PCD1/2/3-Analogue_Signals-With_Fupla

Contents

1. Summary

1.1 Functional description

This example project is intended to show how the standard FBox library or the HeaVAC library can be used to read or write analogue input and output signals.

The project is designed for a PCD3.M5540 controller. All the programs can also be used for a PCD1 or PCD2. The hardware for the analogue input / output modules is treated in exactly the same way.

The following individual modules are covered:

- W10x: PCD2/3.W100, W105
- W2x0: PCD2/3.W200, W210
- W3x0: PCD2/3.W300, PCD2/3.W310, PCD2/3.W340
- W3x5: PCD2/3.W305, PCD2/3.W315, PCD2/3.W325
- W4x0: PCD2/3.W400, PCD2/3.W401
- W5x0: PCD2/3.W500, PCD2/3.W510
- W6x0: PCD2/3.W600, PCD2/3.W610
- W6x5: PCD2/3.W605, PCD2/3.W615, PCD2/3.W625
- W745: PCD2/3.W745

In order to keep the programs compact, only one value will be read or written in each case.

1.2 Possible application

The applications described in this example are basic applications, which can be used in any project with analogue input or output signals.
Any recalculation required can be simply modified for the units required for a given application. Depending on the module type, this may involve changing constants (symbols) or settings in the FBox.

The Fupla programs for the PCD3.W200 and W400 can be used for the PCD3 Demo modell (equipped with a PCD3.S100) without any modifications.

1.3 Hardware and software used

Hardware:
PCD3.M5540 (PCD1.Mxxx or PCD2.Mxxxx or PCD3.Mxxxx also possible)
One of the analogue I/O modules listed above, depending on the requirement
PCD8.K111 programming cable or USB cable (for PCD3 or PCD2.M480)
Where input modules are used, a signal transmitter is required (exception: if the PCD3.S100 is used, the W200 is already wired internally).

Minimum software versions:
SAIA PG5 1.3.110
No additional libraries are required.

2. Structure

2.1 Preparing the PCD

The various programs are written in such a way that the module in the first socket is used in each case. If this is not the case, the base address needs to be modified in the Fupla symbol editor.

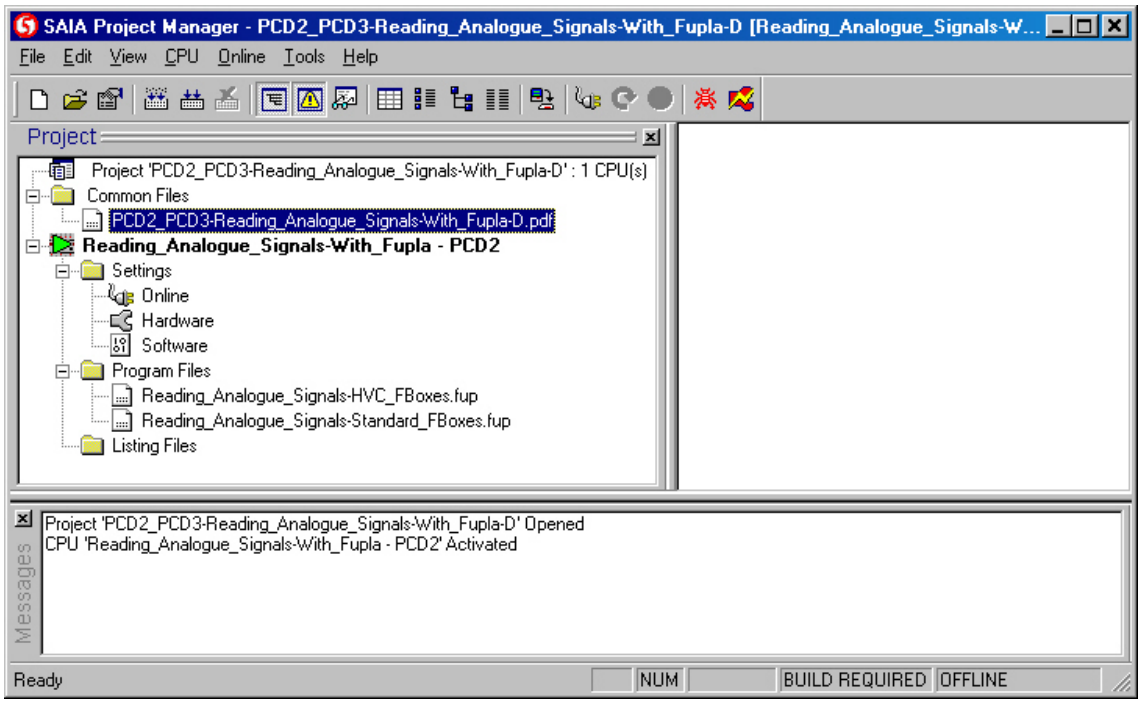
The modules are wired as per manual 26/737 “PCD2 hardware” (or 26/789 “PCD3”).

Analogue input modules are especially sensitive to earth loops. Please be sure to follow the wiring instructions.

2.1.1 Installation of the project

To install the project in your PG5 project directory, you can use the “Restore...” function from the “File” menu in the PG5 Project Manager. This function will copy the project into your project directory.

This document can be found in the “Documentation Files” folder in the project tree, where it can be opened directly by double-clicking on it.



2.1.2 Modification of hardware and software settings in PG5

The first step is to launch PG5 Project Manager (PG5 SPM).
The following procedure should then be followed:

- Connect the PCD to the PC with a PGU programming cable (PCD8.K111) or USB cable, and switch on.
- Open the “Hardware settings” screen (in the Settings folder in the project tree in the Project Manager).
- Select “Upload” to load the hardware configuration for the PCD onto the PC. Then save by clicking “OK”.
- Open the “Software settings” screen (in the Settings folder in the project tree in the Project Manager).
- Set the dynamic range for the resources by clicking on “Set Default”, and confirm by clicking “OK”.
- Link the Fupla file to be used
  Right-click on the desired Fupla program in the “Project Tree” and select “Linked”.
- Where several programs belonging to the project are used, the base address for the relevant program files needs to be modified in the Fupla Editor.

2.1.3 Building and loading the project into the PCD

The project can now be loaded into the controller following a “Rebuild All” (“CPU” menu, “Rebuild All...” option, or Alt+F2). If the controller is already in a “Run” state, the system will ask whether the controller can be stopped. This will be the case during testing. The message is displayed for safety reasons, as it may not be permissible to stop the controller while in use on an existing installation.

2.1.4 Adjusting the project for the PCD3 demo model

Since the PCD3 demo model doesn’t feature all the modules described in this example project, the according module base addresses are to be adjusted.
The base address is depending on the slot in which the concerned module is plugged in. Enter base address 0 for a module plugged in the first slot, 16 for a module plugged in the second slot etc.

The addresses for the PCD3.W200 (BA 32) and PCD3.W400 (BA 48) are adjusted for the PCD3 demo model (equipped with a PCD3.S100). Therefore the Fupla codes for those modules may me used directly without any modification.

2.2 Viewing the program online

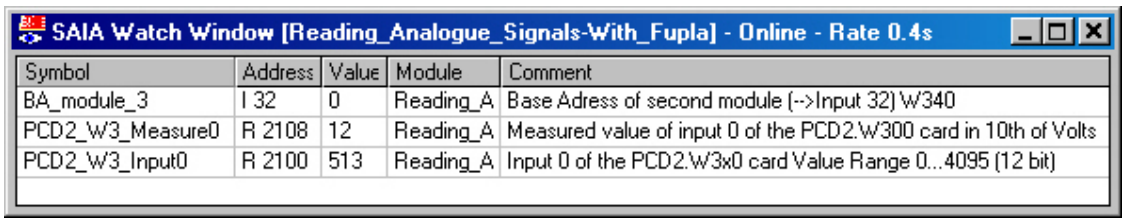
Once the program is loaded into the controller, an online connection can be established to the controller, in order to view the program. Clicking on the "Online" button (with the plug) connects the PC to the PCD. If the PCD is not yet in a Run state, it can be started with the green arrow on the toolbar.

To view the program in the Fupla Editor, it must first be opened. Double-clicking on the Fupla program (*.fup) in the “Program Files” folder in the PG5 SPM project tree opens it automatically.
(An online connection can also be established from within the Fupla Editor, and the program can be activated or stopped.)

By setting “Tests”, the current values of inputs and outputs can be viewed. The tests are set by clicking on the connection lines on the Fupla page.

2.2.1 The SAIA Watch Window

To display and change the values from media on a screen, the Watch Window can be used. This can be opened from the “View” menu in the PG5 Project Manager. The symbols to be displayed can be dragged and dropped into the window.
As soon as PG5 is online, the relevant values will be displayed.



Symbol	Address	Value	Module	Comment
BA_module_3	I 32	0	Reading_A	Base Adress of second module (-->Input 32) W340
PCD2_W3_Measure0	R 2108	12	Reading_A	Measured value of input 0 of the PCD2.W300 card in 10th of Volts
PCD2_W3_Input0	R 2100	513	Reading_A	Input 0 of the PCD2.W3x0 card Value Range 0...4095 (12 bit)

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3. Functional description and settings

3.1 Programming with the standard FBoxes

3.1.1 Reading from a PCD2/3.Wxxx input module

FBoxes are provided for reading analogue values from a PCD2/3.Wxxx module. The standard FBoxes read the digital value (DV) from the relevant input and output it on the right-hand side of the FBox.

The only setting required is to define the base address of the attached module. It is advisable to define a symbol with a unique name, to avoid possible confusion. The base address defined in this way in the Symbol Editor can be dragged and dropped into the field on the corresponding FBox.

The media type and the address for this symbol must match the first input/output for this card.

The intelligent analogue modules are an exception to this. These are modules with codes:

- W340
- W3x5
- W745

The FBoxes for these modules provide a facility to enter the user unit directly. The necessary settings for this have to be entered in the FBox. Double-clicking on the FBox opens the “Adjust” window provided for this purpose.

3.1.2 Converting the DV (digital value) into real values

As the output value from the standard FBoxes for the analogue modules is always the digital value, this then needs to be converted into the units required by the programmer. This is done according to the general formula:

$$\text{Measured value} = \frac{\text{Digital value} * \text{Maximum measured value}}{\text{Resolution of module}}$$

In the example, this conversion is programmed for the first two inputs in each case.

3.1.3 Reading values from a PCD2/3.W340 input card

The FBox for the PCD2/3.W340 is an exception to this. With this FBox, the target unit can be set in the FBox and so calculated directly by the FBox itself. The output value matches the selected units for the corresponding input.

The target unit is set in the “Adjust” window. This is opened by double-clicking on the FBox.

3.1.4 Page 4: Output of analogue values

Special FBoxes are also provided for the output of analogue values. Like the analogue input cards, the standard output cards also work with the digital value (DV). Therefore, before outputting the value, it must first be converted from the units used into the DV for the card.

This is done according to the general formula:

$$Digitalvalue = \frac{\text{Output value} * \text{Resolution of module}}{\text{Maximum output value}}$$

In the example, this conversion is programmed for the first two outputs.

The only setting required on the FBox is to define the base address for the attached module. It is advisable to define a symbol with a unique name, to avoid possible confusion. The base address defined in this way in the Symbol Editor can be dragged and dropped into the field on the corresponding FBox.

The intelligent analogue modules are an exception to this. These are modules with codes:

- W6x5

The FBoxes for these modules provide a facility to output the user unit directly. The necessary settings for this have to be entered in the FBox. Double-clicking on the FBox opens the “Adjust” window provided for this purpose.

4. Errors and debugging

To help to isolate and fix faults quickly, this section describes a number of frequently occurring errors.

4.1 Common errors

Here is a list of frequent causes of malfunction in the example described:

Error	Cause and resolution of error
The value read in from an input module is not in the desired units.	Ensure that the FBox is outputting the digital value of the signal. If so, calculate the desired measurement value as per section 3.1.1.
The analogue output value is always =0 or maximum amplitude	May be caused by incorrect wiring of the module. Please check the wiring against the hardware manual for your PCD.
The analogue input value is always =0	
"Warning 6: The use of any Heavac Fbox needs the Heavac-Init Fbox to be placed at the top of the file" is output at Build time.	No HeaVAC Init FBox has been placed, or an FBox from the HeaVAC family appears before the initialisation FBox in Fupla.
The value read from one or more analogue inputs jumps periodically and is not constant	This phenomenon could be caused by an "earth loop" in the system. Please check the earthing of your system. The earth to the "-" side of the module must have a short and massive connection to the "-" terminal on the PCD (no looping of the earth wire around the PCD!)

4.2 Troubleshooting / debugging

When troubleshooting, it is advisable to start with an underlying function and test further functions one by one. It makes sense to start e.g. by writing a small test program to read input values.
To be sure that there is a signal at the input, the input signal should be verified with a multimeter on commissioning.

The values in the PCD can be verified by means of the Watch Window or by sampling.

4.3 Sources

The information on the FBox options contained in this document can be found in the PG5 online help.

Further information on general Fupla programming can be found in the PG5 User Manual (on the Windows Start menu, under Programs/SAIA Burgess/PG5/Documentation).

Hardware-specific details such as terminal assignments and wiring diagrams can be found in the hardware manual for the relevant controller.