EVOLUTIONS:

Date	Revision	Description
27/10/2015	F	Ethernet Interface for F28 light device.
05/11/2015	G	Update to 1.303 version, add VB.net samples.
12/11/2015	H	Mistakes fix.
17/11/2015	I	Add Auto calibration functions
19/11/2015	J	Add parameters Option's (page 46) and auto calibration function (page 69).
24/11/2015	K	Add parameters and explanation, DLL version 1.402.
02/12/2015	L	Add explanation for auto-calibration with 5 devices, DLL version 1.402.
04/12/2015	M	Add "Start Auto Cal Offset for more than one head in VB.net" DLL version 1.402.
14/12/2015	N	Add specifics error codes (§ 3.9.1) add electronic regulator option, DLL version 1.500.
21/01/2016	O	Update error codes on §3.9.4 "Result status and alarms".
02/02/2016	P	Update error codes on §3.9.4 "Result status and alarms".
15/02/2016	Q	Change to negatives values error codes on §3.9.4 "Result status and alarms".
25/07/2016	R	1- Use F28_RemoveModule then F28_AddModule without reinitialize all. 2- :FIX: Some declarations that can cause Unbalanced Stack
06/03/2017	S	Add F28 Jet Check special cycle, update error messages, dll version 2.004.

Important! *This last DLL version works only with devices with firmware version ≥ 1.500.*

Table of contents

1. INTRODUCTION

1.1. ABOUT THIS DOCUMENT

This manual describes the F28Light ***Application Programming Interface*** *(API)* and the containing functions. As a Win32 DLL for windows W7 & W8, it forms the interface between the user application and the F28Light.

1.2. WHAT'S NEEDED FOR USING THE DLL

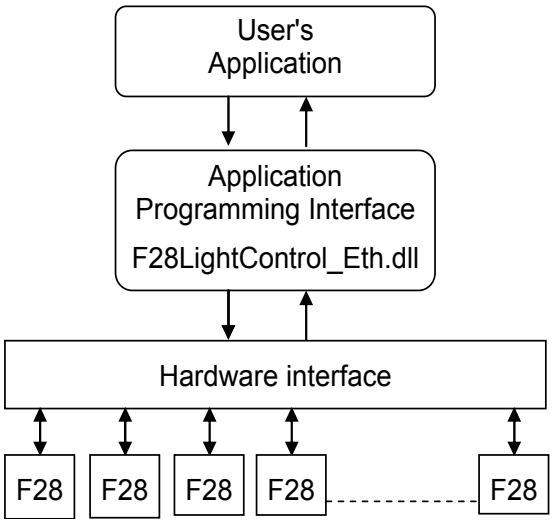
vcredist_x86.exe : Visual C++ Redistributable Packages for Visual Studio 2013.

DLL Ethernet interface : F28LightControl_ETH.dll

The Visual C++ Redistributable Packages install run-time components that are required to run applications that are developed by using Visual Studio 2013, on computers that don't have Visual Studio 2013 installed.

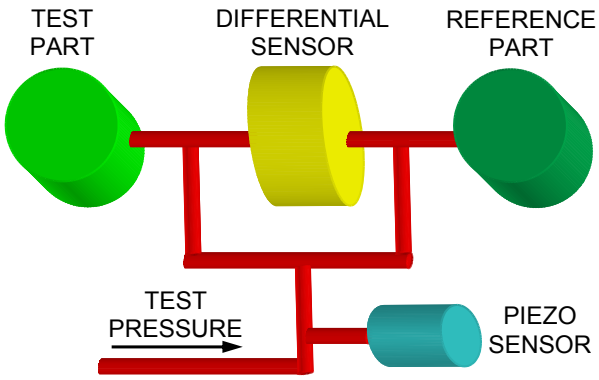
These packages install run-time components of these libraries: C Runtime (CRT), Standard C++, ATL, MFC, C++ AMP, and OpenMP.

1.3. APPLICATION STRUCTURE



1.4. REMINDER OF THE ATEQ F28LIGHT PRINCIPLE

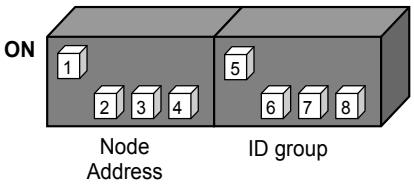
The **ATEQ F28 Light** is a compact air/air leak detector used to test the air-tightness of parts. The method used is based on the measurement of a small variation or drop in differential pressure between the **Test** and **Reference** parts, when both are filled to an identical pressure.



1.5. F28 HEADS IP ADDRESSES

1.6. SWITCHES CONFIGURATION

On each head, on the main board, there's one switch to give a hardware address. The head must be configured as the following example.



Switch **#1** (node) = **On**

Switch **#5** (group) = **On**

Others switches = **Off**.

1.7. IP ADDRESS CONFIGURATION

The IP default configuration for the F28 Light device is in DHCP mode. This mode allows to automatically applying an IP address to the device by a rooter in the network.

For the first start, the device waits 10 seconds for a DHCP configuration. If it is not detected after these 10 seconds, the static **192.168.1.200** IP address is set.

To run the device in the network and update the boards, please use a static IP address.

This static IP address must be different for all the devices connected to the same network.

Keep one IP address for the PC and give different ones to the F28Light devices.

Example:

- **PC**: IP 192.168.1.**1**
- F28Light **#1**: IP 192.168.1.**2**
- F28Light **#2**: IP 192.168.1.**3**
- F28Light **#3**: IP 192.168.1.**4**
- F28Light **#4**: IP 192.168.1.**5** Etc…

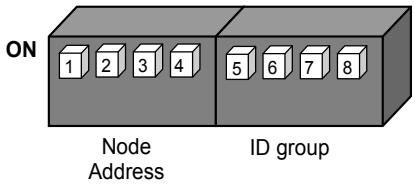
***Remind**: the network's rooter must have the same IP address root than the PC, example: **192.168.1**.X otherwise the device won't be detected.*

1.8. IP ADDRESS LOSS

If the IP address is lost or nor recoverable, the communication between the device and the PC in the network is impossible.

To recover the communication, you must reset the IP address assignation, to be able to give another one.

For that, with the device powered off, set all the "Address" and the "Group" switches to 1.



Switches **#1** to **#8** (node) = **On**

Then power on the device for a few seconds and power off, the IP address is reseted.

1.9. DATA DEFINITIONS

Definition	Description
BYTE, UCHAR	Unsigned char (8 bits)
char	Signed char (8 bits)
short	Signed word (2 bytes)
WORD	Unsigned word (2 bytes)
float	Floating point single precision (4 bytes)
DWORD	Unsigned word (4 bytes)

2. STRUCTURE AND ENUMERATION

2.1. ENUMERATION

2.1.1. Type of test

Test type parameter, to be use with "**wTypeTest**".

Definition	Value	Description
UNDEFINED_TEST	0	Not defined
LEAK_TEST	1	Leak test
SEALED_COMPONENT_TEST	2	Sealed components test
DESENSITIZED_MODE_TEST	3	Desensitized mode test for measurement of large leaks. *

Declaration in C/C++:

```
enum F28_TYPE_TEST
{
      UNDEFINED_TEST,
      LEAK_TEST,
      SEALED_COMPONENT_TEST
      DESENSITIZED_MODE_TEST // Since v1.500 only
};
```

Visual Basic (Vb.Net):

```
Enum F28_TYPE_TEST    'Uses with wTypeTest parameter
      UNDEFINED_TEST
      LEAK_TEST
      SEALED_COMPONENT_TEST
      DESENSITIZED_MODE_TEST // Since v1.500 only
      '
End Enum
```

C#.Net:

```
public enum F28_TYPE_TEST : byte
{
      UNDEFINED_TEST,
      LEAK_TEST,
      SEALED_COMPONENT_TEST
      DESENSITIZED_MODE_TEST // Since v1.500 only
};
.
```

***Note**: the desensitized mode is used for the measurement of large leaks, when the reject level required is above the full scale of the differential sensor; the measurement is performed by the pressure sensor.*

2.1.2. Pressure units

Pressure unit parameter, to be use with "**wPress1Unit**".

Definition	Value	Description
PRESS_PA	0	Pascal
PRESS_KPA,	1	Kilo pascal
PRESS_MPA	2	Mega pascal
PRESS_BAR	3	Bar
PRESS_mBAR	4	Millibar
PRESS_PSI	5	PSI
PRESS_POINTS	6	Points

Declaration in C/C++:

```
enum F28_PRESS_UNITS
{
      PRESS_PA,
      PRESS_KPA,
      PRESS_MPA,
      PRESS_BAR,
      PRESS_mBAR,
      PRESS_PSI,
      PRESS_POINTS,
      NMAX_PRESS_UNITS
};
```

Visual Basic (Vb.Net):

```
Enum F28_PRESS_UNITS As Byte
      PRESS_PA
      PRESS_KPA
      PRESS_MPA
      PRESS_BAR
      PRESS_mBAR
      PRESS_PSI
      PRESS_POINTS
NMAX_PRESS_UNITS
End Enum
```

C#.Net:

```
public enum F28_PRESS_UNITS : byte
{
      PRESS_PA,
      PRESS_KPA,
      PRESS_MPA,
      PRESS_BAR,
      PRESS_mBAR,
      PRESS_PSI,
      PRESS_POINTS,
      NMAX_PRESS_UNITS
};
```

2.1.3. Leak units

Leak unit parameter, to be use with "**wLeakUnit**".

Definition	Value	Description
LEAK_PA	0	Pa
LEAK_PASEC	1	Pa/s
LEAK_PA_HR	2	Pa (High resolution)
LEAK_PASEC_H	3	Pa/s(High resolution)
LEAK_CAL_PA,	4	Calibrated Pascal.
LEAK_CAL_PASEC,	5	Calibrated Pascal/second
LEAK_CCMIN,	6	cm^3/min
LEAK_CCSEC,	7	cm^3/s
LEAK_CCH,	8	cm^3/h.
LEAK_MM3SEC,	9	mm^3/s
LEAK_CM3_SEC,	10	cm^3/s
LEAK_CM3_MIN,	11	cm^3/mn
LEAK_CM3_H,	12	cm^3/h
LEAK_ML_SEC,	13	ml/s
LEAK_ML_MIN,	14	ml/min
LEAK_ML_H,	15	ml/h
USA		
LEAK_INCH3_SEC,	16	$Inch^3$/s
LEAK_INCH3_MIN,	17	$Inch^3$/mn
LEAK_INCH3_H,	18	$Inch^3$/h
LEAK_FT3_SEC,	19	$Feet^3$/s
LEAK_FT3_MIN,	20	$Feet^3$/mn
LEAK_FT3_H,	21	$Feet^3$/h
LEAK_MMCE,	22	mmWg
LEAK_MMCE_SEC,	23	mmWg/s
LEAK_SCCM,	24	sccm
LEAK_POINTS,	25	points

Declaration in C/C++:

```
enum F28_LEAK_UNITS
{
      LEAK_PA,
      LEAK_PASEC,
      LEAK_PA_HR,
      LEAK_PASEC_HR,
      LEAK_CAL_PA,
      LEAK_CAL_PASEC,
      LEAK_CCMIN,
      LEAK_CCSEC,
      LEAK_CCH,
      LEAK_MM3SEC,
      LEAK_CM3_SEC,
      LEAK_CM3_MIN,
      LEAK_CM3_H,
      LEAK_ML_SEC,
      LEAK_ML_MIN,
      LEAK_ML_H,
      //USA------------------
      LEAK_INCH3_SEC,
      LEAK_INCH3_MIN,
      LEAK_INCH3_H,
      LEAK_FT3_SEC,
      LEAK_FT3_MIN,
      LEAK_FT3_H,
      LEAK_MMCE,
      LEAK_MMCE_SEC,
      LEAK_SCCM,
      LEAK_POINTS,
      NMAX_LEAK_UNITS
};
```

Visual Basic (Vb.Net):

```
Enum F28_LEAK_UNITS As Byte 'Uses with
                wLeakUnit parameter
     LEAK_PA
     LEAK_PASEC
     LEAK_PA_HR
     LEAK_PASEC_HR
     LEAK_CAL_PA
     LEAK_CAL_PASEC
     LEAK_CCMIN
     LEAK_CCSEC
     LEAK_CCH
     LEAK_MM3SEC
     LEAK_CM3_SEC
     LEAK_CM3_MIN
     LEAK_CM3_H
     LEAK_ML_SEC
     LEAK_ML_MIN
     LEAK_ML_H
     LEAK_INCH3_SEC
     LEAK_INCH3_MIN
     LEAK_INCH3_H
     LEAK_FT3_SEC
     LEAK_FT3_MIN
     LEAK_FT3_H
     LEAK_MMCE
     LEAK_MMCE_SEC
     LEAK_SCCM
     LEAK_POINTS
     NMAX_LEAK_UNITS
End Enum
```

C#.Net:

```
public enum F28_LEAK_UNITS : byte
{
      LEAK_PA,
      LEAK_PASEC,
      LEAK_PA_HR,
      LEAK_PASEC_HR,
      LEAK_CAL_PA,
      LEAK_CAL_PASEC,
      LEAK_CCMIN,
      LEAK_CCSEC,
      LEAK_CCH,
      LEAK_MM3SEC,
      LEAK_CM3_SEC,
      LEAK_CM3_MIN,
      LEAK_CM3_H,
      LEAK_ML_SEC,
      LEAK_ML_MIN,
      LEAK_ML_H,
      LEAK_INCH3_SEC,
      LEAK_INCH3_MIN,
      LEAK_INCH3_H,
      LEAK_FT3_SEC,
      LEAK_FT3_MIN,
      LEAK_FT3_H,
      LEAK_MMCE,
      LEAK_MMCE_SEC,
      LEAK_SCCM,
      LEAK_POINTS,
      NMAX_LEAK_UNITS
};
```

2.1.4. Volume units

Volume unit, to be use with "**wVolumeUnit**" parameter.

Definition	Value	Description
VOLUME_CM3	0	cm^3
VOLUME_MM3	1	mm^3
VOLUME_ML,	2	ml
VOLUME_LITRE	3	l
VOLUME_INCH3	4	$inch^3$
VOLUME_FT3	5	$Feet^3$

Declaration in C/C++:

```
enum F28_ENUM_VOLUME_UNIT
{
      VOLUME_CM3,
      VOLUME_MM3,
      VOLUME_ML,
      VOLUME_LITRE,
      VOLUME_INCH3,
      VOLUME_FT3,
      NMAX_VOLUME_UNITS
};
```

Visual Basic (Vb.Net):

```
Enum F28_ENUM_VOLUME_UNIT As Byte  'Uses with wVolumeUnit parameter
      VOLUME_CM3
      VOLUME_MM3
      VOLUME_ML
      VOLUME_LITRE
      VOLUME_INCH3
      VOLUME_FT3
      NMAX_VOLUME_UNITS
End Enum
```

C#.Net:

```
public enum F28_ENUM_VOLUME_UNIT : byte
{
      VOLUME_CM3,
      VOLUME_MM3,
      VOLUME_ML,
      VOLUME_LITRE,
      VOLUME_INCH3,
      VOLUME_FT3,
      NMAX_VOLUME_UNITS
};
```

2.1.5. Fill mode

Fill mode parameter, to be use with "**wFillMode**".

Definition	Value	Description
STD_FILL_MODE	0	Standard fill mode
AUTOFILL_MODE	1	Auto fill mode
INSTRUCTION_MODE	2	Fill mode with instruction, only with the electronic regulator option built-in (from v1.500)
RAMP_MODE	3	Fill with a ramp, only with the electronic regulator option built-in (from v1.500)

Declaration in C/C++:

```
enum F28_ENUM_FILL_MODE
{
      STD_FILL_MODE,
      AUTOFILL_MODE,
      INSTRUCTION_MODE, // Electronic regulator option & from v1.500 only
      RAMP_MODE, // Electronic regulator option & from v1.500 only
      NMAX_FILL_MODE

};
```

Visual Basic (Vb.Net):

```
Enum F28_ENUM_FILL_MODE As Byte
      STD_FILL_MODE
      AUTOFILL_MODE
      INSTRUCTION_MODE 'Electronic regulator option & from v1.500 only
      RAMP_MODE 'Electronic regulator option & from v1.500 only
      NMAX_FILL_MODE

End Enum
```

C#.Net:

```
public enum F28_ENUM_FILL_MODE : byte
{
      STD_FILL_MODE,
      AUTOFILL_MODE,
      INSTRUCTION_MODE, // Electronic regulator option & from v1.500 only
      RAMP_MODE, // Electronic regulator option & from v1.500 only
      NMAX_FILL_MODE
};
```

2.1.6. Boot/Application mode

Returned by function "**F28_GetMode**".

Declaration	Data type	Value	Description
F28_MODE_BOOT	short	1	Boot mode
F28_MODE_APPLICATION		2	Application mode

Declaration in C/C++:

```
#define F28_MODE_BOOT 1
#define F28_MODE_APPLICATION 2
```

Visual Basic (Vb.Net):

```
Enum F28_MODE As Byte
      F28_MODE_BOOT = 1
      F28_MODE_APPLICATION = 2
End Enum
```

C#.Net:

```
public enum F28_MODE : byte
{
      F28_MODE_BOOT = 1,
      F28_MODE_APPLICATION = 2
};
```

2.1.7. Group Identifier

Value for variable "**ucGroupID**".

Variable	Data type	Value	Description
ucGroupID	BYTE	F28_GROUP_1 = 1, F28_GROUP_2 = 2, F28_GROUP_3 = 3, F28_GROUP_4 = 4, F28_GROUP_5 = 5, F28_GROUP_6 = 6, F28_GROUP_7 = 7 , F28_GROUP_8 = 8, F28_GROUP_9 = 9, F28_GROUP_10 = 10, F28_GROUP_11 = 11, F28_GROUP_12 = 12, F28_GROUP_13 = 13, F28_GROUP_14 = 14, F28_GROUP_15 = 15	Group identifier (1 -15)

Declaration in C/C++:

```
enum
{
      F28_GROUP_1 = 1,
      F28_GROUP_2,
      F28_GROUP_3,
      F28_GROUP_4,
      F28_GROUP_5,
      F28_GROUP_6,
      F28_GROUP_7,
      F28_GROUP_8,
      F28_GROUP_9,
      F28_GROUP_10,
      F28_GROUP_11,
      F28_GROUP_12,
      F28_GROUP_13,
      F28_GROUP_14,
      F28_GROUP_15
};
```

Visual Basic (Vb.Net):

```
Enum F28_GROUP_ID As Byte
      GROUP_1 = 1
      GROUP_2
      GROUP_3
      GROUP_4
      GROUP_5
      GROUP_6
      GROUP_7
      GROUP_8
      GROUP_9
      GROUP_10
      GROUP_11
      GROUP_12
      GROUP_13
      GROUP_14
      GROUP_15
      GROUP_MAX
End Enum
```

C#.Net:

```
public enum F28_GROUP_ENUM : byte
{
      F28_GROUP_1 = 1,
      F28_GROUP_2,
      F28_GROUP_3,
      F28_GROUP_4,
      F28_GROUP_5,
      F28_GROUP_6,
      F28_GROUP_7,
      F28_GROUP_8,
      F28_GROUP_9,
      F28_GROUP_10,
      F28_GROUP_11,
      F28_GROUP_12,
      F28_GROUP_13,
      F28_GROUP_14,
      F28_GROUP_15
};
```

2.2. MODULE ADDRESS

Value for variable "**ucModuleAddr**".

Variable	Data type	Value	Description
ucModuleAddr	BYTE	F28_MODULE_ADDR_0 = 0 F28_MODULE_ADDR_1 = 1 F28_MODULE_ADDR_2 = 2 F28_MODULE_ADDR_3 = 3 F28_MODULE_ADDR_4 = 4 F28_MODULE_ADDR_5 = 5 F28_MODULE_ADDR_6 = 6 F28_MODULE_ADDR_7 = 7 F28_MODULE_ADDR_8 = 8 F28_MODULE_ADDR_9 = 9 F28_MODULE_ADDR_10 = 10 F28_MODULE_ADDR_11 = 11 F28_MODULE_ADDR_12 = 12 F28_MODULE_ADDR_13 = 13 F28_MODULE_ADDR_14 = 14 F28_MODULE_ADDR_15 = 15	Station address (0 -15)

Declaration in C/C++:

```
enum
{
	F28_MODULE_ADDR_0,
	F28_MODULE_ADDR_1,
	F28_MODULE_ADDR_2,
	F28_MODULE_ADDR_3,
	F28_MODULE_ADDR_4,
	F28_MODULE_ADDR_5,
	F28_MODULE_ADDR_6,
	F28_MODULE_ADDR_7,
	F28_MODULE_ADDR_8,
	F28_MODULE_ADDR_9,
	F28_MODULE_ADDR_10,
	F28_MODULE_ADDR_11,
	F28_MODULE_ADDR_12,
	F28_MODULE_ADDR_13,
	F28_MODULE_ADDR_14,
	F28_MODULE_ADDR_15,
	F28_MAX_MODULES_BY_GROUP
};
```

Visual Basic (Vb.Net):

```
Enum F28_MODULE_ADDR As Byte
     MODULE_ADDR_0 = 0
     MODULE_ADDR_1
     MODULE_ADDR_2
     MODULE_ADDR_3
     MODULE_ADDR_4
     MODULE_ADDR_5
     MODULE_ADDR_6
     MODULE_ADDR_7
     MODULE_ADDR_8
     MODULE_ADDR_9
     MODULE_ADDR_10
     MODULE_ADDR_11
     MODULE_ADDR_12
     MODULE_ADDR_13
     MODULE_ADDR_14
     MODULE_ADDR_15
     MODULE_MAX
End Enum
```

C#.Net:

```
public enum F28_MODULE_ADDR_ENUM : byte
{
	F28_MODULE_ADDR_0,
	F28_MODULE_ADDR_1,
	F28_MODULE_ADDR_2,
	F28_MODULE_ADDR_3,
	F28_MODULE_ADDR_4,
	F28_MODULE_ADDR_5,
	F28_MODULE_ADDR_6,
	F28_MODULE_ADDR_7,
	F28_MODULE_ADDR_8,
	F28_MODULE_ADDR_9,
	F28_MODULE_ADDR_10,
	F28_MODULE_ADDR_11,
	F28_MODULE_ADDR_12,
	F28_MODULE_ADDR_13,
	F28_MODULE_ADDR_14,
	F28_MODULE_ADDR_15,
	F28_MAX_MODULES_BY_GROUP
};
```

2.3. STEP CODE

Step code value for variable ucStatus inside F28_REALTIME_CYCLE structure.

Variable	Data type	Value	Description
ucStatus	BYTE	READY = 0,	Out of cycle
	BYTE	FILL_STEP = 1,	Fill step
	BYTE	STAB_STEP = 2,	Stabilization step
	BYTE	TEST_STEP = 3,	Test step
	BYTE	DUMP_STEP =4	Dump step

Declaration in C/C++:

```
enum F28_ENUM_STEP_CODE
{
      READY,
      FILL_STEP,
      STAB_STEP,
      TEST_STEP,
      DUMP_STEP
};
```

Visual Basic (Vb.Net):

```
Enum F28_ENUM_STEP_CODE As Byte
      READY
      FILL_STEP
      STAB_STEP
      TEST_STEP
      DUMP_STEP
End Enum
```

C#.Net:

```
public enum F28_ENUM_STEP_CODE : byte
{
      READY,
      FILL_STEP,
      STAB_STEP,
      TEST_STEP,
      DUMP_STEP
};
```

2.4. IDENTIFIER OF MODULE

Value for variable sModuleID. The identifier of the module is unique. It returns by the function "**F28_AddModule**".

Variable	Data type	Description
sModuleID	short	High byte = index of channel. Low byte = index of module.

2.5. STRUCTURE DEFINITIONS IN C/C++

***Note**: All structures are 1 byte packed, for easy portability and data exchange between API and Visual basic 2013 application.*

```
#pragma pack(push, 1 )

// Date structure
typedef struct
{
      WORD wYear;
      WORD wMonth;
      WORD wDay;
      WORD wHour;
      WORD wMinute;
      WORD wSecond;
} F28_DATE;

// Result structure
typedef struct
{
      UCHAR ucStatus;
      float fPressureValue;
      float fLeakValue;
      UCHAR ucUnitPressure;
      UCHAR ucUnitLeak;
      BYTE ucGroupID;
      BYTE ucModuleAddr;
      F28_DATE dateReceived;
}F28_RESULT;

// Real time structure
typedef struct F28_REALTIME_CYCLE
{
      UCHAR ucEndCycle;
      UCHAR ucStatus;
      float fPressureValue;
      float fLeakValue;
      UCHAR ucUnitPressure;
      UCHAR ucUnitLeak;
      float fInternalTemperature;
      float fPatm;
}F28_REALTIME_CYCLE;

// Cycle statistics structure
typedef struct
{
      DWORD dwTotalCycles;
      DWORD dwFailCycles;
      DWORD dwSuccessCycles;
}F28_CYCLE_STATISTICS;
```

```
// Communication statistics structure
typedef struct
{
      DWORD dwTransmited;
      DWORD dwReceived;
      DWORD dwErrors;
}F28_COMMUNICATION_STATISTICS;

// Parameter structure

typedef struct F28_PARAMETERS
{
    WORD    wTypeTest;         // STANDARD LEAK
    WORD    wTpsFillVol;
    WORD    wTpsTransfert;
    WORD    wTpsFill;
    WORD    wTpsStab;
    WORD    wTpsTest;
    WORD    wTpsDump;
    WORD    wPress1Unit;       // See F28_PRESS_UNITS
    float   fPress1Min;
    float   fPress1Max;
    float   fSetFillP1;        //instruction auto-fill mode
    float   fRatioMax;         //LARGE LEAK mode only
    float   fRatioMin;         //LARGE LEAK mode only
    WORD    wFillMode;         //STD_FILL_MODE / AUTOFILL_MODE
    WORD    wLeakUnit;         //See F28_LEAK_UNITS
    WORD    wRejectCalc;       //Pa or Pa/s
    WORD    wVolumeUnit;       //See F28_ENUM_VOLUME_UNIT
    float   fVolume;
    float   fRejectMin;
    float   fRejectMax;
    float    fCoeffAutoFill;
    WORD    wOptions;          //Options parameters
    //V1.200
    float   fPatmSTD;          //Patm standard condition (hPa)
    float   fTempSTD;          //Temperature standard condition (in °C)
    float   fFilterTime;       //in (s)
    //V1.300
    float   fOffsetLeak;       //Offset on the leak
}F28_PARAMETERS;
#pragma pack(pop)
```

2.6. STRUCTURE DEFINITIONS IN VISUAL BASIC

```
' -------------------------
' Date structure
' -------------------------
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_DATE
      Dim wYear As UShort
      Dim wMonth As UShort
      Dim wDay As UShort
      Dim wHour As UShort
      Dim wMinute As UShort
      Dim wSecond As UShort
End Structure

' -------------------------
' Result structure
' -------------------------
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_RESULT
      Dim ucStatus As Byte
      Dim fPressureValue As Single
      Dim fLeakValue As Single
      Dim ucUnitPressure As Byte
      Dim ucUnitLeak As Byte
      Dim GroupID As Byte                  ' F28_GROUP_ID
      Dim ModuleAddr As Byte               ' F28_MODULE_ADDR
      Dim dateReceived As F28_DATE
End Structure

' -------------------------
' real time result structure
' -------------------------
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_REALTIME_CYCLE
      Dim ucEndCycle As Byte
      Dim ucStatus As Byte
      Dim fPressureValue As Single
      Dim fLeakValue As Single
      Dim ucUnitPressure As Byte
      Dim ucUnitLeak As Byte
      Dim fInternalTemperature As Single    ' Temperature in °C
      Dim fPatm As Single                   ' Abs pressure in hPa
End Structure

' -------------------------
' Statistic structure
' -------------------------
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_CYCLE_STATISTICS
      Dim dwTotalCycles As UInteger
      Dim dwFailCycles As UInteger
      Dim dwSuccessCycles As UInteger
End Structure
```

```
' -------------------------
' Communication counter structure
' -------------------------
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_COMMUNICATION_STATISTICS
      Dim dwTransmited As UInteger
      Dim dwReceived As UInteger
      Dim dwErrors As UInteger
End Structure

' -------------------------
' Parameter structure
' -------------------------
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_PARAMETERS
Dim wTypeTest As UShort ' STANDARD LEAK
      Dim wTpsFillVol As UShort
      Dim wTpsTransfert As UShort
      Dim wTpsFill As UShort
      Dim wTpsStab As UShort
      Dim wTpsTest As UShort
      Dim wTpsDump As UShort
      Dim wPress1Unit As UShort   ' See F28_PRESS_UNITS
      Dim fPress1Min As Single
      Dim fPress1Max As Single
      Dim fSetFillP1 As Single' Setpoint auto-fill
      Dim fRatioMax As Single
      Dim fRatioMin As Single
      Dim wFillMode As UShort ' STD_FILL_MODE / AUTOFILL_MODE
      Dim wLeakUnit As UShort ' See F28_LEAK_UNITS
      Dim wRejectCalc As UShort   ' Pa or Pa/s
      Dim wVolumeUnit As UShort   ' See F28_ENUM_VOLUME_UNIT
      Dim fVolume As Single
      Dim fRejectMin As Single
      Dim fRejectMax As Single
      Dim fCoeffAutoFill As Single
      Dim wOptions As UShort  ' Options parameters
      Dim fPatmSTD As Single  ' Patm  standard condition (hPa)
      Dim fTempSTD As Single  ' Temperature standard condition (°C)
      Dim fFilterTime As Single   ' in (s)
      Dim fOffsetLeak As Single' Offset on the leak
End Structure
```

2.7. STRUCTURE DEFINITIONS IN C#.NET

```
[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_DATE
{
      public ushort usYear;
      public ushort usMonth;
      public ushort usDay;
      public ushort usHour;
      public ushort usMinute;
      public ushort usSecond;
};

[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_RESULT
{
      public byte     bStatus;
      public float    fPressureValue;
      public float    fLeakValue;
      public byte     bUnitPressure;
      public byte     bUnitLeak;
      public byte     bGroupID;
      public byte     bModuleAddr;
      public F28_DATE dateReceived;
};

[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_REALTIME_CYCLE
{
      public byte     bEndCycle;
      public byte     bStatus;
      public float    fPressureValue;
      public float    fLeakValue;
      public byte     bUnitPressure;
      public byte     bUnitLeak;
      public float    fInternalTemperature;
      public float    fPatm;
};

[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_CYCLE_STATISTICS
{
      public uint uiTotalCycles;
      public uint uiFailCycles;
      public uint uiSuccessCycles;
};
```

```
[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_REGLAGE
{
     long        lOffset;
     float       fCoeffA;
     float       fCoeffB;
     F28_DATE    date;
     [MarshalAs(UnmanagedType.LPStr)] string Operator;
};

[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_COMMUNICATION_STATISTICS
{
     public uint uiTransmited;
     public uint uiReceived;
     public uint uiErrors;
};

[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_PARAMETERS
{
     public ushort usTypeTest;    // STANDARD LEAK
     public ushort usTpsFillVol;
     public ushort usTpsTransfert;
     public ushort usTpsFill;
     public ushort usTpsStab;
     public ushort usTpsTest;
     public ushort usTpsDump;
     public ushort usPress1Unit;  // See F28_PRESS_UNITS
     public float fPress1Min;
     public float fPress1Max;
     public float fSetFillP1;     //auto-fill mode instruction
     public float fRatioMax;      //LARGE LEAK mode only
     public float fRatioMin;      //LARGE LEAK mode only
     public ushort usFillMode;    //STD_FILL_MODE / AUTOFILL_MODE
     public ushort usLeakUnit;    //See F28_LEAK_UNITS
     public ushort usRejectCalc;  //Pa or Pa/s
     public ushort usVolumeUnit;  //See F28_ENUM_VOLUME_UNIT
     public float fVolume;
     public float fRejectMin;
     public float fRejectMax;
     public float fCoeffAutoFill;
     public ushort usOptions;     //Options parameters
     public float fPatmSTD;       //Patm standard condition (hPa)
     public float fTempSTD;       //T° standard condition (in °C)
     public float fFilterTime;    //in (s)
     public float fOffsetLeak;    //Offset on the leak
};
```

2.8. FUNCTION RETURN CODE

Declaration	Data type	Value	Description
F28_FAIL	short	-1	Error
F28_OK		0	Ok

Visual Basic (Vb.Net):

```
Enum F28_RETURN As Short
      F28_FAIL = -1
      F28_OK = 0
End Enum
```

Declaration	Data type	Value	Description
F28_OFFLINE	short	0	Offline
F28_CONNECTED		1	Unit connected

3. APPLICATION PROGRAMMING INTERFACE

3.1. FUNCTIONAL GROUPS IN THE API

- Driver related functions
- Network related functions
- General device functions
- Information related functions
- Unit Control related functions
- Group Control related functions
- Parameters related functions
- Result related functions

3.2. DRIVER RELATED FUNCTIONS

3.2.1. F28_Init

This function detects a head board and initializes a connection. It must be called first.

Function call:

C++:

```
short F28API F28_Init(void);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_Init Lib "F28LightControl_ETH.dll" () As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_Init();
```

Arguments:

Argument	Data type	Description
none		

Return Value:

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.2.2. F28_OpenChannel

This function opens a channel.

Function call:

C++:

```
short F28API F28_OpenChannel(void);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_OpenChannel Lib "F28LightControl_ETH.dll" () _
            As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_OpenChannel();
```

Arguments:

Argument	Data type	Description
none		

Return Value:

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.2.3. F28_Close

This function closes all channels.

Function call:

C++:

```
void F28API F28_Close(void);
```

Visual Basic (Vb.Net):

```
Public Declare Sub F28_Close Lib "F28LightControl_ETH.dll" ()
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern void F28_Close();
```

Arguments:

Argument	Data type	Description
none		

Return Value:

3.2.4. F28_GetDllMajorVersion

Read a major's version of the API.

Function call:

C++:

```
unsigned short F28API F28_GetDllMajorVersion(void);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetDllMajorVersion Lib _
             "F28LightControl_ETH.dll" () As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern ushort F28_GetDllMajorVersion();
```

Arguments:

Argument	Data type	Description
None		

Return Value: *unsigned short*

Major version

3.2.5. F28_GetDllMinorVersion

Read a minor's version of the API.

Function call:

C++:

```
unsigned short F28_GetDllMinorVersion()
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetDllMinorVersion Lib _
             "F28LightControl_ETH.dll" () As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern ushort F28_GetDllMinorVersion();
```

Arguments:

Argument	Data type	Description
none		

Return Value: *unsigned short*

Minor version

3.3. NETWORK RELATED FUNCTIONS

3.3.1. F28_AddModule

Add F28 unit to the network.

Function call:

C++:

```
short F28API  F28_AddModule(ULONG ulIP, BYTE ucModuleAddr, BYTE ucGroupID,
            BYTE ucTimeout);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_AddModule Lib "F28LightControl_ETH.dll" (ByVal
            ulIP As UInteger, ByVal ucModuleAddr As Byte, ByVal ucGroupID
            As Byte, ucTimeout As Byte) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_AddModule(uint ulIP, byte bModuleAddr, byte
            bGroupID, byte bTimeout);
```

Arguments:

Argument	Data type	Description
ulIP	ULONG	IP address in long format
ucModuleAddr	BYTE	Module address
ucGroupID	BYTE	Group ID
ucTimeout	BYTE	Timeout in seconds

Return Value: short.

F28_FAIL: if the function fails.

sModuleID: High byte = channel's index, Low byte = module's index

3.3.2. F28_ReconnectModule

Reconnect F28 unit specified by module ID in the network.

Function call:

C++:

```
short F28API F28_ReconnectModule(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_ReconnectModule Lib "F28LightControl_ETH.dll" _
            (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_ReconnectModule(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.3.3. F28_RemoveModule

Remove F28 unit specified by module ID from network.

Function call:

C++:

```
short F28API F28_RemoveModule(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_RemoveModule Lib "F28LightControl_ETH.dll" _
             (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_RemoveModule(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.3.4. F28_RemoveAllModules

Remove all units specified by channel's ID from the network.

Function call:

C++:

```
short F28API F28_RemoveAllModules(BYTE ucChannelID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_RemoveAllModules Lib "F28LightControl_ETH.dll" _
            (ByVal ucChannelID As Byte) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_RemoveAllModules();
```

Arguments:

Argument	Data type	Description
ucChannelID	BYTE	Channel identifier

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.3.5. F28_ResetEthernetModule

To reset the Ethernet board, this is to fix a communication issue.

Function call:

C++:

```
short F28API F28_ResetEthernetModule(short sModuleID); (
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_ResetEthernetModule Lib _
            "F28LightControl_ETH.dll" _ (ByVal sModuleID As Short) As
            Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_ResetEthernetModule(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4. INFORMATION RELATED FUNCTION

3.4.1. F28_RefreshModuleInformations

Query information about the module.

Function call:

C++:

```
short F28API F28_RefreshModuleInformations(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_RefreshModuleInformations Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_RefreshModuleInformations(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

***Note**: this function must be called before F28_GetSerialNumber, F28_GetModuleSoftVersion, F28_GetModuleHardVersion.*

3.4.2. F28_GetSerialNumber

Retrieve the current serial number from Module Information.

Function call:

C++:

```
short F28API F28_GetSerialNumber(short sModuleID, LPSTR szSerialNumber,
             unsigned short wLength);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetSerialNumber Lib "F28LightControl_ETH.dll" _
             (ByVal sModuleID As Short, ByVal szSerialNumber As String, _
             ByVal Length As UShort) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetSerialNumber(short sModuleID,
             StringBuilder strSerialNumber, ushort usLength);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
szSerialNumber	array of char	Returned serial number
wLength	unsigned short	Length of char to read (20 chars max)

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4.3. F28_GetModuleSoftVersion

Retrieve the version of unit's firmware from Module Information.

Function call:

C++:

```
short F28API F28_GetModuleSoftVersion(short sModuleID, LPSTR szVersion,
             unsigned short wLength);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetModuleSoftVersion Lib_
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short, ByVal _
             szSoftVersion As String, ByVal Length As UShort) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll", CharSet = CharSet.Ansi)]
public static extern short F28_GetModuleSoftVersion(short sModuleID,
             StringBuilder strVersion, ushort usLength);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
szVersion	array of char	Returned software's version of the F28
wLength	unsigned short	Length of char to read

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4.4. F28_GetModuleHardVersion

Retrieve the board's hardware version from Module Information.

Function call:

C++:

```
short F28API F28_GetModuleHardVersion(short sModuleID, LPSTR szVersion,
            unsigned short wLength);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetModuleHardVersion Lib _
            "F28LightControl_ETH.dll" (ByVal sModuleID As Short, ByVal _
            szHardVersion As String, ByVal Length As UShort) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll", CharSet = CharSet.Ansi)]
private static extern short F28_GetModuleHardVersion(short sModuleID,
            StringBuilder strVersion, ushort usLength);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
szVersion	array of char	Returned hardware's version of the F28
wLength	unsigned short	Lenght of byte to read

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4.5. F28_GetAddressIP

Read the IP address of the Module in long format.

Function call:

C++:

```
short F28API F28_GetAddressIP(short sModuleID, ULONG* pAddressIP);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetAddressIP Lib "F28LightControl_ETH.dll"
            (ByVal sModuleID As Short, ByRef pAddressIP As UInteger) As
            Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetAddressIP(short sModuleID, ref uint
            ulAddressIP);
```

Arguments:

Argument	Data type	Description
sModuleID	short	ID of module
pAddressIP	ULONG	Returned IP address of the module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4.6. F28_ETHSoftVersion

Read the version of Ethernet board firmware of the Module.

Function call:

C++:

```
short F28API F28_GetETHSoftVersion(short sModuleID, LPSTR szVersion,
             unsigned short wLength);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetETHSoftVersion Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short, _
             ByVal szVersion As String, ByVal wLength As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetETHSoftVersion(short sModuleID,
             StringBuilder strVersion, ushort usLength);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
szVersion	array of char	Returned software's version of the Ethernet board
wLength	unsigned short	Length of char to read

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4.7. F28_GetETHHardVersion

Read the hard version of Ethernet board of the Module.

Function call:

C++:

```
short F28API F28_GetETHHardVersion(short sModuleID, LPSTR szVersion,
            unsigned short wLength);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetETHHardVersion Lib _
            "F28LightControl_ETH.dll" (ByVal sModuleID As Short, _
            ByVal szVersion As String, ByVal wLength As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetETHHardVersion(short sModuleID,
            StringBuilder strVersion, ushort usLength);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
szVersion	array of char	Returned hardware's version of the Ethernet board
wLength	unsigned short	Length of char to read

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4.8. F28_GetSubnetMask

Read the Subnet mask of the Module in long format.

Function call:

C++:

```
short F28API F28_GetSubnetMask(short sModuleID, ULONG* pAddressIP);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetSubnetMask Lib "F28LightControl_ETH.dll"
            (ByVal sModuleID As Short, ByRef pAddressIP As UInteger) As
            Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetSubnetMask(short sModuleID, ref uint
            ulAddressIP);
```

Arguments:

Argument	Data type	Description
sModuleID	short	ID of module
pAddressIP	ULONG	Returned Subnet mask of the module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4.9. F28_GetGatewayAddressIP

Read the Gateway of the Module in long format.

Function call:

C++:

```
short F28API F28_GetGatewayAddressIP(short sModuleID, ULONG* pAddressIP);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetGatewayAddressIP Lib "F28LightControl_ETH.dll"
             (ByVal sModuleID As Short, ByRef pAddressIP As UInteger) As
             Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetGatewayAddressIP(short sModuleID, ref uint
             ulAddressIP);
```

Arguments:

Argument	Data type	Description
sModuleID	short	ID of module
pAddressIP	ULONG	Returned Gateway address of the module in long format

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.4.10. F28_GetMACAddress

Read the MAC address of the Module Information.

Function call:

C++:

```
short F28API F28_GetMACAddress(short sModuleID, LPSTR szMAC, unsigned short
             wLength);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetMACAddress Lib "F28LightControl_ETH.dll" _
             (ByVal sModuleID As Short, ByVal szMAC As String, ByVal _
             wLength As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetMACAddress(short sModuleID, StringBuilder
             strMAC, ushort usLength);
```

Arguments:

Argument	Data type	Description
sModuleID	short	ID of module
szMAC	LPSTR	Returned MAC address of the module in string

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.5. UNIT CONTROL RELATED FUNCTIONS

3.5.1. F28_IsModuleConnected

Check if the module is connected.

Function call:

C++:

```
short F28API F28_IsModuleConnected(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_IsModuleConnected Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_IsModuleConnected(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_CONNECTED: if the module is connected.

F28_NOT_CONNECTED: if the module is not connected.

F28_FAIL: if the function fails.

3.5.2. F28_StartCycle

The function starts the test cycle of the module.

Function call:

C++:

```
short F28API F28_StartCycle(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StartCycle Lib "F28LightControl_ETH.dll" _
            (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_StartCycle(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.5.3. F28_StopCycle

The function aborts the test cycle of the module.

Function call:

C++:

```
short F28API F28_StopCycle(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StopCycle Lib "F28LightControl_ETH.dll" _
            (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_StopCycle(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.6. GROUP CONTROL RELATED FUNCTIONS

3.6.1. F28_StartCycleByGroup

The function starts the test cycle of all units cycle in the defined group.

Function call:

C++:

```
short F28API F28_StartCycleByGroup(BYTE ucGroupID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StartCycleByGroup Lib _
             "F28LightControl_ETH.dll" (ByVal ucGroupID As Byte) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_StartCycleByGroup(byte bGroupID);
```

Arguments:

Argument	Data type	Description
ucGroupID	BYTE	Identifier of the group

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.6.2. F28_StopCycleByGroup

The function aborts the test cycle of all units cycle in the defined group.

Function call:

C++:

```
short F28API F28_StopCycleByGroup(BYTE ucGroupID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StopCycleByGroup Lib "F28LightControl_ETH.dll" _
             (ByVal ucGroupID As Byte) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_StopCycleByGroup(byte bGroupID);
```

Arguments:

Argument	Data type	Description
ucGroupID	BYTE	Identifier of the group

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.7. PARAMETERS RELATED FUNCTIONS

3.7.1. Parameters structure F28_PARAMETERS

Element	Data type	Description	
wTypeTest	WORD	Test type parameter	
wTpsFillVol	WORD	Fill time for volume transfer in 0.01 sec (0 – 650 sec)	
wTpsTransfert	WORD	Transfer time in 0.01 sec (0 – 650 sec)	
wTpsFill	WORD	Fill time in 0.01 sec (0 – 650 sec)	
wTpsStab	WORD	Stabilization time in 0.01 sec (0 – 650 sec)	
wTpsTest	WORD	Test time in 0.01 sec (0 – 650 sec)	
wTpsDump	WORD	Dump time in 0.01 sec (0 – 650 sec)	
wPress1Unit	WORD	Unit of pressure # 1	
fPress1Min	float	Minimum pressure # 1	
fPress1Max	float	Maximum pressure # 1	
fSetFillP1	float	Setpoint pressure # 1	
fRatioMax	float	Max reject value for ratio P_{start}/P_{end}	
fRatioMin	float	Min reject value for ratio P_{start}/P_{end}	
wFillMode	WORD	Fill mode	
wLeakUnit	WORD	Leak unit	
wRejectCalc	WORD	Pa or Pa/s	
wVolumeUnit	WORD	Volume unit	
fVolume	float	Volume value	
fRejectMin	float	Reject **Reference** side	*See reminder at the beginning of this manual.*
fRejectMax	float	Reject **Test** side	
fCoeffAutoFill	float	Reserved	
wOptions	WORD	See paragraph 3.7.1) Options ("**wOptions**" parameter).	
FPatmSTD	float	Patm standard condition (hPa)	
FTempSTD	float	Temperature standard condition (°C)	
FFilterTime	float	Filter time in sec	
fOffsetLeak	float	Offset on the leak	

Declaration in C/C++:

```
typedef struct
{
    WORD    wTypeTest;          //STANDARD LEAK
    WORD    wTpsFillVol;
    WORD    wTpsTransfert;
    WORD    wTpsFill;
    WORD    wTpsStab;
    WORD    wTpsTest;
    WORD    wTpsDump;
    WORD    wPress1Unit;        //See F28_PRESS_UNITS
    float   fPress1Min;
    float   fPress1Max;
    float   fSetFillP1;         //instruction auto-fill mode
    float   fRatioMax;          //LARGE LEAK mode only
    float   fRatioMin;          //LARGE LEAK mode only
    WORD    wFillMode;          //STD_FILL_MODE / AUTOFILL_MODE
    WORD    wLeakUnit;          //See F28_LEAK_UNITS
    WORD    wRejectCalc;        //Pa or Pa/s
    WORD    wVolumeUnit;        //See F28_ENUM_VOLUME_UNIT
    float   fVolume;
    float   fRejectMin;
    float   fRejectMax;
    float   fCoeffAutoFill;
    WORD    wOptions;           //Options parameters
    float   fPatmSTD;           //Patm standard condition (hPa)
    float   fTempSTD;           //Temperature standard condition (°C)
    float   fFilterTime;        //in (s)
    float   fOffsetLeak;        //Offset on the leak
}F28_PARAMETERS;
```

Declaration in Visual Basic 2013:

```
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_PARAMETERS
      Dim wTypeTest As UShort       'STANDARD LEAK
      Dim wTpsFillVol As UShort
      Dim wTpsTransfert As UShort
      Dim wTpsFill As UShort
      Dim wTpsStab As UShort
      Dim wTpsTest As UShort
      Dim wTpsDump As UShort
      Dim wPress1Unit As UShort     'See F28_PRESS_UNITS
      Dim fPress1Min As Single
      Dim fPress1Max As Single
      Dim fSetFillP1 As Single      'Setpoint auto-fill
      Dim fRatioMax As Single
      Dim fRatioMin As Single
      Dim wFillMode As UShort       'STD_FILL_MODE / AUTOFILL_MODE
      Dim wLeakUnit As UShort       'See F28_LEAK_UNITS
      Dim wRejectCalc As UShort     'Pa or Pa/s
      Dim wVolumeUnit As UShort     'See F28_ENUM_VOLUME_UNIT
      Dim fVolume As Single
      Dim fRejectMin As Single
      Dim fRejectMax As Single
      Dim fCoeffAutoFill As Single
      Dim wOptions As UShort        'Options parameters
      Dim fPatmSTD As Single        'Patm standard condition (hPa)
      Dim fTempSTD As Single        'Temperature standard condition (°C)
      Dim fFilterTime As Single     'in (s)
      Dim fOffsetLeak As Single     'Offset on the leak
End Structure
```

Declaration in C#.Net:

```
[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_PARAMETERS
{
      public ushort usTypeTest;    // STANDARD LEAK
      public ushort usTpsFillVol;
      public ushort usTpsTransfert;
      public ushort usTpsFill;
      public ushort usTpsStab;
      public ushort usTpsTest;
      public ushort usTpsDump;
      public ushort usPress1Unit;  // See F28_PRESS_UNITS
      public float fPress1Min;
      public float fPress1Max;
      public float fSetFillP1;     //auto-fill mode instruction
      public float fRatioMax;      //LARGE LEAK mode only
      public float fRatioMin;      //LARGE LEAK mode only
      public ushort usFillMode;    //STD_FILL_MODE / AUTOFILL_MODE
      public ushort usLeakUnit;    //See F28_LEAK_UNITS
      public ushort usRejectCalc;  //Pa or Pa/s
      public ushort usVolumeUnit;  //See F28_ENUM_VOLUME_UNIT
      public float fVolume;
      public float fRejectMin;
      public float fRejectMax;
      public float fCoeffAutoFill;
      public ushort usOptions;     //Options parameters
      public float fPatmSTD;       //Patm standard condition (hPa)
      public float fTempSTD;       //T° standard condition (in °C)
      public float fFilterTime;    //in (s)
      public float fOffsetLeak;    //Offset on the leak
};
```

3.7.2. Options

Uses with "**wOptions**" parameter

Element	Data type	Value	Description
wOptions	UShort	BIT_SIGN (bit 0)	Sign option validation
		BIT_NO_NEGATIVE_VALUE (bit 1)	No negative value validation
		BIT (bit 2 reserved)	Reserved
		BIT (bit 3 reserved)	Reserved
		BIT_TEST_PRESSURE_CORR (bit 4)	Test pressure correction validation
		BIT_ELECTRONIC_REGULATOR (bit 5)	Electronic regulator option validation

Bit	15 to 6	5	4	3	2	1	0
Option	Reserved	**Electronic regulator option**	**Pressure compensation**	Reserved	Reserved	**No Negative**	**Sign**

Declaration in C/C++:

```
enum F28_OPTIONS
{
      BIT_SIGN = 0,
      BIT_NO_NEGATIVE_VALUE = 1,
      BIT = 2, // reserved
      BIT = 3, // reserved
      BIT_TEST_PRESSURE_CORR = 4
      BIT_ELECTRONIC_REGULATOR = 5
};
```

Visual Basic (Vb.Net):

```
Enum F28_OPTIONS As UShort
      BIT_SIGN = 0
      BIT_NO_NEGATIVE_VALUE = 1
      BIT = 2 'reserved
      BIT = 3 'reserved
      BIT_TEST_PRESSURE_CORR = 4
      BIT_ELECTRONIC_REGULATOR = 5
End Enum
```

C#.Net:

```
public enum F28_OPTIONS : UShort
{
      BIT_SIGN = 0,
      BIT_NO_NEGATIVE_VALUE = 1,
      BIT = 2, // reserved
      BIT = 3, // reserved
      BIT_TEST_PRESSURE_CORR = 4,
      BIT_ELECTRONIC_REGULATOR = 5
};
```

3.7.3. F28_GetModuleParameters

The function reads parameters from the defined module.

When querying the parameters the above F28_PARAMETERS structure is expected in the function call.

Function call:

C++:

```
short F28API F28_GetModuleParameters(short sModuleID, F28_PARAMETERS*
             pPara);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetModuleParameters Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short, _
             ByRef Para As F28_PARAMETERS) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetModuleParameters(short sModuleID, ref
             F28_PARAMETERS tPara);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
pPara	F28_PARAMETERS*	Pointer to a F28_PARAMETERS structure, to place returned values in.

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.7.4. F28_SetModuleParameters

The function writes parameters, F28_PARAMETERS structure, to the defined module.

Function call:

C++:

```
short F28API F28_SetModuleParameters(short sModuleID, F28_PARAMETERS* pPara);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_SetModuleParameters Lib _
              "F28LightControl_ETH.dll"_ (ByVal sModuleID As Short, _
              ByRef Para As F28_PARAMETERS) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_SetModuleParameters(short sModuleID, ref
              F28_PARAMETERS tPara);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
pPara	F28_PARAMETERS*	Pointer to a F28_ PARAMETERS structure to write

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

***Note**: the parameters must be written to the F28 module at least once after power on.*

3.8. SPECIAL CYCLE RELATED FUNCTIONS

3.8.1. F28_StartAutoZeroPressure

The function starts an auto-zero pressure special cycle of the defined module.

Function call:

C++:

```
short F28API F28_StartAutoZeroPressure(short sModuleID, float fDumpTime);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StartAutoZeroPressure Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short, ByVal _
             fDumpTime As Single) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_StartAutoZeroPressure(short sModuleID, float
             fDumpTime);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
fDumpTime	float	Dump time in seconds.

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.8.2. F28_StartRegulatorAdjust

This function allows adjusting manually the regulator.

***Note**: When running, a "**Reset cycle**" must be called to exit the function.*

Function call:

C++:

```
short F28API F28_StartRegulatorAdjust(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StartRegulatorAdjust Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_StartRegulatorAdjust(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.8.3. F28_StartLearningRegulator

The function starts an auto-zero for the pressure sensor and then starts an electronic regulator learning special cycle of the defined module.

This special cycle starts automatically at the module power on.

Function call:

C++:

```
short F28API F28_StartLearningRegulator(short sModuleID, float fDumpTime);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_ StartLearningRegulator Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short, ByVal _
             fDumpTime As Single) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_ StartLearningRegulator (short sModuleID,
             float fDumpTime);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
fDumpTime	float	Dump time in seconds.

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

***Note**: the Dump time (fDumpTime parameter) is the pressure sensor auto-zero time, after this time, the regulator learning cycle begins.*

3.8.4. F28_StartJetCheck

The function start a Jet check special cycle of the defined module.

Function call:

C++:

```
short F28API F28_StartJetCheck(short sModuleID);
```

Visual Basic (Vb.net)

```
Public Declare Function F28_StartJetCheck Lib _ "F28LightControl_Eth.dll"
             (ByVal sModuleID As Short) As Short
```

C#.Net

```
[dllImport("F28LightControl_ETH.dll")]
private static extern short F28_StartJetCheck(short sModuleID) ;
```

Argument :

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

Warning! *When this special cycle has run, the leak unit value (`wLeakUnit`) in the results becomes 255 that is a millimeters unit (mm).*

3.9. RESULT RELATED FUNCTIONS

3.9.1. F28_ClearFIFOResults

This function clears the result inside the FIFO.

***Note**: the FIFO contains only one result.*

Function call:

C++:

```
short F28API F28_ClearFIFOResults(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_ClearFIFOResults Lib "F28LightControl_ETH.dll" _
            (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_ClearFIFOResults(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.9.2. F28_GetResultsCount

This function reads the number of results available in FIFO.

***Note**: when the result is available, the result count is equal to 1.*

Function call:

C++:

```
WORD F28API F28_GetResultsCount(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetResultsCount Lib "F28LightControl_ETH.dll" _
            (ByVal sModuleID As Short) As UShort
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern ushort F28_GetResultsCount(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	Short	Identifier of module

Return Value: short

Number of results: 0 / 1

***Note**: the FIFO contains only one result.*

3.9.3. Result structure F28_RESULT

Element	Data type	Description
ucStatus	UCHAR	Status of result
fPressureValue	float	Pressure value
fLeakValue	float	Leak value
ucUnitPressure	UCHAR	Pressure unit
ucUnitLeak	UCHAR	Leak unit
ucGroupID	UCHAR	Group identifier
ucModuleAddr	UCHAR	Module identifier
wYear	WORD	Year
wMonth	WORD	Month
wDay	WORD	Day
wHour	WORD	Hour
wMinute	WORD	Minute
wSecond	WORD	Second

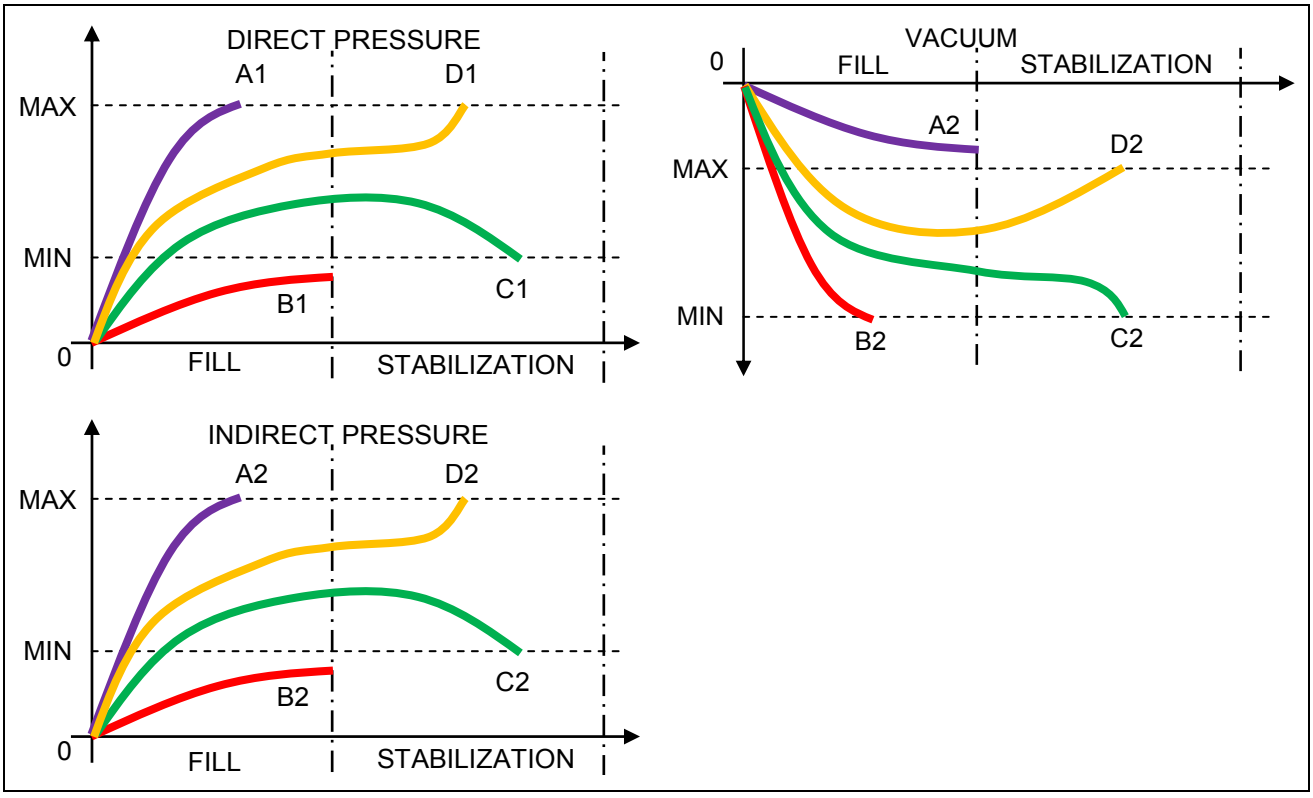
See result status below.

3.9.4. Result status and alarms

Element	Data type	Code value	Description		Leak result value*
ucStatus	UCHAR	0	STATUS_GOOD_PART	Pass part	Value
		1	STATUS_TEST_FAIL_PART	Test fail part. Not used (Reject level at 999)	Value
		2	STATUS_REF_FAIL_PART	Reference fail part	Value
		3	STATUS_ALARM_EEEE	Large leak on Test side, over full scale	Value
		4	STATUS_ALARM_MMMM	Large leak on Reference side, over full scale	Value
		5	STATUS_ALARM_PPPP	Pressure over the maximum pressure range (Tester error)	-399.99
		6	STATUS_ALARM_MPPP	Pressure below the minimum pressure range (Tester error)	-399.99
		7	STATUS_ALARM_OFFD_FUITE	Differential sensor auto-zero error (Tester error)	-399.99
		8	STATUS_ALARM_OFFD_PRESSION	Piezo sensor auto-zero error (Tester error)	-399.99
		9	STATUS_ALARM_PST	Over maximum pressure (pressure too high)	-399.99
				if "Sign" is checked (vacuum or indirect test)	Value
		10	STATUS_ALARM_MPST	Below minimum pressure (pressure too low)	Value
				if "Sign" is checked (vacuum or indirect test)	-399.99
		11	STATUS_ALARM_CS_VOLUME_PETIT	Fail Sealed components volume too small (Tester error)	-399.99
		12	STATUS_ALARM_CS_VOLUME_GRAND	Fail Sealed components volume too large (Tester error)	-399.99
		13	STATUS_ALARM_ERREUR_PRESS_CALIBRATION	Calibration pressure error (Tester error)	-399.99
		14	STATUS_ALARM_ERREUR_LEAK_CALIBRATION	Calibration leak error (Tester error)	-399.99
		15	STATUS_ALARM_ERREUR_LINE_PRESS_CALIB	Calibration line pressure error (Tester error)	-399.99
		16	STATUS_ALARM_APPR_REG_ELEC_ERROR	Electronic regulator learning fail	-399.99
		17	STATUS_ALARM_TEST_PART_LARGE_LEAK	Large leak on Test side Alarm (no value)	+998.00

Element	Data type	Code value	Description		Leak result value*
		18	STATUS_ALARM_REF_SIDE_ LARGE_LEAK	Large leak on Reference side Alarm (no value)	-399.99
		19	STATUS_ALARM_P_TOO_LARGE_ FILL ***See diagrams below***	Over maximum pressure (pressure too high). **Case A1**	-399.99
				If "Sign" is checked (vacuum or indirect test) and over max pressure**. Case A2**	+999.00
		20	STATUS_ALARM_P_TOO_LOW_ FILL ***See diagrams below***	Pressure Below min pressure (pressure too low). **Case B1**	+999.00
				If "Sign" is checked (vacuum or indirect test) and below min pressure**. CaseB2**	-399.99
		21	STATUS_ALARM_JET_CHECK_FAIL	Jet Check out of limits (Jet air supply out of limits or Jet damaged).	-399.99
		22	STATUS_ALARM_JET_CHECK_PASS	Jet Check special cycle succeed	-399.99

*The "**Leak result value**" is sent in the result frame, these specific values are only available from the 1.500 DLL version.



Declaration in C/C++:

```
typedef struct
{
    WORD wYear;
    WORD wMonth;
    WORD wDay;
    WORD wHour;
    WORD wMinute;
    WORD wSecond;
}F28_DATE;

typedef struct
{
    UCHAR ucStatus;
    float fPressureValue;
    float fLeakValue;
    UCHAR ucUnitPressure;
    UCHAR ucUnitLeak;
    BYTE ucGroupID;
    BYTE ucModuleAddr;
    F28_DATE dateReceived;
}F28_RESULT;
```

Declaration in Visual Basic 2013:

```
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_DATE
    Dim wYear As UShort
    Dim wMonth As UShort
    Dim wDay As UShort
    Dim wHour As UShort
    Dim wMinute As UShort
    Dim wSecond As UShort
End Structure

<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_RESULT
    Dim ucStatus As Byte
    Dim fPressureValue As Single
    Dim fLeakValue As Single
    Dim ucUnitPressure As Byte
    Dim ucUnitLeak As Byte
    Dim GroupID As Byte           'F28_GROUP_ID
    Dim ModuleAddr As Byte        'F28_MODULE_ADDR
    Dim dateReceived As F28_DATE
End Structure
```

Declaration in C#.Net:

```
[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_DATE
{
      public ushort usYear;
      public ushort usMonth;
      public ushort usDay;
      public ushort usHour;
      public ushort usMinute;
      public ushort usSecond;
};

[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_RESULT
{
      public byte     bStatus;
      public float    fPressureValue;
      public float    fLeakValue;
      public byte     bUnitPressure;
      public byte     bUnitLeak;
      public byte     bGroupID;
      public byte     bModuleAddr;
      public F28_DATE dateReceived;
};
```

3.9.5. F28_GetNextResult

This function retrieves one result from the FIFO. When querying the above **F28_RESULT** structure is expected in the function call.

***Note**: after reading, the result count is equal to 0.*

Function call:

C++:

```
short F28API F28_GetNextResult(short sModuleID, F28_RESULT* pResult);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetNextResult Lib "F28LightControl_ETH.dll" _
             (ByVal sModuleID As Short, ByRef Result As F28_RESULT) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetNextResult(short sModuleID, ref F28_RESULT
             tResult);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
pResult	F28_RESULT*	Pointer to a F28_RESULT structure, to place returned values in.

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.9.6. F28_GetLastResult

This function retrieves the last cycle result. When querying the above **F28_RESULT** structure is expected in the function call.

Function call:

C++:

```
short F28API F28_GetLastResult(short sModuleID, F28_RESULT* pResult);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetLastResult Lib "F28LightControl_ETH.dll" _
             (ByVal sModuleID As Short, ByRef Result As F28_RESULT) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetLastResult(short sModuleID, ref F28_RESULT
             tResult);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
pResult	F28_RESULT*	Pointer to a F28_RESULT structure, to place returned values in.

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

***Note**: if the result is valid, this function can be called one or more times.*

3.10. REAL TIME CYCLE RELATED FUNCTIONS

3.10.1. Real time data structure F28_REALTIME_CYCLE

Element	Data type	Description
ucEndCycle	UCHAR	1 = End of cycle, 0 = Cycle in progress
ucStatus	UCHAR	see Step code
fPressureValue	float	Pressure value
fLeakValue	float	Leak value
ucUnitPressure	UCHAR	Pressure unit
ucUnitLeak	UCHAR	Leak unit
fInternalTemperature	float	Temperature in °C
fPatm	float	Abs pressure in hPa

Declaration in C/C++:

```
// Real time structure
typedef struct F28_REALTIME_CYCLE
{
      UCHAR ucEndCycle;
      UCHAR ucStatus;
      float fPressureValue;
      float fLeakValue;
      UCHAR ucUnitPressure;
      UCHAR ucUnitLeak;
      float fInternalTemperature;
      float fPatm;
}F28_REALTIME_CYCLE;
```

Declaration in Visual Basic 2013:

```
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_REALTIME_CYCLE
    Dim ucEndCycle As Byte
    Dim ucStatus As Byte
    Dim fPressureValue As Single
    Dim fLeakValue As Single
    Dim ucUnitPressure As Byte
    Dim ucUnitLeak As Byte
    Dim fInternalTemperature As Single      ' Temperature in °C
    Dim fPatm As Single                     ' Abs pressure in hPa
End Structure
```

C#.Net:

```
[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_REALTIME_CYCLE
{
      public byte     bEndCycle;
      public byte     bStatus;
      public float    fPressureValue;
      public float    fLeakValue;
      public byte     bUnitPressure;
      public byte     bUnitLeak;
      public float    fInternalTemperature;
      public float    fPatm;
};
```

3.10.2. F28_GetRealTimeData

The function reads real time data from the defined module. When querying, the above F28_REALTIME_CYCLE structure is expected in the function call.

Function call:

C++:

```
short F28API F28_GetRealTimeData(short sModuleID, F28_REALTIME_CYCLE*
             pCycle);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetRealTimeData Lib "F28LightControl_ETH.dll" _
             (ByVal sModuleID As Short, ByRef Cycle As _
             F28_REALTIME_CYCLE)  As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetRealTimeData(short sModuleID, ref
             F28_REALTIME_CYCLE tCycle);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
pCycle	F28_REALTIME_CYCLE*	Pointer to a F28_REALTIME_CYCLE structure, to place returned values in.

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.11. STATISTIC COUNTER RELATED FUNCTIONS

3.11.1. Cycle statistic structure F28_CYCLE_STATISTICS

Element	Data type	Description
dwTotalCycles	DWORD	Cycle counter
dwFailCycles	DWORD	Fail counter
dwSuccessCycles	DWORD	Pass counter

Declaration in C/C++:

```
typedef struct
{
      DWORD dwTotalCycles;
      DWORD dwFailCycles;
      DWORD dwSuccessCycles;
}F28_CYCLE_STATISTICS;
```

Declaration in Visual Basic 2013:

```
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_CYCLE_STATISTICS
     Dim dwTotalCycles As UInteger
     Dim dwFailCycles As UInteger
     Dim dwSuccessCycles As UInteger
End Structure
```

Declaration in C#.Net:

```
[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_CYCLE_STATISTICS
{
      public uint uiTotalCycles;
      public uint uiFailCycles;
      public uint uiSuccessCycles;
};
```

3.11.2. F28_GetCycleStatistics

This function allows reading the cycle statistics.

When querying the the above cycle statistic, F28_CYCLE_STATISTICS, structure is expected in the function call.

Function call:

C++:

```
short F28API F28_GetCycleStatistics(short sModuleID, F28_CYCLE_STATISTICS*
             pInfo);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetCycleStatistics Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short, ByRef _
             Info As F28_CYCLE_STATISTICS) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetCycleStatistics(short sModuleID, ref
             F28_CYCLE_STATISTICS tInfo);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
pInfo	F28_CYCLE_STATISTICS*	Pointer to a F28_CYCLE_STATISTICS structure, to place returned values in.

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.11.3. Communication statistic structure F28_COMMUNICATION_STATISTICS

Element	Data type	Description
dwTransmited	DWORD	Transmit counter
dwReceived	DWORD	Receive counter
dwErrors	DWORD	Error counter

Declaration in C/C++:

```
typedef struct
{
      DWORD dwTransmited;
      DWORD dwReceived;
      DWORD dwErrors;
}F28_COMMUNICATION_STATISTICS;
```

Declaration in Visual Basic 2013:

```
<StructLayout(LayoutKind.Sequential, Pack:=1)> _
Structure F28_COMMUNICATION_STATISTICS
     Dim dwTransmited As UInteger
     Dim dwReceived As UInteger
     Dim dwErrors As UInteger
End Structure
```

Declaration in C#.Net:

```
[StructLayout(LayoutKind.Sequential, Pack = 1, CharSet = CharSet.Ansi)]
public struct F28_CYCLE_STATISTICS
{
      public uint uiTotalCycles;
      public uint uiFailCycles;
      public uint uiSuccessCycles;
};
```

3.11.4. F28_GetCommunicationStatistics

This function allows reading the communication statistics.

When querying the above communication statistic structure, F28_COMMUNICATION_STATISTICS, is expected in the function call.

Function call:

C++:

```
short F28API F28_GetCommunicationStatistics(short sModuleID,
             F28_COMMUNICATION_STATISTICS* pInfo);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetCommunicationStatistics Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short, ByRef _
             Info As F28_COMMUNICATION_STATISTICS) As Short
```

C#.Net:

```
[DllImport("F28LightControl_ETH.dll")]
private static extern short F28_GetCommunicationStatistics(short sModuleID,
             ref F28_COMMUNICATION_STATISTICS tInfo);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
pInfo	F28_COMMUNICATION_STATISTICS*	Pointer to a F28_COMMUNICATION_STATISTICS structure, to place returned values in.

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.12. AUTO CALIBRATION FUNCTIONS

3.12.1. F28_GetEOCOffset

This function allows reading the end of cycle for the offset calculation.

Function call:

C++:

```
UCHAR F28API F28_GetEOCOffset(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetEOCOffset Lib "F28LightControl_ETH.dll"_
             (ByVal sModuleID As Short) As Byte
```

C#.Net:

```
[DllImport(strDllName)]
private static extern byte F28_GetEOCOffset(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

0: Cycle in progress.

1: End of cycle.

3.12.2. F28_GetEOCVolume

This function allows reading the end of cycle for the volume measurement.

Function call:

C++:

```
UCHAR F28API F28_GetEOCVolume(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetEOCVolume Lib "F28LightControl_ETH.dll"_
             (ByVal sModuleID As Short) As Byte
```

C#.Net:

```
[DllImport(strDllName)]
private static extern byte F28_GetEOCVolume(short sModuleID);Coming soon.
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

0: Cycle in progress.

1: End of cycle.

3.12.3. F28_StartAutoCalOffsetOnly

This function allows calculating the offset of the measurement only.

Function call:

C++:

```
short F28API F28_StartAutoCalOffsetOnly(short sModuleID, WORD wNbCycles,
             WORD wInterCycleTime, float fOffsetMax);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StartAutoCalOffsetOnly Lib _
             "F28LightControl_ETH.dll" (ByVal sModuleID As Short, ByVal _
             wNbCycles As UShort, ByVal wInterCycleTime As UShort, ByVal _
             fOffsetMax As Single) As Short
```

C#.Net:

```
[DllImport(strDllName)]
private static extern short F28_StartAutoCalOffsetOnly(short sModuleID,
             ushort wNbCycles, ushort wInterCycleTime, float fOffsetMax);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
wNbCycles	WORD	Number of cycles of offset calculation
wInterCycleTime	WORD	Time between each offset cycle (ms)
fOffsetMax	float	Maximum reject for the calculated offset (sccm)

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

***Important**! For complete calibration, the offset calibration must be carried on and succeed in first step and then the volume measurement succeed in second step.*

3.12.4. F28_StartAutoCalOffset (first step)

This function allows calculating the offset of the measurement; it is the first step of volume and offset calculation.

Function call:

C++:

```
short F28API F28_StartAutoCalOffset(short sModuleID, WORD wNbCycles, WORD
             wInterCycleTime, float fOffsetMax);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StartAutoCalOffset Lib "F28LightControl_ETH.dll"_
             (ByVal sModuleID As Short, ByVal wNbCycles As UShort, ByVal _
             wInterCycleTime As UShort, ByVal fOffsetMax As Single) As Short
```

C#.Net:

```
[DllImport(strDllName)]
private static extern short F28_StartAutoCalOffset(short sModuleID, ushort
             wNbCycles, ushort wInterCycleTime, float fOffsetMax);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
wNbCycles	WORD	Number of cycles of offset calculation
wInterCycleTime	WORD	Time between each offset cycle
fOffsetMax	float	Maximum reject for the calculated offset

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

***Note**: if this function succeeds, the second step (volume measurement) is required to complete the calibration.*

3.12.5. F28_StartAutoCalVolume (second step)

This function allows measuring the volume of the installation; it is the second step of volume and offset calculation.

Function call:

C++:

```
short F28API F28_StartAutoCalVolume(short sModuleID, WORD wNbCycles, WORD
             wInterCycleTime, float fLeak, float fPressure, float fVolMin,
             float fVolMax);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StartAutoCalVolume Lib "F28LightControl_ETH.dll"_
             (ByVal sModuleID As Short, ByVal wNbCycles As UShort, ByVal _
             wInterCycleTime As UShort, ByVal fLeak As Single, ByVal _
             fPressure As Single, ByVal fVolMin As Single, ByVal fVolMax _
             As Single) As Short
```

C#.Net:

```
[DllImport(strDllName)]
private static extern short F28_StartAutoCalVolume(short sModuleID, ushort
             wNbCycles, ushort wInterCycleTime, float fLeak, float
             fPressure, float fVolMin, float fVolMax);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module
wNbCycles	WORD	Number of cycles of offset calculation
wInterCycleTime	WORD	Time between each offset cycle (ms)
fLeak	float	Value of the master leak (sccm)
fPressure	float	Pressure value of the master leak (bar)
fVolMin	float	Maximum reject for the measured volume (cm^3)
fVolMax	float	Minimum reject for the measured volume (cm^3)

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

***Note**: if this second function succeeds, the calibration is complete.*

3.12.6. F28_StopAutoCal

This function allows aborting any auto calibration cycles. This function must be called to abort a current calibration process.

Function call:

C++:

```
short F28API F28_StopAutoCal(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_StopAutoCal Lib "F28LightControl_ETH.dll" _
             (ByVal sModuleID As Short) As Short
```

C#.Net:

```
[DllImport(strDllName)]
private static extern short F28_StopAutoCal(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

F28_OK: if the function succeeds.

F28_FAIL: if the function fails.

3.12.7. F28_GetAutoCalAlarm

This function allows reading the if an alarm has been triggered during the calibration cycles.

Function call:

C++:

```
UCHAR F28API F28_GetAutoCalAlarm(short sModuleID);
```

Visual Basic (Vb.Net):

```
Public Declare Function F28_GetAutoCalAlarm Lib "F28LightControl_ETH.dll"_
             (ByVal sModuleID As Short) As Byte
```

C#.Net:

```
[DllImport(strDllName)]
private static extern byte F28_GetAutoCalAlarm(short sModuleID);
```

Arguments:

Argument	Data type	Description
sModuleID	short	Identifier of module

Return Value: short

= 0: no Alarm.

≠ 0: Alarm triggered.

3.13. HOW TO RUN CALIBRATION FUNCTIONS

3.13.1. Offset Calculation only

1) Start Offset calculation:

```
// Use: F28_StartAutoCalOffsetOnly(m_hDevice, m_wNbCycles, m_wInterCycle);
```

2) Wait End of Cycle of Offset calculation:

```
// Use: While (!F28_GetEOCOffset(m_hDevice))
```

3) Read Auto Calibration alarm:

```
// Use: F28_GetAutoCalAlarm( m_hDevice)
```

4) If no alarm, read and save parameters:

```
// Use: F28_GetParameters(m_DeviceInfo.hHandle, &tPara) == F28_OK)
```

3.13.2. Volume and Offset Calculation

1) State Offset calculation:

```
// Use: F28_StartAutoCalOffset(m_hDevice, m_wNbCycles, m_wInterCycle);
```

2) Wait End of Cycle of Offset calculation:

```
// Use: While (!F28_GetEOCOffset(m_hDevice))
```

3) Wait Master leak:

```
// Ask user to plug master leak
```

4) if (Wait master leak Ok) start volume calculation:

```
// Use: F28_StartAutoCalVolume(m_hDevice, m_wNbCycles, m_wInterCycle,
                    m_fVolumeLeak, m_fVolumePressure,
                    m_fVolumeMin, m_fVolumeMax)
```

5) Wait End of Cycle of Volume calculation:

```
// Use: (!F28_GetEOCVolume(m_hDevice))
```

6) Read Auto Calibration alarm:

```
// Use: F28_GetAutoCalAlarm( m_hDevice)
```

7) If no alarm, read and save parameters:

```
// Use: F28_GetParameters((m_hDevice, &tPara) == F28_OK)
```

3.14. CALIBRATION CODE EXAMPLE

3.14.1. Start calibration (first step)

```
' ****************************************************
' Start Calibration
' ****************************************************
Public Function StartCal(sModuleID As Short, ucMode As Byte, _
wNbCycles As UShort, _
wInterCycle As UShort, _
fOffsetMax As Single, _
Optional fVolumeLeak As Single = 0, _
Optional fVolumePressure As Single = 0, _
Optional fVolumeMin As Single = 0, _
Optional fVolumeMax As Single = 0) As Boolean
Dim bRet As Boolean
bRet = False
If sModuleID > 0 Then
        m_wNbCycles = wNbCycles
        m_wInterCycle = wInterCycle
        m_fOffsetMax = fOffsetMax
        m_fVolumeLeak = fVolumeLeak
        m_fVolumePressure = fVolumePressure
        m_fVolumeMin = fVolumeMin
        m_fVolumeMax = fVolumeMax
        m_sModuleId = sModuleID
        m_ucMode = ucMode
        m_wError = 0
        m_ucPhase = CAL_AUTO_PHASES.AUTO_START_OFFSET ' CAL_AUTO_PHASES.AUTO_INIT
        m_bRunning = True
        bRet = True
End If
Return bRet
End Function
```

3.14.2. Abort calibration

```
' ****************************************************
' Stop Calibration
' ****************************************************
Public Function StopCal() As Short
Dim sRet As Short
sRet = F28_RETURN.F28_FAIL
If (m_sModuleId > 0) And (m_ucPhase <> CAL_AUTO_PHASES.AUTO_IDDLE) Then
        sRet = F28_StopAutoCal(m_sModuleId)
End If
m_ucPhase = CAL_AUTO_PHASES.AUTO_IDDLE
m_bRunning = False
Return sRet
End Function
```

3.14.3. Continue calibration (second step)

```
' ***************************************************
' Continue calibration after validation -> Run Volume Calibration
' ***************************************************
Public Sub RunContinue(bForward As Boolean)
If (bForward = True) Then
	m_ucPhase = CAL_AUTO_PHASES.AUTO_START_VOLUME
	Else
	m_wError = m_ucPhase
	m_ucPhase = CAL_AUTO_PHASES.AUTO_IDDLE
	m_bRunning = False
	StopCal()
End If
End Sub
```

3.14.4. Running calibration process

```
' ***************************************************
' Purpose : Run Calibration
' Return :
' - True : EOC calibration
' - False : Running
' ***************************************************
Public Function RunCal() As Boolean
Dim sRet As Short
Dim bReturn As Boolean
' Not End of Run
bReturn = False
Select Case m_ucPhase
Case CAL_AUTO_PHASES.AUTO_START_OFFSET ' Start auto Cal
	If (m_ucMode = MODE_AUTO_CAL.OFFSET) Then
		sRet = F28_StartAutoCalOffsetOnly(m_sModuleId, m_wNbCycles, m_wInterCycle,
		m_fOffsetMax)
		Else
		sRet = F28_StartAutoCalOffset(m_sModuleId, m_wNbCycles, m_wInterCycle,
		m_fOffsetMax)
	End If
	If (sRet = F28_RETURN.F28_OK) Then
		m_ucPhase = CAL_AUTO_PHASES.AUTO_WAIT_EOC_OFFSET
	Else
		m_wError = m_ucPhase
		m_ucPhase = CAL_AUTO_PHASES.AUTO_END
	End If
Case CAL_AUTO_PHASES.AUTO_WAIT_EOC_OFFSET ' Wait EOC Offset
	If (F28_GetEOCOffset(m_sModuleId) > 0) Then
		If (m_ucMode = MODE_AUTO_CAL.OFFSET) Then
			m_wError = 0 ' Pas d'erreur
			m_ucPhase = CAL_AUTO_PHASES.AUTO_END
		Else
			m_wError = m_ucPhase
			m_ucPhase = CAL_AUTO_PHASES.AUTO_WAIT_MASTER_LEAK
		End If
	End If
Case CAL_AUTO_PHASES.AUTO_WAIT_MASTER_LEAK ' Waiting master leak
	' Wait validation from user
	' Do nothing
Case CAL_AUTO_PHASES.AUTO_START_VOLUME ' Start auto volume
	If (F28_StartAutoCalVolume(m_sModuleId, _
		m_wNbCycles, _
		m_wInterCycle, _
		m_fVolumeLeak, _
```

```
                m_fVolumePressure, _
                m_fVolumeMin, _
                m_fVolumeMax) = F28_RETURN.F28_OK) Then
                m_ucPhase = CAL_AUTO_PHASES.AUTO_WAIT_EOC_VOLUME
        Else
                m_wError = m_ucPhase
                m_ucPhase = CAL_AUTO_PHASES.AUTO_END
        End If
Case CAL_AUTO_PHASES.AUTO_WAIT_EOC_VOLUME ' Wait EOC Auto volume
        If (F28_GetEOCVolume(m_sModuleId) > 0) Then
                m_wError = 0 ' Pas d'erreur
                m_ucPhase = CAL_AUTO_PHASES.AUTO_END
        End If
Case CAL_AUTO_PHASES.AUTO_END ' End of auto calibration
        m_wError = m_ucPhase
        m_ucPhase = CAL_AUTO_PHASES.AUTO_IDDLE
        m_bRunning = False
        bReturn = True
Case CAL_AUTO_PHASES.AUTO_IDDLE ' Ready do nothing
        ' do nothing
End Select
Return bReturn
End Function
```

3.15. How to Run Calibration functions for 5 devices

3.15.1. We have 5 devices

The device ID's are in the:

```
arrayID(5) = {sModuleID1, sModuleID2, sModuleID3, sModuleID4, sModuleID5}
```

3.15.2. Offset Calculation only

1) Start Offset Calculation for 5 devices.

1.1) Repeat `F28_StartAutoCalOffsetOnly` for each unit,

For Id = 0 to 4,

```
F28_StartAutoCalOffsetOnly(arrayID[i], m_wNbCycles, m_wInterCycle);
```

Next.

2) Wait EOC of Offset for 5 devices.

Do:

2.1) Read Real time for each unit,

```
F28_GetRealTimeData(arrayID[i], m_realTime)
```

2.2) Display "Real time" for each unit,

2.3) If End of cycle, read last result,

```
F28_GetLastResult(arrayID[i], m_Result)
```

2.4) Display last result,

2.5) If Number of cycles is not reached, start group (start next cycle for all unit),

```
F28_StartCycleByGroup(ucGroup)
```

Or,

For Id = 0 to 4,

```
F28_StartCycle(arrayID[i])
```

Next,

Or,

Wait till intercycle elapsed,

```
While (not F28_GetEOCOffset(arrayID[i]))
```

3) Read Auto-calibration alarm for the 5 units, at the end of calibration,

For Id = 0 to 4

Read alarm code

```
F28_GetAutoCalAlarm(arrayID[i])
```

If no Alarm read and save parameters,

```
F28_GetParameters(arrayID[i], &tPara)
```

Save parameters

Next

3.15.3. Volume & Offset Calculation

1) Start Offset calculation

1.1) Repeat `F28_StartAutoCalOffsetOnly` for each unit

For Id = 0 to 4

```
F28_StartAutoCalOffsetOnly(arrayID[i], m_wNbCycles, m_wInterCycle);
```

Next

2) Wait EOC of Offset for 5 devices,

Do:

2.1) Read Real time for each unit,

```
F28_GetRealTimeData(arrayID[i], m_realTime)
```

2.2) Correction leak to Pa/s,

```
m_realTime.fLeakValue = m_realTime.fLeakValue * 1000
m_realTime.ucUnitLeak = F28_LEAK_UNITS.LEAK_PASEC
```

2.3) Display Real time for each unit,

2.4) If end of cycle, last result,

```
F28_GetLastResult(arrayID[i], m_Result)
```

2.5) Correction leak to Pa/s

```
m_Result.fLeakValue = m_Result.fLeakValue * 1000
m_Result.ucUnitLeak = F28_LEAK_UNITS.LEAK_PASEC
```

2.6) Display Last Result,

2.7) If Number of Cycles is not reached, start group (start next cycle for all units),

```
F28_StartCycleByGroup(ucGroup)
```

Or,

For Id = 0 to 4,

```
    F28_StartCycle(arrayID[i])
```

Next,

Or,

Wait till intercycle elapsed,

```
While (not F28_GetEOCOffset(arrayID[i]))
```

3) Select/Plug master leak for all devices.

4) Start volume Calculation for all devices,

1.1 Repeat F28_StartAutoCalVolume for each unit

For Id = 0 to 4

```
F28_StartAutoCalVolume(arrayID[i],  m_wNbCycles,  m_wInterCycle,  m_fVolumeLeak,
            m_fVolumePressure, m_fVolumeMin, m_fVolumeMax)
```

Next

5) Wait EOC of Volume Calibration for 5 devices

Do:

5.1) Read Real time for each unit,

```
F28_GetRealTimeData(arrayID[i], m_realTime)
```

5.2) Correction leak to Pa/s,

```
m_realTime.fLeakValue = m_realTime.fLeakValue * 1000
m_realTime.ucUnitLeak = F28_LEAK_UNITS.LEAK_PASEC
```

5.3) Display Real time for each unit,

5.4) If end of cycle, Read last result,

```
F28_GetLastResult(arrayID[i], m_Result)
```

5.5) Correction leak to Pa/s,

```
m_Result.fLeakValue = m_Result.fLeakValue * 1000
m_Result.ucUnitLeak = F28_LEAK_UNITS.LEAK_PASEC
```

5.6 Display last result,

5.7 If Number Of Cycles Not Reached, Start next cycle for all unit,

```
- F28_StartCycleByGroup(ucGroup)
```

Or,

For Id = 0 to 4,

```
F28_StartCycle(arrayID[i])
```

Next,

Or,

Wait till intercycle elapsed

```
While (not F28_GetEOCVolume(arrayID[i]))
```

6) Read Auto-calibration alarm for the 5 units, at the end of calibration,

For Id = 0 to 4,

Read alarm code,

```
F28_GetAutoCalAlarm(arrayID[i])
```

If no alarm, read and save parameters,

```
F28_GetParameters(arrayID[i], &tPara)
```

Save parameters,

Next.

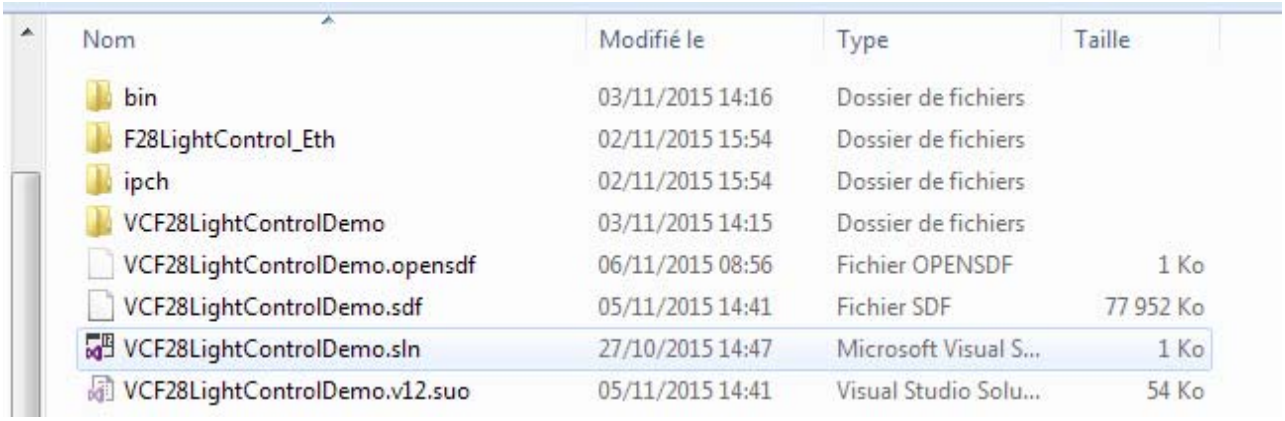
4. APPENDICIES 1

4.1. WHAT'S NEEDED FOR USING THE SAMPLES PROJECT C++/MFC / C# / VB.NET

- Microsoft Visual Studio 2013 Update5 must be installed,
- Microsoft.Net Framework 4.5,
- DLL Ethernet interface: **F28LightControl_ETH.dll**.

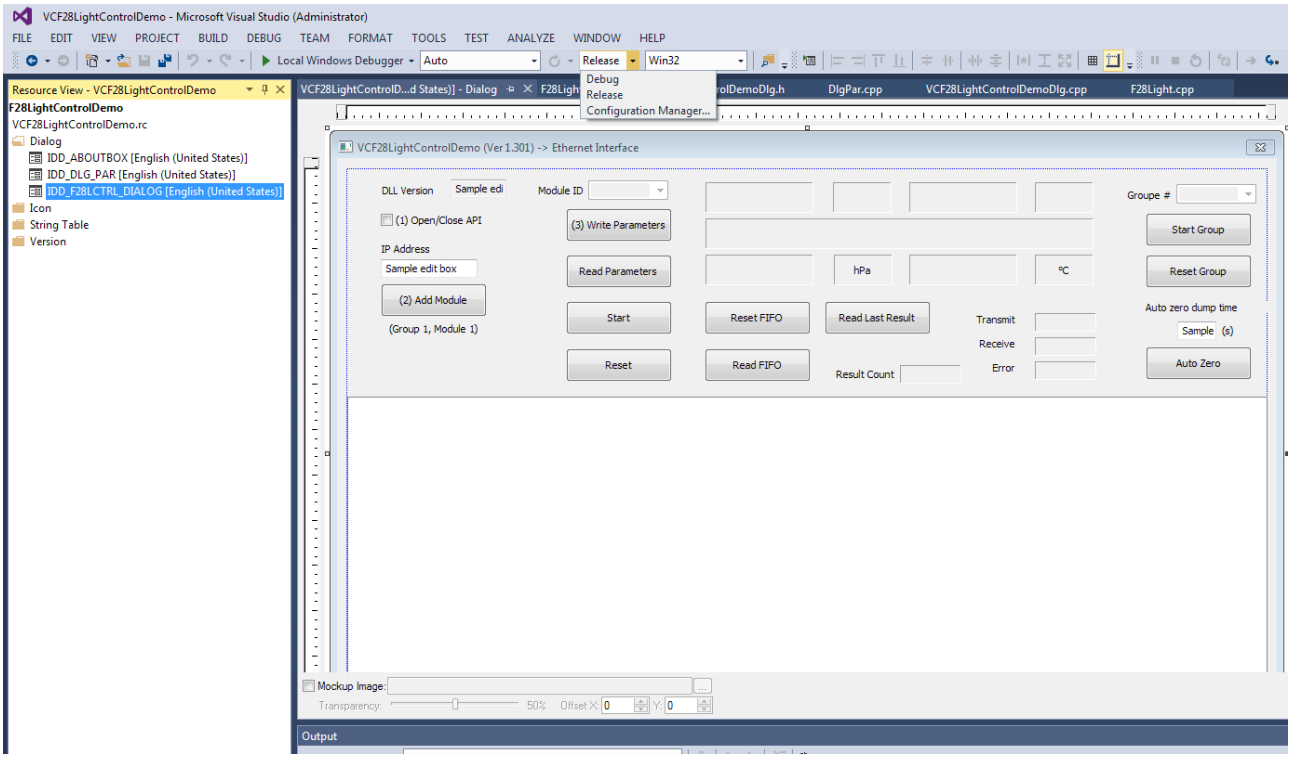
4.2. VISUAL C++/MFC SAMPLE

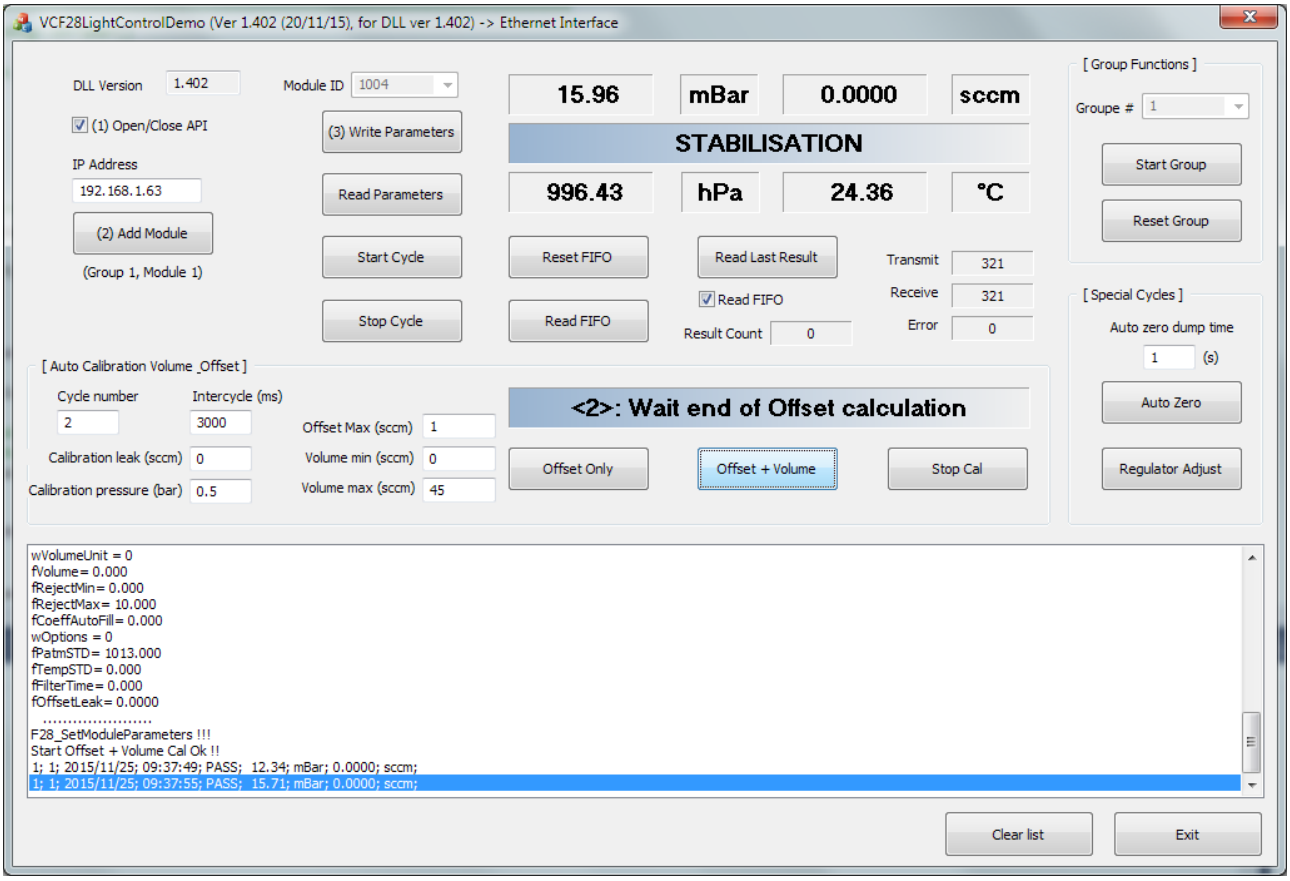
4.2.1. Build Project

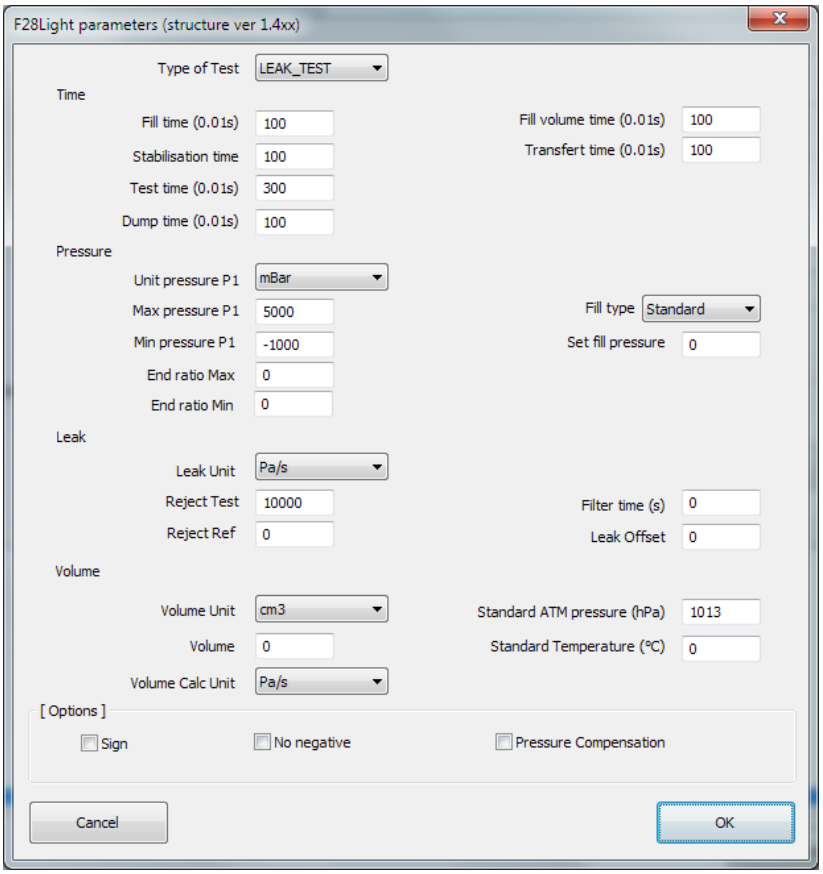


Release → for Release,

Debug → for debug.

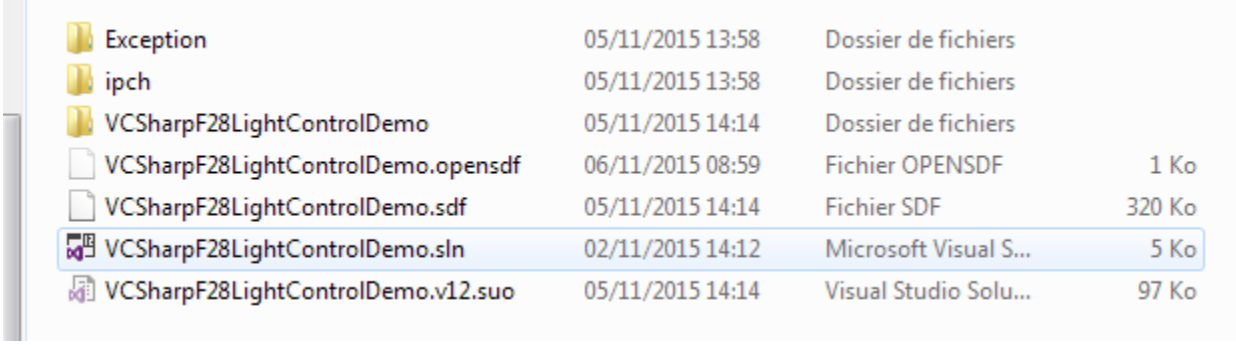



VCF28LightControlDemo (Ver 1.402 (20/11/15), for DLL ver 1.402) -> Ethernet Interface
DLL Version
1.402
Module ID
1004
(1) Open/Close API
IP Address
192.168.1.63
(2) Add Module
(Group 1, Module 1)
(3) Write Parameters
Read Parameters
Start Cycle
Stop Cycle
15.96
mBar
0.0000
sccm
STABILISATION
996.43
hPa
24.36
°C
Reset FIFO
Read FIFO
Read Last Result
Read FIFO
Result Count
0
Transmit
321
Receive
321
Error
0
[Group Functions]
Groupe #
1
Start Group
Reset Group
[Special Cycles]
Auto zero dump time
1
(s)
Auto Zero
Regulator Adjust
[Auto Calibration Volume _Offset]
Cycle number
2
Intercycle (ms)
3000
Calibration leak (sccm)
0
Calibration pressure (bar)
0.5
Offset Max (sccm)
1
Volume min (sccm)
0
Volume max (sccm)
45
<2>: Wait end of Offset calculation
Offset Only
Offset + Volume
Stop Cal
wVolumeUnit = 0
fVolume= 0.000
fRejectMin= 0.000
fRejectMax= 10.000
fCoeffAutoFill= 0.000
wOptions = 0
fPatmSTD= 1013.000
fTempSTD= 0.000
fFilterTime= 0.000
fOffsetLeak= 0.0000
F28_SetModuleParameters !!!
Start Offset + Volume Cal Ok !!
1; 1; 2015/11/25; 09:37:49; PASS; 12.34; mBar; 0.0000; sccm;
1; 1; 2015/11/25; 09:37:55; PASS; 15.71; mBar; 0.0000; sccm;
Clear list
Exit


F28Light parameters (structure ver 1.4xx)
Type of Test
LEAK_TEST
Time
Fill time (0.01s)
100
Stabilisation time
100
Test time (0.01s)
300
Dump time (0.01s)
100
Fill volume time (0.01s)
100
Transfert time (0.01s)
100
Pressure
Unit pressure P1
mBar
Max pressure P1
5000
Min pressure P1
-1000
End ratio Max
0
End ratio Min
0
Fill type
Standard
Set fill pressure
0
Leak
Leak Unit
Pa/s
Reject Test
10000
Reject Ref
0
Filter time (s)
0
Leak Offset
0
Volume
Volume Unit
cm3
Volume
0
Volume Calc Unit
Pa/s
Standard ATM pressure (hPa)
1013
Standard Temperature (°C)
0
[Options]
Sign
No negative
Pressure Compensation
Cancel
OK

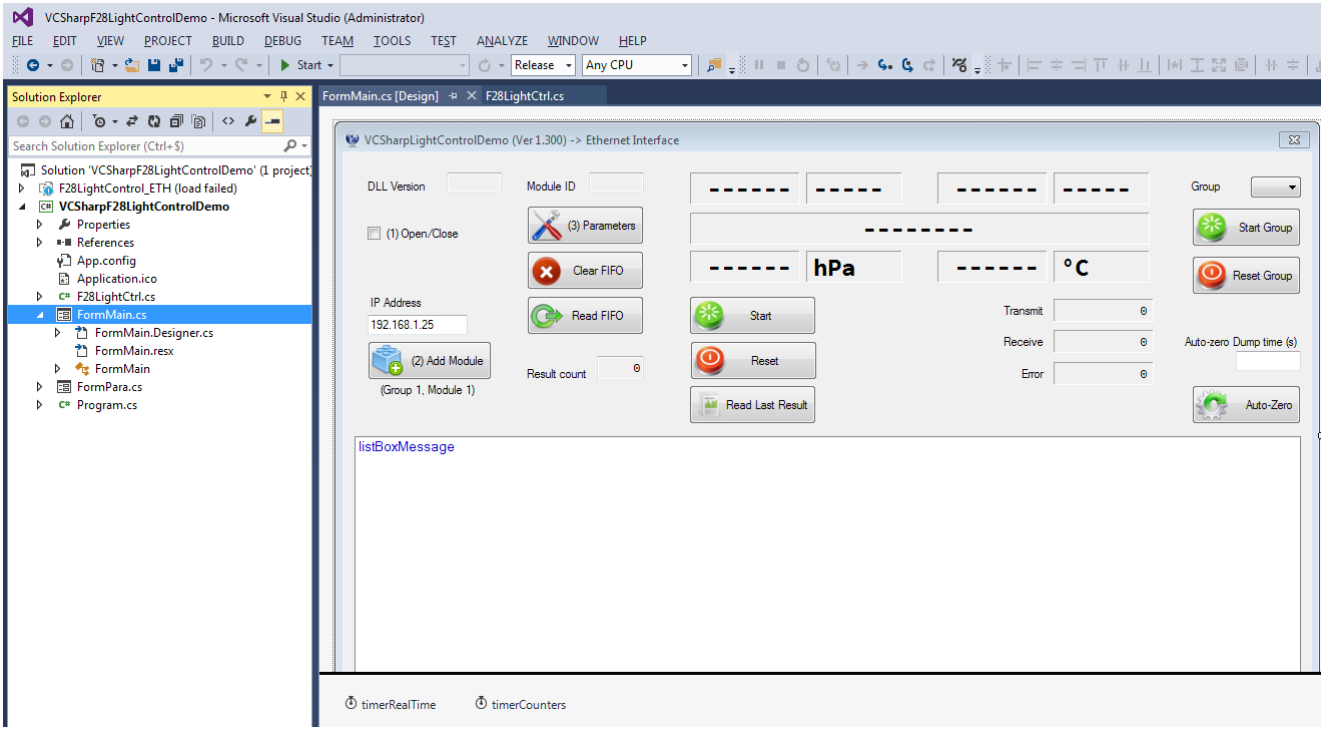
4.3. VISUAL C# SAMPLE

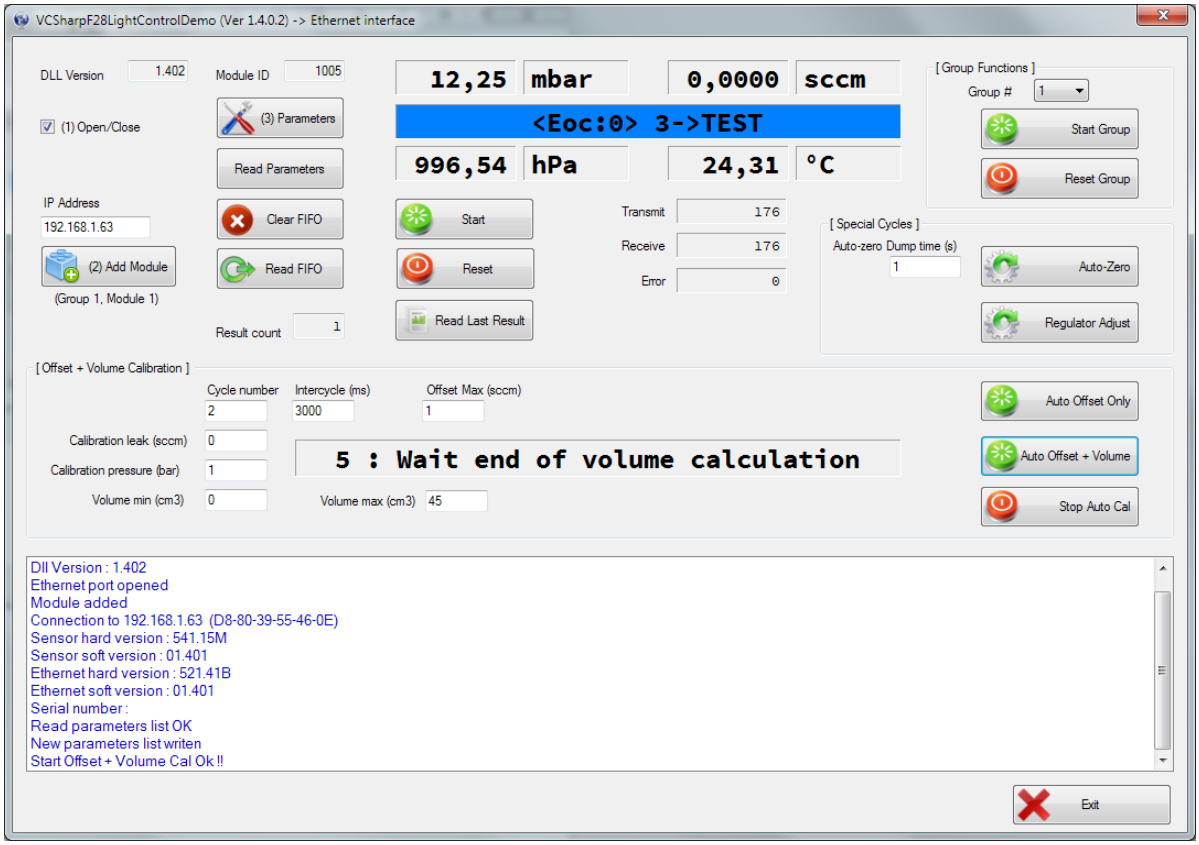
4.3.1. Build Project

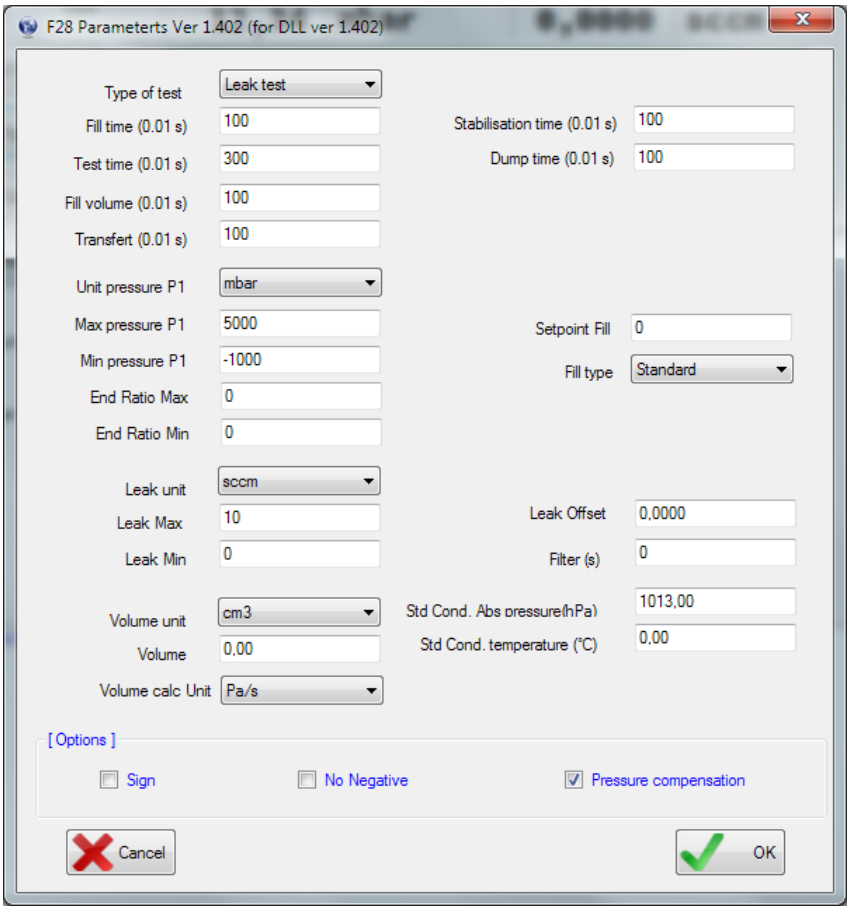


Release → for Release,

Debug → for debug.

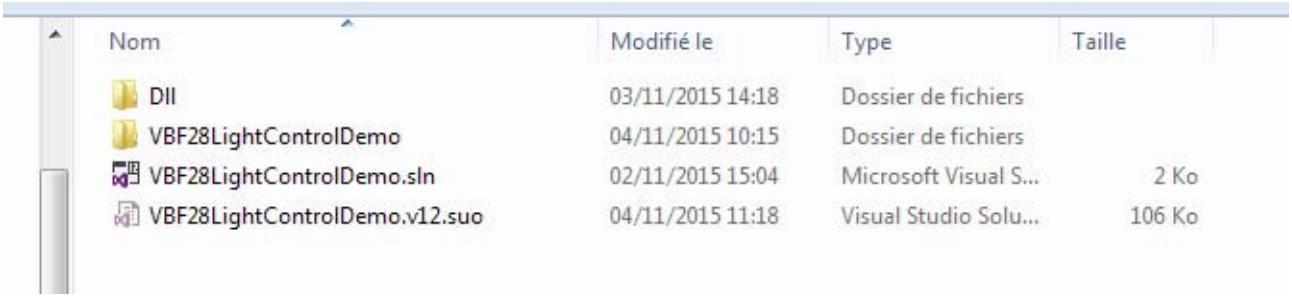



VCSharpF28LightControlDemo (Ver 1.4.0.2) -> Ethernet interface
DLL Version
1.402
Module ID
1005
(1) Open/Close
(3) Parameters
Read Parameters
IP Address
192.168.1.63
Clear FIFO
(2) Add Module
Read FIFO
(Group 1, Module 1)
Result count
1
12,25
mbar
0,0000
sccm
<Eoc:0> 3->TEST
996,54
hPa
24,31
°C
Start
Reset
Read Last Result
Transmit
176
Receive
176
Error
0
[Group Functions]
Group #
1
Start Group
Reset Group
[Special Cycles]
Auto-zero Dump time (s)
1
Auto-Zero
Regulator Adjust
[Offset + Volume Calibration]
Cycle number
Intercycle (ms)
Offset Max (sccm)
2
3000
1
Calibration leak (sccm)
0
Calibration pressure (bar)
1
Volume min (cm3)
0
5 : Wait end of volume calculation
Volume max (cm3)
45
Auto Offset Only
Auto Offset + Volume
Stop Auto Cal
Dll Version : 1.402
Ethernet port opened
Module added
Connection to 192.168.1.63 (D8-80-39-55-46-0E)
Sensor hard version : 541.15M
Sensor soft version : 01.401
Ethernet hard version : 521.41B
Ethernet soft version : 01.401
Serial number :
Read parameters list OK
New parameters list writen
Start Offset + Volume Cal Ok !!
Exit


F28 Parameterts Ver 1.402 (for DLL ver 1.402)
Type of test
Leak test
Fill time (0.01 s)
100
Test time (0.01 s)
300
Fill volume (0.01 s)
100
Transfert (0.01 s)
100
Stabilisation time (0.01 s)
100
Dump time (0.01 s)
100
Unit pressure P1
mbar
Max pressure P1
5000
Min pressure P1
-1000
End Ratio Max
0
End Ratio Min
0
Setpoint Fill
0
Fill type
Standard
Leak unit
sccm
Leak Max
10
Leak Min
0
Leak Offset
0,0000
Filter (s)
0
Volume unit
cm3
Volume
0,00
Volume calc Unit
Pa/s
Std Cond. Abs pressure(hPa)
1013,00
Std Cond. temperature (°C)
0,00
[Options]
Sign
No Negative
Pressure compensation
Cancel
OK

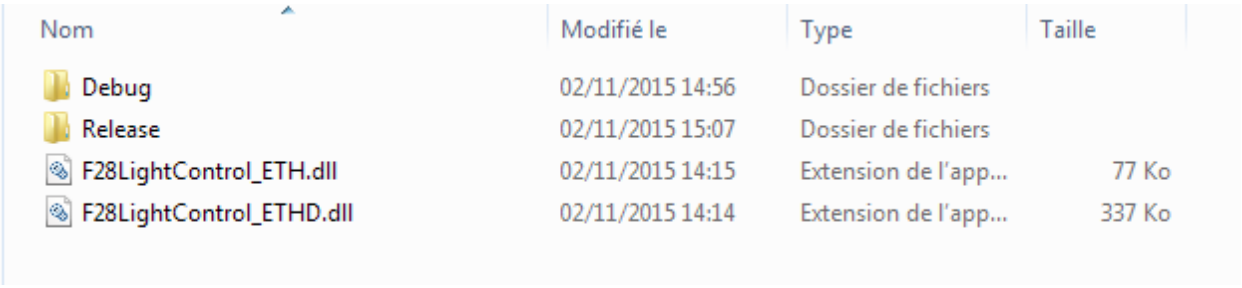
4.4. VISUAL BASIC .NET SAMPLE

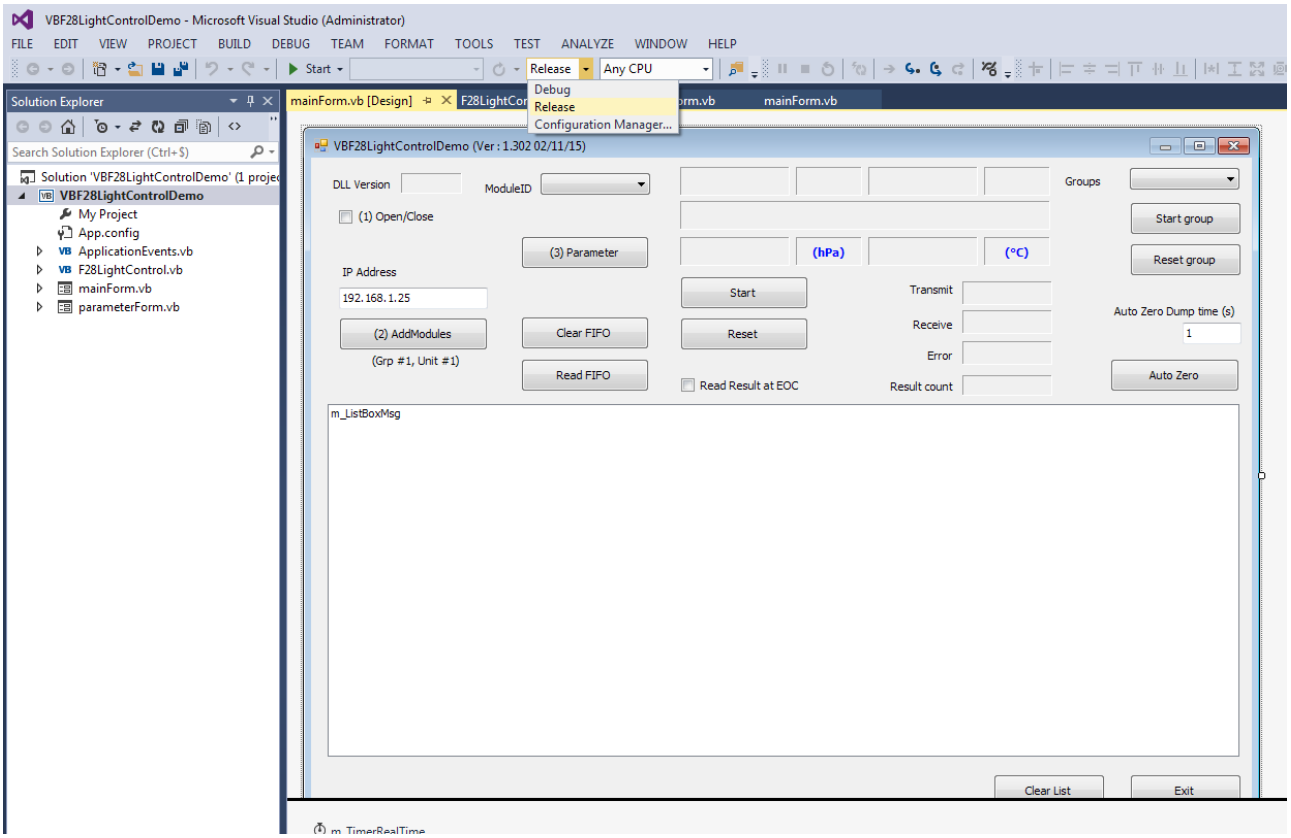
4.4.1. Build Project

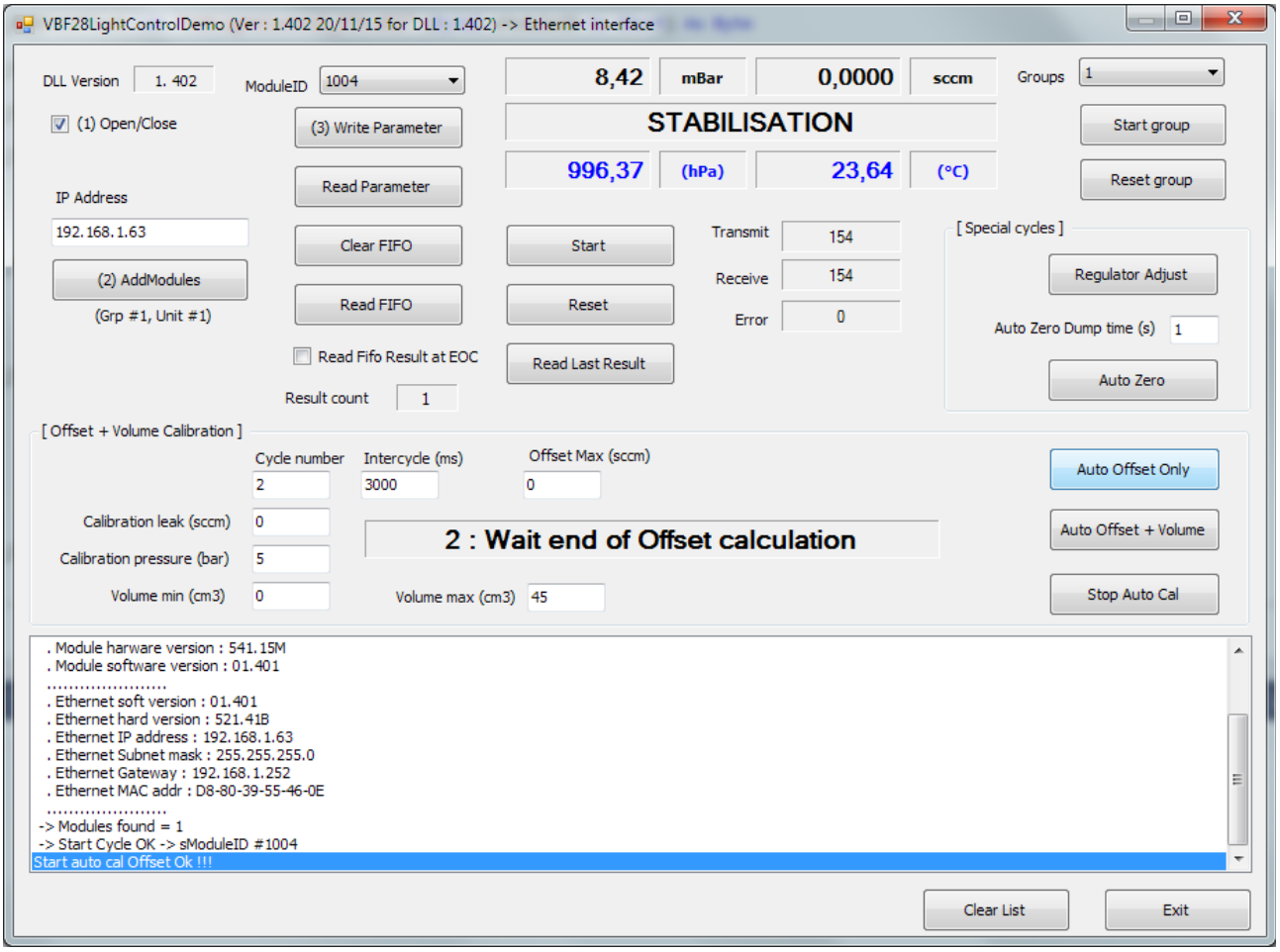


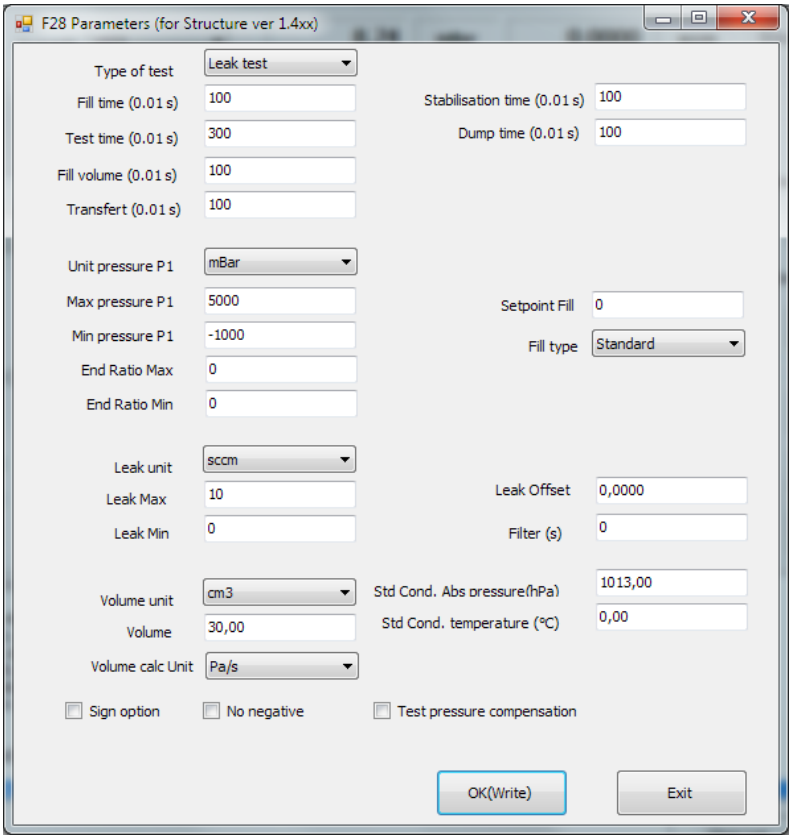
Release → for Release,

Debug → for debug.






VBF28LightControlDemo (Ver : 1.402 20/11/15 for DLL : 1.402) -> Ethernet interface
DLL Version
1. 402
ModuleID
1004
8,42
mBar
0,0000
sccm
Groups
1
(1) Open/Close
(3) Write Parameter
STABILISATION
Start group
Read Parameter
996,37
(hPa)
23,64
(°C)
Reset group
IP Address
192.168.1.63
Clear FIFO
Start
Transmit
154
[Special cycles]
(2) AddModules
(Grp #1, Unit #1)
Read FIFO
Reset
Receive
154
Regulator Adjust
Error
0
Auto Zero Dump time (s)
1
Read Fifo Result at EOC
Read Last Result
Result count
1
Auto Zero
[Offset + Volume Calibration]
Cycle number
Intercycle (ms)
Offset Max (sccm)
Auto Offset Only
2
3000
0
Calibration leak (sccm)
0
2 : Wait end of Offset calculation
Auto Offset + Volume
Calibration pressure (bar)
5
Volume min (cm3)
0
Volume max (cm3)
45
Stop Auto Cal
. Module harware version : 541.15M
. Module software version : 01.401
. Ethernet soft version : 01.401
. Ethernet hard version : 521.41B
. Ethernet IP address : 192.168.1.63
. Ethernet Subnet mask : 255.255.255.0
. Ethernet Gateway : 192.168.1.252
. Ethernet MAC addr : D8-80-39-55-46-0E
-> Modules found = 1
-> Start Cycle OK -> sModuleID #1004
Start auto cal Offset Ok !!!
Clear List
Exit


F28 Parameters (for Structure ver 1.4xx)
Type of test
Leak test
Fill time (0.01 s)
100
Stabilisation time (0.01 s)
100
Test time (0.01 s)
300
Dump time (0.01 s)
100
Fill volume (0.01 s)
100
Transfert (0.01 s)
100
Unit pressure P1
mBar
Max pressure P1
5000
Setpoint Fill
0
Min pressure P1
-1000
Fill type
Standard
End Ratio Max
0
End Ratio Min
0
Leak unit
sccm
Leak Max
10
Leak Offset
0,0000
Leak Min
0
Filter (s)
0
Volume unit
cm3
Std Cond. Abs pressure(hPa)
1013,00
Volume
30,00
Std Cond. temperature (°C)
0,00
Volume calc Unit
Pa/s
Sign option
No negative
Test pressure compensation
OK(Write)
Exit

4.5. SAMPLE CODE IN VB.NET

4.5.1. Get & Display Ethernet information

```
' ------------------------------------------------------------------
' Convert from IP string to Long
' ------------------------------------------------------------------
Private Function IPString2Long(ByVal DottedIP As String) As Long
	Dim arrDec() As String
	Dim lResult As Long
	lResult = 0
	If DottedIP <> "" Then
		arrDec = DottedIP.Split(".")
		If (arrDec.Length = 4) Then
			lResult = CLng(arrDec(3)) * 2 ^ 24 + CLng(arrDec(2)) * 2 ^ 16 +
			CLng(arrDec(1)) * 2 ^ 8 + CLng(arrDec(0))
		End If
	End If
	Return lResult
End Function

' ------------------------------------------------------------------
' Read & display Ethernet information
' ------------------------------------------------------------------
'
Private Function GetEthernetInformation(ByVal sModuleID As Short, ByRef Info As T_ETH_INFO) As
Short
	Dim sRet As Short
	Dim strBuff As String
	Dim ulIP As ULong
	Dim strMsg As String
	Const ucMaxBuff As Byte = 30


	strMsg = " ....................."
	DisplayTxt(strMsg)

	' Read soft version
	If (sRet = F28_RETURN.F28_OK) Then
		strBuff = Space(ucMaxBuff)
		sRet = F28_GetETHSoftVersion(sModuleID, strBuff, ucMaxBuff - 1)
		If (sRet = F28_RETURN.F28_OK) Then
			Info.strVersion = strBuff

			strMsg = " . Ethernet soft version : " + Info.strVersion
			DisplayTxt(strMsg)

		End If
	End If

	' Read hard version
	If (sRet = F28_RETURN.F28_OK) Then
		strBuff = Space(ucMaxBuff)
		sRet = F28_GetETHHardVersion(sModuleID, strBuff, ucMaxBuff - 1)
		If (sRet = F28_RETURN.F28_OK) Then
			Info.strHardVersion = strBuff

			strMsg = " . Ethernet hard version : " + Info.strHardVersion
			DisplayTxt(strMsg)

		End If
	End If
```

```
        ' Read IP address
        sRet = F28_GetAddressIP(sModuleID, ulIP)
        If (sRet = F28_RETURN.F28_OK) Then
                Dim curIPAdd As New IPAddress(ulIP)
                Info.strIP = curIPAdd.ToString()

                strMsg = " . Ethernet IP address : " + Info.strIP
                DisplayTxt(strMsg)

        End If

        ' Read Mask
        If (sRet = F28_RETURN.F28_OK) Then
                sRet = F28_GetSubnetMask(sModuleID, ulIP)
                If (sRet = F28_RETURN.F28_OK) Then
                        Dim curIPAdd As New IPAddress(ulIP)
                        Info.strSubnetMask = curIPAdd.ToString()

                        strMsg = " . Ethernet Subnet mask : " + Info.strSubnetMask
                        DisplayTxt(strMsg)

                End If
        End If

        ' Read gateway
        If (sRet = F28_RETURN.F28_OK) Then
                sRet = F28_GetGatewayAddressIP(sModuleID, ulIP)
                If (sRet = F28_RETURN.F28_OK) Then
                        Dim curIPAdd As New IPAddress(ulIP)
                        Info.strGateway = curIPAdd.ToString()

                        strMsg = " . Ethernet Gateway : " + Info.strGateway
                        DisplayTxt(strMsg)

                End If
        End If

        ' Read MAC address
        If (sRet = F28_RETURN.F28_OK) Then
                strBuff = Space(ucMaxBuff)
                sRet = F28_GetMACAddress(sModuleID, strBuff, ucMaxBuff - 1)
                If (sRet = F28_RETURN.F28_OK) Then
                        Info.strMACAddress = strBuff

                        strMsg = " . Ethernet MAC addr : " + Info.strMACAddress
                        DisplayTxt(strMsg)

                End If
        End If

        strMsg = " ......................"
        DisplayTxt(strMsg)

        Return sRet

End Function
```

4.5.2. Get module information

```
'--------------------------------------------------------------------------
' GetModuleInfo
'--------------------------------------------------------------------------
'
Private Function GetModuleInfo(ByVal sModuleID) As Short
	Dim sRetCode As Short
	Dim strBuff As String
	Dim strMsg As String

	sRetCode = F28_RefreshModuleInformations(sModuleID)

	If (sRetCode = F28_RETURN.F28_OK) Then
		strBuff = Space(100)
		sRetCode = F28_GetSerialNumber(sModuleID, strBuff, 20)
		If (sRetCode = F28_RETURN.F28_OK) Then
		strMsg = strBuff.Insert(0, " . Serial number : ")
		DisplayTxt(strMsg)
		End If
	End If

	If (sRetCode = F28LightControl.F28_RETURN.F28_OK) Then
		strBuff = Space(100)
		sRetCode = F28_GetModuleHardVersion(sModuleID, strBuff, 20)
		If (sRetCode = F28LightControl.F28_RETURN.F28_OK) Then
			strMsg = strBuff.Insert(0, " . Module harware version : ")
			DisplayTxt(strMsg)
		End If
	End If

	If (sRetCode = F28LightControl.F28_RETURN.F28_OK) Then
		strBuff = Space(100)
		sRetCode = F28_GetModuleSoftVersion(sModuleID, strBuff, 20)
		If (sRetCode = F28LightControl.F28_RETURN.F28_OK) Then
			strMsg = strBuff.Insert(0, " . Module software version : ")
			DisplayTxt(strMsg)
		End If
	End If

	' 1.301 Get Ethernet info
	If (sRetCode = F28_RETURN.F28_OK) Then
		sRetCode = GetEthernetInformation(sModuleID, m_deviceEthernetInfo)
	End If

	GetModuleInfo = sRetCode

End Function
```

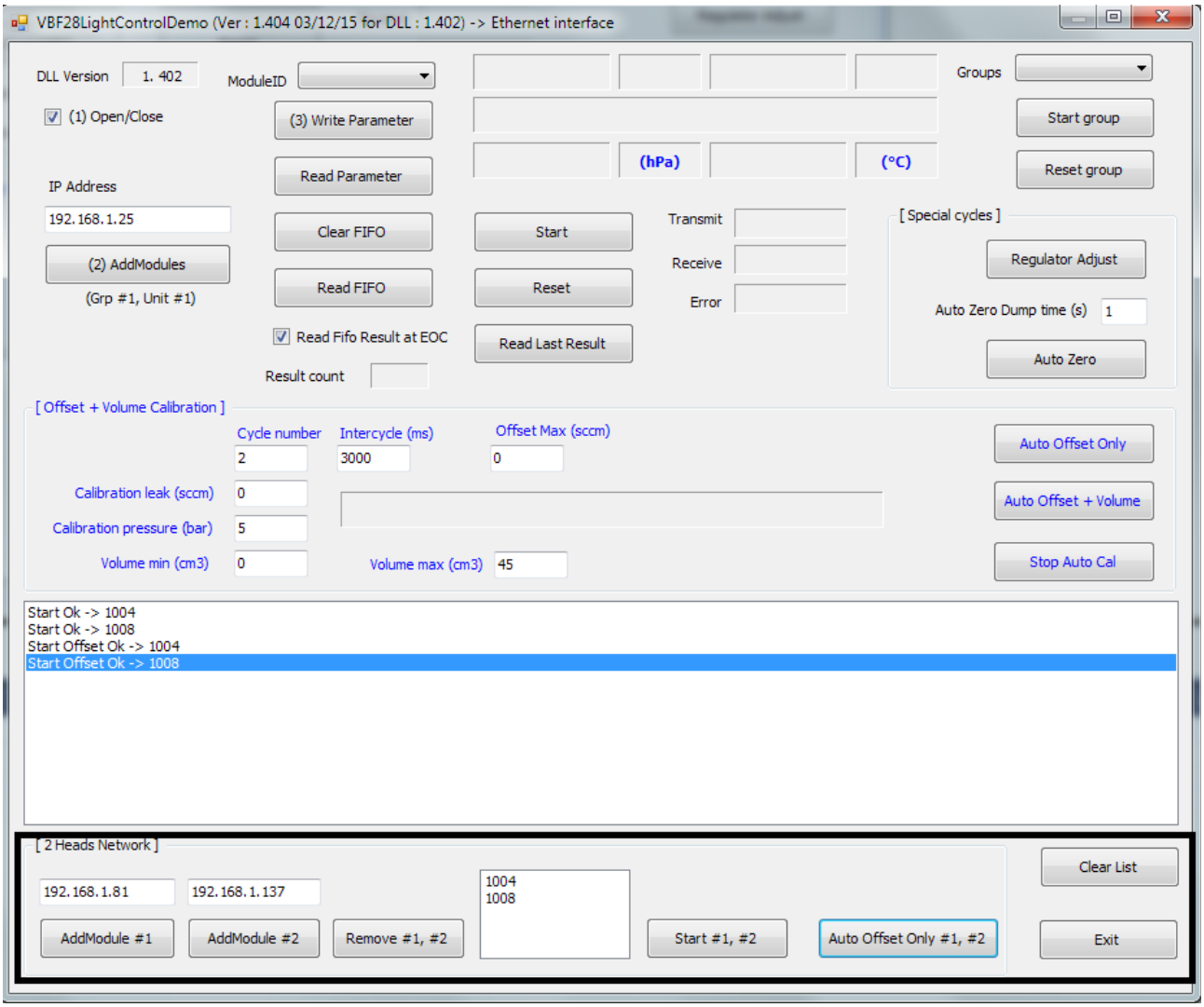
4.5.3. Read real time status & Read Result cycle

```
' ------------------------------------------------------------------
' Read & display real time status & Measurement
' ------------------------------------------------------------------
Private Sub m_TimerRealTime_Tick(sender As Object, e As EventArgs) Handles
m_TimerRealTime.Tick
	Dim sRetCode As Short
	Dim wCount As UShort
	If m_bAPIOpened And F28_IsModuleConnected(m_sModuleID) Then

		' Read real time status & measurement
		sRetCode = F28_GetRealTimeData(m_sModuleID, m_realTime)
		If sRetCode = F28_RETURN.F28_OK Then

			' Display real time
			DisplayRealTime()

			' If end of cycle -> Read last result & display
			If (m_realTime.ucEndCycle > 0) Then

				' Stop real time reading at EOC
				m_TimerRealTime.Stop()

				' Read Last Result
				sRetCode = F28_GetLastResult(m_sModuleID, m_Result)
				If sRetCode = F28_RETURN.F28_OK Then
					DisplayResult(0)
				End If

				' Read Get fifo Result count
				wCount = F28_GetResultsCount(m_sModuleID)
				m_labelFifoCount.Text = wCount.ToString

				' Read fifo if demands
				If wCount > 0 And m_chkReadFifo.Checked Then
					' Read fifo
					sRetCode = F28_GetNextResult(m_sModuleID, m_Result)
					If sRetCode = F28_RETURN.F28_OK Then
						DisplayResult(1)
					End If

					wCount = F28_GetResultsCount(m_sModuleID)
					m_labelFifoCount.Text = wCount.ToString
				End If
			End If
		End If
	End If

' Read & display counter
If sRetCode = F28_RETURN.F28_OK Then
	sRetCode = F28_GetCommunicationStatistics(m_sModuleID, m_rCptComm)
	If sRetCode = F28_RETURN.F28_OK Then
		DisplayCounter()
	End If
End If
End Sub
```

4.5.4. Auto zero pressure

```
' ------------------------------------------------------------------
' Auto Zero pressure
' ------------------------------------------------------------------
'
Private Sub btnAZPressure_Click(sender As Object, e As EventArgs) Handles
btnAZPressure.Click

	Dim fDumpTime As Single
	Dim sRetCode As Short

	If m_bAPIOpened And F28_IsModuleConnected(m_sModuleID) Then

		' Get dump time in sec
		fDumpTime = Convert.ToSingle(textBoxAZDumpTime.Text)

		sRetCode = F28_StartAutoZeroPressure(m_sModuleID, fDumpTime)

		If (sRetCode = F28_RETURN.F28_OK) Then
			DisplayTxt("Start auto zero Ok !!!")
		Else
			DisplayTxt("Start auto zero error !!!")
		End If
	End If

End Sub
```

4.6. START AUTO CAL OFFSET FOR MORE THAN ONE HEAD IN VB.NET



Below is a example of VB.net code, how to do a Start /Start Auto Cal Offset only for more than one heads.

We need only to repeat the command to each heads.

```
 ' ------------------------------------------------------------------
    ' Start auto cal offset for all heads inside the listBox
' ------------------------------------------------------------------
'
Private Sub Button5_Click(sender As Object, e As EventArgs) Handles btnOffset2.Click
Dim n As Integer
       Dim strBuff As String
       Dim sNum As Short
       Dim sRet As Short
       Dim wNbCycles As UShort
       Dim wInterCycle As UShort
       Dim fOffsetMax As Single

       wNbCycles = Convert.ToInt16(textBoxCycleNumber.Text)
       wInterCycle = Convert.ToInt16(textBoxIntercycle.Text)
       fOffsetMax = Convert.ToSingle(textBoxOffset.Text)

       ' Get number of heads inside the listbox
       n = m_listBox2Heads.Items.Count

       ' If not empty
       If n > 0 Then

' Repeat for all heads
       For i = 0 To n - 1

              ' Get sModuleID for head i
              strBuff = m_listBox2Heads.Items.Item(i)
              sNum = CShort(strBuff)

              ' Check if the module is connected
              If m_bAPIOpened And F28_IsModuleConnected(sNum) Then

                     ' Start auto Cal Offset for head i
                     sRet  =  F28_StartAutoCalOffsetOnly(sNum,  wNbCycles,  wInterCycle,
                     fOffsetMax)

                     If (sRet = F28_RETURN.F28_OK) Then
                            DisplayTxt("Start Offset Ok -> " + sNum.ToString())
                     Else
                            DisplayTxt("Start Offset error -> " + sNum.ToString())
                     End If

              End If

              Next
       End If

End Sub
```