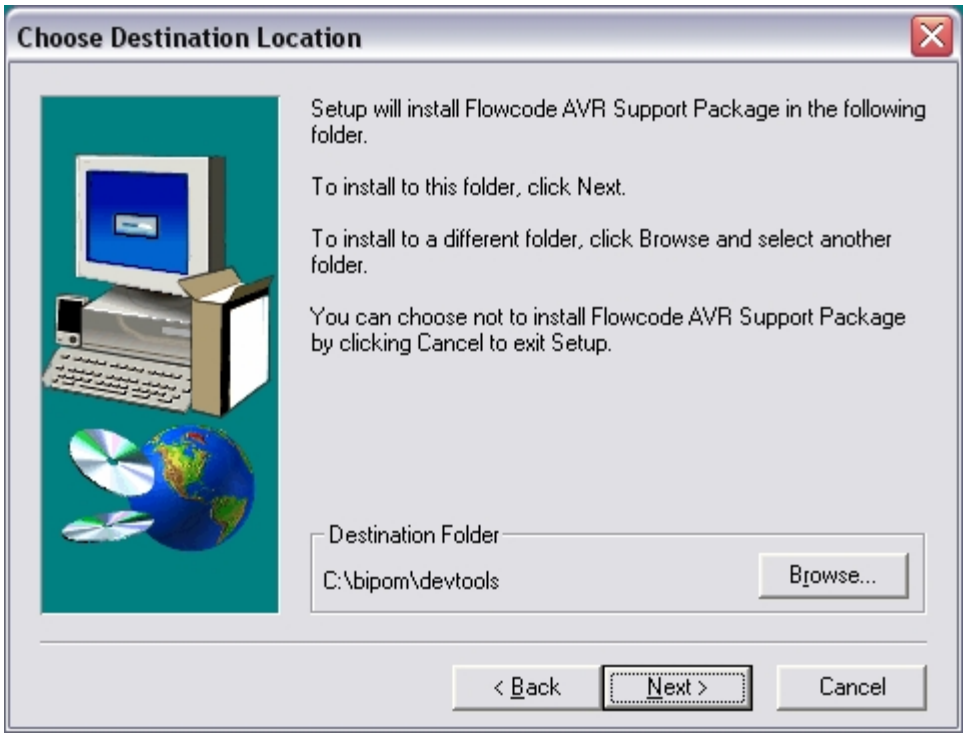
2.2 Then download Flowcode™ Support Package for AVR from BiPOM web:

www.bipom.com/web_softwares/3245104.html

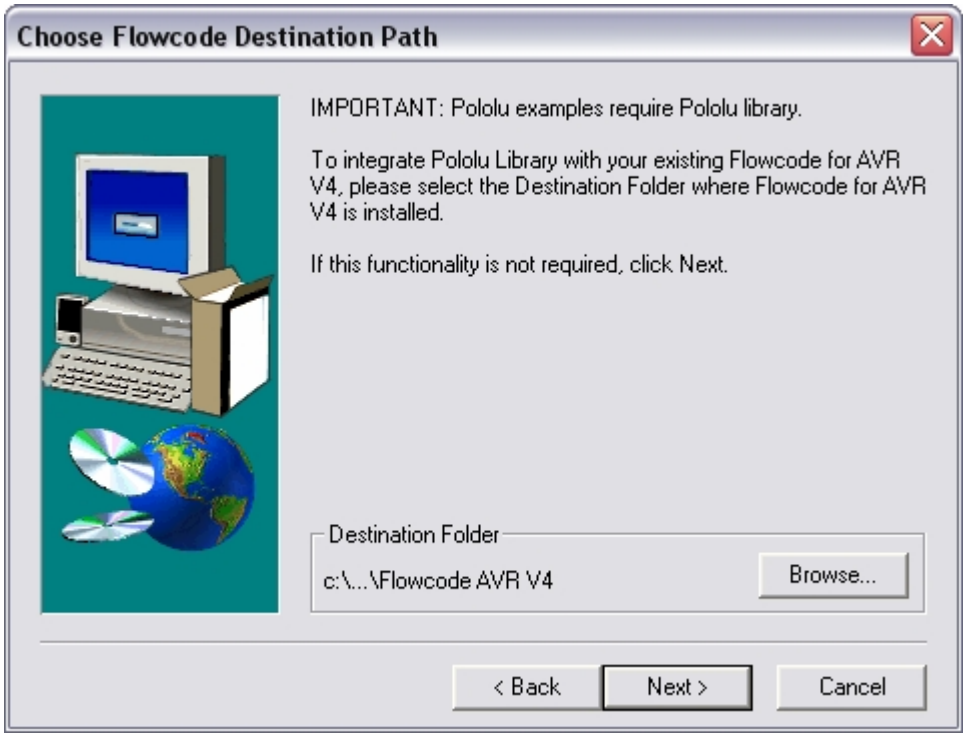
2.3 Run downloaded file



2.4 Click **Next**

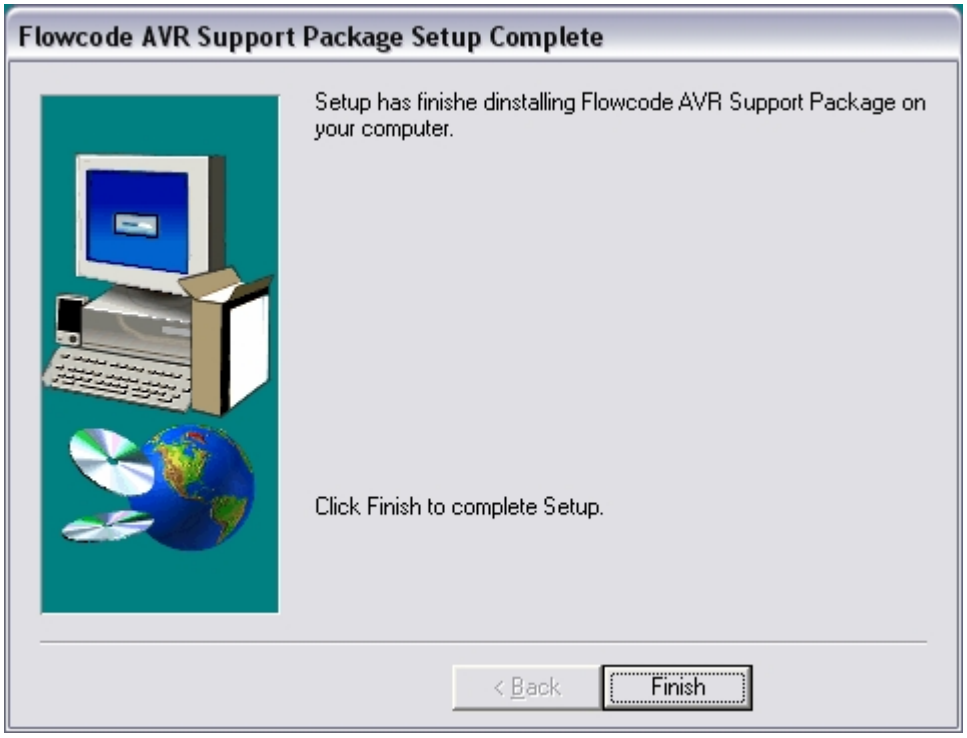


2.5 Click **Next**



2.6 On **Choose Flowcode Destination Folder** window you should enter path to folder where **Flowcode™ for AVR Version 4** is installed. If you don't have installed Flowcode for AVR product then don't change path.

Click **Next** when you browse directory.



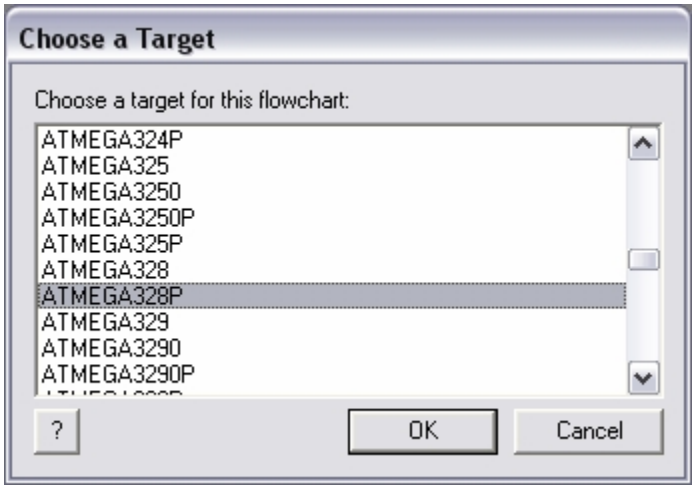
2.7 When all files will be installed click **Finish**.

3. Create new project for Pololu 3pi robot

3.1 Run Flowcode software

3.2 Click File → New (or press CTRL + N shortcut on keyboard)

3.3 Select **ATMEGA328P** target in **Choose a Target** window and click **OK**.

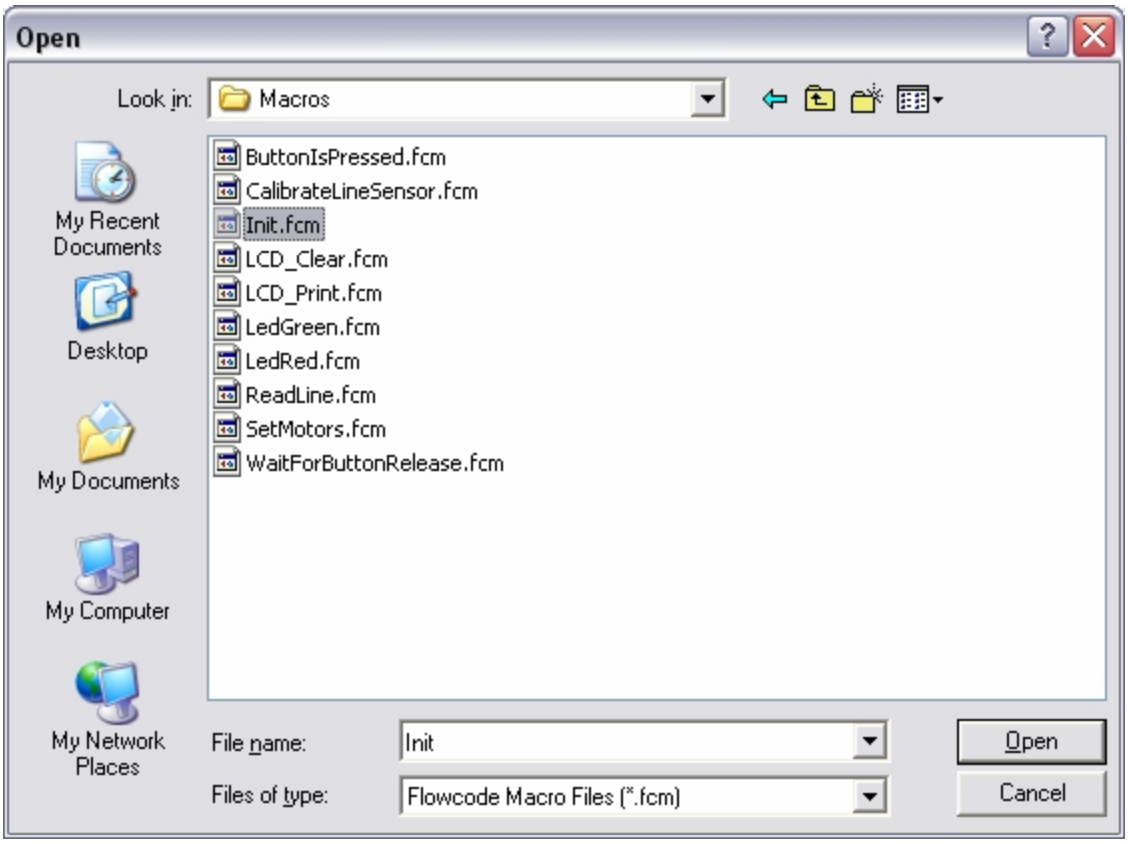


3.4 As first step with Pololu 3pi robot you should initialize board sensors. For this you should call special macro.

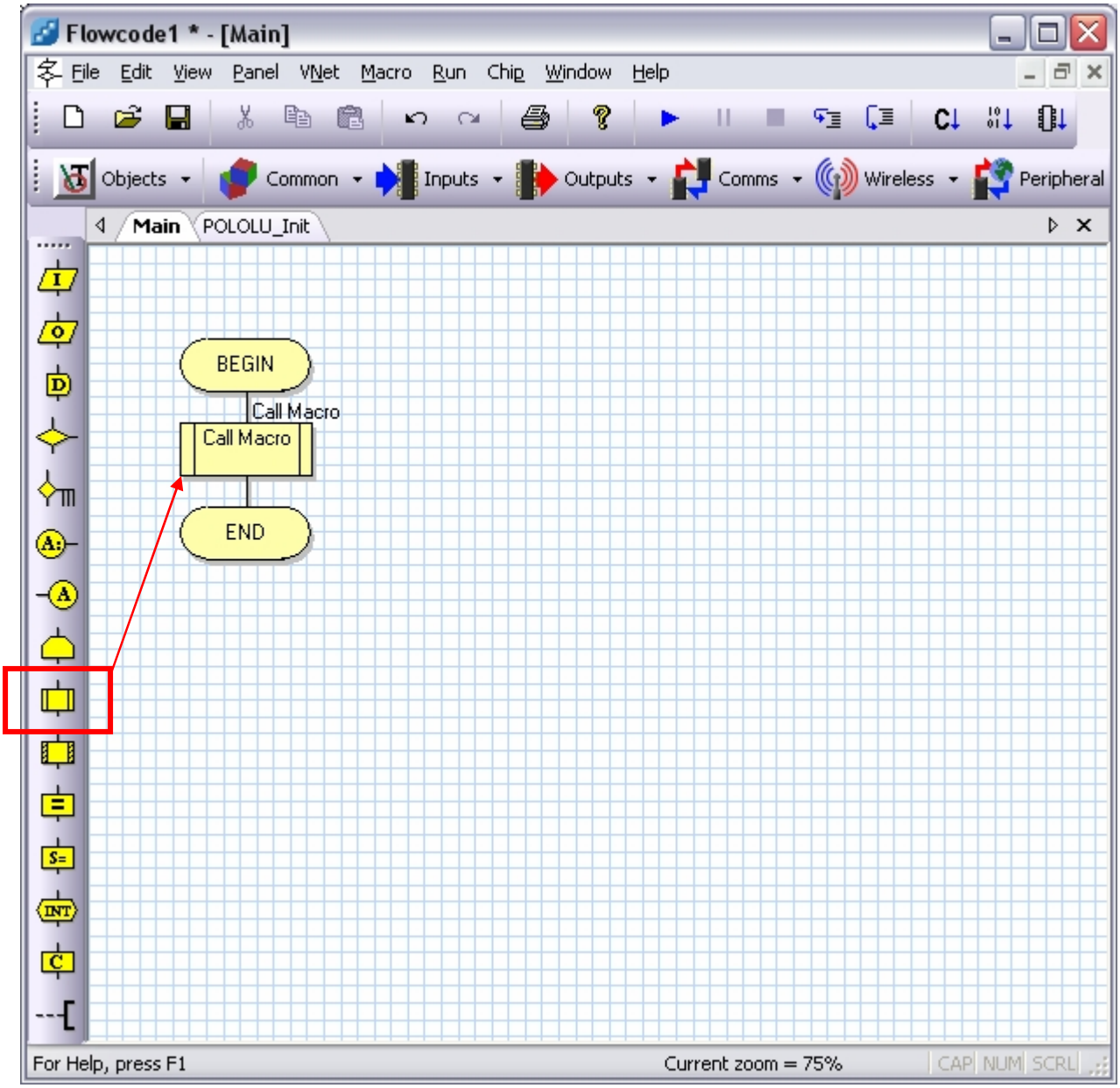
3.5 Click **Macro → Import …** In opened window go to folder

c:\bipom\devtools\Flowcode\pololu\examples\ Macros

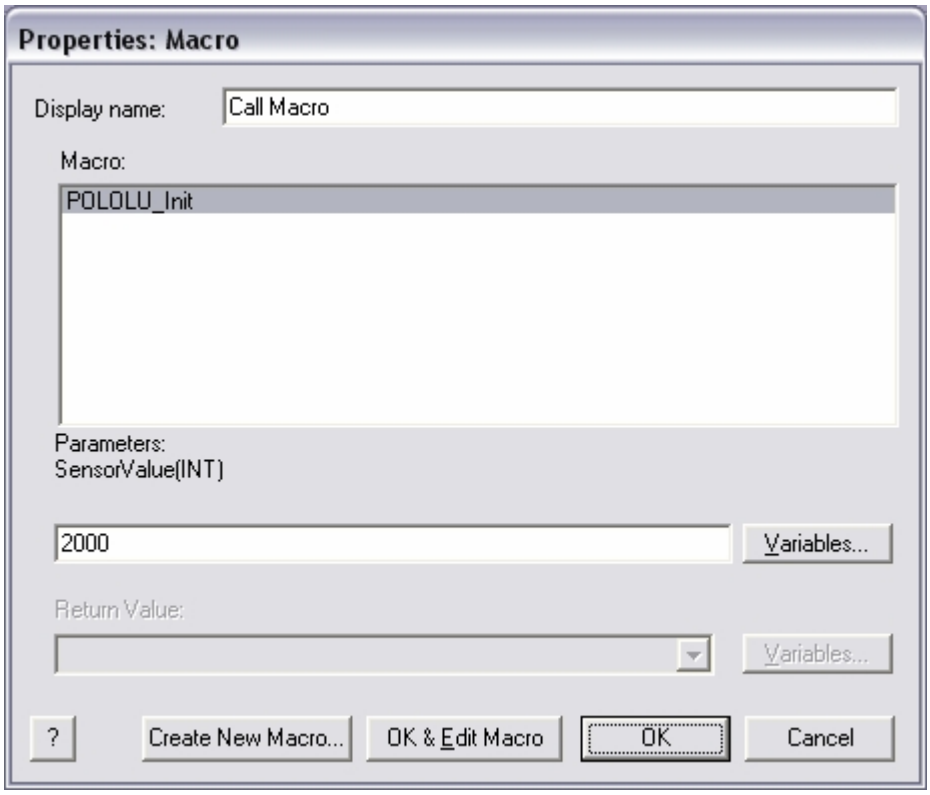
3.6 This folder contains several macros for Pololu 3pi robot. You can import this macro to your project in order to use them. For initializing board's sensors we need **`Init.fcm`** macro. Select it and click **Open**.



3.7 It will be opened in Flowcode. Now switch to Main chart and insert **Macro** block.



3.8 Now double click on new Macro block on chart. In opened window select **POLOLU_Init** macro from the list and enter value **2000** in Parameters text box. Click **OK**.

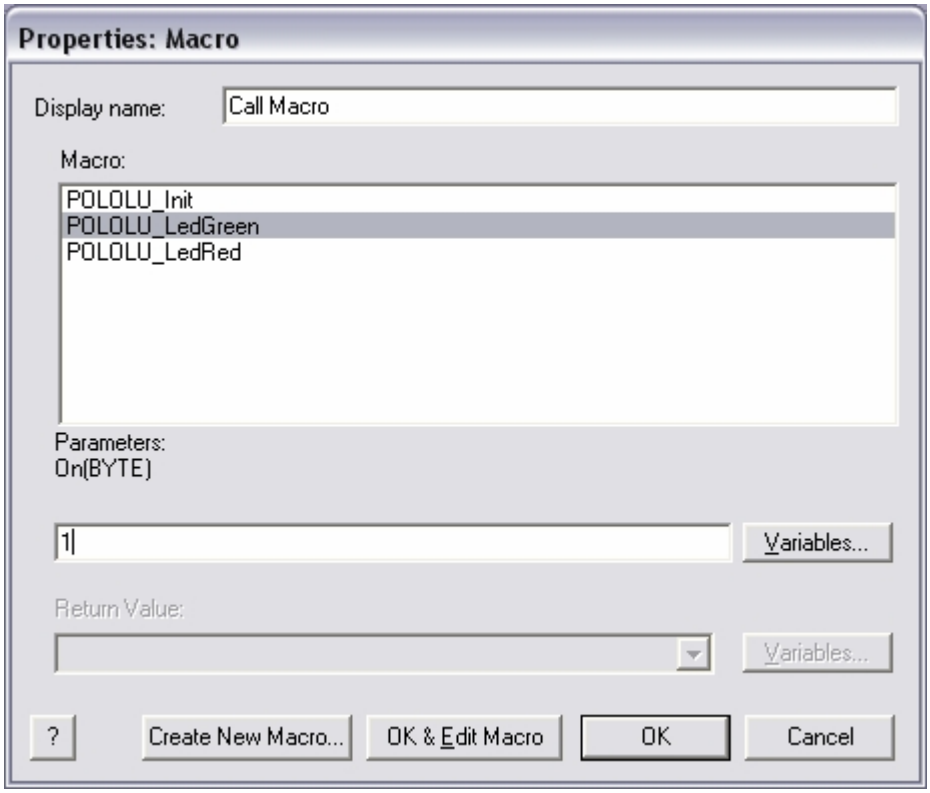


3.9 As next step we will turn on both leds (red and green) on pololu 3pi robot. For this you should also import special macros to your project.

3.10 Click **Macro → Import …** Import 2 macro: **`LedGreen.fcm`** and **`LedRed.fcm.`** Please note, you can import only one macro per time, so you should do the same operation for each macro:

- Click **Macro → Import …**
- Select required **Macro**
- Click **OK**

3.11 Switch to main chart and insert new **Macro** block. Double click on it and select **POLOLU_LedGreen** macro from the list. As parameter enter value **1**. This will turn green led on. If you set value to **0** this will turn green led off.

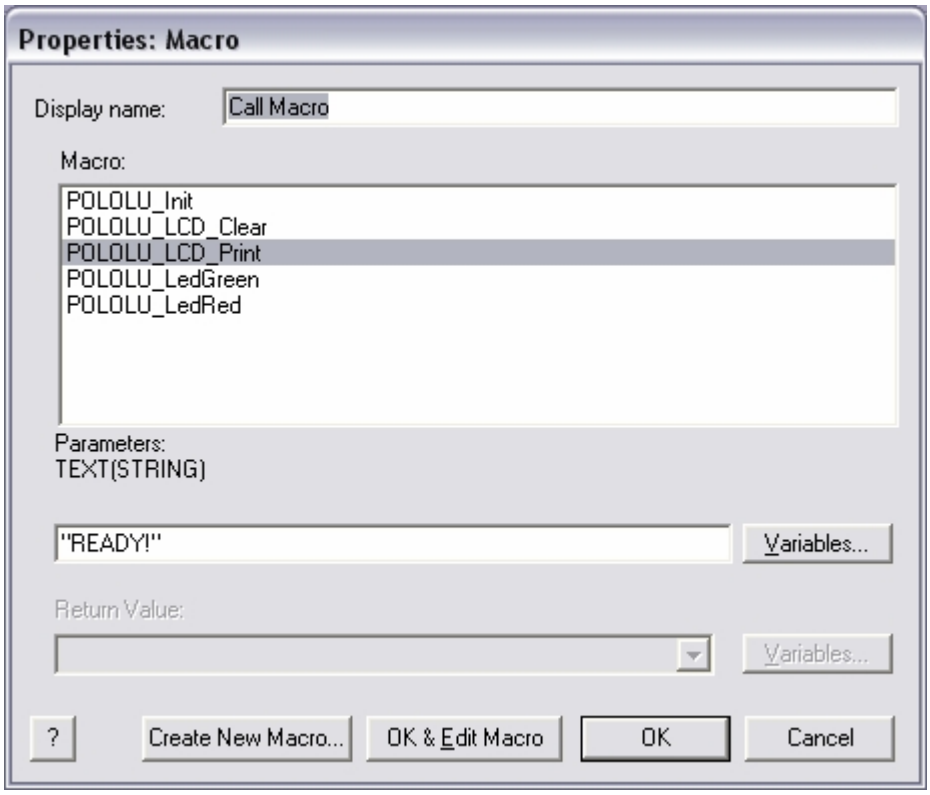


3.12 Insert new **Macro** block again. Double click on it and select **POLOLU_LedRed** macro from the list. As parameter enter value **1**. This will turn red led on. If you set value to **0** this will turn red led off.

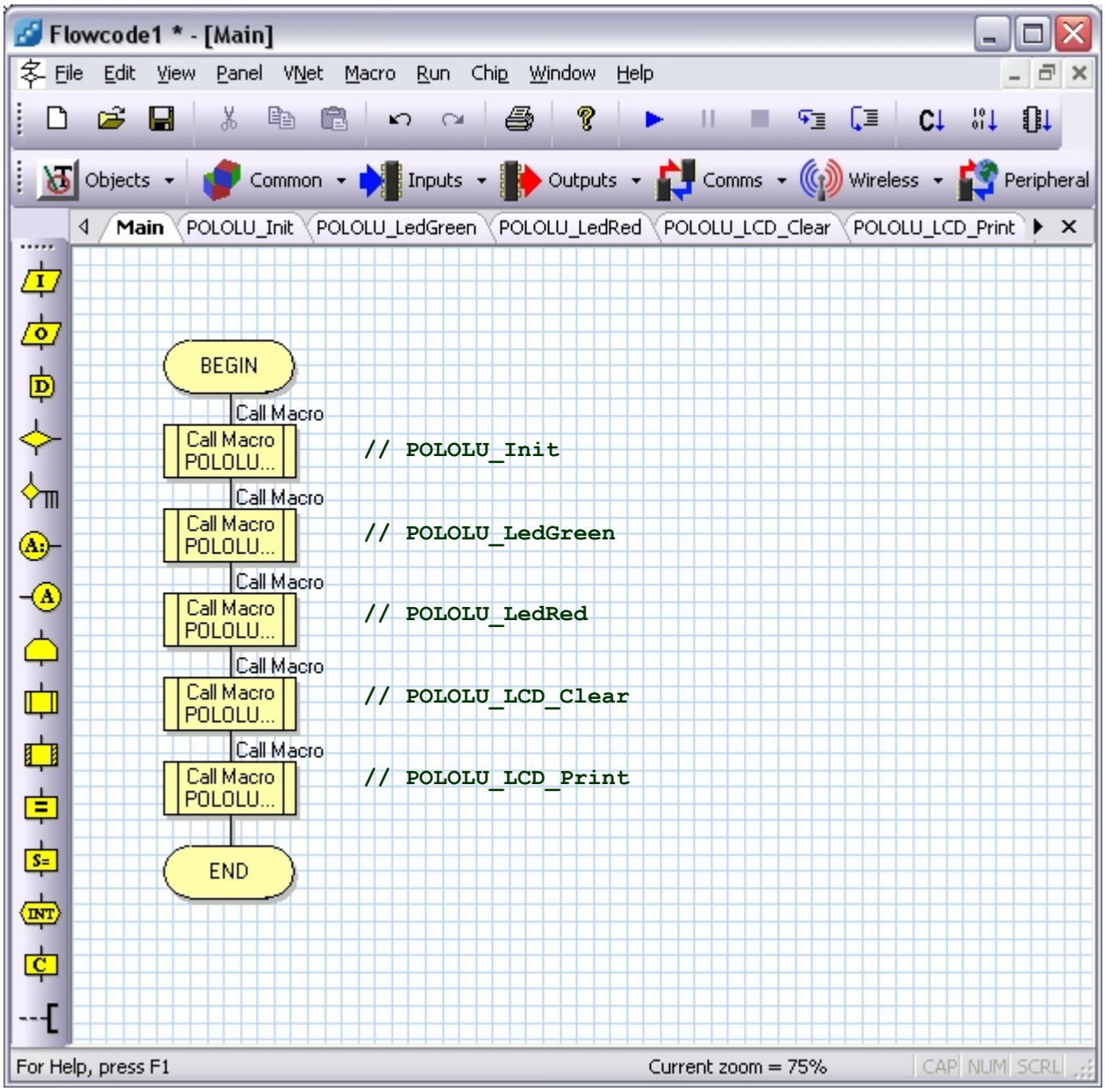
3.13 Now print "**READY!**" on LCD. To work with LCD we also need special macro. Please do the same steps as before and import **`LCD_Clear.fcm`** and **`LCD_Print.fcm`**.

3.14 Switch to main chart and insert new **Macro** block near the end of chart. Double click it. In opened window select **POLOLU_LCD_Clear** macro. This macro doesn't require any parameters, so simple click **OK**. This macro clear LCD.

3.15 Insert new **Macro** block near the end of chart again. Double click it. In opened window select **POLOLU_LCD_Print** macro. Enter string **"READY!"** in parameters text box. This macro print specified string on LCD.

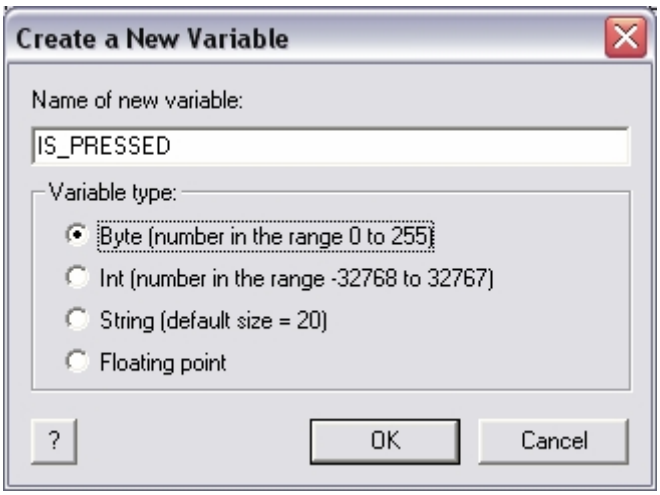


3.16 Now Main chart should looks like following (green text labels are comments and not present on the chart):

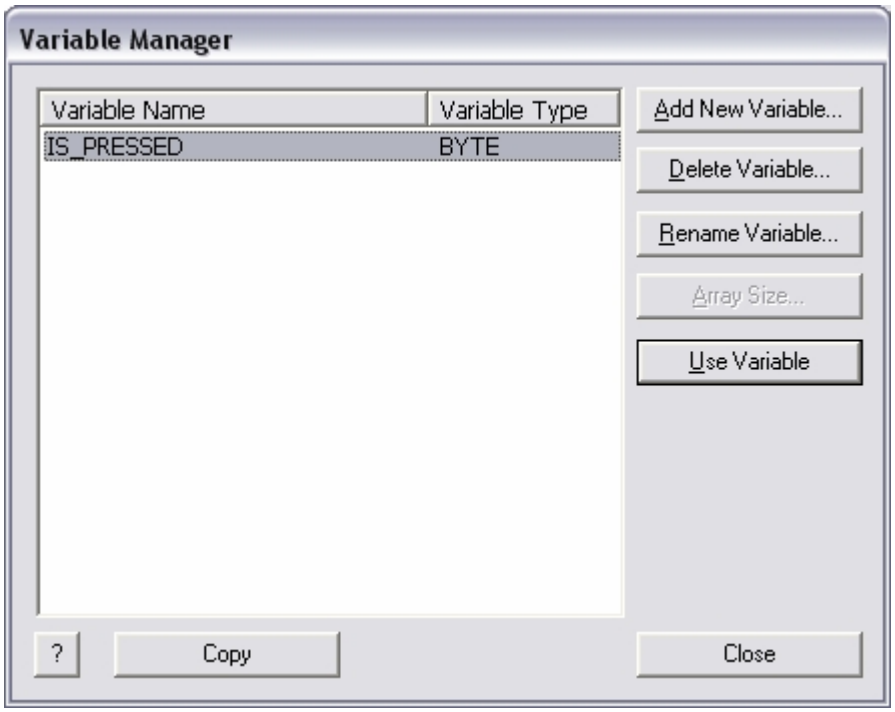


3.17 Next we will add button pressing. Please do the steps as before and import **ButtonIsPressed.fcm** and **WaitForButtonrelease.fcm**.

3.18 Switch to Main chart and add new **Calculation** block after all other blocks. Double click it. In opened window click **Variables…** button. **Variable Manager** window will be opened. Click **Add New Variable…** button. Enter **`IS_PRESSED`** as name of new variable and leave type of variable as **`Byte`**. Click **OK**.



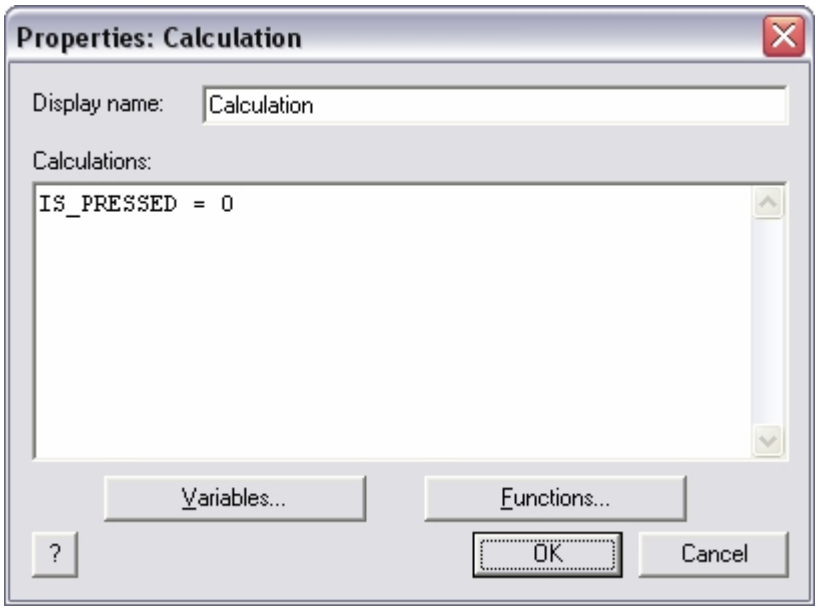
3.19 After click OK you will be returned to **Variable Manager** window. Select **IS_PRESSED** variable in the list and click **Use Variable** button.



3.20 In **Calculation Properties** window enter to **Calculations** field following text:

```
IS_PRESSED = 0
```

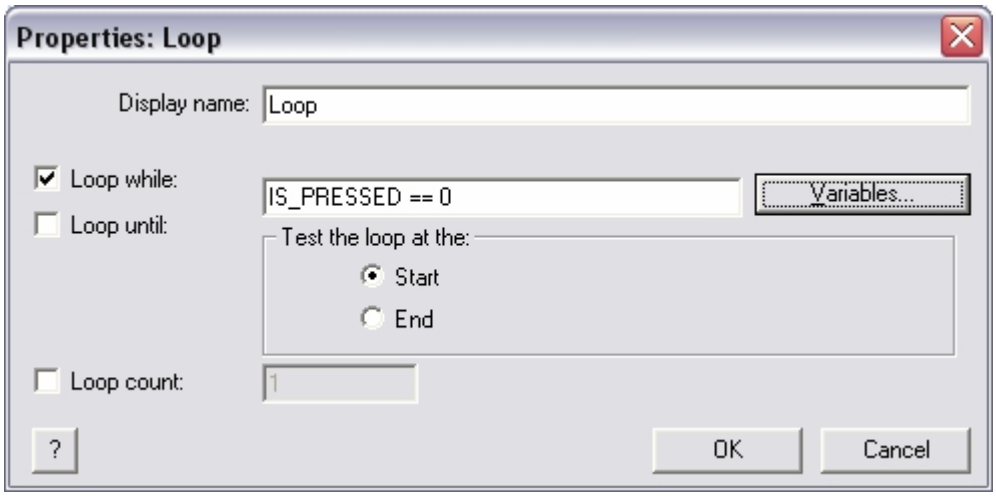
This will set initial value of variable IS_PRESSED to zero. Click **OK**.



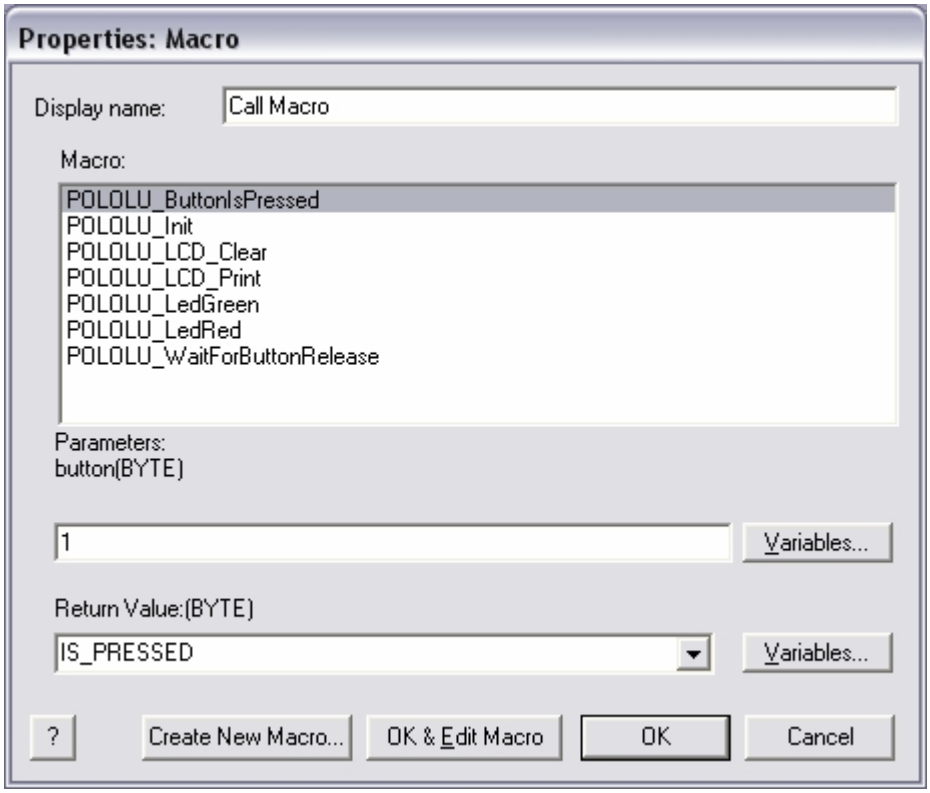
3.21 We will check if button is pressed inside this loop. So robot will wait pressing of button. We will use button **A**. Add **Loop** block to the end of chart and double click it. In opened window enter following conditions for loop:

```
IS_PRESSED == 0
```

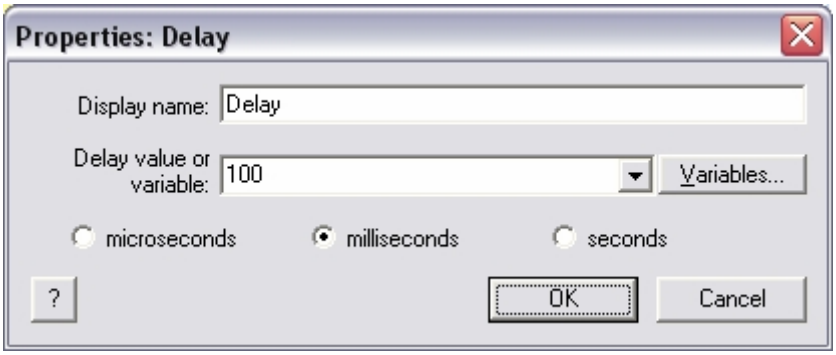
This means that program will do loop when variable **`IS_PRESSED`** equal to zero. As soon variable **`IS_PRESSED`** will be set to any other value program will go to the block next after **Loop** block.



3.22 Add new **Macro** block between **Loop** blocks. This macro block will be executed inside loop. Double click it and select **POLOLU_ButtonIsPressed** macro from the list. As input parameter set value **1** which means that we will test button **A**. As Return Value select variable **`IS_PRESSED`** from drop down list. Click **OK**.

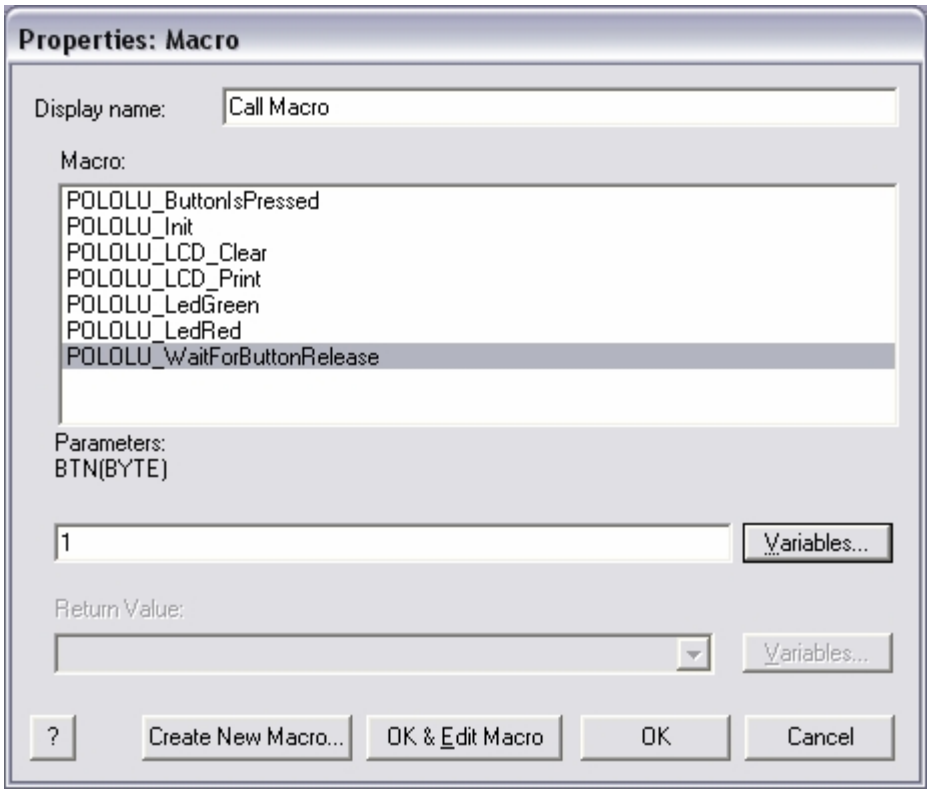


3.23 Now add **Delay** block after new **Macro** inside **Loop** blocks. Double click it and set value of delay 100ms. Click **OK**.

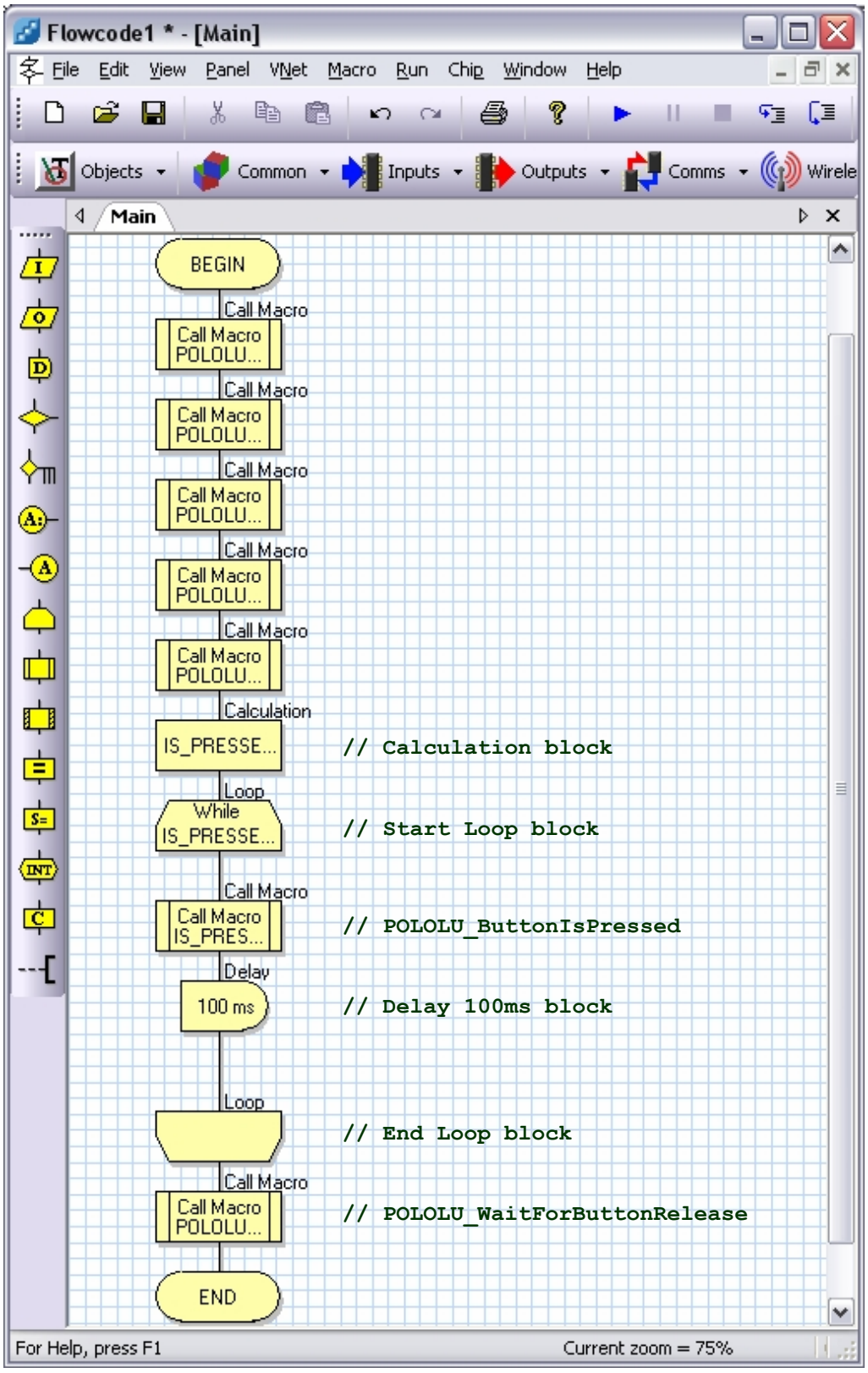


3.23 So when program started it will initialize robot sensor, turn leds on, show greeting message and will wait when button A will be pressed. As next step we will add code to run motors. But it is better to run motors when button is released, so robot will not start moving when finger still on the button. To do this you should add call of **POLOLU_WaitForButtonRelease** macro after **Loop** blocks.

3.24 Add new **Macro** block after **Loop** blocks and double click it. In opened window select **POLOLU_WaitForButtonRelease** macro and enter value 1 as input parameter. This means that macro will wait when button A will be released. Click OK.



3.25 Main chart should looks like following (green text labels are comments and not present on the chart):

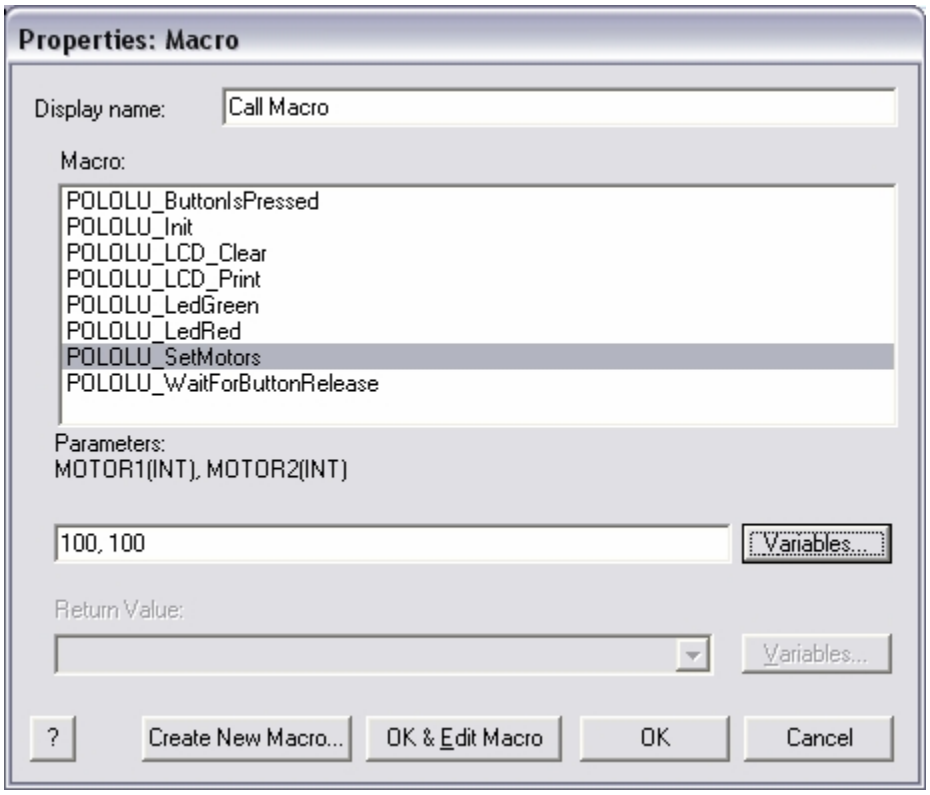


3.26 Now we will run motors on the robot so it will move forward. We need special macro for this. Please do the same steps as before and import **`SetMotors.fcm`** macro.

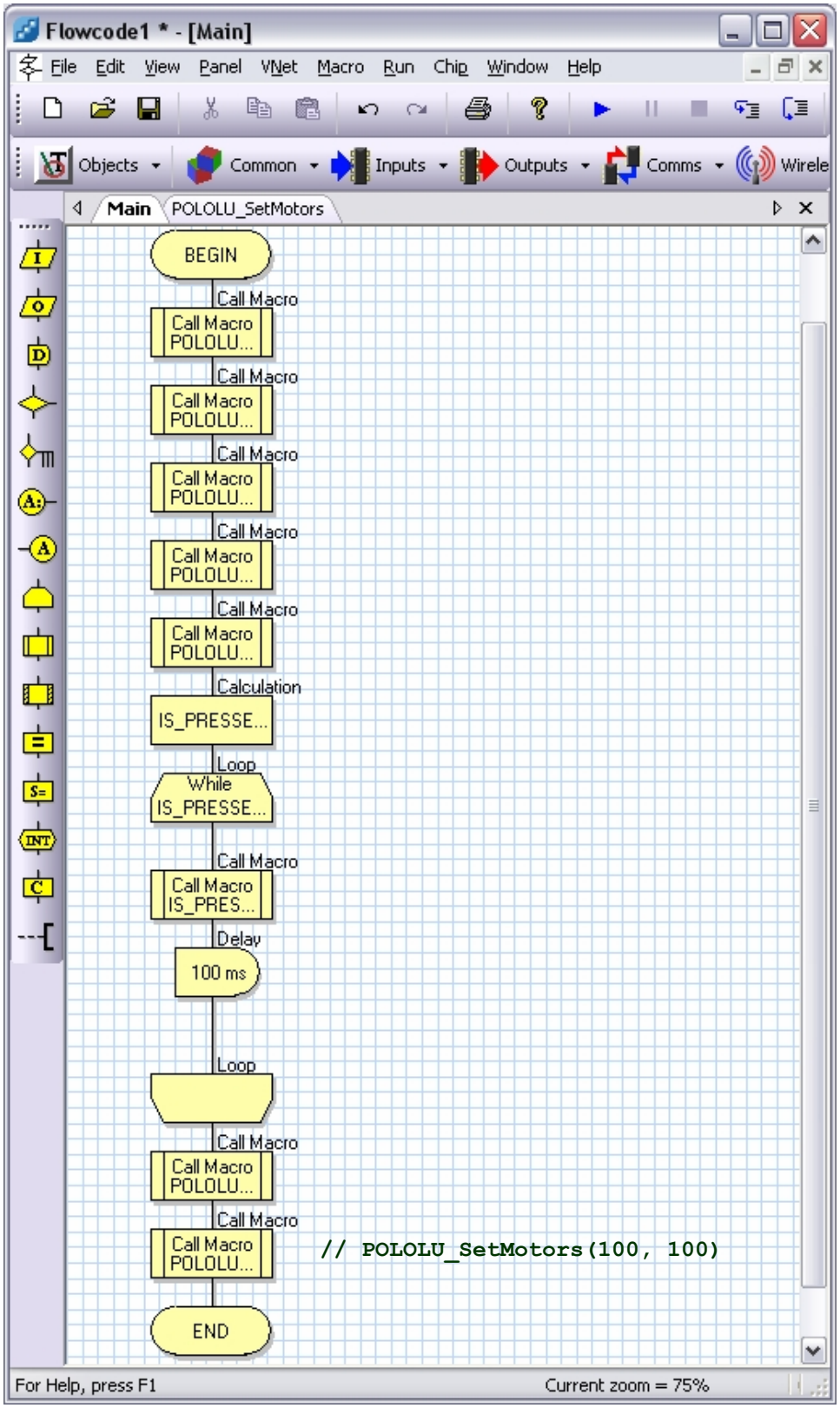
3.27 Add new **Macro** block at the end of chart and double click it. In opened window select **POLOLU_SetMotors** macro. Enter "**`100, 100`**" as input parameters. This will set motors speed to 100. This is middle peed of forward direction. The range of available values are from -255 to 255.

-255 – maximum speed backward.
+255 – maximum speed forward.
0 – full brake.

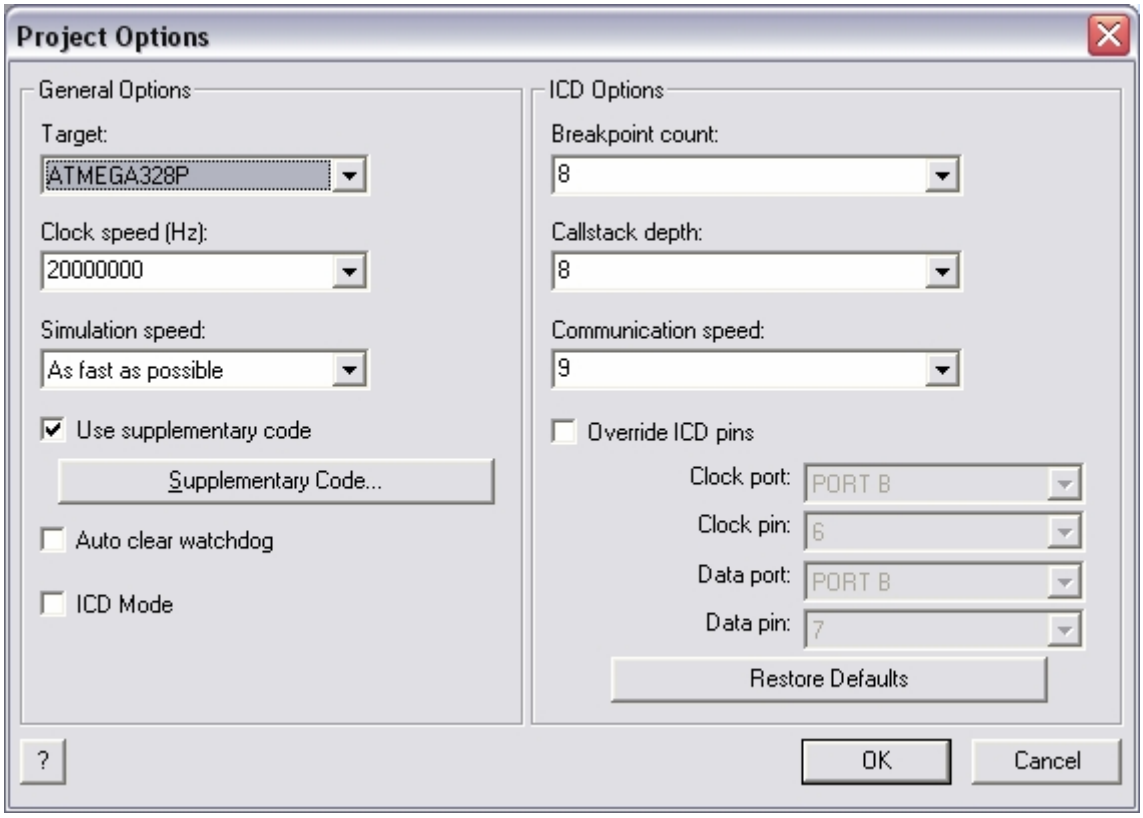
First parameter set speed of left motor and second parameter set speed of right motor.



3.28 Click OK. This is last block in program chart. The chart should look like following:

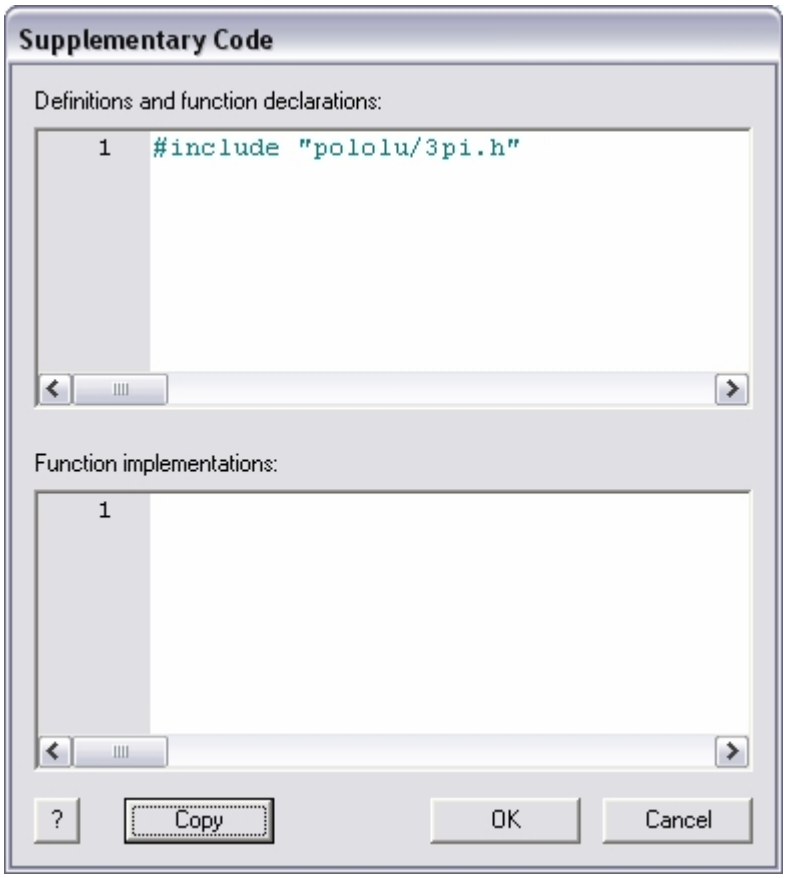


3.29 In order to build this project you also should include library file with declarations for Pololu 3pi robot. Click **View → Project Options…** . In opened window check **Use supplementary code** checkbox and click **Supplementary Code...** button.



In opened window enter following text to **Definitions and function declarations** text box:

```
#include "pololu/3pi.h"
```



Click **OK**. You will be returned to **Project Options** window. Click **OK** again.

3.30 Save chart (**File → Save** or **Ctrl + S** shortcut on keyboard). Call this project **MoveRobot** and save somewhere on your hard disk.

3.31 Build project (**Chip → Compile to HEX**). If you all done correctly then you should be able to build this project.