

## DGS2 – Programming Guide

### DESCRIPTION

The DGS2 ships from SPEC Sensors pre-loaded with firmware and pre-configured for the attached sensor. The firmware initializes and maintains the gas sensor circuit operation, measures the gas sensor signal, measures the temperature sensor, implements temperature compensation algorithms, manages UART communication, and manages low-power operation. Many sensor parameters, such as the gas sensor type, calibration, and control circuit operation may be changed via a library of user commands and/or the SPEC Sensors DGS2 Setup Tool (GUI), the firmware also allows.

Users and developers with an open-source license agreement from SPEC Sensors may modify the firmware and re-flash the DGS2 module. Be advised that many available settings and operation modes are not compatible with all gas sensors. Applying incompatible settings to a sensor may cause temporary or permanent damage. Default module settings for each sensor type are described in the *DGS2 970-Series Datasheet*.



#### 1. Required SPEC Sensors Hardware

- DGS2 Rev C1.2 Module with Sensor

#### 2. Required SPEC Sensors Firmware

From the *Open-Source Files* link on the *Documents* page of the [spec-sensors.com](https://spec-sensors.com) website:

- Pre-compiled DGS2 firmware hex file
- Open-source firmware file

#### 3. Required 3<sup>rd</sup>-Party Hardware

- Microchip PICkit 3 or PICkit 4 USB Programmer
- 6-pin, 0.1" pitch header

#### 4. Required 3<sup>rd</sup>-Party Software

The pre-compiled DGS2 firmware hex file may be flashed on the DGS2 with free tools from Microchip. To modify and re-compile the open-source firmware, access to the paid compiler is necessary. The software below is available in the Microchip MPLAB Ecosystem Downloads Archive: <https://www.microchip.com/en-us/tools-resources/archives/mplab-ecosystem>

- Flash the pre-compiled DGS2 firmware hex file
  - MPLAB X v5.50
- Modify, re-compile, and flash the open source DGS2 firmware
  - MPLAB XC16 Compiler v1.35

#### 5. Instructions to flash the pre-compiled DGS2 firmware hex file

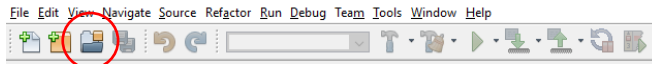
- Download and install MPLAB X v5.50. Open MPLAB X IDE
- Select *Device: PIC24F16KM202* and press *Apply*
- From the menu bar, select *Settings > Advanced Mode*
  - Log on with *Password: microchip*
- Select *Power* tab, check the box: *Power target circuit from PICkit*. Ensure *Voltage Level* is 3.25
- Select *Operate* tab. With PICkit connected to the PC, select it from *Tool* and press *Connect*
- Adjacent to *Hex File*, *Browse* to the location of the pre-compiled DGS2 firmware hex file downloaded from the SPEC Sensors website.
- Connect the PICkit programmer to the DGS2 as shown here and select *Program*.



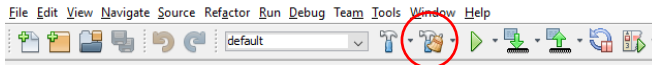
Programming the DGS2: Insert the pin header into the programming holes, matching the black and white arrows on the programmer and DGS2.

## 6. Instructions re-compile and flash the open source DGS2 firmware

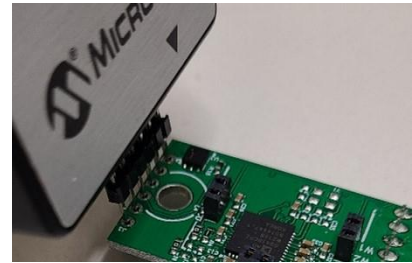
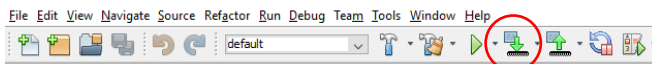
- Download and install MPLAB X v5.50. Open MPLAB X IDE
- Select the *Open Project* button. Locate, select, and open the DGS2 open-source firmware file downloaded from the SPEC Sensors website.



- Compile the project by clicking the *Clean and Build Project* button.



- From the menu bar, select *Production > Project Configuration > Customize...*
  - In the left pane, navigate to *Conf: [Config\_F] > PICKit4*
  - Check the box to *Power target circuit from PICKit4*
- Connect the PICKit programmer to the DGS2 as shown and select the *Make and Program Device* button.



Programming the DGS2: Insert the pin header into the programming holes, matching the black and white arrows on the programmer and DGS2.