
# Program Block Editor and Compiler (PBEC)

## For *Hercules*

**User Manual Version 1.7.5**


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## IMPORTANT NOTICE

**When using this manual, please remember the following:**

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# 1. Introduction

The Hercules Program Bock Compiler and Editor (PBEC) is a Windows™-based application which allows a user to create a Hercules program block that is composed of ANSI C code.

The *Program Block Editor and Compiler* provides an interface for you to enter code (see *section 2.2*), save it in a compiler-accessible PSF file (see *section 2.3*), and then compile it (see *section 2.4*).

To use the *Program Blocks* feature in the Hercules Application, select the *Configuration* menu, followed by the **Program Blocks** command to display the *Program Blocks* dialog.

> **NOTE:** Examples of program blocks are available at the Dearborn Group Technical Support website at http://www.dgtech.com.

The main screen for the *Program Block Editor* and *Compiler* allows you to select from four options: *File, Compile, Language* and *Help.*

## *1.1 File menu*

The *File* menu allows you the options of creating a new Program Source File (PSF), opening a previously saved PSF, saving changes to an existing PSF, or saving a PSF under a new file name (see *section 2.3)*.

## *1.2 Compile menu*

Once you have saved your program code in a PSF file, this menu allows you to compile it by selecting **Build Exe** (see *section 2.4*).

## *1.3 Language menu*

You may select one of two language formats for the *Program Block Editor and Compiler* applications screen display: **English** or **German**. Make your selection by selecting (✓) the appropriate language on this menu.

## *1.4 Help menu*

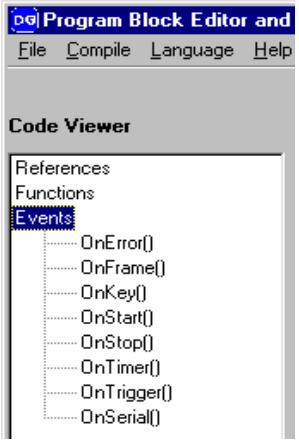
The following three options are available on this menu:

| | |
|---|---|
| **`Open F1`** | displays the *Table of Contents* dialog for a series of available help pages: also contains *Program Block Editor and Compiler* user tips and special instructions. |
| **`Hot Keys`** | displays an information dialog that contains a list of the *Hot Keys* used in the *Program Block Editor and Compiler* application. The function (**F**) keys listed are valid anywhere in the application. However, the control (**CTRL**) keys are only active in *Global References*, *Function Code*, and *Event Code* boxes. |
| **`About`** | displays a window identifying the version number of the software installed. |

# 2. Program Blocks

With the PBEC you can develop and *compile* custom event handler applications that can be uploaded to the hardware. Once uploaded, these applications can be accessed by the Hercules communication interface, via the *Program Blocks* option on the Hercules software's *Configuration* menu (see *section 4.8* of the Hercules User Manual).

A Hercules program block is composed of ANSI C code and is executed in response to the specific events shown below (described in *section 2.2.3*).




**OnError** (uchar channel, uchar error_type)

**OnFrame** (DataFrame *frame, uchar channel)

**OnKey** (char character)

**OnStart** (long time)

**OnStop** (long time)

**OnTimer** (uint timerid)

**OnTrigger** (long time)

**OnSerial** (const void * data, unsigned short datacount)

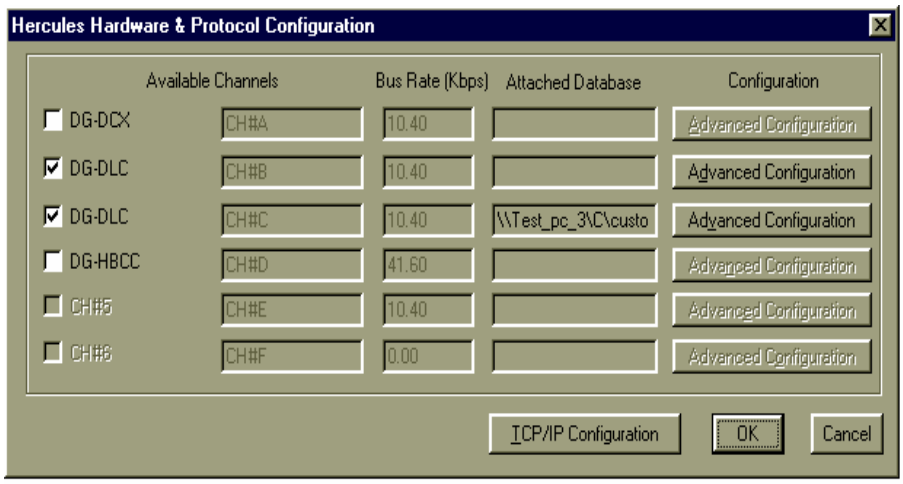
### Hercules/Program Block channel mismatch

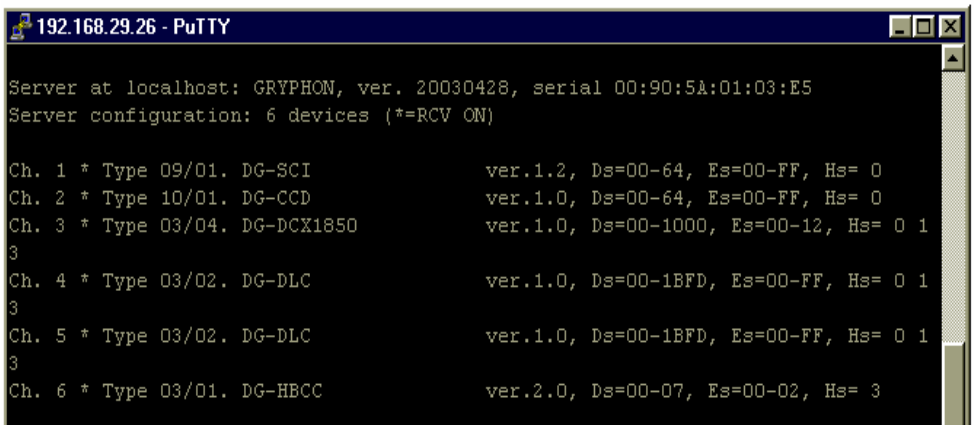
Hercules and program blocks do not recognize the channels the same way resulting in the possibility that frames expected to be transmitted are not when a program block is loaded. Program blocks recognize the channel order literally the way they appear in Gryphon. Hercules Hardware & Protocol Configuration sequentially lists channels for each recognizable card in the Gryphon. Hercules does not recognize every card.

A mismatch occurs if there is an unrecognizable card in a previous slot in the Gryphon, and the user writes a program block to transmit frames on a channel listed in Hercules. Hercules does not display an error message and Information view displays that the program block is successful even though nothing is transmitted.

Note that the Gryphon channels, not the Hercules channels, must be used in order to have a successful transmission.

Gryphon channels are viewable by opening a Telnet session to the Gryphon IP address [For example: **telnet 192.168.1.1**], logging in with the name: **root** and a password: **dggryphon** then typing in the command: **`gryphrx -`**.



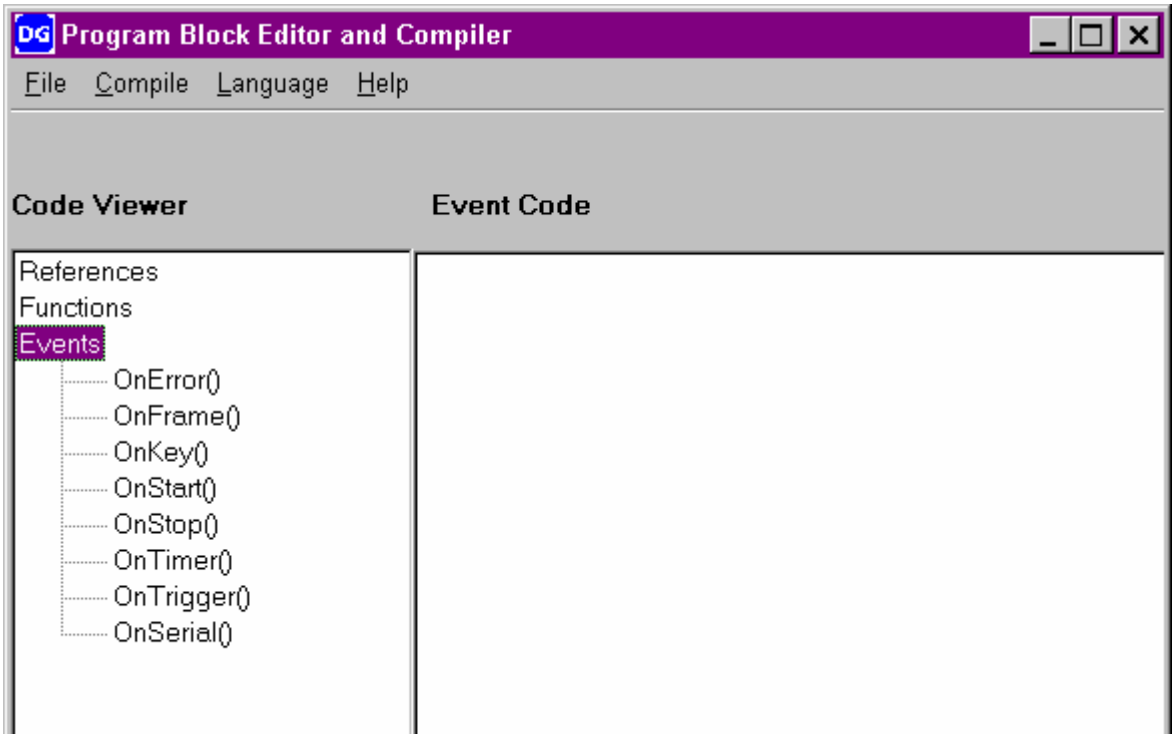

## *2.1 Starting the Program Block Editor and Compiler*

To install and start up the *Program Block Editor and Compiler* application, follow the instructions provided in the following sections.

### 2.1.1 Starting up the application

Select **Start | Programs**; select the **Hercules Software | Hercules Compiler** from the *Programs* menu or double click the icon that appears on the desktop. This is also selectable from the *Configuration* menu using the **Program Blocks** command.

The *Program Block Editor and Compiler* application's main screen (shown below) should appear.




Accessible from this screen are all of the menus and viewers that support the following features:

- Code editing (access by reference, function, or event) – see section 2.2.
- File management (of PSF file) – see section 2.3.
- Compiling functions (via *DJGPP Public Access Cross-Compiler* freeware by DJ Delorie: http://www.delorie.com) – see section 2.4.

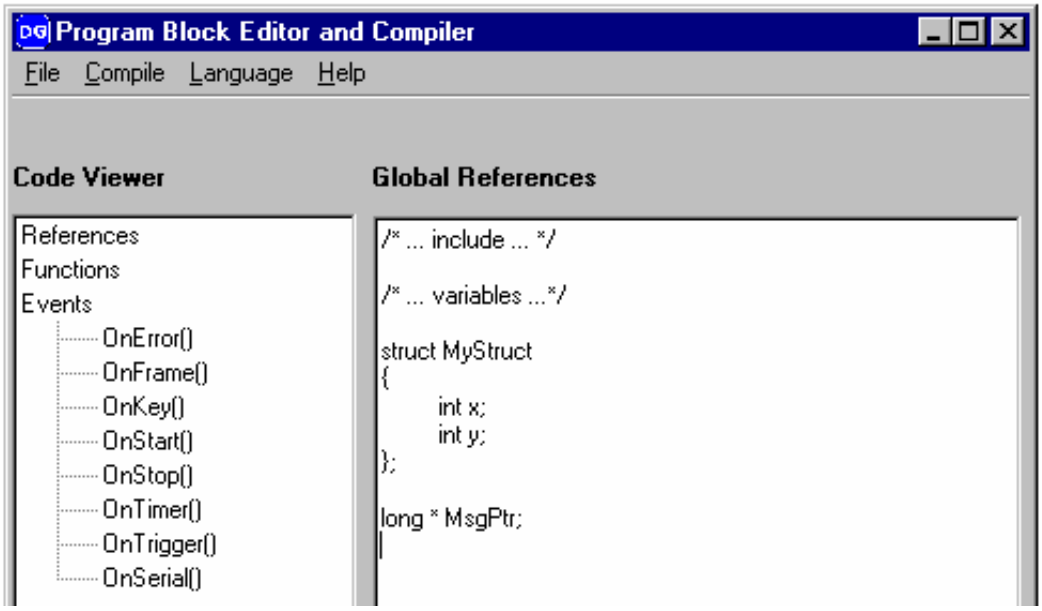
## *2.2 Creating and editing code*

The *Code Viewer* is used for the display and editing of instructions (code) to be performed whenever specific events occur on the hardware interface. (The event handlers utilized are listed and described in section 2.2.3.) The code viewer organizes this program source file (PSF) code in three main areas (*References*, *Functions*, and *Events*) described in the sections that follow.

### 2.2.1 Creating global *References*

To create global references accessible by various functions, click on the **References** node name in the *Code Viewer* window. You may then enter your ANSI C references, along with your *Include* headers, in the *Global References* box to the right of the *Code Viewer*. Controls for editing code are: CTRL-X (cut), CTRL-C (copy), and CTRL-V (paste).

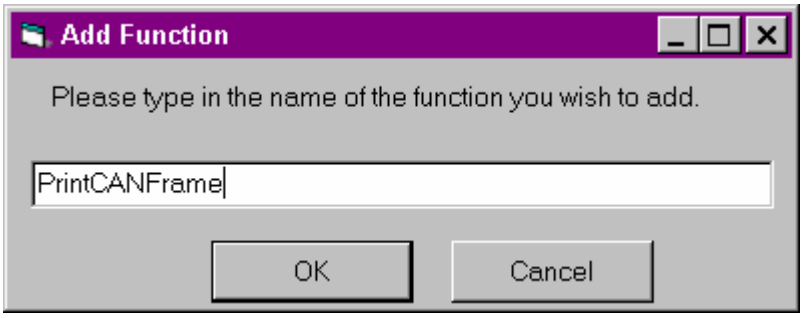
References defined here will be global to the entire program source file (PSF).



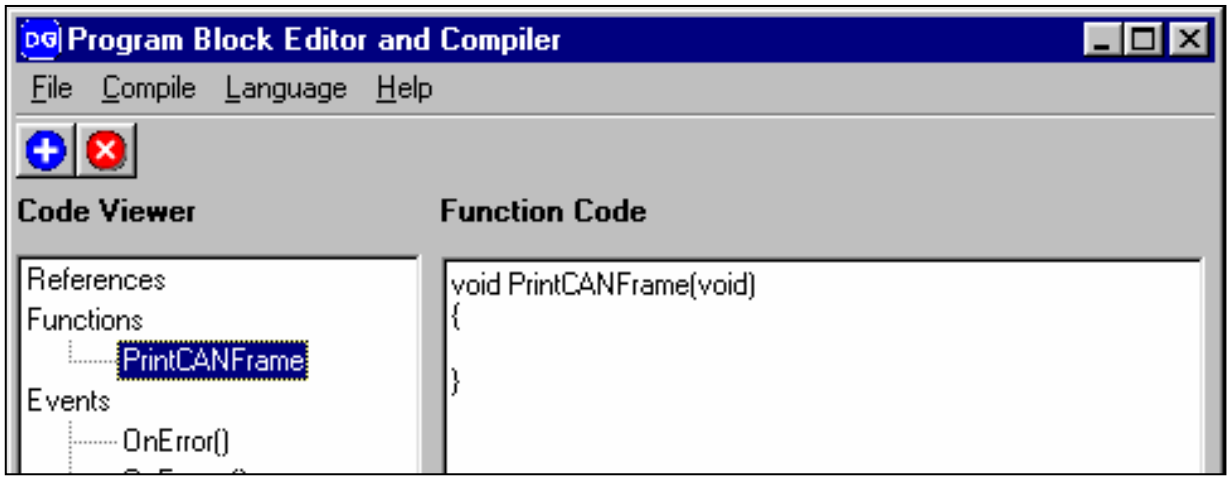

### 2.2.2 Creating global *Functions*

To create global functions, click on the **Functions** node name in the *Code Viewer* window; a function tool bar with a blue "**+**" button and a red "**X**" button should appear above *Code Viewer*.

To add a function, click the "**add function**" (blue ⊕) button, and enter the function **name** (but NOT its prototype or arguments) in the dialog that appears.




Click **OK**. The function name should now be listed in the *Code Viewer* box:

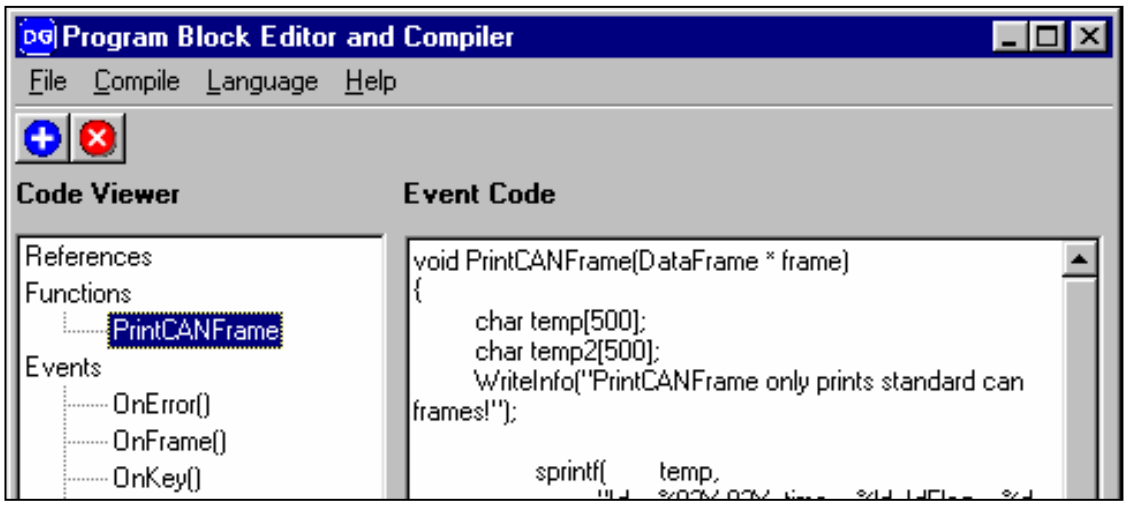



To delete a function, **select** it from the *Code Viewer* menu and click the **red** ⊗ (*delete*) icon, then click **Yes**. The deleted function cannot be undeleted.

#### 2.2.2.1 *Function Code* display

The code of the function currently **selected** in the *Code Viewer* display appears in the *Function Code* box to its right. A default prototype and body appear here when that function is first added to the *Functions* list (see screen display above).

You may modify this prototype, but you should not change the name of the function here. Doing so will result in compiling errors. To change the name of a function, you should delete that function from the *Functions* list and add a new function with the name you desire. The following is an example of code modified from the default prototype shown above.



#### 2.2.2.2 Library functions

The following library routines are available for use anywhere in a Hercules program source file and utilize the predefined *DataFrame* structure. (See the Hercules User Manual for more information.)

> **NOTE:** The following two commands in Program Blocks involve the channel. The command **`TransmitDataFrame(DataFrame *frame, uchar channel)`**. The command **TransmitError(unsigned char channel, unsigned char error Type)**. When you create a program block using these two commands, you must enter the channel as the number identified by the Gryphon, not by Hercules Hardware and Protocol Configuration. Gryphon channels are viewable by completing a Telnet session for the Gryphon IP address, then typing in the **gryphrx** – command.

**int WriteInfo (char *string)**

This function sends a string to the external program (Hercules software) that activated the compiled program source executable on the hardware interface. A returned value of **0** indicates a successful transmission; a **–1** indicates an error condition.

**int TransmitDataFrame (DataFrame *frame, uchar channel)**

This function transmits a data frame to the channel specified in the channel argument. The address of a DataFrame structure is passed as the first argument. A returned value of **0** indicates a successful transmission; a **–1** indicates an error condition.

**int TransmitError (unsigned char channel, unsigned char error Type)**

This function transmits an error frame to the channel specified in the channel argument. A returned value of **0** indicates a successful transmission; a **–1** indicates an error condition.

Possible error types:

```
GCAN     /* for CAN ErrorFrame */

GFORDUBP /* for NACK */
```

**int StartTimer (uint name, int period, void (*funct)(uint name))**

This function starts a periodic timer that calls the function in the third parameter each time the timer expires. The function called can be **`OnTimer`** or a user-defined function (see third paragraph).

The first **`StartTimer`** argument, *name*, is a user-defined, unsigned integer value used to identify the timer being started by **`StartTimer`**; each time the timer expires, it restarts automatically. The timer's period (a millisecond value between 0.001 and 2,147,483.647 seconds) is passed via the *period* argument.

If a user-defined function is called, then it must have a *uint* parameter passed to it from the first parameter in **StartTimer**, (e.g., 0x01 in the following example):

**Example:**

*Definition of this [user-defined] function:*

```
void MyFunction(uint timerid)
{

//insert function code here
}
```

*Call to StartTimer:*

```
int StartTimer(0x01,50,MyFunction);
```

*Inside StartTimer, **0x01** will be the only parameter passed into **MyFunction**, like this:*

```
MyFunction(0x01);
```

A returned value of **0** indicates a successful transmission; a return value of **–1** indicates an error condition.

**int StopTimer (uint name)**

This function stops the running periodic timer identified in the *name* parameter. A returned value of **0** indicates a successful transmission; a **–1** indicates an error condition.

**int SendSerial(const void * data, unsigned short datacount)**

This function sends the data supplied in the data parameter to the PC's serial port. The serial port must first be configured in the *Hercules* software's **`Serial Port Configuration`** window (see *Configuration* menu).

**int SendTrigger (void)**

This function, when called from a program block, causes the Hercules tool to log to the buffer according to the pre- and post-trigger values selected (see section 4.3 of the Hercules User Manual). The Hercules software buffer configuration must be set to **`Triggered`** mode. This function has the same effect as the pressing of **`CTRL-T`** (also see section 4.3 as indicated above). Once the buffer is filled, the Hercules tool will go into OFFLINE mode.

**long DecodeData(unsigned char* m_data, unsigned int m_dataLen, PARAM_INFO m_paramInfo, double* m_value)**

This function decodes the data bytes in *m_data* and returns the resulting value in *m_value*. The data bits used for decoding and the resolution and offset values applied are supplied in the *m_paramInfo* structure outlined in the box below.

## PARAM_INFO Structure

```
typedef struct
{
 unsigned int m_startByte;           //valid values 0 - 7
 unsigned int m_startBit;            //valid values 0 - 7
 unsigned long m_paramLength;        //length in bits
 double m_resolution;                //scaling parameter
 double m_offset;                    //scaling parameter
 unsigned int m_signedUnsignedFlag;  //0 = unsigned, 1= signed
 unsigned int m_applyScaling;        //0 = do not apply scaling, 1 =
                                     //apply scaling

} PARAM_INFO;
```

**long EncodeData(unsigned char* m_data, unsigned int m_dataLen, PARAM_INFO m_paramInfo, double m_value)**

This function encodes the *m_value* parameter value and puts it into the *m_data* data bytes field. The *m_paramInfo* structure (described in the box above) determines the storage location for the value within the data bytes. The resolution and offset values supplied in *m_paramInfo* are used in this calculation.

**DataFrame * CreateDataFrame (unsigned short maxIdlen, unsigned short maxDatalen, unsigned short maxExtralen)**

This function is called to allocate memory for a DataFrame (see section 2.2.2.3: *DataFrame structure*, below). The values of **`maxIdlen`** (maximum ID length, in bits), **`maxDatalen`** (maximum data length, in bytes), and **`maxExtralen`** (maximum extra data length, in bytes) specify the amount of memory to allocate for the pointers to *Id*, *data*, and *extraData*, respectively, in the DataFrame structure. If the DataFrame is created successfully, then a valid pointer to a DataFrame is returned. If not, a value of NULL is returned.

**NOTE:** You should make sure to call the ***FreeDataFrame*** function (see **int FreeDataFrame** section that follows) to free up allocated memory once you are finished with using the frame specified here. If a value of zero is specified for any of these arguments, then the corresponding pointer in the structure will be NULL.

Example:

```
dataFrame * x;

x = CreateDataFrame(29,8,0); /* creates a frame with a header of
29 bits(4 bytes), 8 data bytes, and 0 extra data bytes */

if(x=NULL)

   return;

else
{
   /* we want a frame representing a CAN header of 0x00234523 and
data of 0x66 0x77 */
   x->Idlen = 29; //length in bits, actually 4 bytes
   x->datalen = 2;

ID(x)[0] = 0x00;

ID(x) [1] = 0x23;

   ID(x) [2] = 0x45;
   ID(x) [3] = 0x23;
   DATA(x)[0] = 0x66;
   DATA(x) [1] = 0x77;
}
```

**int FreeDataFrame( DataFrame * frame)**

This function is used to de-allocate memory that was allocated by the function *CreateDataFrame* (see above). A return value of **0** indicates success; a value of **–1** indicates a failure.

## Example:

```
DataFrame * x;

x = CreateDataFrame(11,4,0);

if(x!=NULL)
{

if(FreeDataFrame(x)==0)
        WriteString("Your memory has been given freedom!");
}
```

Error constants are now free to be passed to the software from the hardware tool. These constants are defined in files found on the hardware itself, in the */include/hw/* folder. The files in question are included with respect to the modules installed (connected); they are named as *dev_xxx.h*, where *xxx* is the type of channel (e.g., *dev_can.h* or *dev_scp.h*).

#### 2.2.2.3 Data Frame Structure

All messages received or transmitted by the Hercules tool are stored in accordance with the following structure. Structure members are accessible from any point within your program source file.

DataFrame structure:

```
typedef struct {
    unsigned long time;     /* range is 0 to 0xFFFFFFFF          */
                            /* represents time in 10E-5 seconds  */
    void *Id;               /* The address of the header         */
    void *data;             /* The address of the data           */
    void *extraData;        /* The address of the extra data     */

    unsigned short Idlen;   /* represents header size in bits    */
    unsigned short datalen;
    unsigned short extralen;
    unsigned char  mode;
    unsigned char  priority;
    unsigned char  stat;
    unsigned char  context;
    unsigned char  buffer[1];     /* do not modify or use!!! */
} DataFrame;

void OnFrame( DataFrame *  frame, uchar channel)
{

if (frame != NULL)

{

if (frame->mode&MODE_RX)

{

/*  message was received from a node from the outside world */

/* put your code here */

}

else

if(frame->mode&MODE_TX)

{

/* message originated from hardware or Gryphon® */

/* put your code here */

}

}

}
```

**Sample initialization of a DataFrame**

For transmission of a frame with

*Frame Header = 0x3FFFFFFF*
*Data = 0x01 0x02 0x03 0x04 0x05 0x06 0x07 0x08*

the frame structure would be initialized as follows:

```
DataFrame x;
x = CreateDataFrame(29,8,0);
      x->Idlen = 29;
x->datalen = 5;
x->extralen = 0;
ID(x) [0] = 0x3F;
ID(x) [1] = 0xFF
ID(x) [2] = 0xFF;
ID(x) [3] = 0xFF;
DATA(x)[0] = 0x01;
DATA(x) [1] = 0x02;
DATA(x) [2] = 0x03;
DATA(x) [3] = 0x04;
DATA(x) [4] = 0x05;
DATA(x) [5] = 0x06;
DATA(x) [6] = 0x07;
DATA(x) [7] = 0x08;
```

### 2.2.3 Events: viewing event handler functions

The *Code Viewer* is used for the display and editing of instructions to be performed whenever specific events occur on the hardware interface. The event handlers utilized are listed and described below.

#### 2.2.3.1 OnError(uchar channel, uchar error_type

This event handler is called in response to a fatal error or CAN controller error.

Sample function code:

```
void OnError(uchar channel, uchar error_type)
{
   WriteInfo("On Error!");
}
```

#### 2.2.3.2 OnFrame(DataFrame *frame, uchar channel)

This event handler is called whenever the hardware receives a frame. The contents of the received frame—including the header, data count, data, time stamp and CAN channel—may be accessed via the user's code.

Sample function code:

```
void OnFrame(DataFrame *frame)
{
   PrintCANFrame(frame);
}
```

#### 2.2.3.3 OnKey(char character)

This event handler is called whenever the user presses any letter key (except for *C* or *T*) along with the **CTRL** key. The value (identity) of the letter key pressed may be accessed via the user's code. The *character* argument value is the ASCII value of the letter key. (In the case of **CTRL-A** being pressed, for example, the value **0x41** would be supplied when the **OnKey** function was called.)

> **NOTE:** The two following key combinations have been reserved and are not processed by the OnKey event handler: Ctrl-B (“clear buffer”) and Ctrl-T (“trigger on”).

#### 2.2.3.4 OnStart(long time)

This event handler is called when measurement starts. The [absolute] time the measurement started shall be available in a parameter accessible via the user's source code.

Sample function code:

```
void OnStart(long time)
{

char temp[50];
        sprintf(temp,"OnStart time was %d",time);
        WriteInfo(temp);
}
```

#### 2.2.3.5 OnStop(long time)

This event handler is called when measurement is stopped. The [absolute] time the measurement stopped is accessible via the user's source code

Sample function code:

```
void OnStop(long time)
{
   char temp[50];
        sprintf(temp,"OnStop time was %d",time);
   WriteInfo(temp);
}
```

#### 2.2.3.6 OnTimer(uint timerid)

This event handler is called periodically following a call to the library function **StartTimer**. The [absolute] time the event occurred and the name of the timer are available in a parameter accessible via the user's source code.

Sample function code:

```
void OnTimer(uint p_timerid)
{

char temp[50];
        sprintf(temp,"OnTimer Id  was %d",p_timerid);
        WriteInfo(temp);

}
```

#### 2.2.3.7 OnTrigger(long time)

This event handler is called in response to a trigger. In order for this event handler to be called, the *Buffer Configuration of the Hercules tool* must be set to **`Triggered`**. The time of the trigger is available in a parameter accessible via the user's source code

Sample function code:

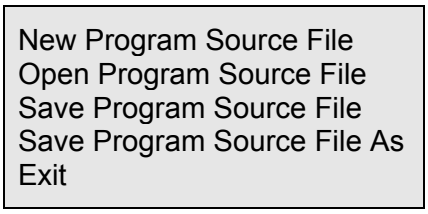
```
void OnTrigger(long time)
{
   char temp[50];
   sprintf(temp,"Trigger time was %d",time);
   WriteInfo(temp);
}
```

#### 2.2.3.8 OnSerial(const void * data, unsigned short datacount)

This event is called when data is received over the PC's serial port. Through the *Code Viewer*, the user can enter function code identifying actions to be taken when data is received by the serial port. The serial port must first be configured in the **Serial Port Configuration** window of the Hercules software (see **Configuration** menu).

## *2.3 Creating and Managing PSF files*

Before you attempt to compile program code to be uploaded to the Hercules tool, you must save it to a program source (*.psf*) file. The *File* menu allows you the following options for creating a new PSF, opening a previously saved PSF, saving changes to an existing PSF, or saving a PSF under a new file name, respectively:



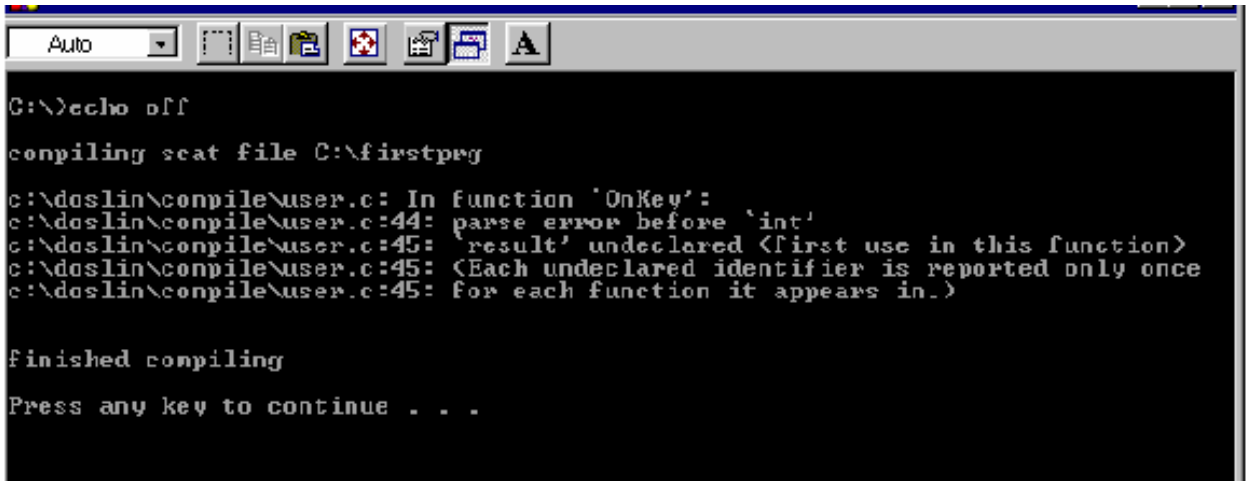

The file name of the active file, once saved, will appear in the left-hand panel of the status bar. (There will be a "successful save" comment in the right panel.)


Once you have saved the program as a PSF file, you may compile it by following the instructions provided in section 2.4.

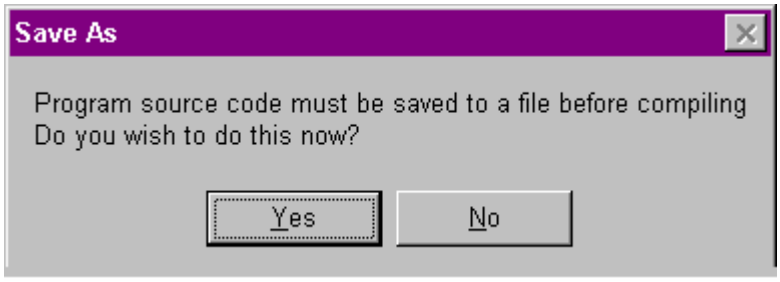
## 2.4 Compiling PSF Files

Once you have saved your program code in a PSF file (*see section 2.3* for instructions), you may compile it by selecting **`Build Exe`** from the *Compile* menu.

The following DOS shell should appear, listing any compiler errors that occurred during compilation.

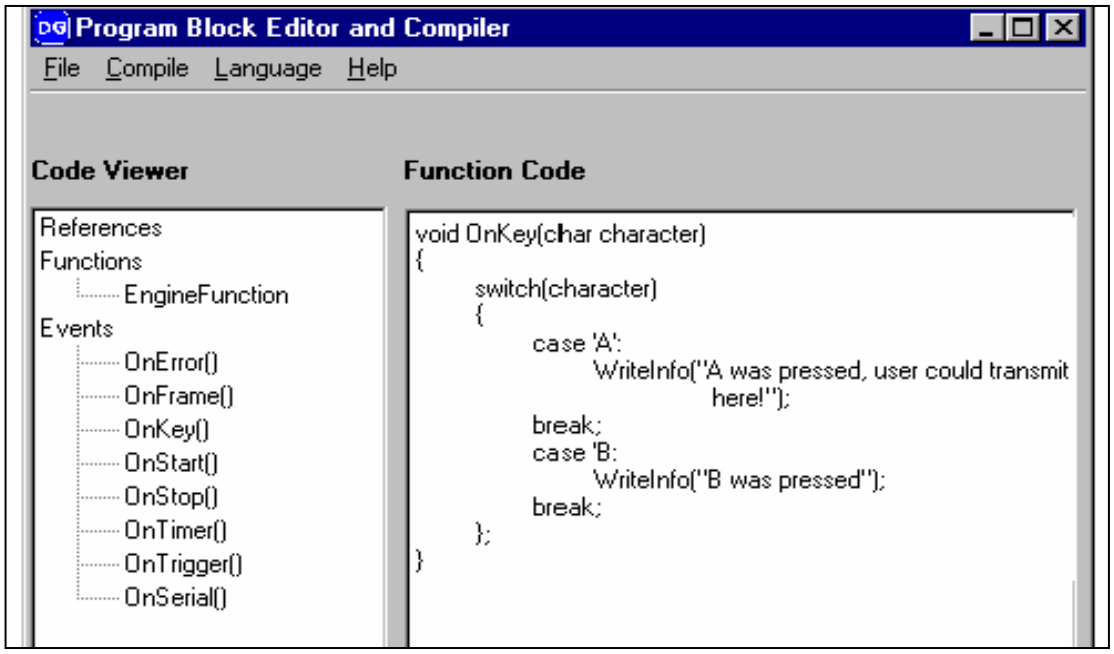



**NOTE:** If you attempt to compile code without first saving it to a PSF file, the compiler software will prompt you to save it.



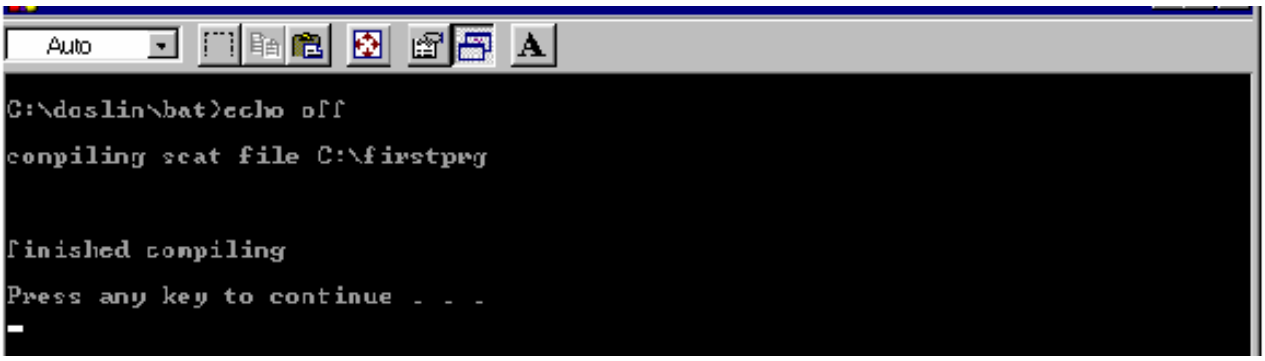

Select **Yes**, and save your file under a valid filename; compilation of the program source file will then begin.

If any compiler errors appear here—as they have in the DOS window shown above—you can press any key to return to the Code Viewer, and make any necessary changes to your code.



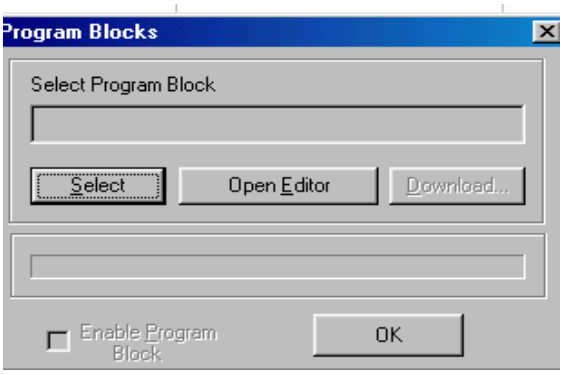

Save the new code (using the **`Save Program Source File`** or **`Save Program Source File As`** option on the **File** menu), and recompile by again selecting **`Build Exe`** from the *Compile* menu. When the compilation is complete, a "finished compiling" message will appear on the screen, along with the prompt, "Press any key to continue . . ."

Press any key to return to the main screen, which should display a *Compilation Complete!* message in the right-hand panel of the status bar.




This file containing your executable is now ready to be uploaded to the hardware interface and enabled (also refer to *section 4.8* of the Hercules User Manual).

Once compiled and saved as a Hercules binary (*.out*) file, a program block can be downloaded to the hardware interface. To download a saved .out file, select the **Program Blocks** option on the *Configuration* menu to open the following dialog.




Click **Select** to display the *Open* dialog. Locate and **select** the .out program file you wish to download, and click **Open**. Click **Download** in the *Program Blocks* window.

The progress bar will fill as the file is downloaded. When the download is finished, click **OK**. Enable the program block by **selecting** (☑) the *Enable Programming Block* check box in the bottom of this window. You can also make this selection later in the *Global Options* dialog accessed from the *Configuration* menu, (*see Global Options below*). Click **OK**.

Open an **Information View** (from the *Display* menu) so that you will be able to view the status of your program block. Messages will show based on keys or events chosen in the dialog from "Select".

Once you have initiated an ONLINE monitoring session (i.e., selected **Start** from the *Monitoring* menu or the main toolbar), the *Information View* should indicate the successful execution of your program block.

***Global Options*** lets you **enable** or **disable** the filtering, frame responder, UCS, and program block features for a monitoring session. The default setting for menu options is *disabled* (box cleared: ☐). To enable a feature from this list, **select** (☑) its box. A feature is only available for selection if it has been configured for the current monitoring session.