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Technical description

ADDIALOG PA 3110

Standard software

Edition: 09.01-07/2005

Tabellen

1 INTRODUCTION

IMPORTANT!
Note the following conventions in the text:

Function: "i_PA3110_SetBoardInformation"
Variable: *ui_Address*

Table 1-1: Type Declaration for Dos and Windows 3.1X

	Borland C	Microsoft C	Borland Pascal	Microsoft Visual Basic Dos	Microsoft Visual Basic Windows
VOID	void	void	pointer		any
BYTE	unsigned char	unsigned char	byte	integer	integer
INT	int	int	integer	integer	integer
UINT	unsigned int	unsigned int	word	long	long
LONG	long	long	longint	long	long
PBYTE	unsigned char *	unsigned char *	var byte	integer	integer
PINT	int *	int *	var integer	integer	integer
PUINT	unsigned int *	unsigned int *	var word	long	long
PCHAR	char *	char *	var string	string	string

Table 1-2: Type Declaration for Windows 95/NT

	Borland C	Microsoft C	Borland Pascal	Microsoft Visual Basic Dos	Microsoft Visual Basic Windows
VOID	void	void	pointer		any
BYTE	unsigned char	unsigned char	byte	integer	integer
INT	int	int	integer	integer	integer
UINT	unsigned int	unsigned int	long	long	long
LONG	long	long	longint	long	long
PBYTE	unsigned char *	unsigned char *	var byte	integer	integer
PINT	int *	int *	var integer	integer	integer
PUINT	unsigned int *	unsigned int *	var long	long	long
PCHAR	char *	char *	var string	string	string

Table 1-3: Define value

Define name	Decimal value	Hexadecimal value
DLL_COMPILER_C	0	0
DLL_COMPILER_VB	1	1
DLL_COMPILER_PASCAL	2	2
DLL_LABVIEW	3	3
DLL_COMPILER_VB_5	4	4
PA3110_DISABLE	0	0
PA3110_ENABLE	1	1
PA3110_CHANNEL0	0	0
PA3110_CHANNEL1	1	1
PA3110_CHANNEL2	2	2
PA3110_CHANNEL3	3	3
PA3110_CHANNEL4	4	4
PA3110_CHANNEL5	5	5
PA3110_CHANNEL6	6	6
PA3110_CHANNEL7	7	7
PA3110_CHANNEL8	8	8
PA3110_CHANNEL9	9	9
PA3110_CHANNEL10	10	A
PA3110_CHANNEL11	11	B
PA3110_CHANNEL12	12	C

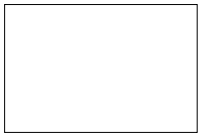
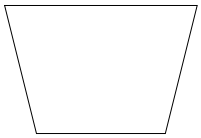
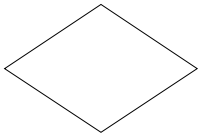
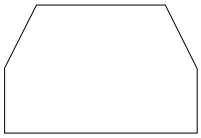
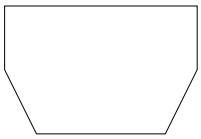
Define name	Decimal value	Hexadecimal value
PA3110_CHANNEL13	13	D
PA3110_CHANNEL14	14	E
PA3110_CHANNEL15	15	F
PA3110_1_GAIN	0	0
PA3110_2_GAIN	16	10
PA3110_5_GAIN	32	20
PA3110_10_GAIN	48	30
PA3110_UNIPOLAR	128	80
PA3110_BIPOLAR	0	0
PA3110_SIMPLE_MODUS	0	0
PA3110_DELAY_MODUS	1	1
PA3110_DMA_NOT_USED	0	0
PA3110_DMA_USED	1	1
PA3110_SINGLE	0	0
PA3110_CONTINUOUS	1	1

2 DIN 66001- GRAPHICAL SYMBOLS

This chapter describes all software functions (API) necessary for the operation of the **PA 1700-2** board.

To illustrate these functions, we designed flow charts with the graphical symbols listed below.

It gives the user a quick overview of the hierarchy between the different functions.

	**Process,** general (including inputs and outputs)
	**Manual operation** (including inputs and outputs)
	**Decision** **Selection unit** (e.g.: switch)
	**Loop limit** Beginning
	**Loop limit** End

3 SOFTWARE FUNCTIONS (API)

3.1 Initialisation

1) i_PA3110_InitCompiler (..)

Syntax:
<Return value> = i_PA3110_InitCompiler (BYTE b_CompilerDefine)

Parameters:
- Input:

BYTE	b_CompilerDefine	The user has to choose the language (under Windows) in which he/she wants to program - DLL_COMPILER_C: The user programs in C - DLL_COMPILER_VB: The user programs in Visual Basic for Windows - DLL_COMPILER_VB5: The user programs in Visual Basic 5 for Windows - DLL_COMPILER_PASCAL: The user programs in Pascal - DLL_LABVIEW: The user programs in Labview

-Output:
No output signal has occurred.

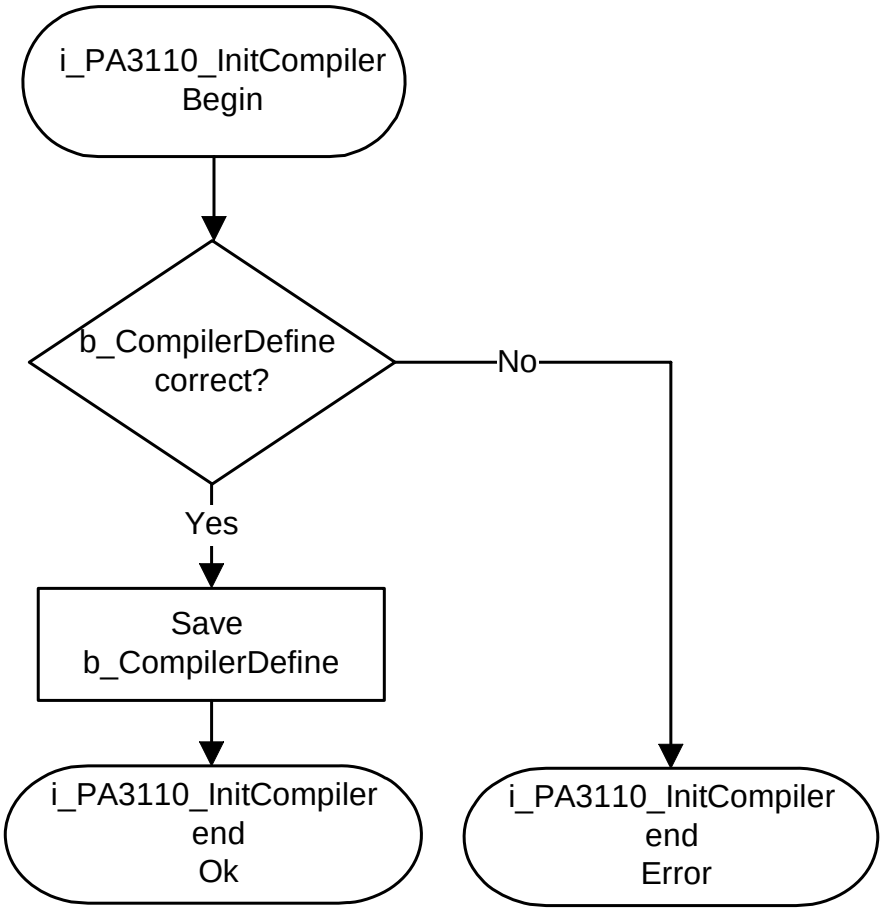
Task:
If you want to use the DLL functions choose the language in which you want to program. This function must be the first to be called up.

WICHTIG!
This function is only available with a Windows environment.

Calling convention:
ANSI C :

```
int i_ReturnValue;

i_ReturnValue = i_PA3110_InitCompiler (DLL_COMPILER_C);
```

Return value:
0: No error
-1: Compiler parameter is wrong

Input
b_CompilerDefine
Function diagram

Output
<Return Value>

IMPORTANT!
This function is only available for DOS and Windows 3.11 applications

2) i_PA3110_SetBoardInformation (...)

Syntax:

```
<Return value> =  i_PA3110_SetBoardInformation
                                  (UINT    ui_Address,
                                   BYTE    b_InterruptNbr,
                                   BYTE    b_DMAChannelNbr,
                                   BYTE    b_AnalogInputChannelNbr,
                                   BYTE    b_AnalogOutputChannelNbr,
                                   PBYTE   pb_BoardHandle)
```

Parameters:

- Input:

UINT	ui_Address	Base address of board **PA 3110**
BYTE	b_InterruptNbr	Interrupt line of the board (IRQ3, 5, 9, 10, 11, 12, 14, 15) If 0, no interrupt line is used
BYTE	b_DMAChannelNbr	Number of the channel (DMA5, 6 or 7). If 0, DMA is not used.
BYTE	b_AnalogInputChannelNbr	Number of the analog input channels (8 or 16)
BYTE	b_AnalogOutputChannelNbr	Number of the analog output channels (4 or 8)

- Output:

PBYTE	pb_BoardHandle	Handle[1] of board **PA 3110** to use the functions

Task:
Verifies if board **PA 3110** is present. Stores the following information:
- base address,
- the interrupt number
- the number of the DMA channel
- and the number of analog input channels.
- and the number of analog output channels.

A handle is returned to the user which allows to use the next functions.
Handles allow to operate several boards.

Calling convention:
ANSI C :

```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_SetBoardInfomation     (0x390, 0, 0, 16, 8,
                                                 &b_BoardHandle);
```

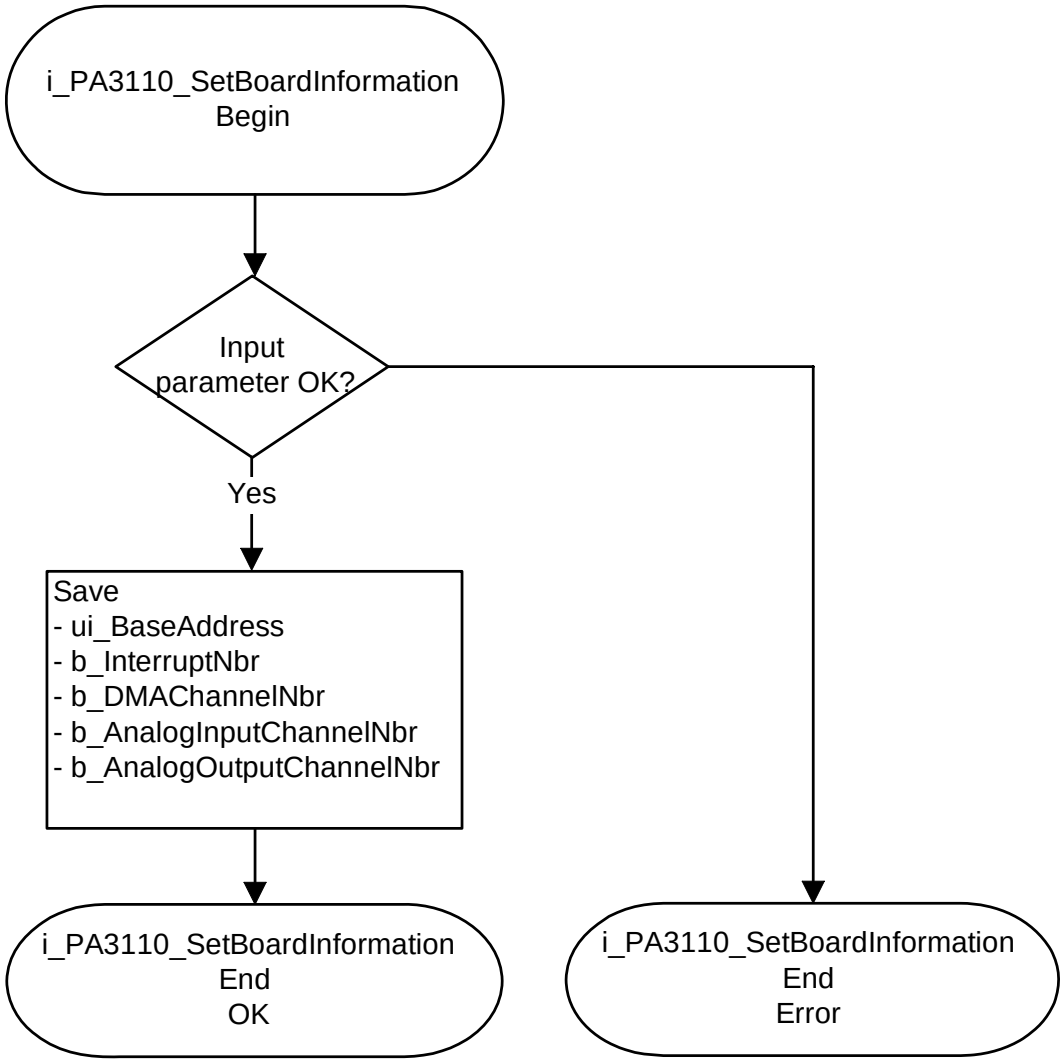
[1] Identification number of the board

Return value:
0: No error
-1: Board not present
-2: Number of the DMA channel is wrong
-3: IRQ number is wrong
-4: Number of analog input channels is wrong
-5: Number of analog output channels is wrong
-6: No handle is available for the board (up to 10 handles can be used)

Input

ui_BaseAddress
b_InterruptNbr
b_DMAChannelNbr
b_AnalogInputChannelNbr
b_AnalogOutputChannelNbr

Function diagram



Output

pb_BoardHandle

<Return Value>

IMPORTANT!
This function is only available for Windows NT / 95 applications

3) i_PA3110_SetBoardInformationWin32 (...)

Syntax:
<Return value> = i_PA3110_SetBoardInformationWin32
(PCHAR pc_Identifier
BYTE b_AnalogInputChannelNbr
BYTE b_AnalogOutputChannelNbr
PBYTE pb_BoardHandle)

Parameters:
- Input:

PCHAR	pc_Identifier	Identifier string for the board selection The identifier string is determined by the ADDIREG registration program.
BYTE	b_AnalogInputChannelNbr	Number of the analog input channels (8 or 16)
BYTE	b_AnalogOutputChannelNbr	Number of the analog output channels (4 or 8)

- Output:

PBYTE	pb_BoardHandle	Handle of the board PA 3110 to use the functions

Task:
Call up all hardware information about the **PA 3110** given by the ADDIREG registration program and stores the following information:
- the base address,
- the interrupt number,
- the DMA channel number,
- the number of analog inputs
- the number of analog outputs

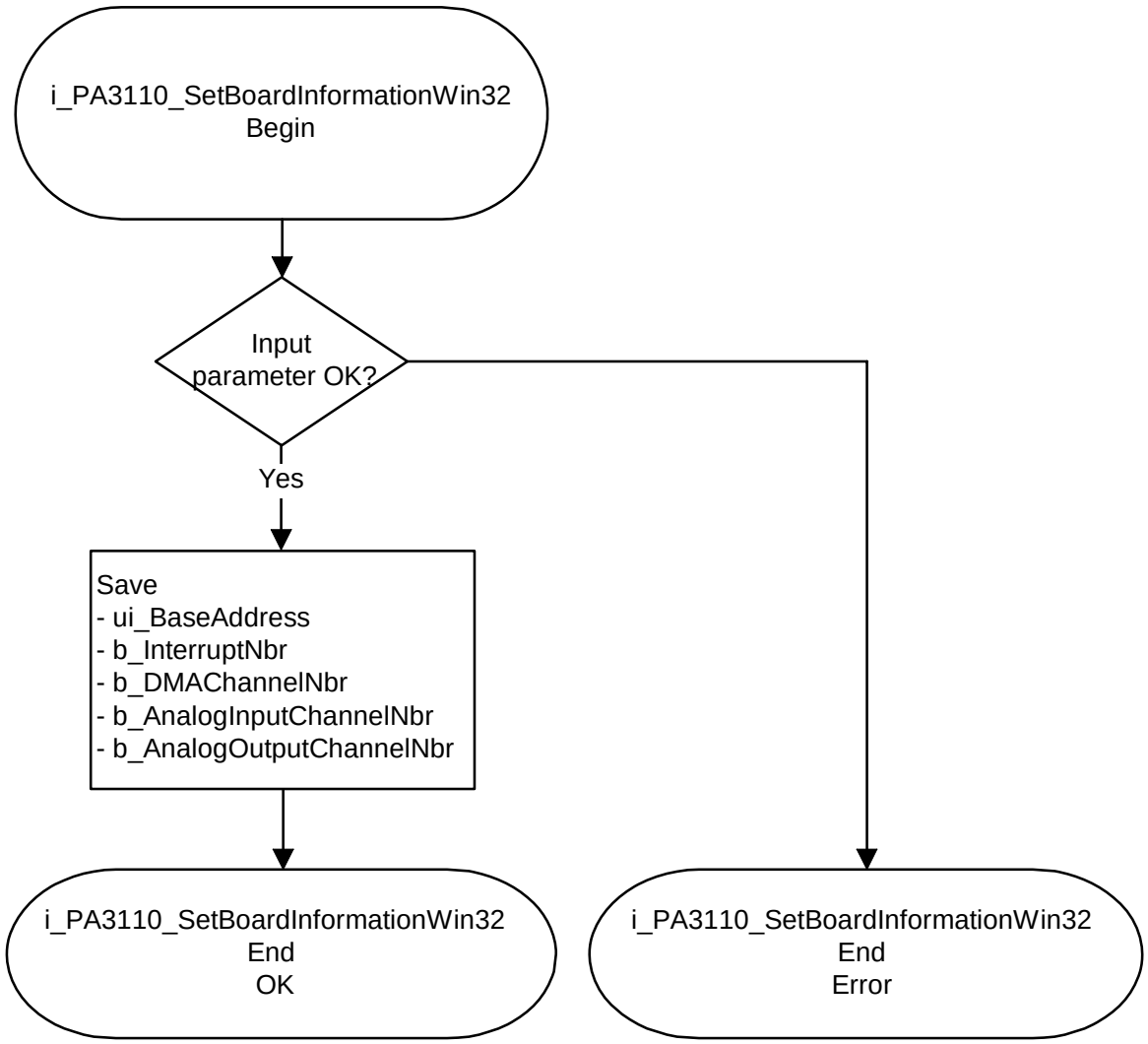
Then verifies if board **PA 3110** is present.

A handle is returned to the user which allows to use the next functions.
Handles allow to operate several boards.

Calling convention:
ANSI C :

```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_SetBoardInfomationWin32
                                (“PA3110-00“, 16, 8, &b_BoardHandle);
```

Return value:
0: No error
-1: Board not present
-2: Number of analog input channels is wrong
-3: Number of analog output channels is wrong
-4: No handle is available for the board (up to 10 handles can be used)
-5: Error when opening the driver in Windows NT/95

Input
pc_Identifier b_AnalogOutputchannelNbr b_AnalogInputchannelNbr
Function diagram

Output
pb_BoardHandle
<Return Value>

4) i_PA3110_SetAnalogInputResolution (...)

Syntax:
<Return value> = i_PA3110_SetAnalogInputResolution
(BYTE b_BoardHandle,
BYTE b_AnalogInputResolution)

Parameters:
-Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
BYTE	b_AnalogInputResolution	Analog input resolution: 14 or 16 bit

- Output:
No output signal has occurred.

Task:
Sets the analog input resolution of the selected **PA 3110**.

Calling convention:
ANSI C :

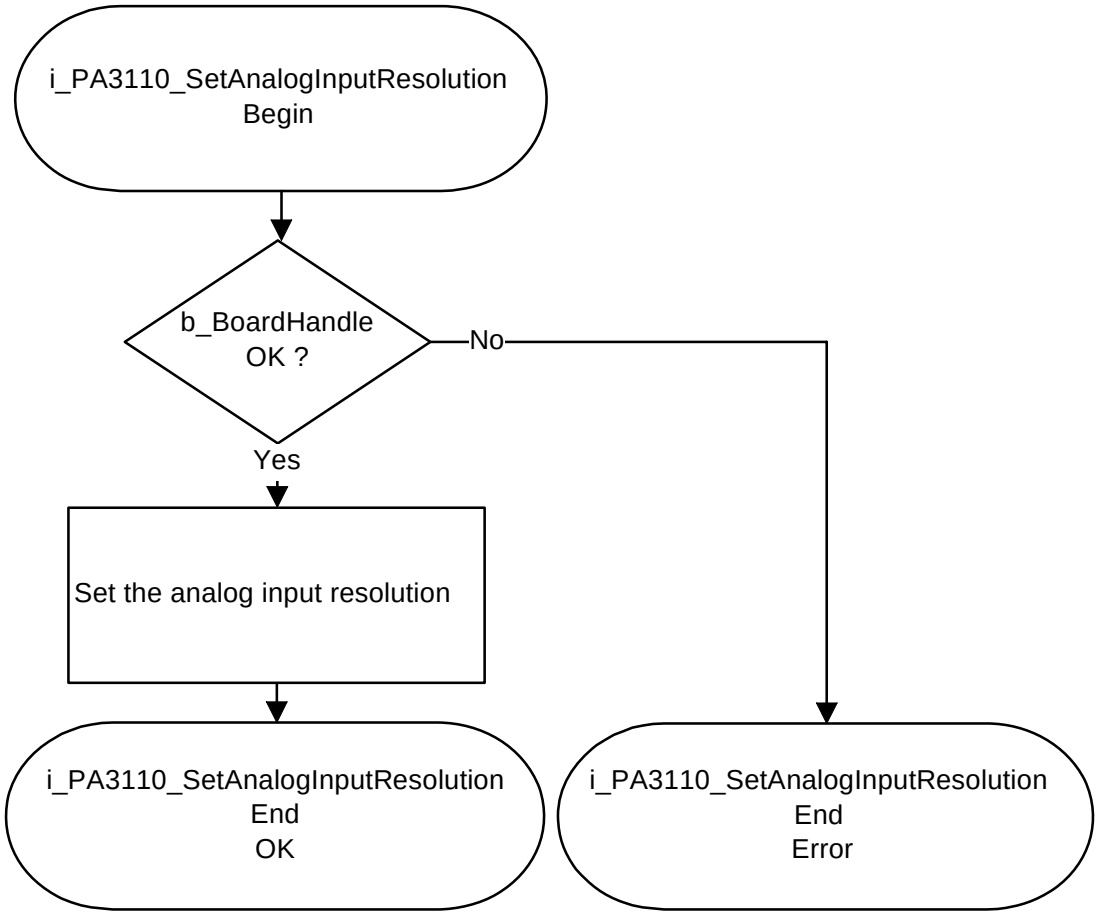
```
int             i_ReturnValue;

i_ReturnValue = i_PA3110_SetAnalogInputResolution (b_BoardHandle,
                                                   14);
```

Return value:
0: No error
-1: The handle parameter of the board is wrong
-2: Analog input resolution selection is wrong (14 or 16 bit)

Input

b_BoardHandle
b_AnalogInputResolution

Function diagram



Output

<Return Value>

5) i_PA3110_GetHardwareInformation (...)

Syntax:

```
<Return value> =  i_PA3110_GetHardwareInformation
                                  (BYTE   b_BoardHandle,
                                   PUINT  pui_BaseAddress,
                                   PBYTE  pb_InterruptNbr,
                                   BYTE   pb_DMAChannelNbr)
```

Parameters:

-Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**

- Output:

PUINT	pui_BaseAddress	**PA 3110** base address
PBYTE	pb_InterruptNbr	**PA 3110** interrupt line.
PBYTE	pb_DMAChannelNbr	Number of the DMA channel (DMA5,6,7). If 0, no DMA is used

Task:

Returns the base address, the interrupt and DMA number of the **PA 3110**.

Calling convention:

ANSI C :

```
int             i_ReturnValue;
unsigned int    ui_BaseAddress;
unsigned char   b_DMAChannelNbr;
unsigned char   b_InterruptNbr;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_GetHardwareInformation (b_BoardHandle,
                                                 &ui_BaseAddress,
                                                 &b_InterruptNbr,
                                                 &b_DMAChannelNbr);
```

Return value:

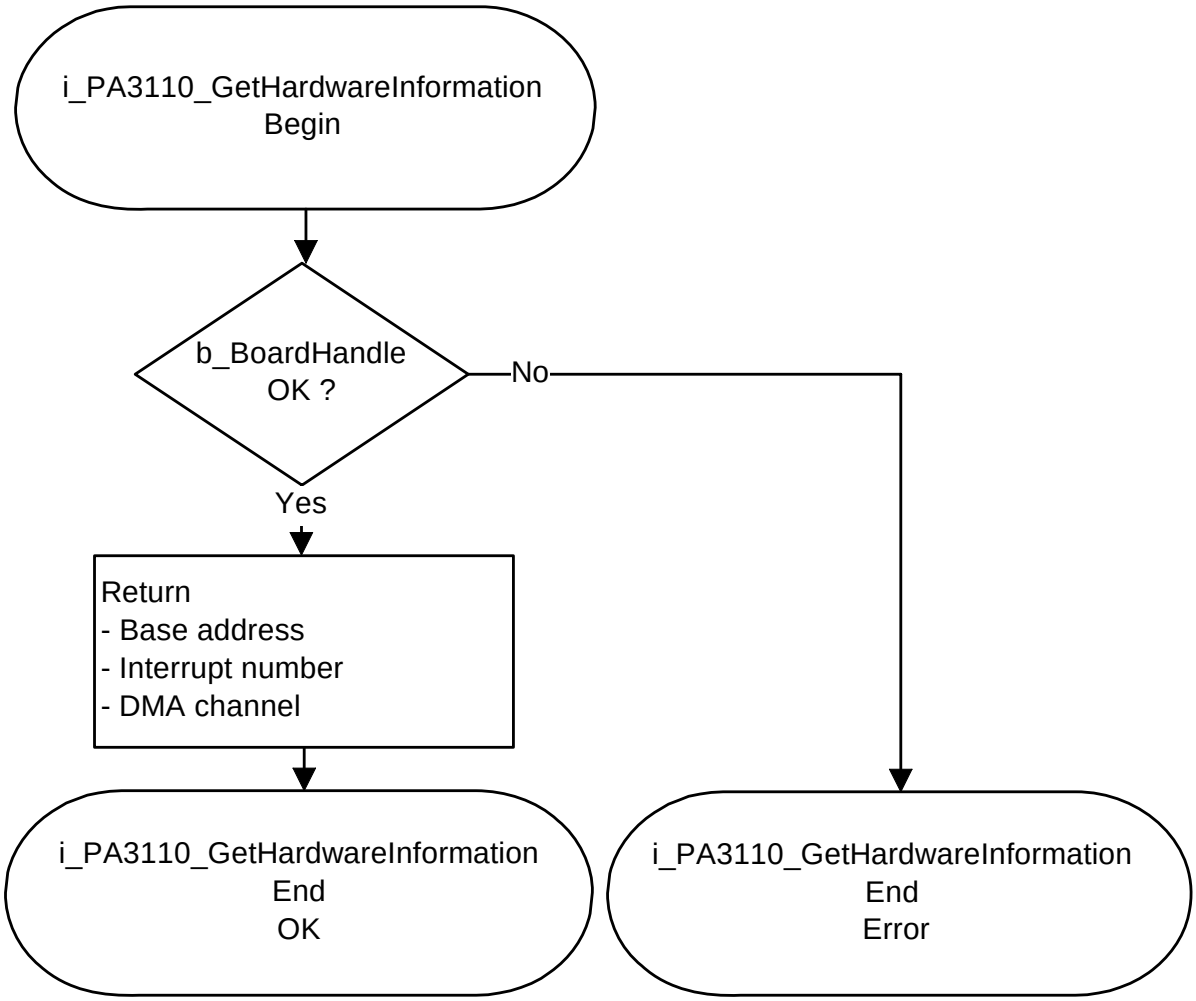
0: No error

-1: The handle parameter of the board is wrong

Input

b_BoardHandle

Function diagram



Output

pui_BaseAddress pb_DMAChannelNbr
pb_InterruptNbr

<Return Value>

IMPORTANT!
Call up this function each time you want to leave the user program!

6) i_PA3110_CloseBoardHandle

Syntax:
<Return value> = i_PA3110_CloseBoardHandle (BYTE b_BoardHandle)

Parameters:
- Input:
BYTE b_BoardHandle Handle of board **PA 3110**
- Output:
No output signal has occurred.

Task:
Releases the board handle. Blocks the access to the board.

Calling convention:
ANSI C :

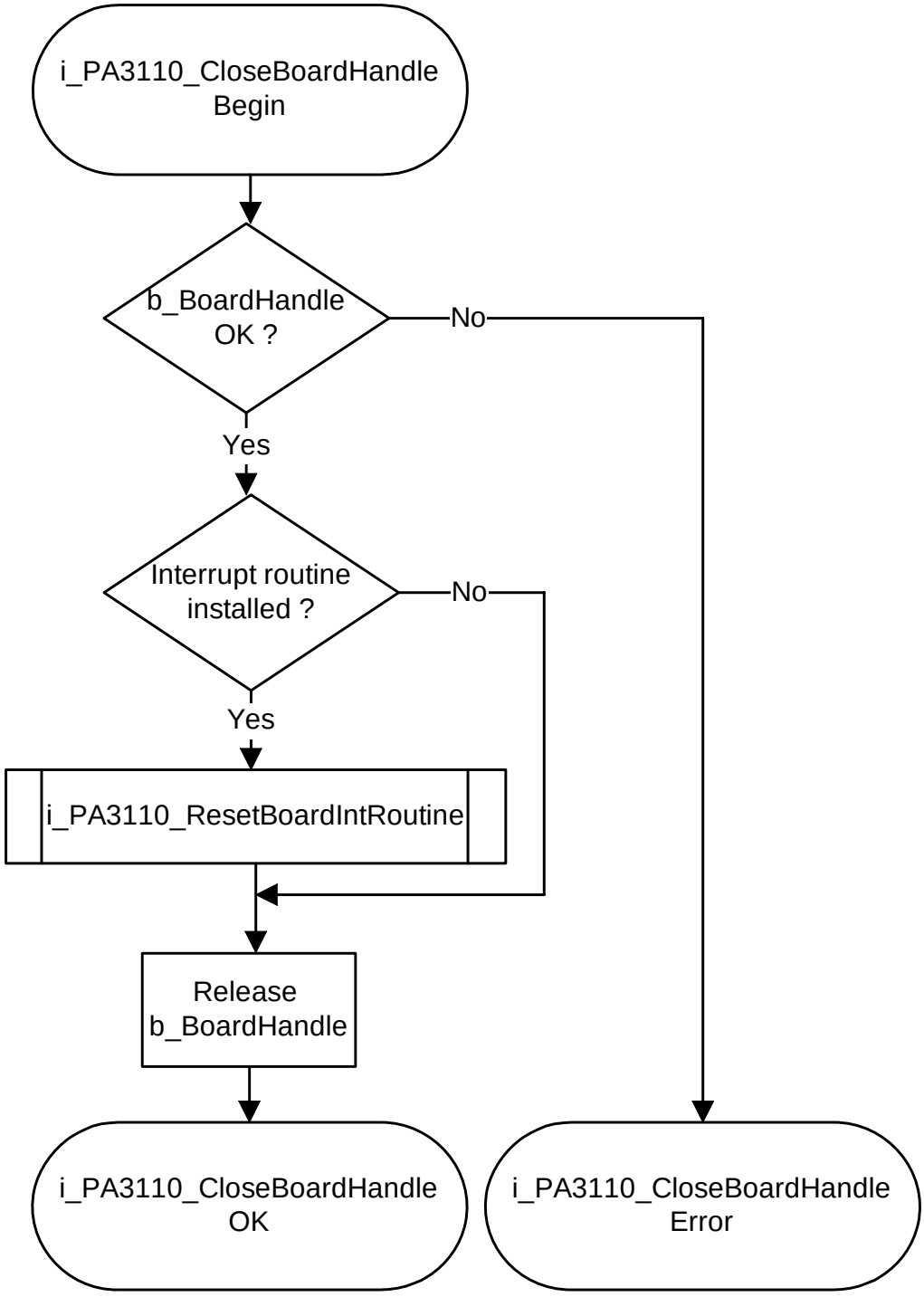
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

  i_ReturnValue = i_PA3110_CloseBoardHandle   (b_BoardHandle);
```

Return value:
0: No error
-1: The handle parameter of the board is wrong

Input

b_BoardHandle

Function diagram



Output

<Return Value>

3.2 Interrupt

IMPORTANT!
This function is only available for C/C++ and Pascal for DOS.

1) i_PA3110_SetBoardIntRoutineDos (..)

Syntax:
<Return value> = i_PA3110_SetBoardIntRoutineDos
(BYTEb_boardHandle
VOID v_FunctionName
(BYTE b_BoardHandle,
BYTE b_InterruptMask,
PUINT pui_AnalogInputValue))

Parameters:
- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
VOID	v_FunctionName	Name of the user interrupt routine

-Output:
No output signal has occurred.

Task:

This function can be called up several times.

This function must be called up for each PA 3110 on which an interrupt is to be enabled. It installs an user interrupt on all boards on which the interrupt has been enabled.

When the function is called up for the first time (first board):
- the user interrupt routine is installed
- interrupts are enabled.

If you operate several boards **PA 3110** which have to react to interrupts, call up the function as often as you operate boards **PA 3110**.

From the second callup of the function (next board):
- interrupts are enabled.

The variable *v_FunctionName* is only relevant when the function is called up **for the first time**.

Interrupt
The user interrupt routine is called up by the system when an interrupt is generated.

If several boards **PA 3110** are operated and if they have to react to interrupts, the variable *b_BoardHandle* returns the identification number (handle) of the board which has generated the interrupt.

The user interrupt routine must have the following syntax:

```
VOID  v_FunctionName (BYTE    b_BoardHandle,
                      BYTE    b_InterruptMask,
                      PUINT   pui_AnalogInputValue)
```

v_FunctionName	Name of the user interrupt routine
b_BoardHandle	Handle of the **PA 3110** which has generated the interrupt
b_InterruptMask	Mask of the events which have generated the interrupt
pui_AnalogInputValue	The values of the analog input channels and of the DMA buffer are returned.

Table 3-1: Values returned for the analog inputs

Event	Variable name	Variable content
b_InterruptMask = 1	*pui_AnalogInputValue [0]*	Number of the last analog input
	pui_AnalogInputValue [1]	Value of the analog input
b_InterruptMask = 2	*pui_AnalogInputValue [0]*	Number of the last analog input
	pui_AnalogInputValue [1]	Value of the analog input
b_InterruptMask = 4	*pui_AnalogInputValue [0]*	Number of the last analog input
	pui_AnalogInputValue [1]	Value of the analog input
b_InterruptMask = 8	*pui_AnalogInputValue*	Values of the DMA buffer

Table 3-2: Interrupt mask

Mask	Meaning
0000 000**1**	End of Conversion (EOC)
0000 00**1**0	Conversion driven by timer is completed
0000 0**1**00	Conversion driven by EOS is completed
0000 **1**000	DMA conversion cycle is completed
000**1** 0000	Timer 2 has run down
00**1**0 0000	Watchdog has run down

The user can give another name for *v_FunctionName, b_BoardHandle, b_InterruptMask, pui_AnalogInputValue.*

Calling convention:

ANSI C :

```
void      v_FunctionName      (unsigned char  b_BoardHandle,
                               unsigned char  b_InterruptMask,
                               unsigned int * ui_AnalogInputValue)
          {
          .
          .
          }

int               i_ReturnValue;
unsigned char     b_BoardHandle;

i_ReturnValue = i_PA3110_SetBoardIntRoutineDos   (b_BoardHandle,
                                                  v_FunctionName );
```

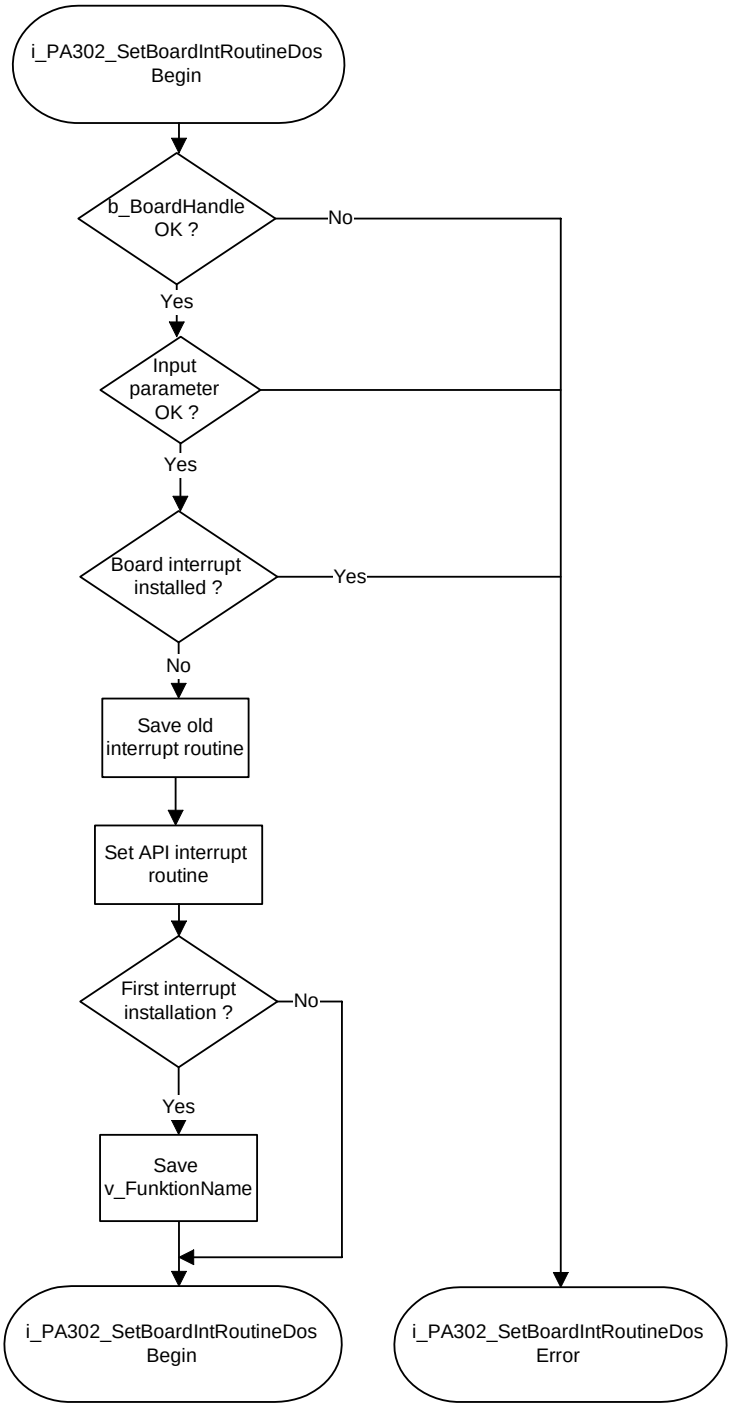
Return value:

0: No error
-1: The handle parameter of the board is wrong
-2: No interrupt line has been initialised
-3: Interrupt already installed

Input

b_BoardHandle
v_FunctionName

Function diagram



Output

<Return Value>

IMPORTANT!
This function is only available for Visual Basic DOS.

2) i_PA3110_SetBoardIntRoutineVBDos (..)

Syntax:
<Return value> = i_PA3110_SetBoardIntRoutineVBDos
(BYTE b_BoardHandle)

Parameters:
- Input:
BYTE b_BoardHandle Handle of board **PA 3110**
- Output:
No output signal has occurred.

Task:

This function must be called up for each **PA 3110** on which an interrupt is to be enabled. If an interrupt occurs, a Visual basic event is generated.
See calling convention.

When the function is called up for the first time (first board):
- interrupts are allowed for the selected board.

If you operate several boards **PA 3110** which have to react to interrupts, call up the function as much as you operate boards **PA 3110**.

Interrupt
The user interrupt routine is called up by the system when an interrupt is generated.

Controlling the interrupt management
Please use instead the following functions

"ON UEVENT GOSUB xxxxxxxxx" of Visual Basic for DOS

and

"i_PA3110_TestInterrupt"

This function tests the interrupt of the **PA 3110**. It is used to obtain the values of *b_BoardHandle , b_InterruptMask, pui_AnalogInputValue*.

Calling convention:

Visual Basic DOS:

```
Dim Shared i_ReturnValue            As Integer
Dim Shared i_BoardHandle            As Integer
Dim Shared i_InterruptMask          As Integer
Dim Shared l_AnalogInputValue( )    As Long



IntLabel:


i_ReturnValue = i_PA3110_TestInterrupt      (i_BoardHandle, _
                                             i_InterruptMask,  _
                                             l_AnalogInputValue (0) )
.
.
.

Return


ON UEVENT GOSUB IntLabel
UEVENT ON
i_ReturnValue = i_PA3110_SetBoardIntRoutineVBDos      (b_BoardHandle)
```

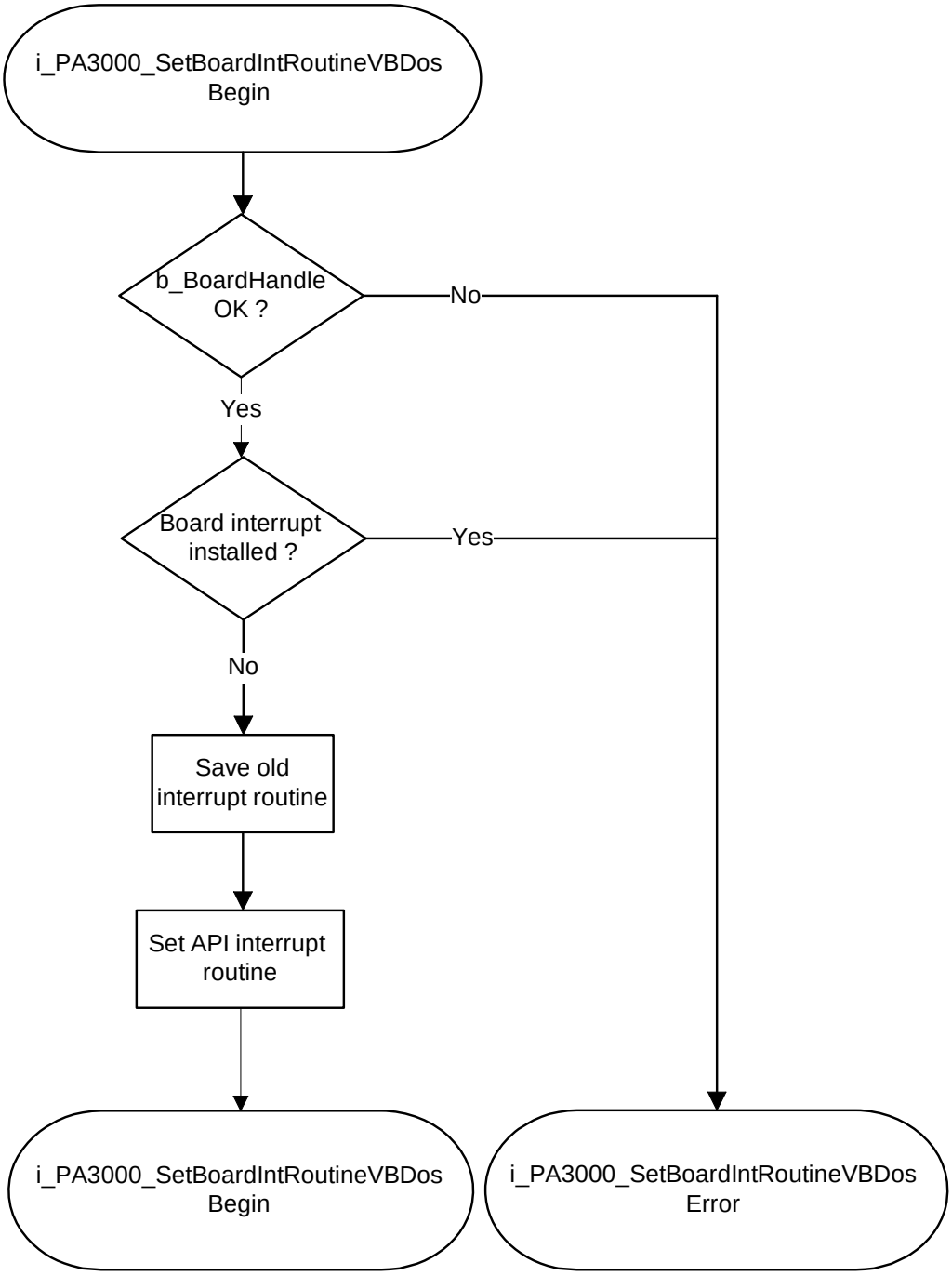
Return value:

0: No error
-1: The handle parameter of the board is wrong
-2: No interrupt line has been initialised
-3: Interrupt already installed

Input

b_BoardHandle

Function diagram



Output

<Return Value>

3) i_PA3110_SetBoardIntRoutineWin16

Syntax:

```
<Return value> = i_PA3110_SetBoardIntRoutineWin16
                 (BYTE     b_BoardHandle,
                  VOID     v_FunctionName  (BYTEb_BoardHandle,
                                            BYTE        b_InterruptMaske,
                                            PUINT       pui_AnalogInputValue))
```

Parameters:

- Input:

BYTE	b_BoardHandle	Handle of the **PA 3110**
VOID	v_FunctionName	Name of the user interrupt routine.

- Output:

No output signal has occurred.

Task:

This function can be called up several times.

First calling (first board):
- interrupts are enabled.

If you operate several boards **PA 3110** which have to react to interrupts, call up the function as often as you operate boards **PA 3110**. The variable *v_FunctionName* is only relevant **for the first calling**.

From the second callup of the function (next board):
- interrupts are enabled.

Interrupt

The user interrupt routine is called up by the system when an interrupt is generated.
If several boards are operated and if they have to react to interrupts, the variable *b_BoardHandle* returns the identification number (handle) of the board which has generated the interrupt.

The user interrupt routine must have the following syntax:

```
VOID   v_FunctionName  (BYTE     b_BoardHandle,
                        BYTE     b_InterruptMask,
                        PUINT    pui_AnalogInputValue)
```

v_FunctionName	Name of the user interrupt routine
b_BoardHandle	Handle of the **PA 3110** which has generated the interrupt
b_InterruptMask	Mask of the events which have generated the interrupt
pui_AnalogInputValue	The values of the analog input channels and of the DMA buffer are returned.

The user can give another name for *v_FunctionName, b_BoardHandle, b_InterruptMask, pui_AnalogInputValue.*

IMPORTANT!
If you use Visual Basic for Windows the following parameter has no meaning. You must use the „i_PA3110_TestInterrupt“ function.

VOID *v_FunctionName* (BYTE*b_BoardHandle*,
BYTE *b_InterruptMask*,
PUINT *pui_AnalogInputValue*)

Calling convention:
ANSI C :

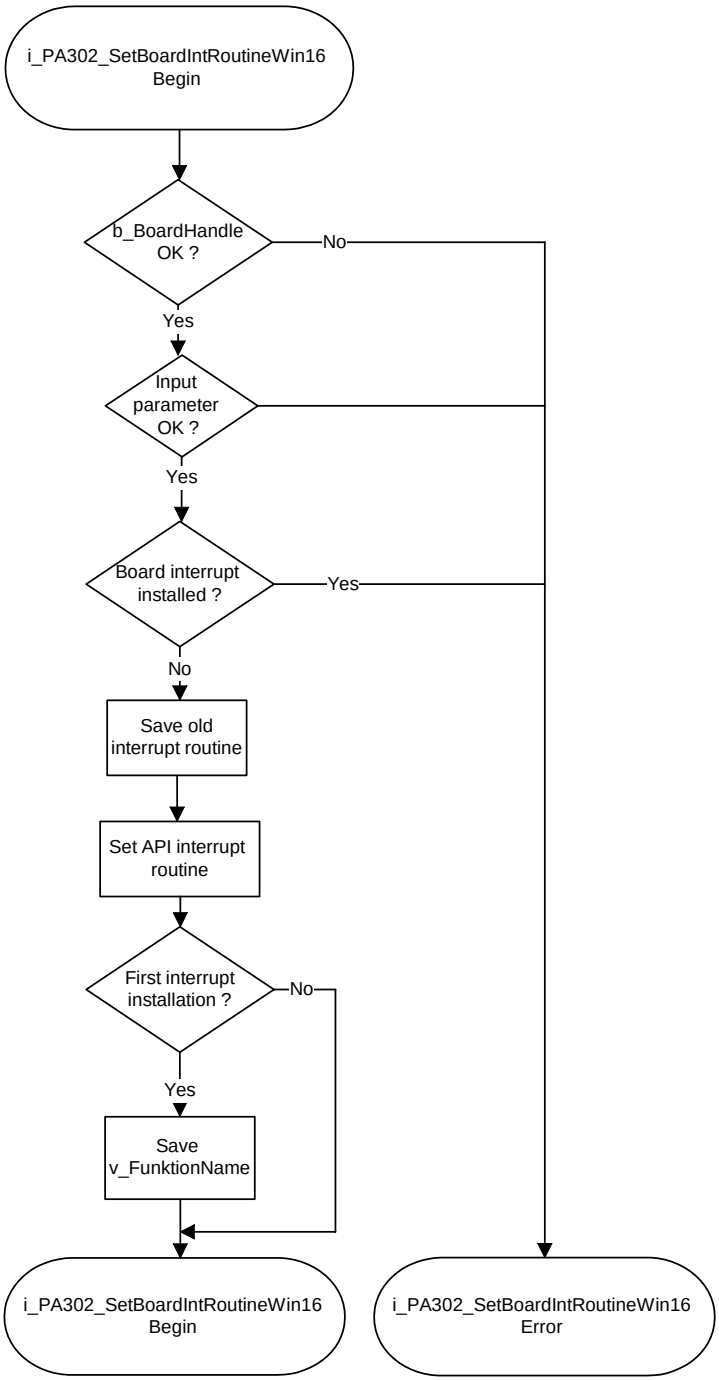
```
void      v_FunctionName      (unsigned char  b_BoardHandle,
                               unsigned char  b_InterruptMask,
                               unsigned int * ui_AnalogInputValue)
          {
          .
          .
          }

int               i_ReturnValue;
unsigned char     b_BoardHandle;

i_ReturnValue = i_PA3110_SetBoardIntRoutineWin16 (b_BoardHandle,
                                                  v_FunctionName );
```

Return value:
0: No error
-1: The handle parameter of the board is wrong
-2: No interrupt line has been initialised
-3: Interrupt already installed

Input

b_BoardHandle
v_FunctionName

Function diagram



Output

<Return Value>

IMPORTANT!
This function is only available for Windows NT and Windows 95.

4) i_PA3110_SetBoardIntRoutineWin32 (..)

Syntax:

```
<Return value> = i_PA3110_SetBoardIntRoutineWin32
                 (BYTE     b_BoardHandle,
                  BYTE     b_UserCallingMode,
                  ULONG    ul_UserSharedMemorySize,
                  VOID **  ppv_UserSharedMemory,
                  VOID     v_FunctionName  (BYTE    b_BoardHandle,
                                            BYTE    b_InterruptMask,
                                            PUINT   pui_AnalogInputValue,
                                            BYTE    b_UserCallingMode,
                                            VOID *  pv_UserSharedMemory))
```

Parameters:

- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
BYTE	b_UserCallingMode	PA3110_SYNCHRONOUS_MODE : The user routine is directly called by the driver interrupt routine. PA3110_ASYNCHRONOUS_MODE : The user routine is called by the driver interrupt thread.
VOID	v_FunctionName	Name of the user interrupt routine
ULONG	ul_UserSharedMemorySize	Determines the size in bytes of the user shared memory. Only used if you have selected PA3110_SYNCHRONOUS_MODE

IMPORTANT!
The size of the User Shared Memory is limited to 63 MB. It could cause problems if more memory is required.

- Output:

VOID **	ppv_UserSharedMemory	User shared memory address Only used if you have selected PA3110_SYNCHRONOUS_MODE

Task:

If you use Visual Basic 5.0:
- only the asynchronous mode is available.

Windows 32-bit information

For Windows NT and Windows 95, 4 rings (ring 0 to ring 3) are available.

- The user application operates in ring 3. This ring does not give access to hardware.
- VXD and SYS drivers operate in ring 0 and give access to hardware.
- Ring 0 has no direct access to the global variables of ring 3. It has to use a shared memory.
- Ring 0 and ring 3 have a pointer that points on this shared memory. The 2 pointers are not configured under the same address.

This function must be called up for each **PA 3110** for which an interrupt is to be enabled. It installs one user interrupt function in all boards on which an interrupt is to be enabled.

First calling (first board):
- the user interrupt routine is installed
- interrupts are enabled
- user shared memory is allocated if PA3110_SYNCHROUNOUS_MODE has been selected.

If you operate several boards **PA 3110** which have to react to interrupts, call up the function as often as you operate boards **PA 3110**. The variable *v_FunctionName* is only relevant **for the first calling**.

From the second call of the function (next board):
- interrupts are enabled.

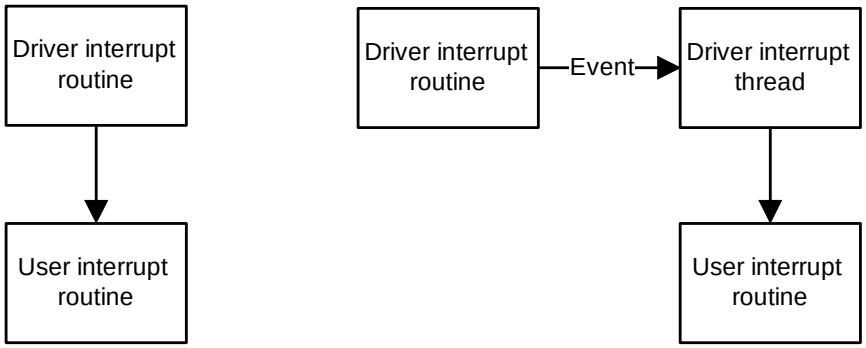
Interrupt

The user interrupt routine is called up by the system when an interrupt is generated.

If several boards are operated and if they have to react to interrupts, the variable *b_BoardHandle* returns the identification number (handle) of the board which has generated the interrupt.

User interrupt routine can be called:
- directly by driver interrupt routine (Synchronous mode). The code of the user interrupt routine directly operates in ring 0.
- by the driver interrupt thread (Asynchronous mode). An event is generated and the interrupt thread calls up the user interrupt routine. The code of the user interrupt routine operates in ring 3.
  The driver interrupt thread have the highest priority (31) in the system.

Synchronous mode **Asynchronous mode**



	SYNCHRONOUS MODE
ADVANTAGE	The code of the user interrupt routine is directly called by driver interrupt routine (ring 0). The time between interrupt and the user interrupt routine is reduced.
RESTRICTION	The user cannot debug the user interrupt routine.
	The user routine cannot call Windows API functions.
	The user routine cannot call functions which give access to global variables. The user can still use a shared memory.
	The user routine can only call PA 3110 driver functions with the following extension “i_PA3110_KRNL_XXXX“
	This mode is not available for Visual Basic

	ASYNCHRONOUS MODE
ADVANTAGE	The user can debug the user interrupt routine
	The user routine can call Windows API functions.
	The user routine can call functions which give access to global variables.
	The user routine can call all PA 3110 driver functions with the following extension: “i_PA3110_XXXX“
RESTRICTION	The code of the user interrupt routine is called by driver interrupt thread routine (ring 3). The time between interrupt and the user interrupt routine is increased.

Shared memory
If you have selected the PA3110_SYNCHRONOUS_MODE you cannot have access to global variables. But you have the possibility to create a shared memory (*ppv_UserSharedMemory*). The user shared memory can have all predefined compiler types or user define types.
The variable *ul_UserSharedMemorySize* indicates the size in byte of the selected user type. A pointer of the variable *ppv_UserSharedMemory* is given to the user interrupt routine with the variable *pv_UserSharedMemory.* This is not possible for Visual Basic.

The user interrupt routine must have the following syntax:

```
VOID   v_FunctionName (BYTEb_BoardHandle,
                       BYTE      b_InterruptMask,
                       PUINT     b_AnalogInputValue,
                       BYTE      b_UserCallingMode,
                       VOID *    pv_UserSharedMemory)
```

v_FunctionName	Name of the user interrupt routine
b_BoardHandle	Handle of the **PA 3110** which has generated the interrupt
b_InterruptMask	Mask of the events which have generated the interrupt.
pui_AnalogInputValue	The latched values of the counter are returned.
b_UserCallingMode	PA3110_SYNCHRONOUS_MODE : The user routine is directly called by driver interrupt routine. PA3110_ASYNCHRONOUS_MODE : The user routine is called by driver interrupt thread
pv_UserSharedMemory	Pointer of the user shared memory.

IMPORTANT!
If you use Visual Basic 4 the following parameters have no meaning. You must used the „i_PA3110_TestInterrupt“ function.

```
BYTE      b_UserCallingMode,
ULONG     ul_UserSharedMemorySize,
VOID **   ppv_UserSharedMemory,
VOID      v_FunctionName    (BYTEb_BoardHandle,
                             BYTE      b_InterruptMask,
                             PUINT     pui_AnalogInputValue,
                             BYTE      b_UserCallingMode,
                             VOID *    pv_UserSharedMemory)
```

The user can give another name for v_FunctionName, b_BoardHandle, b_InterruptMask, pui_AnalogInputValue, b_UserCallingMode, pv_UserSharedMemory.

Calling convention:

ANSI C :

```
typedef struct
   {
   .
   .
   .
   }str_UserStruct;

str_UserStruct * ps_UserSharedMemory;

void     v_FunctionName     (unsigned char   b_BoardHandle,
                             unsigned char   b_InterruptMask,
                             unsigned int    *ui_AnalogInputValue,
                             unsigned char   b_UserCallingMode,
                             void *          pv_UserSharedMemory)
         {
         str_UserStruct * ps_InterruptSharedMemory;

ps_InterruptSharedMemory = (str_UserStruct *) pv_UserSharedMemory;
         .
         .
         }
int              i_ReturnValue;
unsigned char    b_BoardHandle;

i_ReturnValue = i_ PA3110_SetBoardIntRoutineWin32
                          (b_BoardHandle, PA3110_SYNCHRONOUS_MODE,
                           sizeof (str_UserStruct),
                           (void **) &ps_UserSharedMemory,
                           v_FunctionName);
```

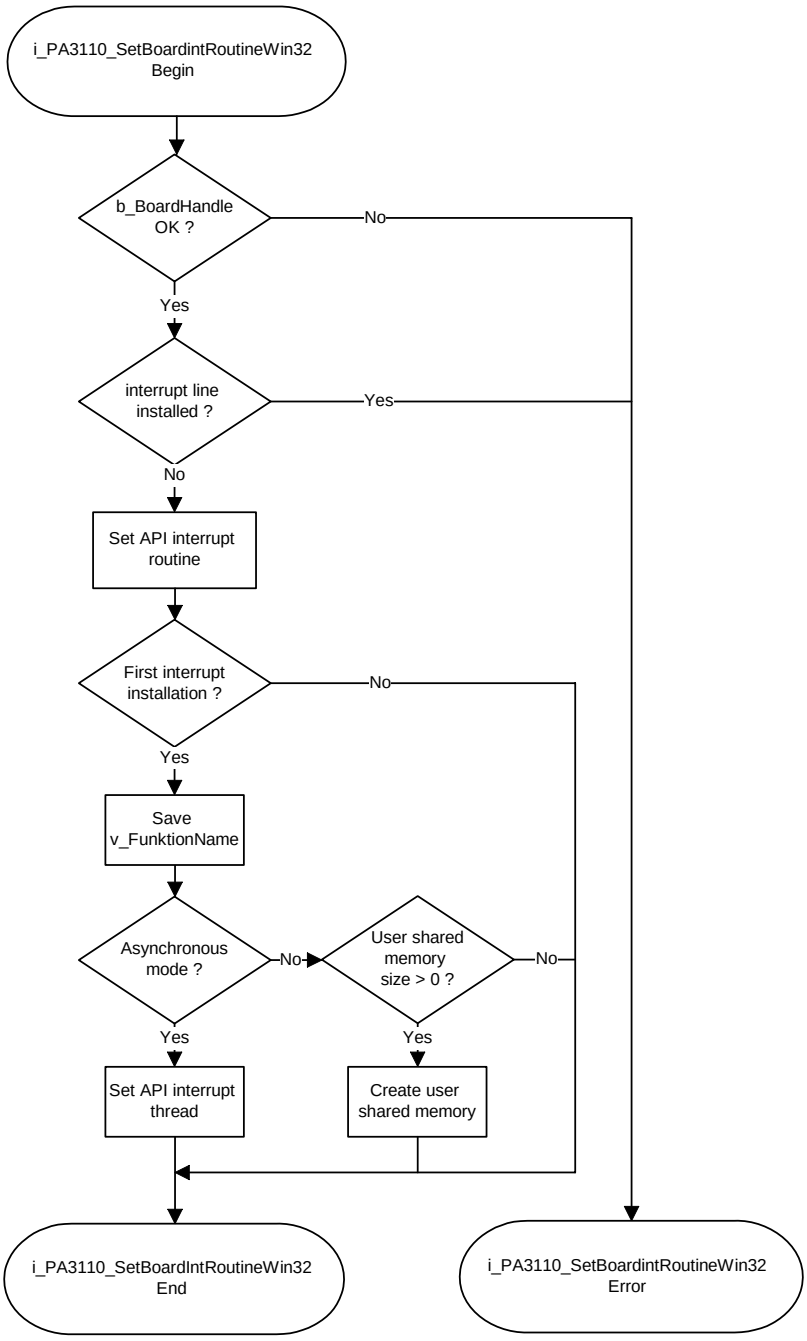
Return value:

 0: No error
-1: The handle parameter of the board is wrong
-2: All interrupt lines cannot have the value 0 or
    interrupt already installed
-3: Parameter b_UserCallingMode is wrong.

Input

b_BoardHandle	ul_UserSharedMemorySize
b_UserCallingMode	v_FunctionName

Function diagram



Output

ppv_UserSharedMemory

<Return Value>

IMPORTANT!
This function is only available in Visual Basic for DOS and Windows .

5) i_PA3110_TestInterrupt (..)

Syntax:

```
<Return value> = i_PA3110_TestInterrupt     (PBYTE   pb_BoardHandle,
                                             PBYTE  pb_InterruptMask,
                                             PUINT  pui_AnalogInputValue)
```

Parameters:

- Input:

No input signal occurs

- Output:

PBYTE	pb_BoardHandle	Handle of the board **PA 3110** which has generated the interrupt
PBYTE	pb_InterruptMask	Mask of the events which have generated the interrupt.
PUINT	pui_AnalogInputValue	The values of the analog input channels and of the DMA buffer are returned.

Task:

Verifies if a board **PA 3110** has generated an interrupt. If yes, the function returns the board handle and the interrupt source.

Calling convention:

ANSI C :

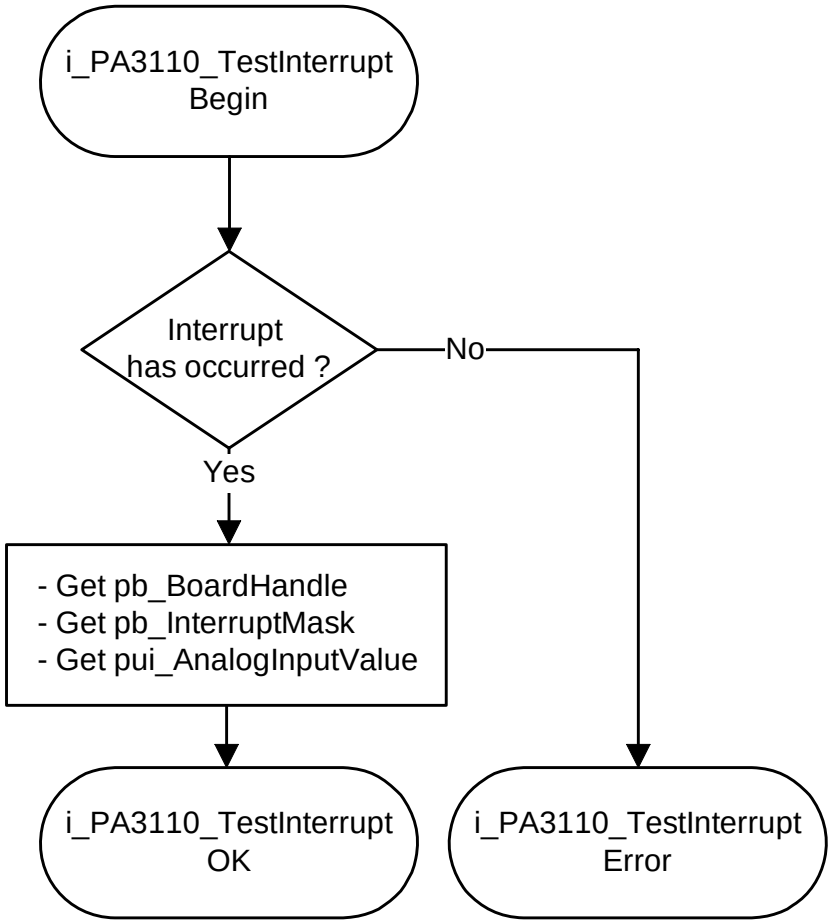
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;
unsigned char   b_InterruptMask;
unsigned int    ui_AnalogInputValue [XX];
i_ReturnValue = i_PA3110_TestInterrupt      (&b_BoardHandle,
                                             &b_InterruptMask,
                                             ui_AnalogInputValue);
```

Return value:

-1 No interrupt
> 0 IRQ number

Input

Function diagram



Output

pb_BoardHandle pui_AnalogInputvalue
pb_InterruptMask

<Return Value>

6) i_PA3110_ResetBoardIntRoutine (..)

Syntax:
<Return value> = i_PA3110_ResetBoardIntRoutine (BYTE b_BoardHandle)

Parameters:
- Input:
BYTE b_BoardHandle Handle of board **PA 3110**
- Output:
No output signal has occurred.

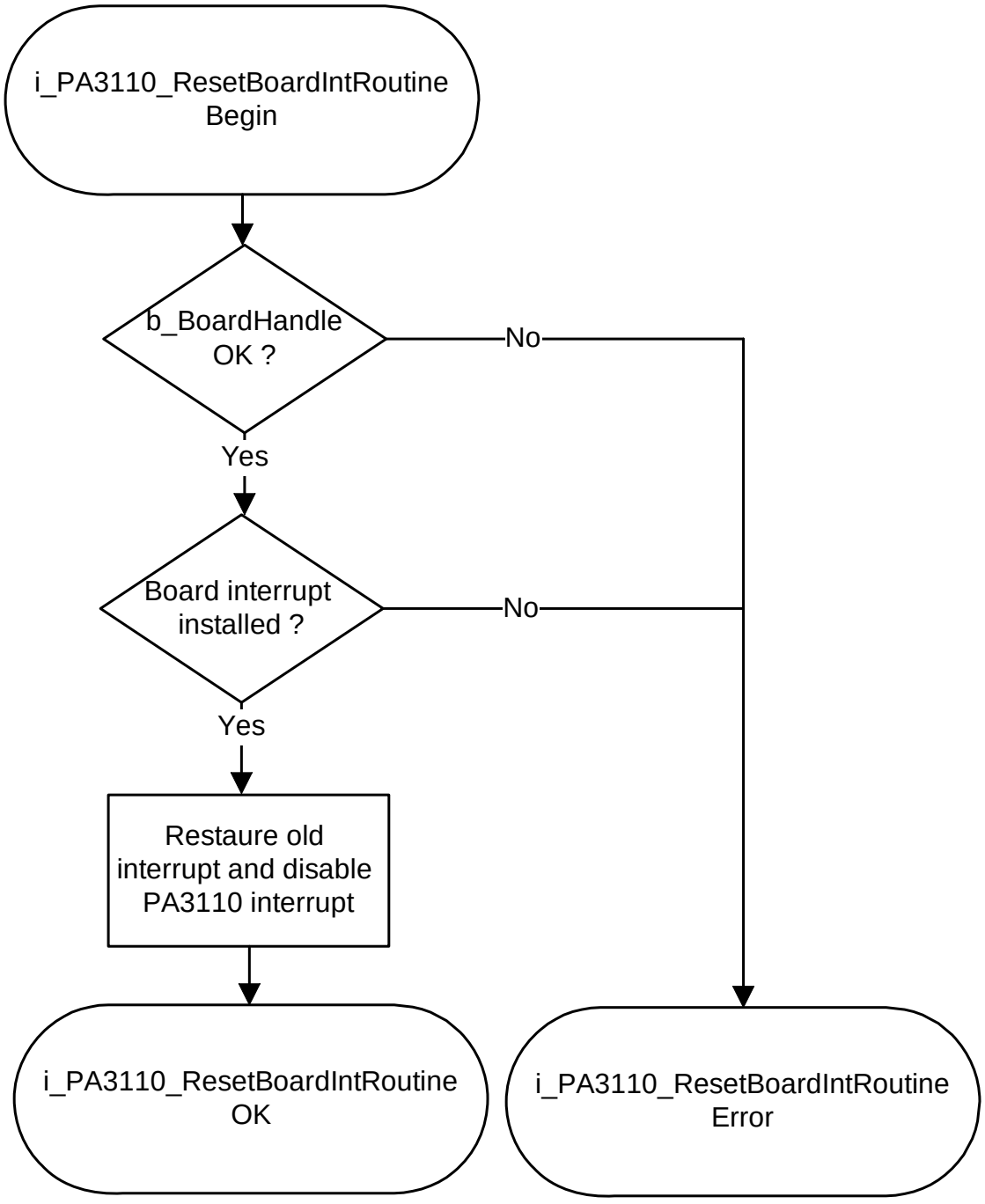
Task:
Stops the interrupt management of board **PA 3110.**
Deinstalls the user interrupt routine if the management of interrupts of all boards **PA 3110** is stopped.

Return value:
0: No error
-1: The handle parameter of the board is wrong
-2: No interrupt has been initialised with function
"i_PA3110_SetBoardIntRoutineXXX"

Input

b_BoardHandle

Function diagram



Output

<Return Value>

3.3 Direct conversion of the analog input channels

1) i_PA3110_Read1AnalogInput (...)

Syntax:

```
<Return value> =  i_PA3110_Read1AnalogInput
                                  (BYTE     b_BoardHandle,
                                   BYTE     b_Channel,
                                   BYTE     b_Gain,
                                   BYTE     b_Polarity.
                                   UINT     ui_ConvertTiming,
                                   BYTE     b_InterruptFlag,
                                   PUINT    pui_AnalogInputValue)
```

Parameters:

- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
BYTE	b_Channel	Number of the analog input channel to be read. (0 to 15) See table 3-3.
BYTE	b_Gain	Gain selection (see table 3-4)
BYTE	b_Polarity	Selection of the input voltage range of the analog input channel to convert (see table 3-5)
UINT	ui_ConvertTiming	Selection of the conversion time from 7 µs to 45874 µs.
BYTE	b_InterruptFlag	PA3110_ENABLE: An interrupt is generated at the end of conversion. See function "i_PA3110_SetBoardIntRoutineXXX". PA3110_DISABLE: No interrupt is generated at the end of conversion. The analog value is in the parameter *pui_AnalogInputValue*.

- Output:

PUINT	pui_AnalogInputValue	The analog value is returned 14-bit: 0 to 16383 16-bit: 0 to 65535

Task:

Reads the current value of the analog input channel *b_Channel* with a gain of *b_Gain*, an input voltage range of *b_Polarity* and a conversion time of *ui_ConvertTiming*.

Calling convention:

ANSI C :

```
int             i_ReturnValue;
unsigned char   b_BoardHandle;
unsigned int    ui_AnalogInputValue;

i_ReturnValue = i_PA3110_Read1AnalogInput      (b_BoardHandle,
                                                PA3110_CHANNEL_0,
                                                PA3110_1_GAIN,
                                                PA3110_UNIPOLAR,
                                                10,
                                                PA3110_DISABLE,
                                                & ui_AnalogInputValue);
```

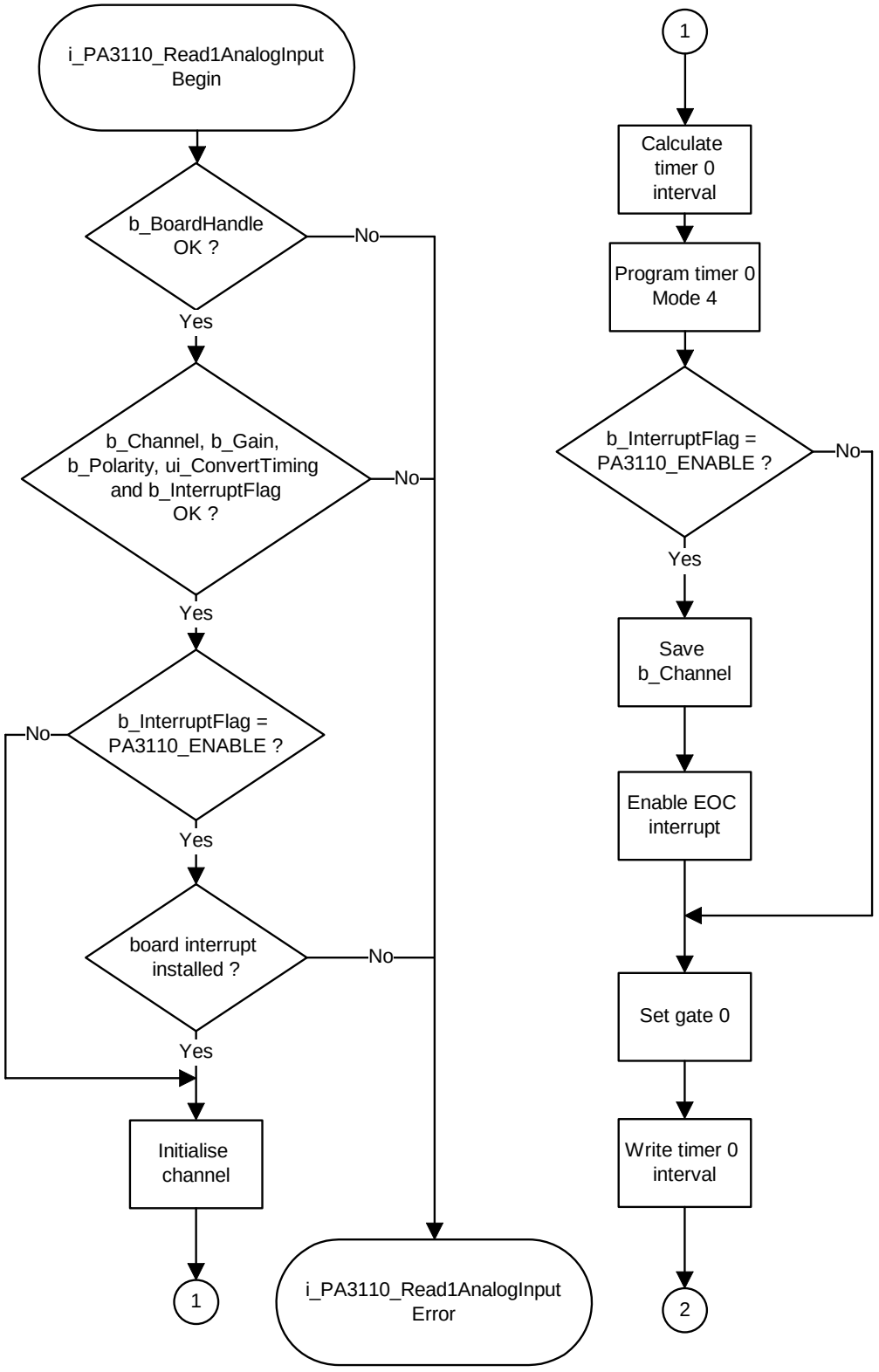
Return value:

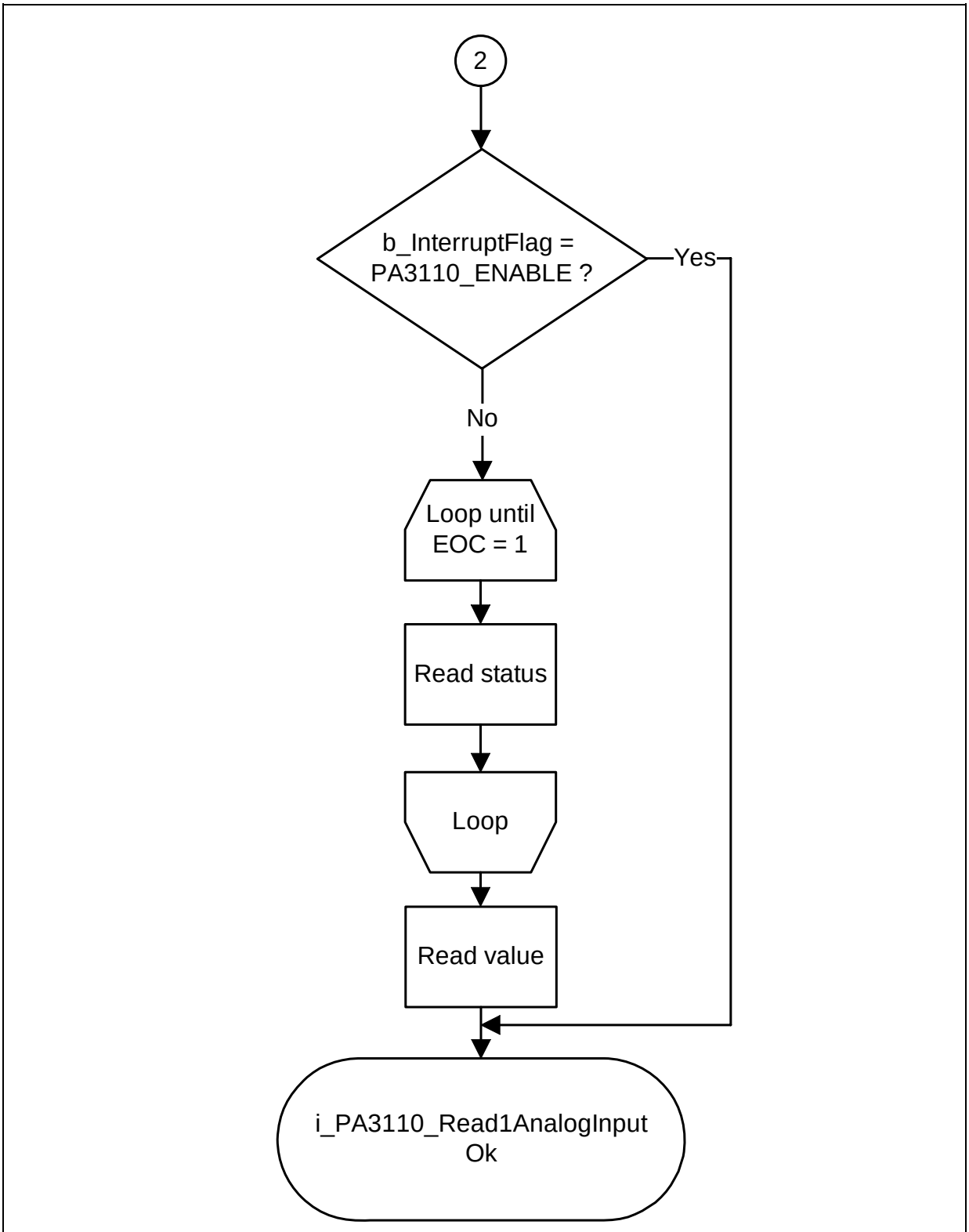
0: No error
-1: The handle parameter of the board is wrong
-2: Number of the analog input channel is wrong. See table 3-3.
-3: The gain selected is wrong. See table 3-4.
-4: The input voltage range selected is wrong. See table 3-5.
-5: The conversion time selected is wrong
-6: A wrong parameter has been passed for *b_InterruptFlag* or the user interrupt routine has not been installed.
See function "i_PA3110_SetBoardIntRoutine".

Input

b_BoardHandle	b_Polarity
b_Channel	ui_ConvertTimimg
b_Gain	b_InterruptFlag

Function diagram





Output
pui_AnalogInputvalue
<Return Value>

2) i_PA3110_ReadMoreAnalogInput (...)

Syntax:

```
<Return value> =  i_PA3110_ReadMoreAnalogInput
                                  (BYTE    b_BoardHandle,
                                   BYTE    b_SequenzArraySize,
                                   PBYTE   pb_ChannelArray,
                                   PBYTE   pb_GainArray,
                                   PBYTE   pb_PolarityArray,
                                   UINT    ui_ConvertTiming
                                   BYTE    b_InterruptFlag,
                                   PUINT   pui_AnalogInputValueArray)
```

Parameters:

- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
BYTE	b_SequenzArraySize	Size of the scan lists (1 up to 16 elements)
PBYTE	pb_ChannelArray	Scan list for the analog input channels. See table 3-3.
PBYTE	pb_GainArray	Scan list for gain See table 3-4.
PBYTE	pb_PolarityArray	Scan list for the input voltage range See table 3-5.
UINT	ui_ConvertTiming	Selection of the conversion time From 10 µs up to 45874 µs.
BYTE	b_InterruptFlag	PA3110_ENABLE : An interrupt is generated when the last conversion of the channel group is completed (EOS). See function "i_PA3110_SetBoardIntRoutine". PA3110_DISABLE : No interrupt is generated at the end of conversion. The analog values are located in parameter *pui_AnalogInputValueArray*.

- Output:

PUINT	pui_AnalogInputValue	The analog values are returned

Task:

Reads several analog input channels.
The priority of the analog input channels is set with the scan list.
The scan list allows to determine the input voltage range and the gain for each analog input channel. The gain is defined with parameter *pb_GainArray* for each analog input channel.
The input voltage range is defined with parameter *pb_PolarityArray* for each analog input channel.

Calling convention:

ANSI C :

```
int             i_ReturnValue;
unsigned char   b_BoardHandle;
unsigned char   b_ChannelArray          [16];
unsigned char   b_GainArray             [16];
unsigned char   b_PolarityArray         [16];
unsigned int    ui_AnalogInputValueArray [16];

i_ReturnValue = i_PA3110_ReadAllAnalogInput   (b_BoardHandle,
                                               16,
                                               b_ChannelArray,
                                               b_GainArray,
                                               b_PolarityArray,
                                               PA3110_DISABLE,
                                               ui_AnalogInputValue);
```

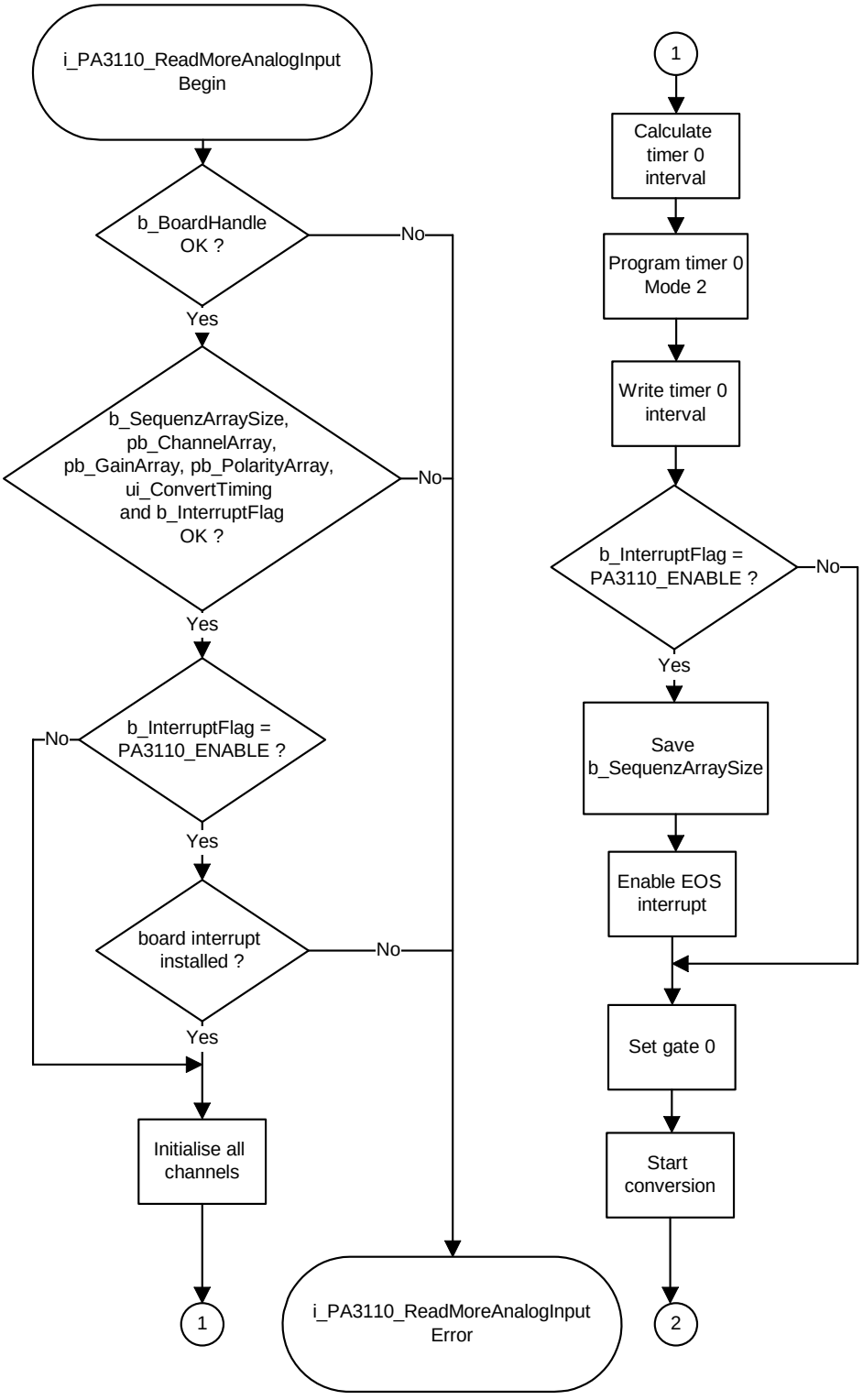
Return value:

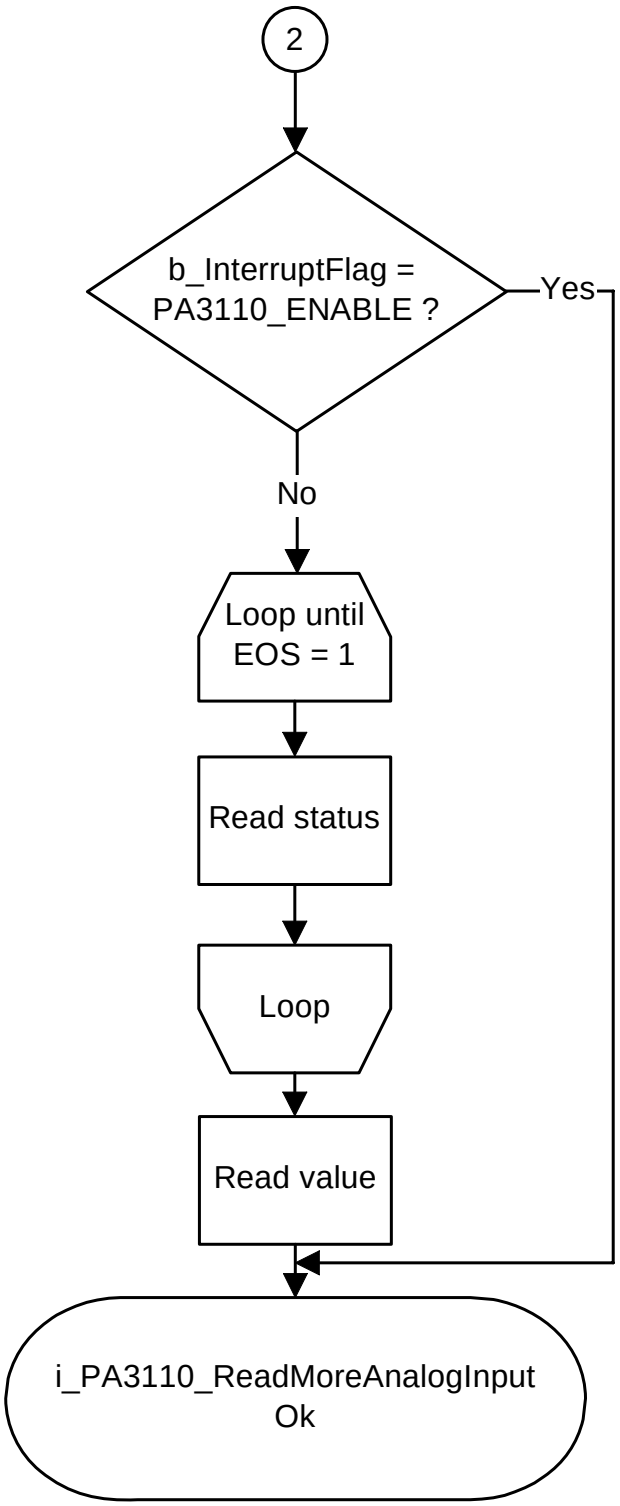
0: No error
-1: The handle parameter of the board is wrong
-2: The size of the scan list is wrong
-3: Wrong parameter detected in table "pb_ChannelArray"
-4: Wrong parameter detected in table "pb_GainArray"
-5: Wrong parameter detected in table "pb_PolarityArray"
-6: Selected conversion time is wrong
-7: Wrong parameter entered for *b_InterruptFlag*, or the user interrupt routine has not been installed.
See function "i_PA3110_SetBoardIntRoutine".

Input

b_BoardHandle	b_SequenzArraySize
pb_ChannelArray	b_GainArray
b_PolarityArray	ui_ConvertTimimg
b_InterruptFlag	

Function diagram





Output
pui_AnalogInputValueArray
<Return Value>

3.4 Cyclic conversion of analog input channels

1) i_PA3110_InitAnalogInputAcquisition (...)

Syntax:

```
<Return value> =  i_PA3110_InitAnalogInputAcquisition
                                  (BYTE     b_BoardHandle,
                                   BYTE     b_SequenzArraySize,
                                   PBYTE    pb_ChannelArray,
                                   PBYTE    pb_GainArray,
                                   PBYTE    pb_PolarityArray,
                                   BYTE     b_AcquisitionMode,
                                   UINT     ui_AcquisitionTiming,
                                   LONG     l_DelayTiming,
                                   UINT     ui_NumberOfAcquisition,
                                   BYTE     b_DMAUsed,
                                   BYTE     b_AcquisitionCycle)
```

Parameters:

- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
BYTE	b_SequenzArraySize	Size of the scan lists (1 to 16 elements)
PBYTE	pb_ChannelArray	Scan list for the analog input channels. See table 3-3.
PBYTE	pb_GainArray	Scan list for gain See table 3-4.
PBYTE	pb_PolarityArray	Scan list for the input voltage range See table 3-5.
BYTE	b_AcquisitionMode	Two conversion cycles are possible: - PA3110_SIMPLE_MODUS: A conversion occurs every *ui_AcquisitionTiming* (time interval) See example 2. - PA3110_DELAY_MODUS: Both times are used in this mode: *ui_AcquisitionTiming* and *l_DelayTiming*. Conversions occur every *ui_AcquisitionTiming* (time interval) until all the analog input channels have been acquired (determined by *b_SequenzArraySize*) Step 1 of example 3. Afterwards there is a waiting time of *l_DelayTiming*. Step 2 of example 3. The two steps are repeated. See example 3.

UINT	ui_AcquisitionTiming	Time in µs between 2 conversions of successive input channels - from 7 µs to 45874 µs, if you use the option PA3110_DMA_USED. - from 1500 µs to 45874 µs, if you use the option PA3110_ DMA_ NOT_USED See example 1 and 2.
LONG	l_DelayTiming	Waiting time in µs between two conversion cycles (from 70 µs to 4587400 µs). This parameter has only a signification if you use the mode PA3110_DELAY_MODUS.
UINT	ui_NumberOfAcquisition	This parameter determines how many conversions have to happen (1 to 32767).
BYTE	b_DMAUsed	Determines if DMA must be used or not. - PA3110_DMA_USED: All the conversion values are saved and returned to the user. An interrupt is generated when the conversions (set by *ui_NumberOfAcquisition*) are completed. See function "i_PA3110_SetBoardIntRoutineXXX". - PA3110_DMA_NOT_USED: An interrupt is generated at the end of each conversion and the analog value is returned to the user through the interrupt routine. See function "i_PA3110_SetBoardIntRoutineXXX".
BYTE	b_AcquisitionCycle	Determines the type of DMA conversion. - PA3110_CONTINUOUS: An interrupt is generated each time a DMA conversion cycle is completed. A new DMA conversion cycle is started. - PA3110_SINGLE: The DMA conversion cycle is only carried out once: i.e. you receive one single interrupt at the end of the first DMA conversion cycle. See example 1.

- Output:
No output signal has occurred.

Task:
This function initialises a cyclic conversion.
The priority of the analog input channels is set with the scan list.
The scan list allows to determine the input voltage range and the gain for each analog input. See example 1.
The DMA option (PA3110_DMA_USED) allows to acquire in the background analog values of a high frequency.

An interrupt is generated at the end of conversion. In your interrupt routine a "2" is passed through the parameter *b_InterruptMaske*. The DMA buffer is returned through the parameter *pui_AnalogInputValue*.
See function "i_PA3110_SetBoardIntRoutineXXX".

You have to:
- set the priority of the analog input channels through the scan list.
- enter the mode through the parameter *b_AcquisitionMode*.
- enter the time between two conversions through the parameter *ui_AcquisitionTiming*.
- enter the waiting time between two conversion cycles through the parameter *l_DelayTiming* (if you use the mode PA3110_DELAY_MODUS).
- determine if DMA must be used (parameter *b_DMAUsed*)
- enter the number of acquisitions through the parameter *ul_NumberOfAcquisition* (if DMA is used)
- enter the DMA conversion cycle through the parameter *b_AcquisitionCycle* (if DMA is used)

Table 3-3: Selection of the analog input channels

pb_ChannelArray Parameter	Analog input channel	Define decimal value
PA3110_CHANNEL_0	0	0
PA3110_CHANNEL_1	1	1
PA3110_CHANNEL_2	2	2
PA3110_CHANNEL_3	3	3
PA3110_CHANNEL_4	4	4
PA3110_CHANNEL_5	5	5
PA3110_CHANNEL_6	6	6
PA3110_CHANNEL_7	7	7
PA3110_CHANNEL_8	8	8
PA3110_CHANNEL_9	9	9
PA3110_CHANNEL_10	10	10
PA3110_CHANNEL_11	11	11
PA3110_CHANNEL_12	12	12
PA3110_CHANNEL_13	13	13
PA3110_CHANNEL_14	14	14
PA3110_CHANNEL_15	15	15

Table 3-4: Gain selection

pb_GainArray Parameter	Gain	Define decimal value
PA3110_1_GAIN	1	0
PA3110_2_GAIN	2	16
PA3110_5_GAIN	5	32
PA3110_10_GAIN	10	48

Table 3-5 Selection of the input voltage range

pb_PolarityArray parameter	Voltage range	Define decimal value
PA3110_UNIPOLAR	0-10V (gain 1)	128
PA3110_BIPOLAR	±10V (gain 1)	0

Examples:

Example 1:

b_RamArraySize = 16
pb_ChannelArray [0] = PA3110_CHANNEL_0
pb_ChannelArray [1] = PA3110_CHANNEL_1
pb_ChannelArray [2] = PA3110_CHANNEL_2
pb_ChannelArray [3] = PA3110_CHANNEL_3
pb_ChannelArray [4] = PA3110_CHANNEL_2
pb_ChannelArray [5] = PA3110_CHANNEL_1
pb_ChannelArray [6] = PA3110_CHANNEL_0
pb_ChannelArray [7] = PA3110_CHANNEL_4
pb_ChannelArray [8] = PA3110_CHANNEL_5
pb_ChannelArray [9] = PA3110_CHANNEL_6
pb_ChannelArray [10] = PA3110_CHANNEL_7
pb_ChannelArray [11] = PA3110_CHANNEL_8
pb_ChannelArray [12] = PA3110_CHANNEL_9
pb_ChannelArray [13] = PA3110_CHANNEL_10
pb_ChannelArray [14] = PA3110_CHANNEL_11
pb_ChannelArray [15] = PA3110_CHANNEL_12

pb_GainArray [0]	= PA3110_1_GAIN	pb_PolarityArray [0]	= PA3110_UNIPOLAR
pb_GainArray [1]	= PA3110_1_GAIN	pb_PolarityArray [1]	= PA3110_UNIPOLAR
pb_GainArray [2]	= PA3110_1_GAIN	pb_PolarityArray [2]	= PA3110_UNIPOLAR
pb_GainArray [3]	= PA3110_1_GAIN	pb_PolarityArray [3]	= PA3110_UNIPOLAR
pb_GainArray [4]	= PA3110_5_GAIN	pb_PolarityArray [4]	= PA3110_BIPOLAR
pb_GainArray [5]	= PA3110_5_GAIN	pb_PolarityArray [5]	= PA3110_BIPOLAR
pb_GainArray [6]	= PA3110_5_GAIN	pb_PolarityArray [6]	= PA3110_BIPOLAR
pb_GainArray [7]	= PA3110_10_GAIN	pb_PolarityArray [7]	= PA3110_UNIPOLAR
pb_GainArray [8]	= PA3110_10_GAIN	pb_PolarityArray [8]	= PA3110_UNIPOLAR
pb_GainArray [9]	= PA3110_10_GAIN	pb_PolarityArray [9]	= PA3110_BIPOLAR
pb_GainArray [10]	= PA3110_1_GAIN	pb_PolarityArray [10]	= PA3110_UNIPOLAR
pb_GainArray [11]	= PA3110_1_GAIN	pb_PolarityArray [11]	= PA3110_UNIPOLAR
pb_GainArray [12]	= PA3110_2_GAIN	pb_PolarityArray [12]	= PA3110_UNIPOLAR
pb_GainArray [13]	= PA3110_2_GAIN	pb_PolarityArray [13]	= PA3110_UNIPOLAR
pb_GainArray [14]	= PA3110_2_GAIN	pb_PolarityArray [14]	= PA3110_UNIPOLAR
pb_GainArray [15]	= PA3110_1_GAIN	pb_PolarityArray [15]	= PA3110_UNIPOLAR

In this example the priority is set as follows:

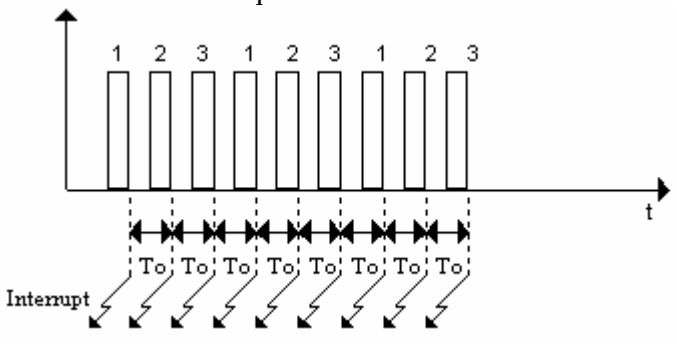
Element	Analog input channel	Input voltage range
1	0	0-10 V
2	1	0-10 V
3	2	0-10 V
4	3	0-10 V
5	2	± 2 V
6	1	± 2 V
7	0	± 2 V
8	4	0-1 V
9	5	0-1 V
10	6	± 1 V
11	7	0-10 V
12	8	0-10 V
13	9	0-5 V
14	10	0-5 V
15	11	0-5 V
16	12	0-10 V

Example 2:

```
i_PA3110_InitAnalogInputAcquisition
                    (b_BoardHandle,
                     3,
                     pb_ChannelArray,
                     pb_GainArray,
                     pb_PolarityArray,
                     PA3110_SIMPLE_MODUS,
                     T0,
                     0,
                     3,
                     PA3110_DMA_NOT_USED,
                     PA3110_SINGLE)
```

- b_AcquisitionMode = PA3110_SIMPLE_MODUS
- b_ExternTrigger = PA3110_DISABLE
- ui_AcquisitionTiming = To
- b_DMAUsed = PA3110_DMA_NOT_USED
- ui_NumberOfAcquisition = 3

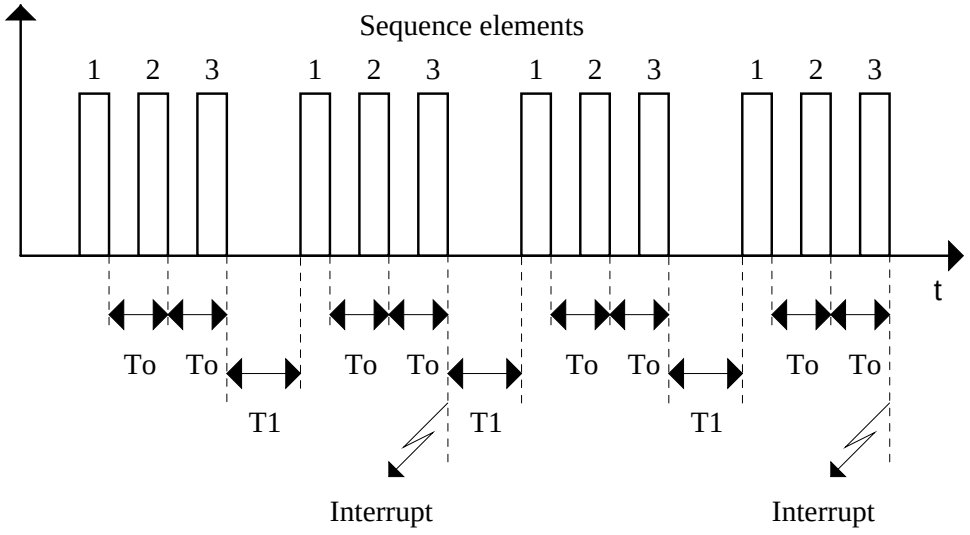
Sequence elements



Example 3: Cyclic conversion with DMA without external trigger

```
i_PA3110_InitAnalogInputAcquisition
                    (b_BoardHandle,
                     3,
                     pb_ChannelArray,
                     pb_GainArray,
                     pb_PolarityArray,
                     PA3110_DELAY_MODUS,
                     T0,
                     T1,
                     6,
                     PA3110_DMA_USED,
                     PA3110_CONTINUOUS)
```

- b_AcquisitionMode = PA3110_DELAY_MODUS
- ui_NumberOfAcquisition = 6
- ui_AcquisitionTiming = To
- l_DelayTiming = T1
- b_DMAUsed = PA3110_DMA_USED
- b_AcquisitionCycle = PA3110_CONTINUOUS
- b_ExternTrigger = PA3110_DISABLE



Calling convention:

ANSI C :

```
int             i_ReturnValue;
unsigned char   b_BoardHandle;
unsigned int    ui_AnalogInputValue;
unsigned char   b_ChannelArray      [16];
unsigned char   b_GainArray         [16];
unsigned char   b_PolarityArray     [16];

i_ReturnValue = i_PA3110_InitAnalogInputAcquisition
                                                (b_BoardHandle,
                                                 16,
                                                 b_ChannelArray,
                                                 b_GainArray,
                                                 b_PolarityArray,
                                                 PA3110_DELAY_MODUS,
                                                 100,
                                                 3110,
                                                 1000,
                                                 DMA_NOT_USED,
                                                 PA3110_SINGLE);
```

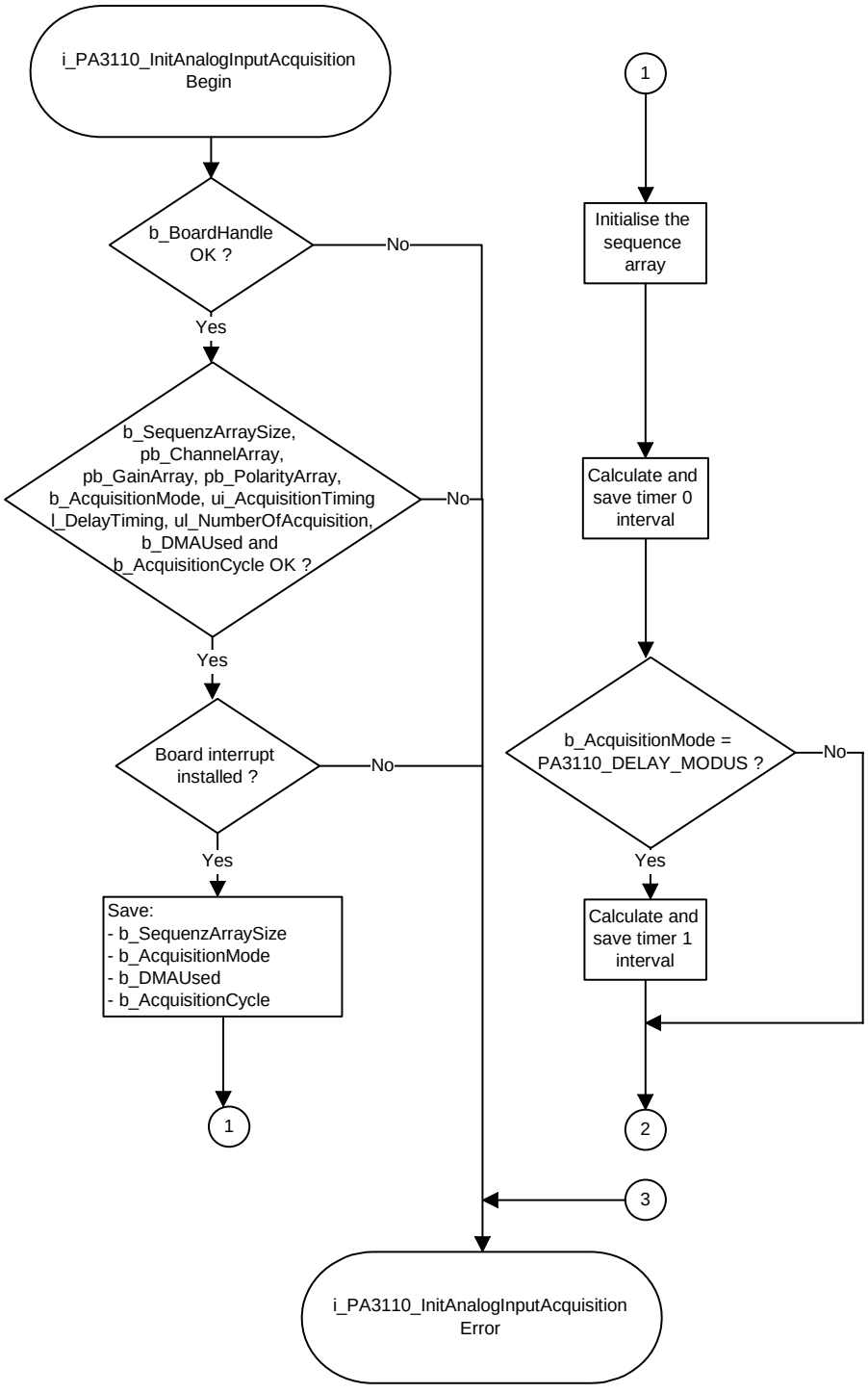
Return value:

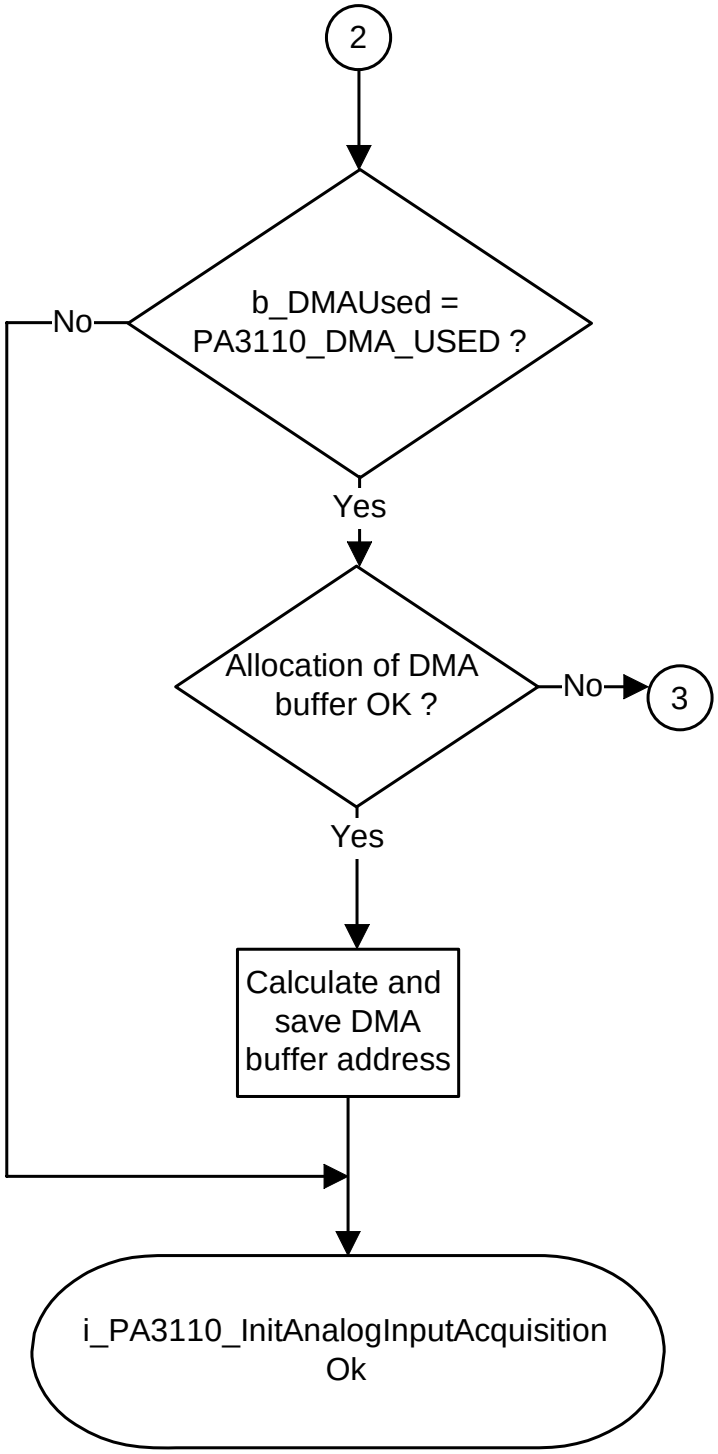
 0: No error
-1: The handle parameter of the board is wrong
-2: The user interrupt routine is not installed.
    See function "i_PA3110_SetBoardIntRoutine"
-3: The size of the sequence table is wrong
-4: Wrong parameter in table "pb_ChannelArray"
-5: Wrong parameter in table "pb_GainArray"
-6: Wrong parameter in table "pb_PolarityArray"
-7: The number of analog conversions is wrong (1 to 32767)
-8: The waiting time between 2 conversion cycles is too high
-9: The selected time for *ui_AcquisitionTiming* or *l_DelayTiming* is wrong
-10: The parameter *b_DMAUsed* is wrong
-11: The parametered running time of the DMA conversion cycle is wrong
    (PA3110_CONTINUOUS or PA3110_SINGLE)
-12: The parametered conversion cycle is wrong
    (PA3110_SIMPLE_MODUS or PA3110_DELAY_MODUS
-13: DMA channel not installed
    See function "i_PA3110_SetBoardInformation"
-14: Not enough memory available.

Input

b_BoardHandle	ui_AcquisitionTiming
b_SequenzArraySize	l_DelayTiming
pb_ChannelArray	ui_NumberOfAcquisition
pb_GainArray	b_DMAUSed
pb_PolarityArray	b_AcquisitionCycle
b_AcquisitionMode	

Function diagram





Output
<Return Value>

2) i_PA3110_StartAnalogInputAcquisition (...)

Syntax:
<Return value> = i_PA3110_StartAnalogInputAcquisition
(BYTE b_BoardHandle)
Parameters:
- Input:
BYTE b_BoardHandle Handle of the **PA 3110**
- Output:
No output signal has occurred.

Task:
Starts the cyclic conversion. It has been previously initialised with function "i_PA3110_InitAnalogInputAcquisition".

Calling convention:
ANSI C :

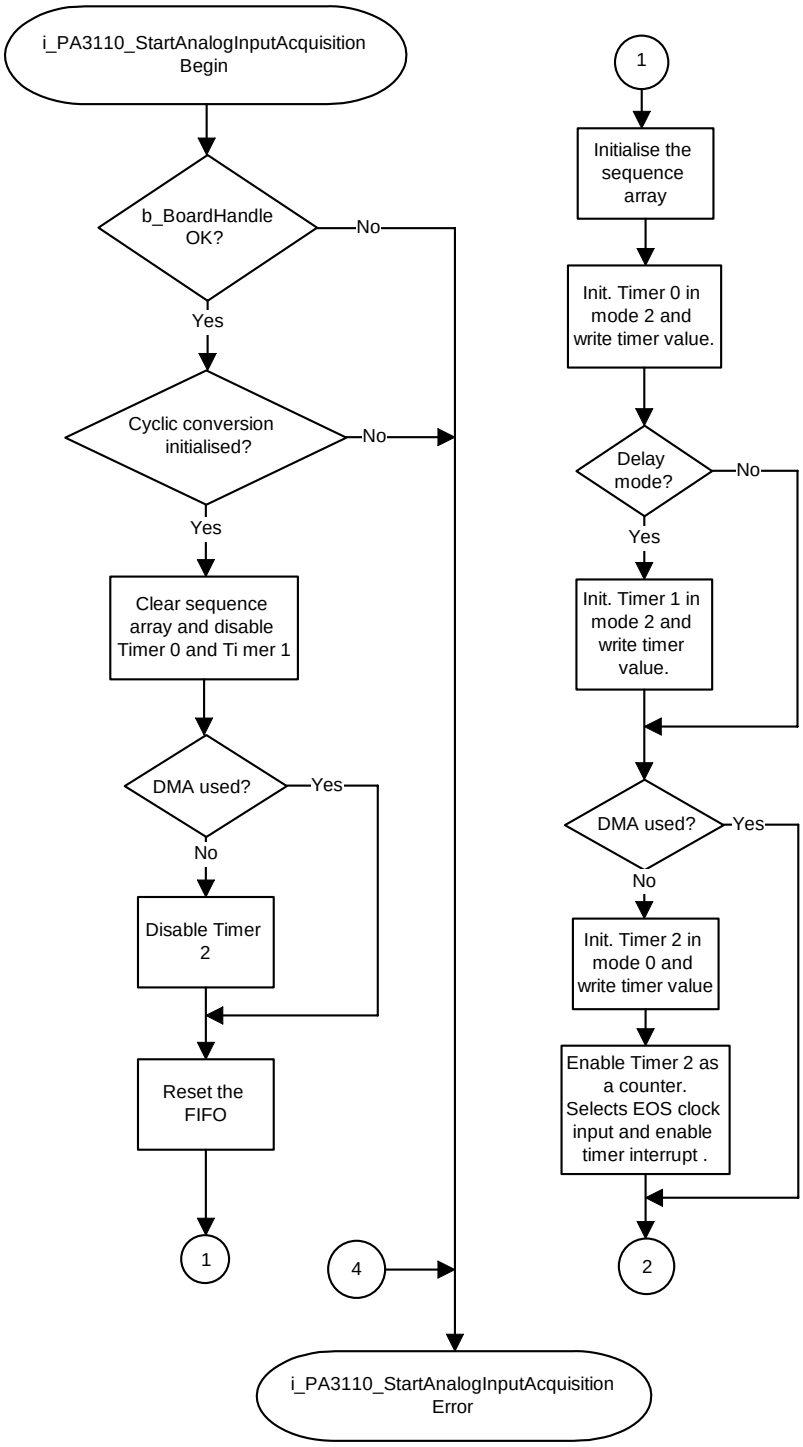
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_StartAnalogInputAcquisition    (b_BoardHandle);
```

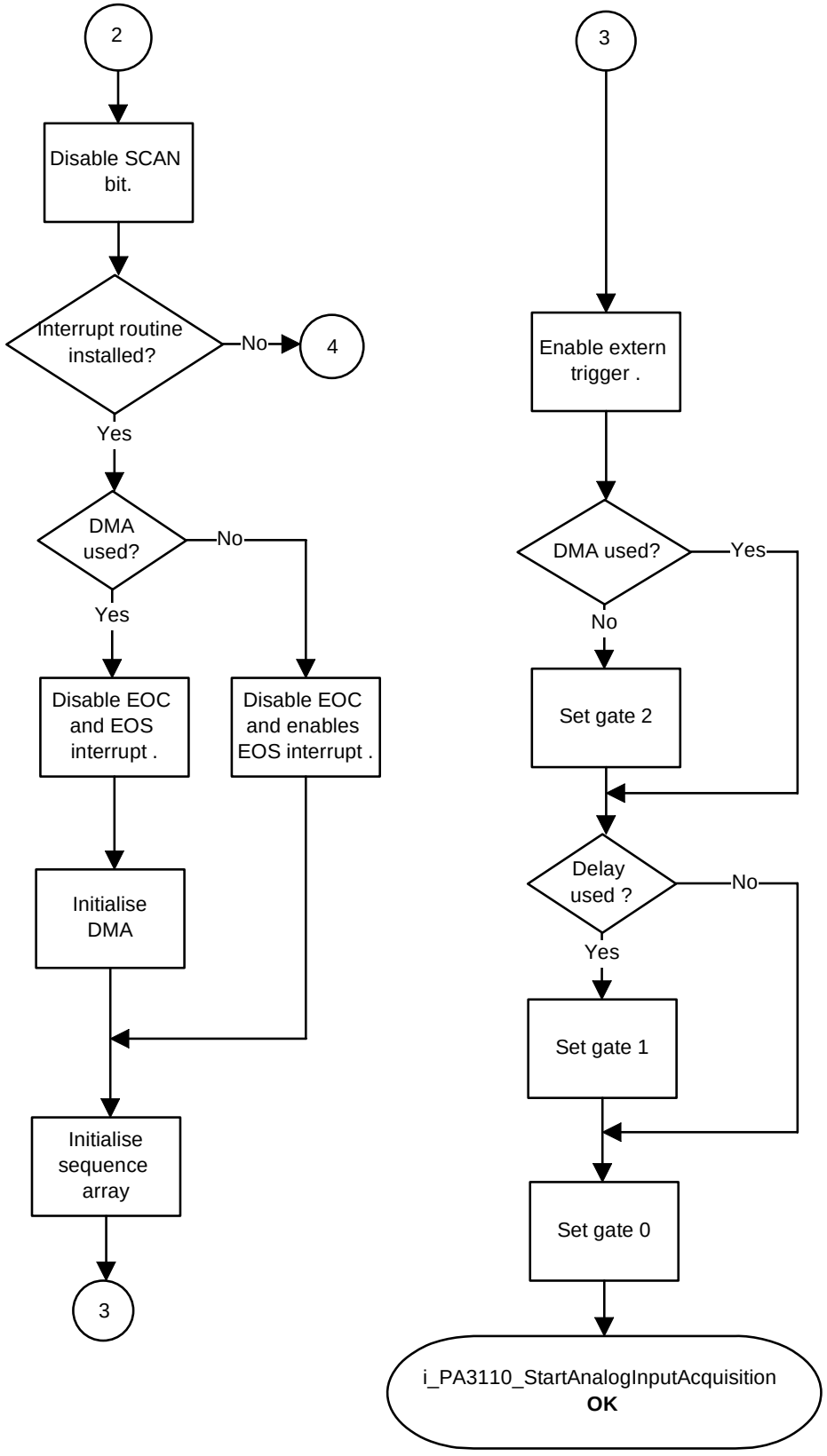
Return value:
0: No error
-1: The handle parameter of the board is wrong
-2: The cyclic conversion has not been initialised.
"i_PA3110_InitAnalogInputAcquisition"

Input

b_BoardHandle

Function diagram





Output

<Return Value>

3) i_PA3110_StopAnalogInputAcquisition (...)

Syntax:
<Return value> = i_PA3110_StopAnalogInputAcquisition
(BYTE b_BoardHandle)

Parameters:
- Input:
BYTE b_BoardHandle Handle of board **PA 3110**
- Output:
No output signal has occurred.

Task:
Stops the cyclic conversion. It has been previously started with function "i_PA3110_StartAnalogInputAcquisition".

Calling convention:
ANSI C :

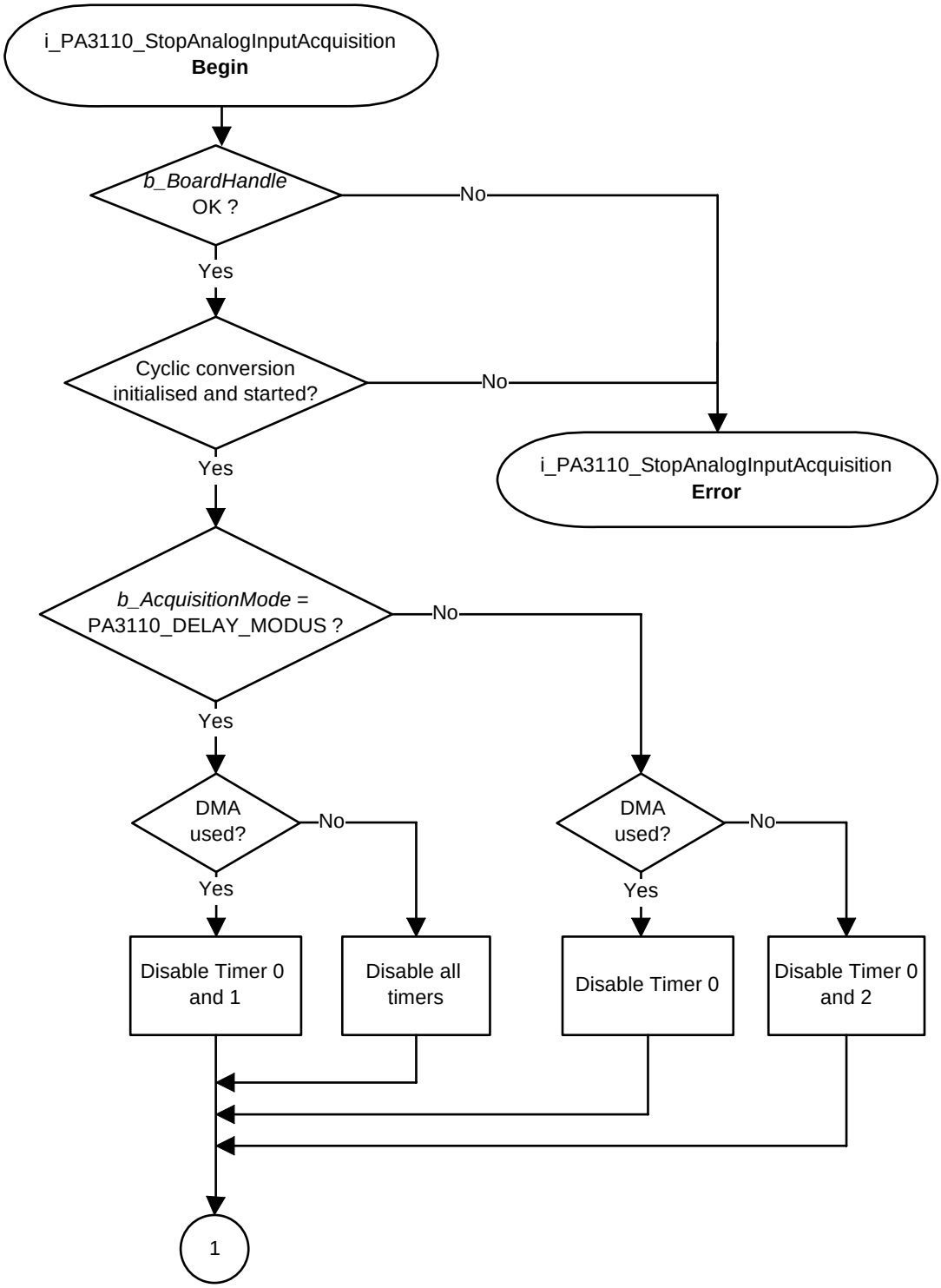
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_StopAnalogInputAcquisition (b_BoardHandle);
```

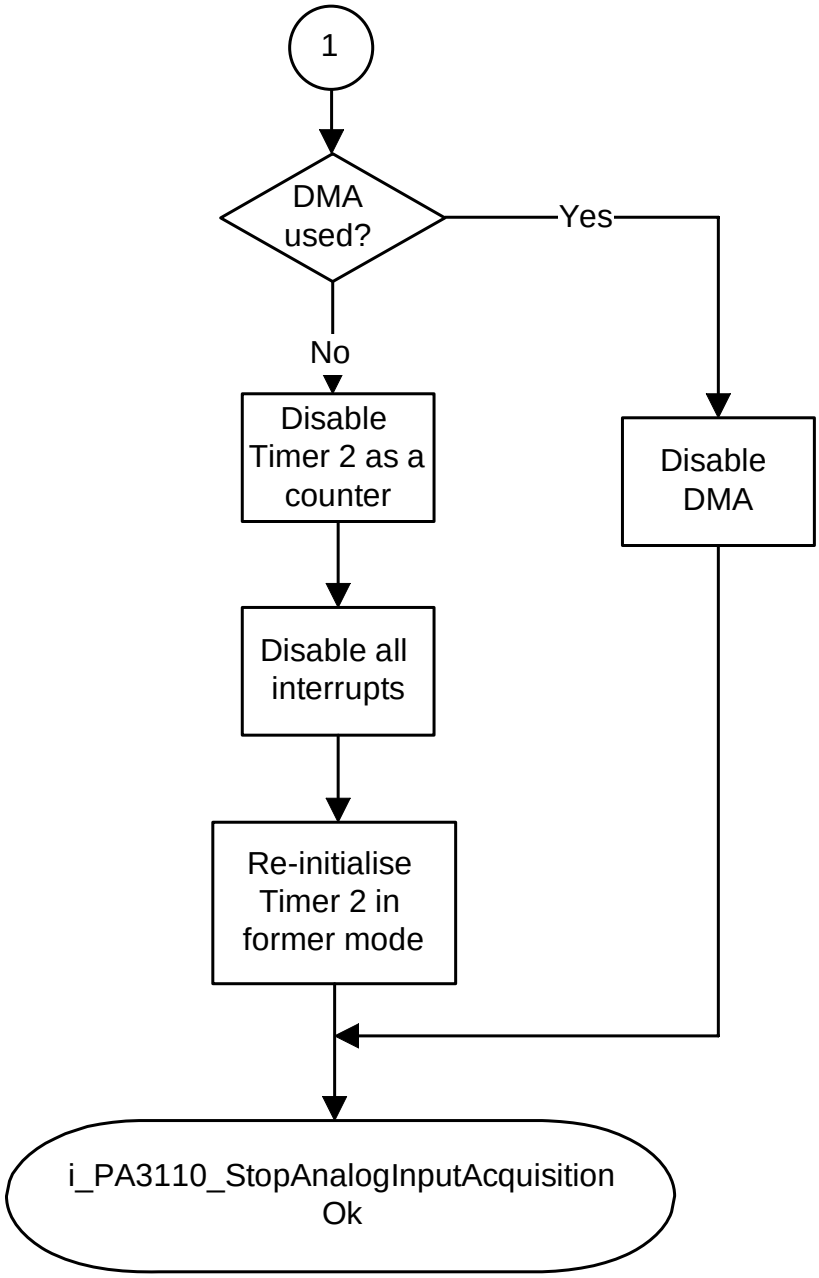
Return value:
0: No error
-1: The handle parameter of the board is wrong
-2: The cyclic conversion has not been started.
"i_PA3110_StartAnalogInputAcquisition"

Input

b_BoardHandle

Function diagram





Output

<Return Value>

4) i_PA3110_ClearAnalogInputAcquisition (...)

Syntax:
<Return value> = i_PA3110_ClearAnalogInputAcquisition
(BYTE b_BoardHandle)

Parameters:
- Input:
BYTE b_BoardHandle Handle of board **PA 3110**
- Output:
No output signal has occurred.

Task:
Deinstalls the DMA buffer.

Calling convention:
ANSI C :

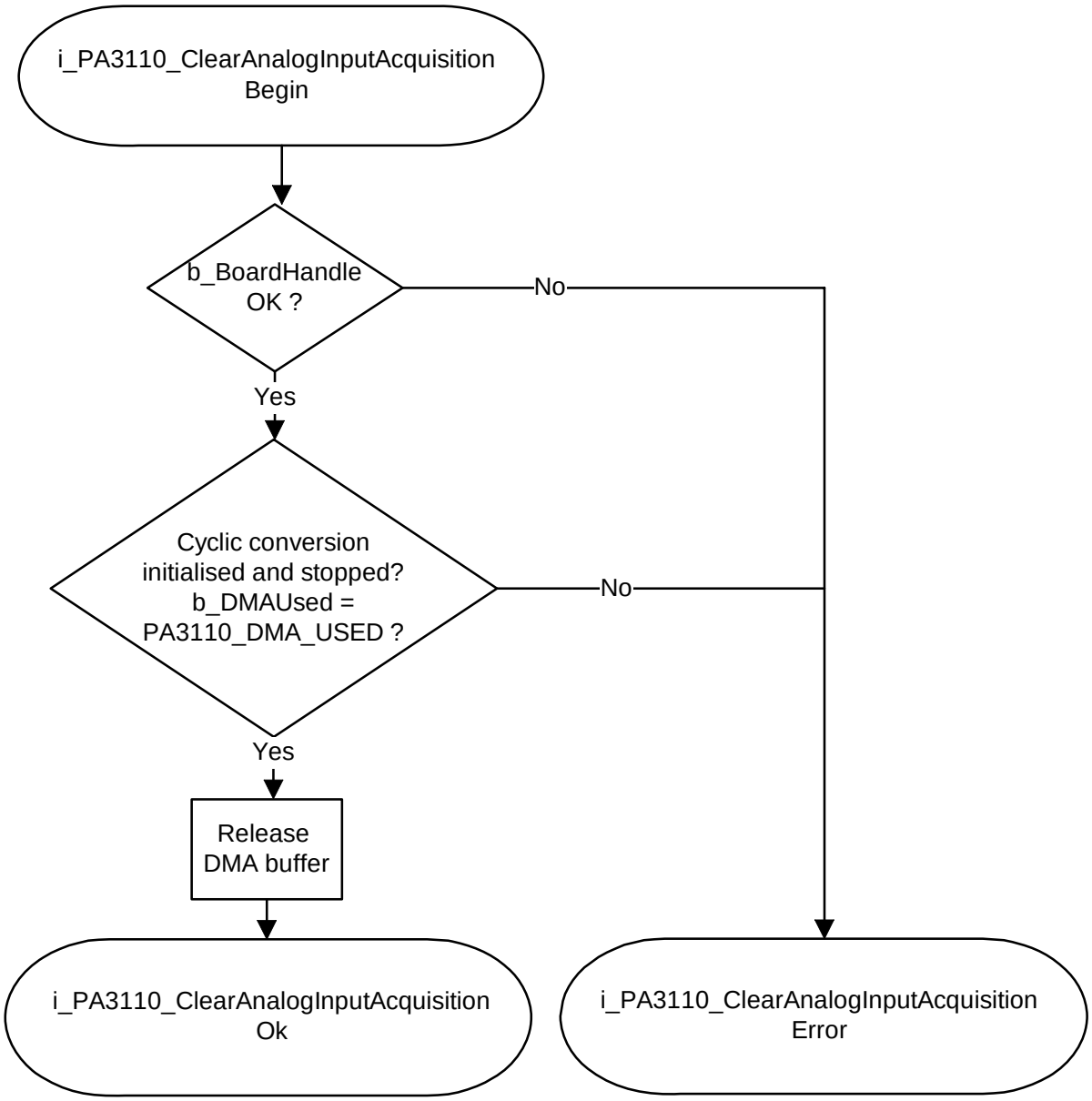
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;


 i_ReturnValue = i_PA3110_StartAnalogInputAcquisition  (b_BoardHandle);
```

Return value:
0: No error.
-1: The handle parameter of the board is wrong.
-2: The cyclic conversion has not been initialised.
"i_PA3110_InitAnalogInputAcquisition"

Input

b_BoardHandle

Function diagram



Output

<Return Value>

3.5 Analog output channels

1) i_PA3110_Write1AnalogValue (...)

Syntax:
<Return value> = i_PA3110_Write1AnalogValue
(BYTEb_BoardHandle,
BYTE b_ChannelNbr,
UINT ui_ValueToWrite)

Parameters:
- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
BYTE	b_ChannelNbr	Number of the analog output channel
UINT	ui_ValueToWrite	Analog output value to write (0 to 4095)

- Output:
No output signal has occurred.

Task:
Writes an analog value (*ui_ValueToWrite*) on the analog output channel *b_ChannelNbr*.

Calling convention:
ANSI C :

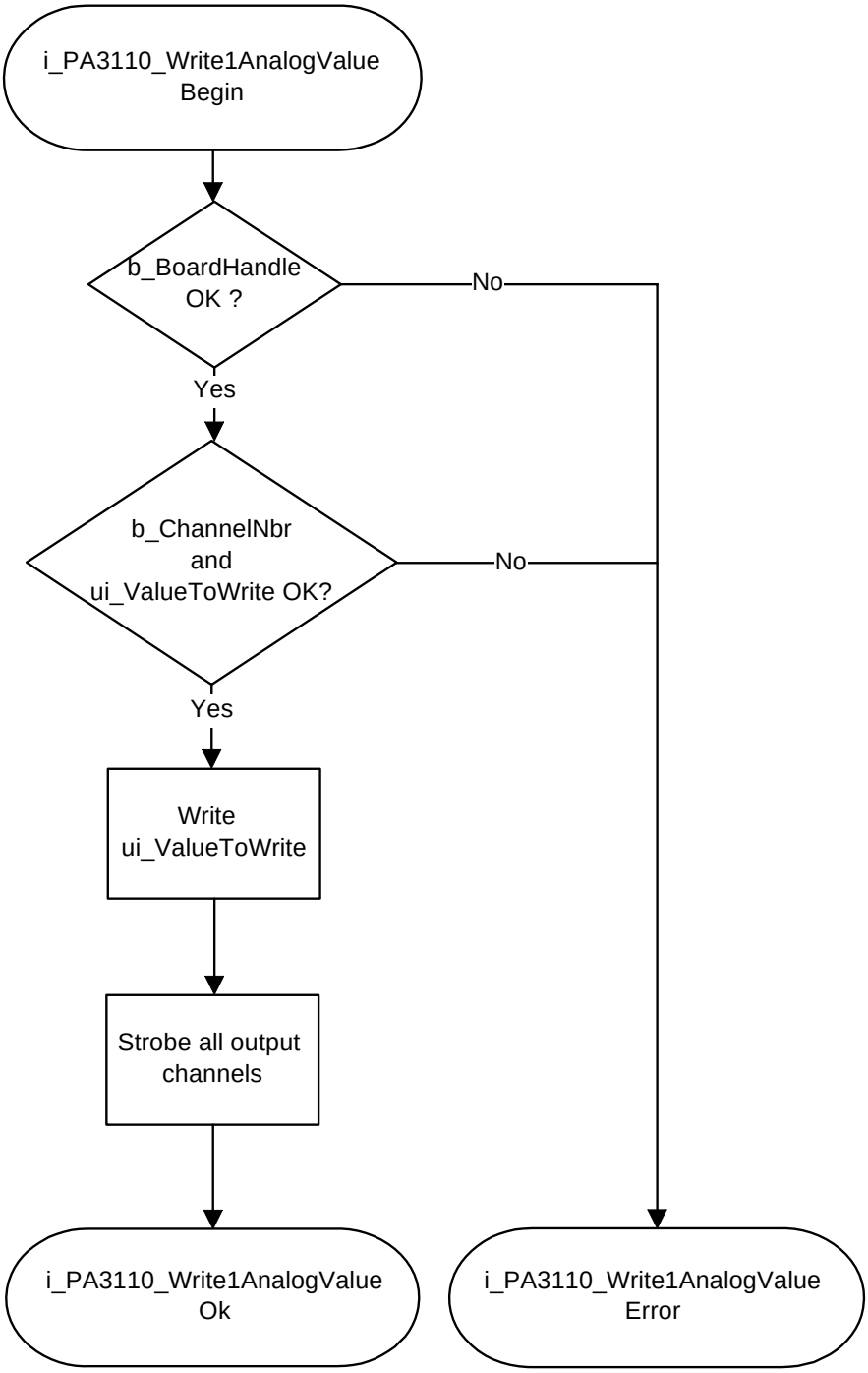
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_Write1AnalogValue  (b_BoardHandle,
                                             1,
                                             4095);
```

Return value:
0: No error
-1: The handle parameter of the board is wrong
-2: Number of the analog output channel is wrong.
-3: Output value too high

Input

b_BoardHandle ui_ValueToWrite
b_ChannelNbr

Function diagram



Output

<Return Value>

2) i_PA3110_WriteMoreAnalogValue (...)

Syntax:

```
<Return value> =  i_PA3110_WriteMoreAnalogValue
                                        (BYTEb_BoardHandle,
                                         BYTE       b_FirstChannelNbr,
                                         BYTE       b_NbrOfChannel,
                                         PUINT      pui_ValueArray)
```

Parameters:

- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
BYTE	b_FirstChannelNbr	Number of the first analog output channel (0 to 7)
BYTE	b_NbrOfChannel	Number of analog output channels you wish to write on (1 to 8)
PUINT	pui_ValueArray	Table of analog output values on which you want to write

- Output:

No output signal has occurred.

Task:

Writes several analog values on several analog output channels.
The variable *b_FirstChannelNbr* defines the first analog output channel.
The variable *b_NbrOfChannel* defines the number of analog output channels .

Example:

Parameter

```
b_FirstChannelNbr    = 2
b_NbrOfChannel       = 3

pui_ValueArray  [0]  = 0
pui_ValueArray  [1]  = 2047
pui_ValueArray  [2]  = 4095
```

The value 0 (0V) is written in the buffer of analog output 2
The value 2047 (5V) is written in the buffer of analog output 3
The value 4095 (10V) is written in the buffer of analog output 4.

Calling convention:

ANSI C :

```
int             i_ReturnValue;
unsigned char   b_BoardHandle;
unsigned char   b_PolarityArray      [8];
unsigned int    ui_ValueArray  [8];

i_ReturnValue = i_PA3110_WriteMoreAnalogValue
                                                    (b_BoardHandle,
                                                     0,
                                                     8,
                                                     b_PolarityArray,
                                                     ui_ValueArray);
```

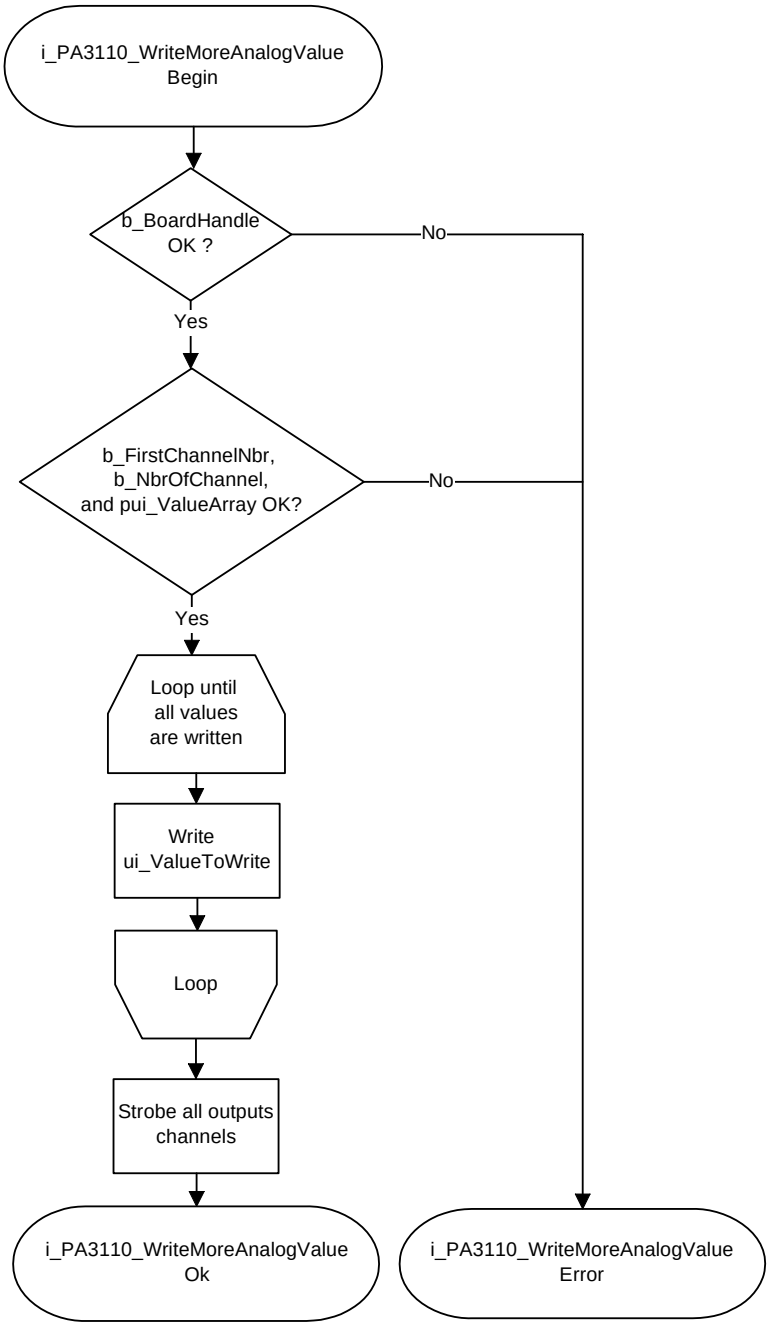
Return value:

0: No error
-1: The handle parameter of the board is wrong
-2: Number of the analog output channel is wrong
-3: The number of analog output channels you wish to write on is wrong
See function "i_PA3110_SetBoardInformation"
-4: One or several output value are too high.

Input

b_BoardHandle	b_NbrOfChannel
b_FirstChannelNbr	pui_ValueArray

Function diagram



Output

<Return Value>

3.6 Timer

1) i_PA3110_InitTimerWatchdog (...)

Syntax:
<Return value> = i_PA3110_InitTimerWatchdog
(BYTE b_BoardHandle,
BYTE b_TimerMode,
LONG l_DelayValue,
BYTE b_InterruptFlag)

Parameters:
- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**
BYTE	b_TimerMode	Defines the mode of the timer - PA3110_TIMER: The timer/watchdog is used as an edge generator. - PA3110_WATCHDOG: The timer/watchdog is used as a watchdog for the analog output channels.
LONG	l_DelayValue	Time interval (watchdog time) of the timer from 70 µs up to 4587400 µs
BYTE	b_InterruptFlag	PA3110_ENABLE: Timer: an interrupt is generated at the end of each time interval Watchdog: an interrupt is generated when the watchdog has run down PA3110_DISABLE: No interrupt is generated.

- Output:
No output signal has occurred

Task:
Initialises the timer as an edge generator or as a watchdog for the analog outputs.

Calling convention:
ANSI C :

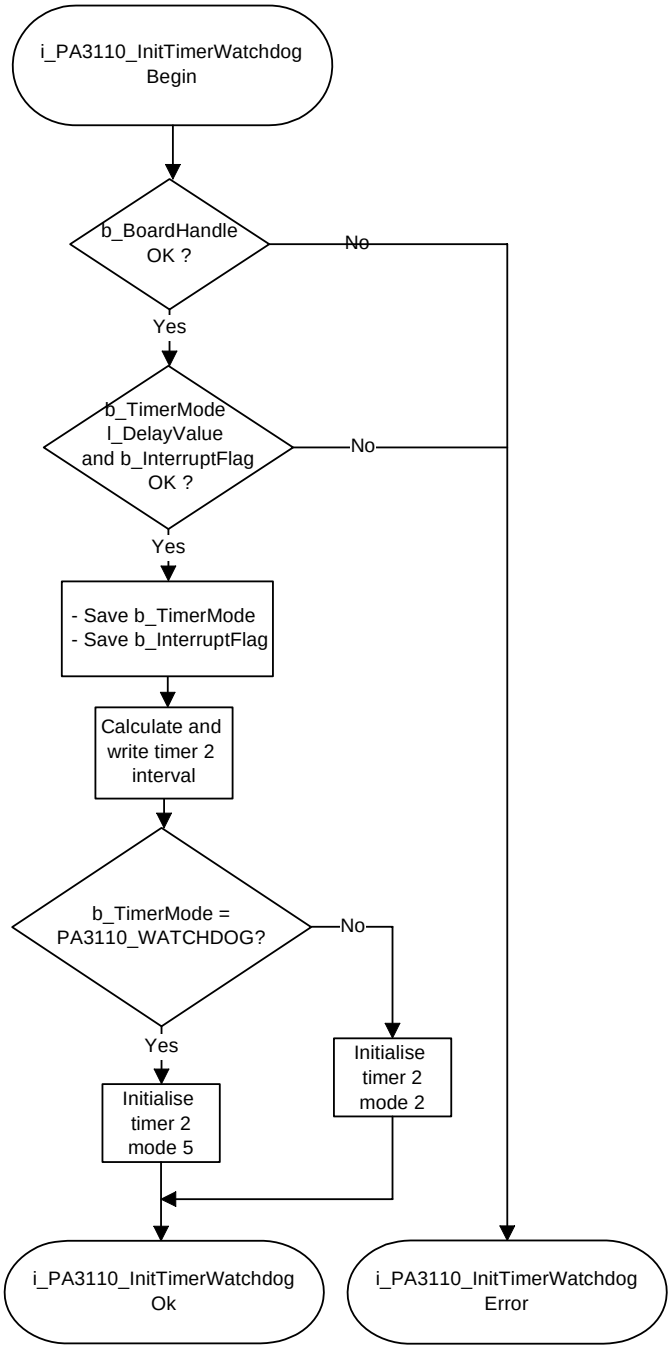
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_InitTimerWatchdog  (b_BoardHandle,
                                             PA3110_UNIPOLAR,
                                             1000,
                                             PA3110_DISABLE);
```

Return value:
0: No error.
-1: The handle parameter of the board is wrong.
-2: The mode parametered for the timer is wrong.
-3: The user interrupt routine has not been installed
See function "i_PA3110_SetBoardIntRoutineXXX"
-4: The interrupt parameter is wrong
-5: Time selection is wrong

Input

b_BoardHandle	l_DelayValue
b_TimerMode	b_InterruptFlag

Function diagram



Output

<Return Value>

2) i_PA3110_StartTimerWatchdog (...)

Syntax:
<Return value> = i_PA3110_StartTimerWatchdog (BYTE b_BoardHandle)

Parameters:
- Input:
BYTE b_BoardHandle Handle of board **PA 3110**
- Output:
No output signal has occurred.

Task:
Starts the timer/watchdog.

Calling convention:
ANSI C :

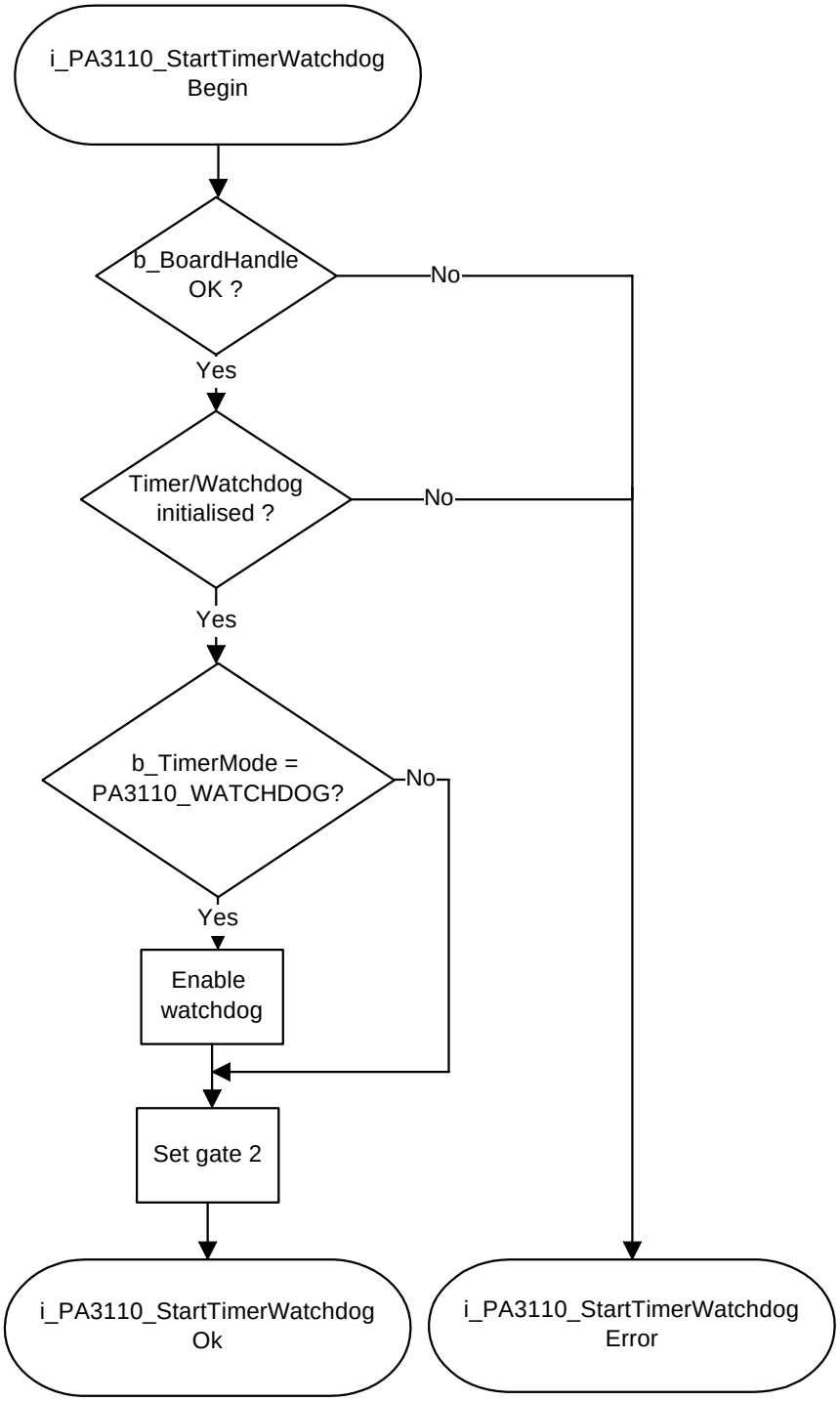
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_StartTimerWatchdog   (b_BoardHandle);
```

Return Value:
0: No error.
-1: The handle parameter of the board is wrong.
-2: Timer/watchdog has not been initialised.

Input

b_BoardHandle

Function diagram



Output

<Return Value>

3) i_PA3110_StopTimerWatchdog (...)

Syntax:
<Return value> = i_PA3110_StopTimerWatchdog
(BYTE b_BoardHandle)

Parameters:
- Input:
BYTE b_BoardHandle Handle of the board **PA 3110**
- Output:
No output signal has occurred.

Task:
Stops the timer/watchdog.

Calling convention:
ANSI C :

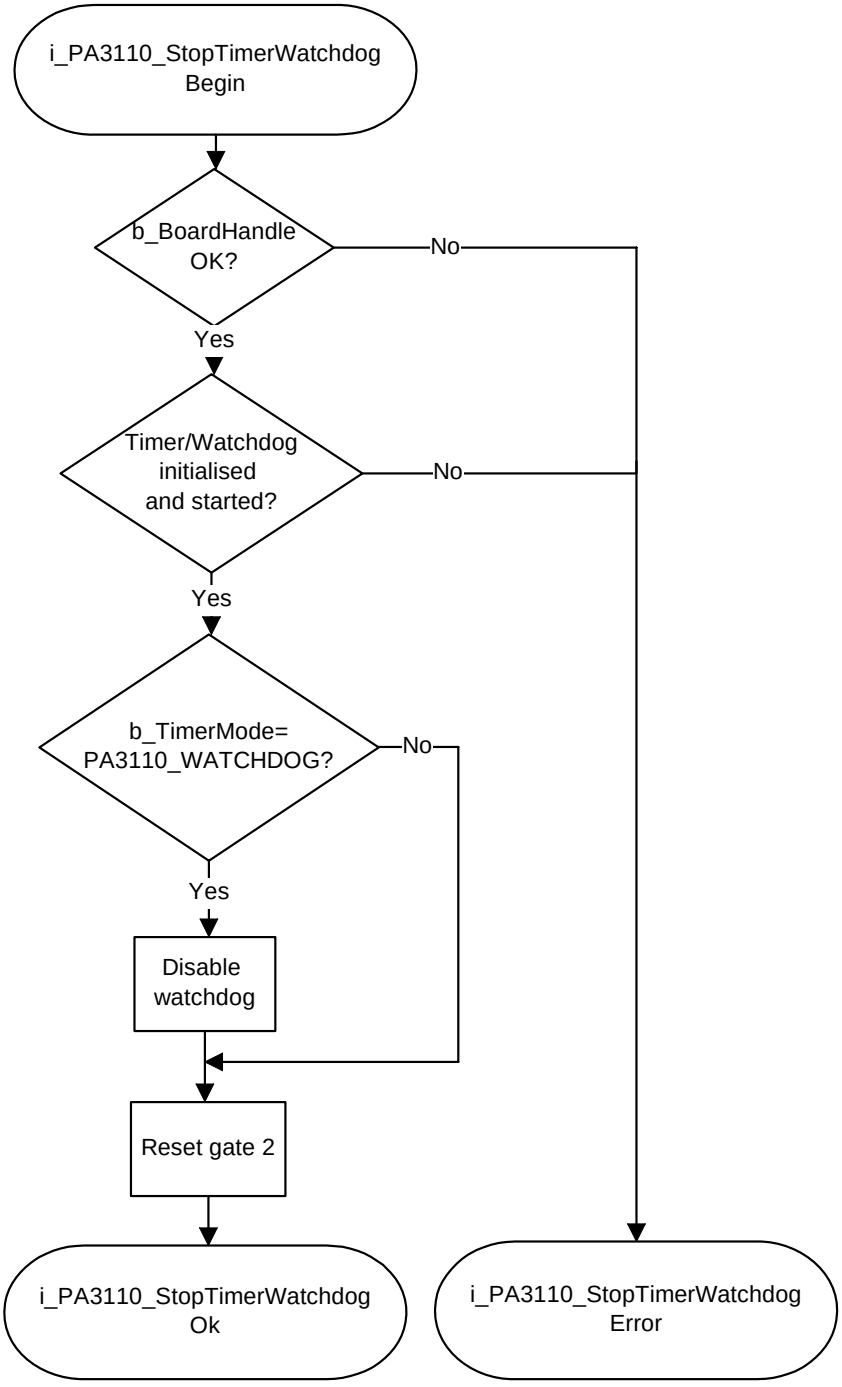
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_StopTimerWatchdog    (b_BoardHandle);
```

Return Value:
0: No error.
-1: The handle parameter of the board is wrong.
-2: Timer/watchdog has not been initialised.
-3: Timer/watchdog has not been started.

Input

b_BoardHandle

Function diagram



Output

<Return Value>

4) i_PA3110_ReadTimer (...)

Syntax:
<Return value> = i_PA3110_ReadTimer
(BYTE b_BoardHandle
LONG pl_ReadValue)

Parameters:
- Input:

BYTE	b_BoardHandle	Handle of the board **PA 3110**

- Output:

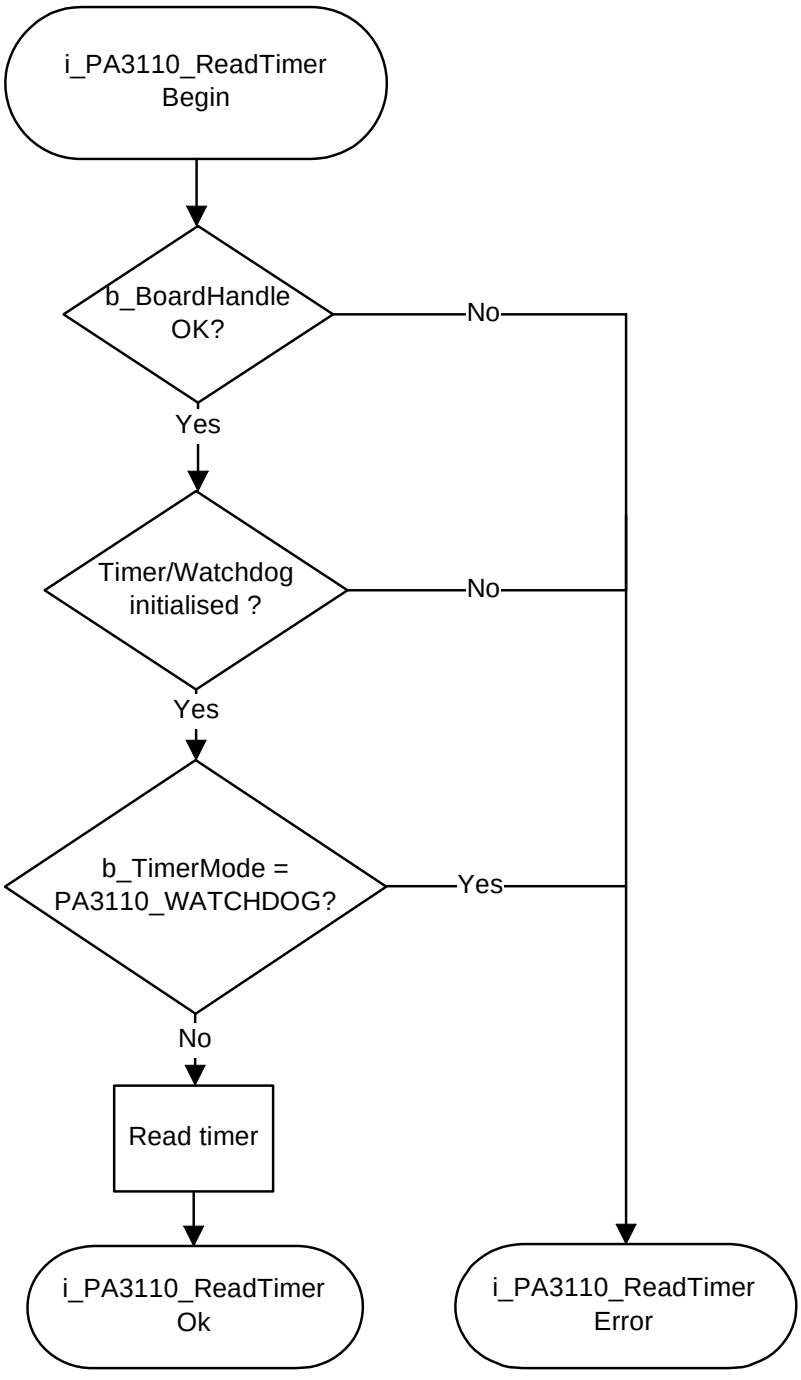
PLONG	pl_ReadValue	Current timer value (from 0 to FFFFFF Hex)

Task:
Reads the current value of the timer.

Calling convention:
ANSI C :

```
int             i_ReturnValue;
unsigned char   b_BoardHandle;
long            l_ReadValue;

i_ReturnValue = i_PA3110_ReadTimer      (b_BoardHandle,
                                         &l_ReadValue);
```

Return value:
0: No error.
-1: The handle parameter of the board is wrong.
-2: Timer/watchdog has not been initialised.
-3: Timer/watchdog has been initialised as a watchdog.

Input
b_BoardHandle pl_ReadValue
Function diagram

Output
pl_ReadValue
<Return Value>

5) i_PA3110_WriteTimer (...)

Syntax:
<Return value> = i_PA3110_WriteTimer (BYTE b_BoardHandle
LONG l_WriteValue)

Parameters:
- Input:

BYTE	b_BoardHandle	Handle of the board **PA 3110**
LONG	l_WriteValue	New timer value (from 0 to FFFFFF Hex)

- Output:
No output signal has occurred.

Task:
Writes a new value in the timer.

Calling convention:
ANSI C :

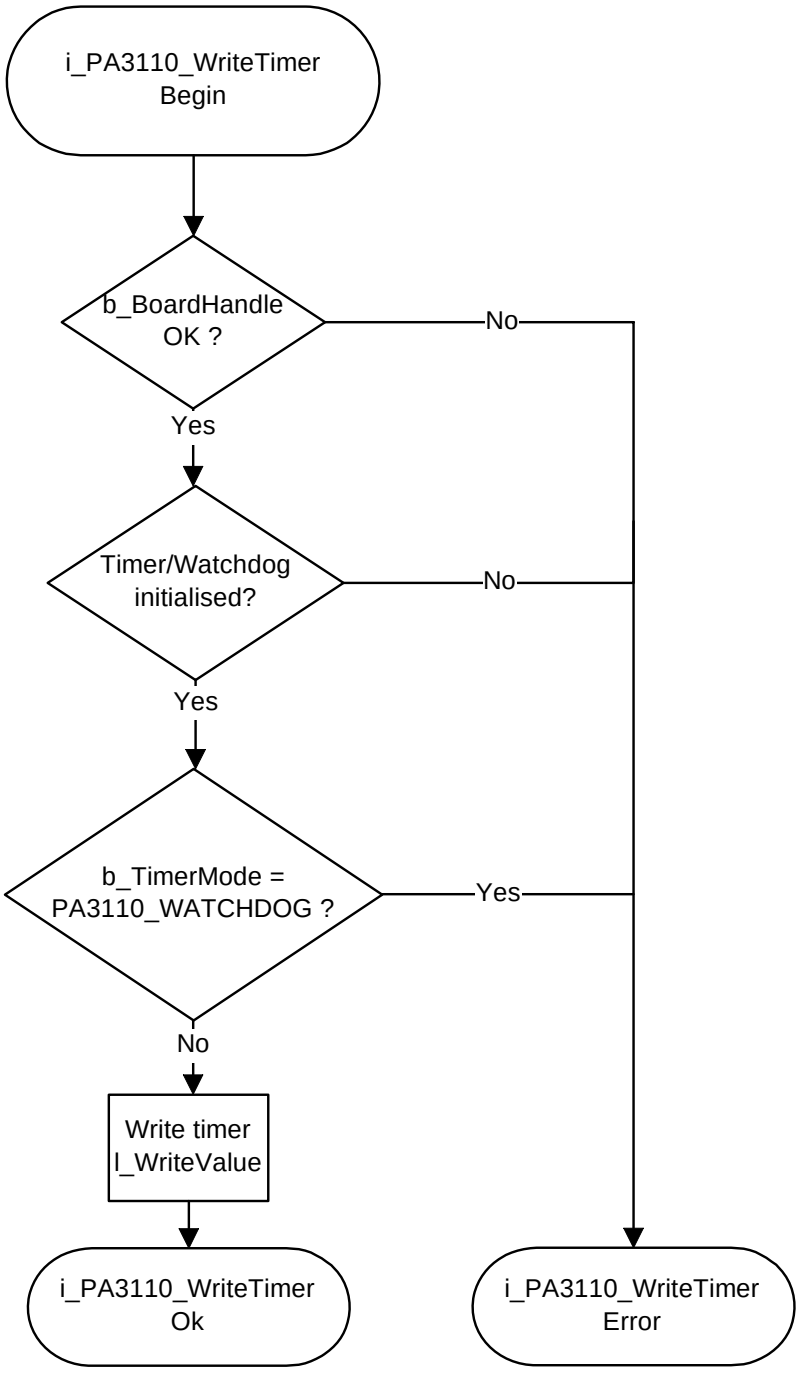
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;

i_ReturnValue = i_PA3110_WriteTimer (b_BoardHandle,
                                     1000);
```

Return value:
0: No error.
-1: The handle parameter of the board is wrong.
-2: Timer/watchdog has not been initialised.
-3: Timer/watchdog has been initialised as a watchdog.

Input

b_BoardHandle l_WriteValue

Function diagram



Output

<Return Value>

6) i_PA3110_ReadWatchdogStatus (...)

Syntax:
<Return Value> = i_PA3110_ReadWatchdogStatus
(BYTE b_BoardHandle
PBYTE pb_WatchdogStatus)

Parameters:
- Input:

BYTE	b_BoardHandle	Handle of board **PA 3110**

- Output:

PBYTE	pb_WatchdogStatus	0: Watchdog has not run down 1: Watchdog has run down

Task:
Writes a new value in the timer.

Calling convention:
ANSI C :

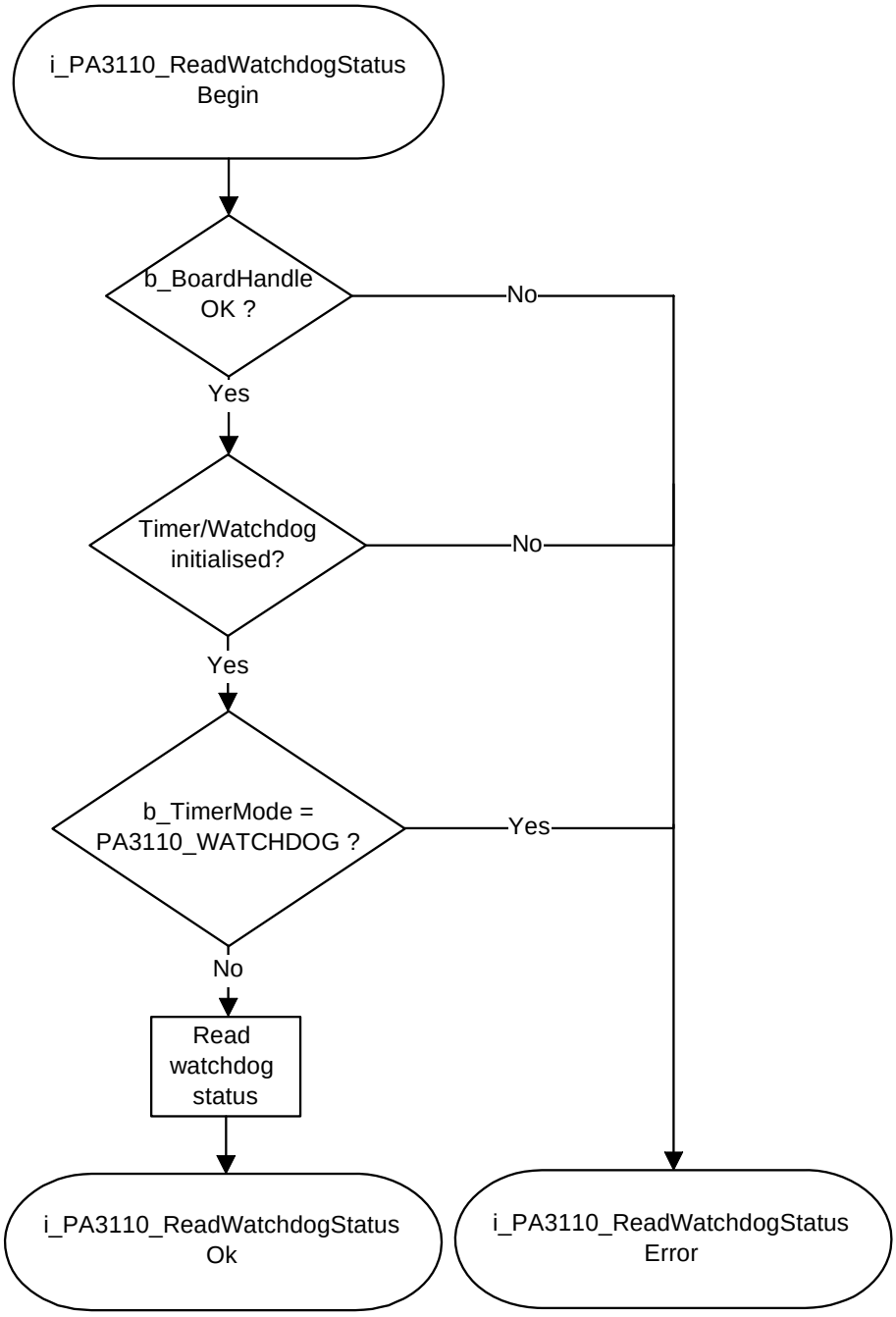
```
int             i_ReturnValue;
unsigned char   b_BoardHandle;
unsigned char   b_WatchdogStatus;

i_ReturnValue = i_PA3110_ReadWatchdogStatus    (b_BoardHandle,
                                                &b_WatchdogStatus);
```

Return Value:
0: No error.
-1: The handle parameter of the board is wrong.
-2: Timer/watchdog has not been initialised.
-3: Timer/watchdog has been initialised as a timer.

Input

b_BoardHandle

Function diagram



Output

pb_WatchdogStatus

<Return Value>

3.7 Functions to be used in Kernel mode

1) i_PA3110_KRNL_Write1AnalogValue (...)

Syntax:

```
<Return value> =  i_PA3110_KRNL_Write1AnalogValue
                                  (UINT     ui_Address,
                                   BYTE     b_ChannelNbr,
                                   UINT     ui_ValueToWrite)
```

Parameters:

- Input:

UINT	ui_Address	Address of the board **PA 3110**
BYTE	b_ChannelNbr	Number of the analog output channel (0 to 7)
UINT	ui_ValueToWrite	Analog output value to write (0 to 4095)

- Output:

No output signal has occurred.

Task:

Writes an analog value (*ui_ValueToWrite*) on the analog output channel *b_ChannelNbr*.

Calling convention:

ANSI C :

```
int             i_ReturnValue;

i_ReturnValue = i_PA3110_KRNL_Write1AnalogValue
                                        (0x390,
                                         1,
                                         4095);
```

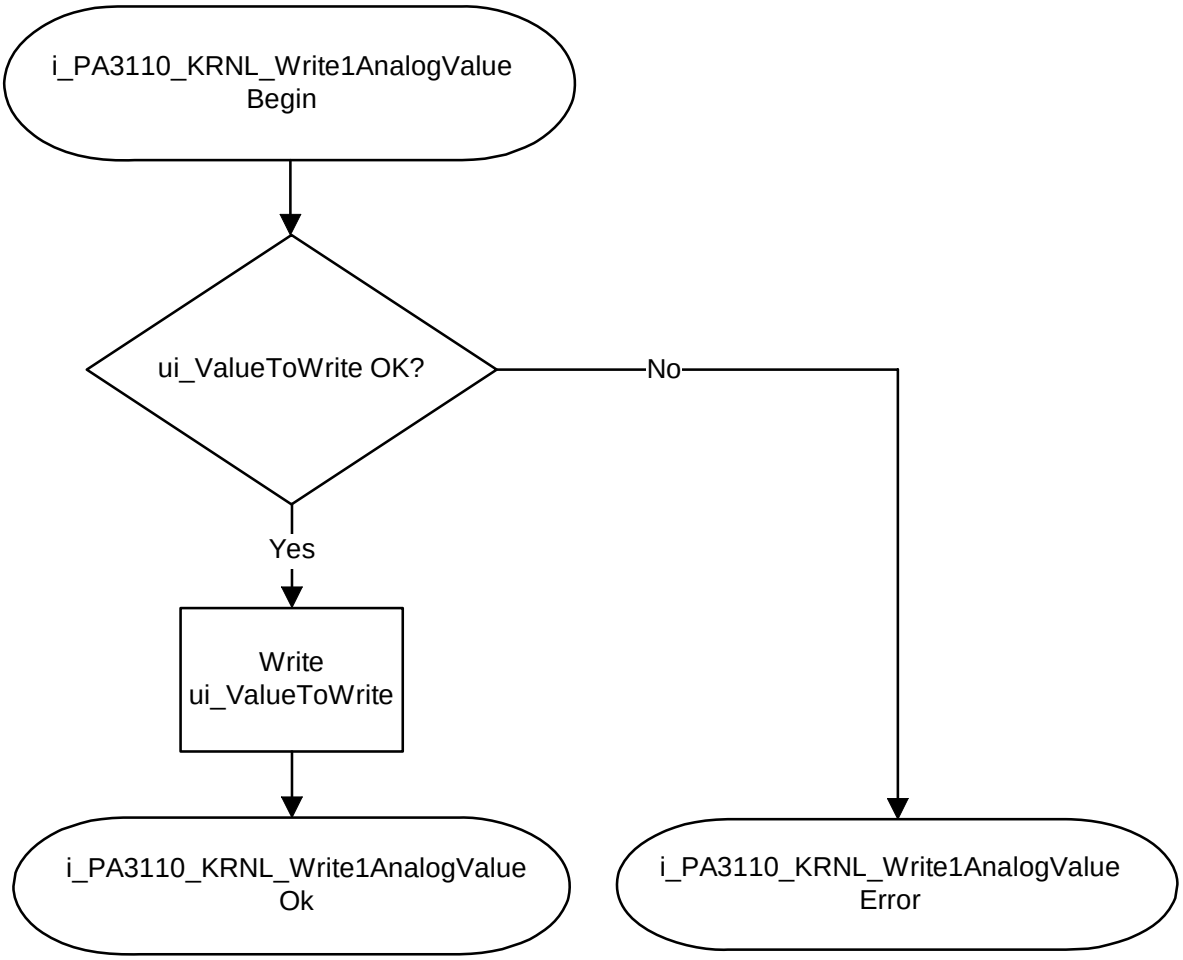
Return value:

0: No error
-1: Channel number is wrong
-2: Output value too high

Input

ui_Address ui_ValueToWrite
b_ChannelNbr

Function diagram



Output

<Return Value>