

Using UIM I/O Boards with CoDeSys

This document provides a description of the UIM local I/O modules designed for use in the UniOP HMI products. This technical note includes a description of the hardware as well as a description CoDeSys support for the I/O board. General information about CoDeSys and Designer software are included in the manual tn200.

Contents

1	Introduction and notes.....	3
2	I/O Boards Overview and Common Explanations	4
	2.1 Diagnostic information.....	4
3	UIM03.....	5
4	UIM05.....	6
	4.1 Overview	6
	4.2 CoDeSys Support for UIM05	6
	4.3 Analog Input Configuration	7
	4.4 Configuration of Analog Outputs.....	9
	4.5 Digital Input and Digital Output Configuration.....	10
	4.6 Counter/Timer Inputs	11
	4.6.1 Encoder Input.....	13
	4.7 Diagnostic	14
5	UIM06.....	15
	5.1 Overview	15
	5.2 CoDeSys Support for UIM06	15
	5.3 Analog Input Configuration	16
	5.4 Analog Output Configuration.....	18
	5.5 Digital Input and Digital Output Configuration.....	20
	5.6 Counter/Timers Input	21
	5.6.1 Encoder Input.....	23
	5.7 Diagnostic	24

Tn212

Ver. 1.00

© 2005 Sitek S.p.A. – Verona, Italy

Subject to change without notice

The information contained in this document is provided for informational purposes only. While efforts were made to verify the accuracy of the information contained in this documentation, it is provided “as is” without warranty of any kind.

www.exor-rd.com

1 Introduction and notes

This document focuses on using the local I/O boards UIM03, UIM05 and UIM06 in combination with CoDeSys in the SCM modules. Please refer to the board hardware manual for specific information on the connectors and the wiring diagrams.

2 I/O Boards Overview and General Information

Most of the I/O boards have special functions that can be configured at design-time using specific Module Parameters in the CoDeSys PLC Configuration Editor, or at run-time using a common interface named EXOR_IO_CTRL as shown in the figure below.

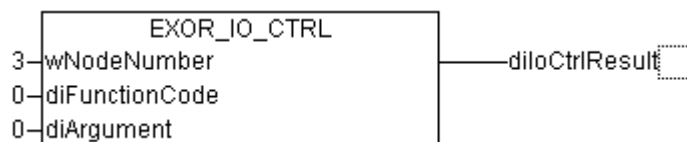


Figure 1

This function is included in the library “EXOR.lib” supplied with the SITEK/EXOR target support package. Please see the manual tn200 for additional information on the support packages.

The function has the following input parameters:

wNodeNumber	Each board in the CoDeSys PLC Configuration Editor has a progressive Node Number starting from zero; this is assigned by CoDeSys and can be seen in the board “Base Parameters”. This parameter identifies the board to which the “diFunctionCode” and “diArgument” parameters will be passed.
diFunctionCode	This parameter is passed to the specified board; its significance varies from board to board.
diArgument	This parameter is passed to the specified board; its significance varies from board to board.

The function has the following output parameters:

diIoCtrlResult	This is the return value; its significance varies from board to board and from FunctionCode to FunctionCode.
-----------------------	--

2.1 Diagnostic information

Each board when added to the “PLC Configuration” is assigned a “Diagnostic Address”. Each board reserves at least 4 bytes starting from this “Diagnostic Address”.

Diagnostic information at the moment is not supported; the addressing space is reserved for future enhancements.

3 UIM03

The following figure shows a configuration including the UIM03 board.
The board is divided in Input and Output points.
No parameters have to be configured for this board.

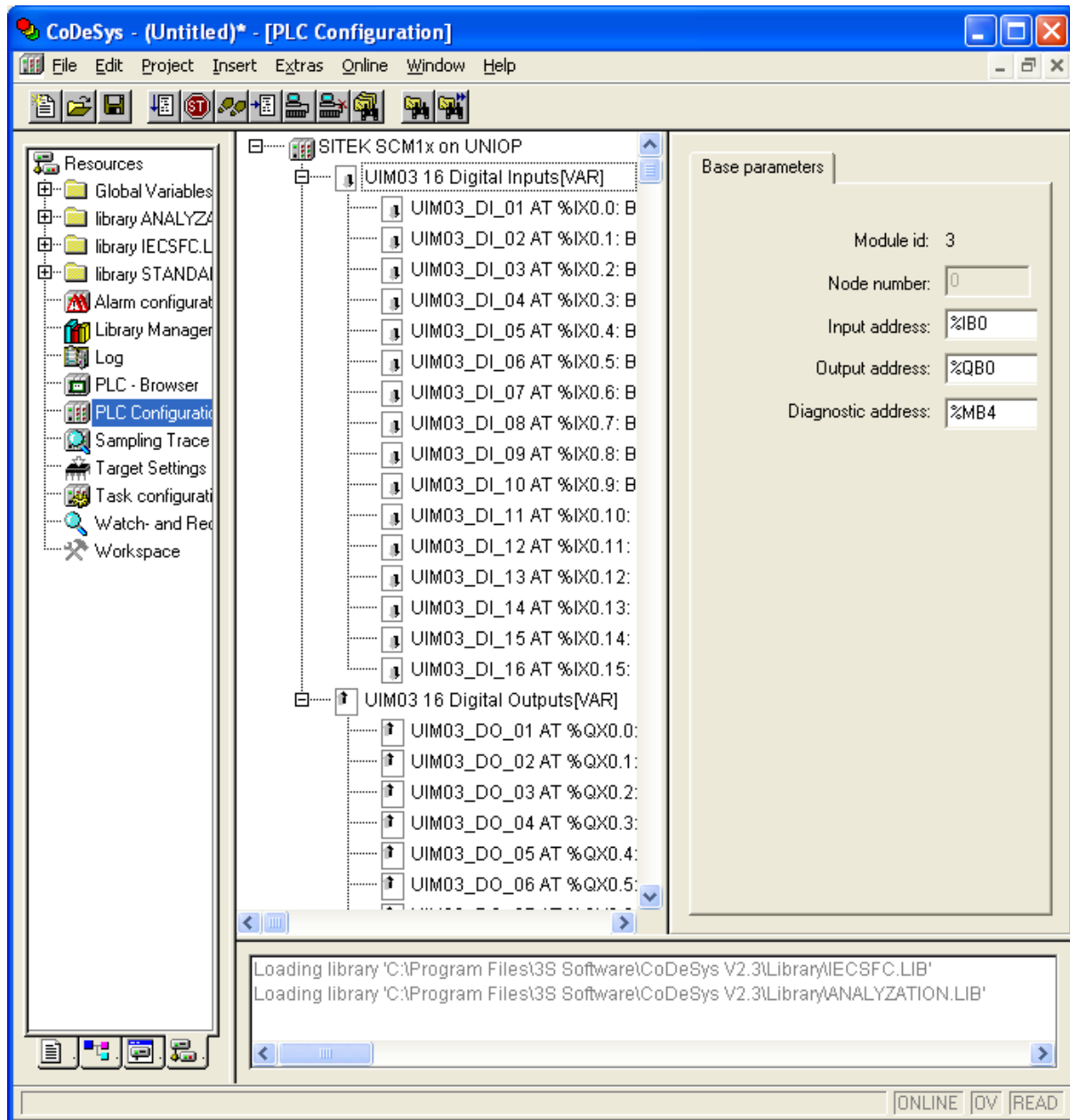


Figure 2

4 UIM05

4.1 Overview

UIM05 is general purpose (multifunction) I/O board, compatible with all UniOP hardware type – 0050. UIM05 should satisfy most of the typical process I/O signals. The main feature of the UIM05 is its configurability. Due to the high level of integration, UIM05 offers a “one-board solution” for most typical I/O configurations.

The current version of UIM05 board includes the following:

- 20 Optically isolated digital inputs
- 12 Optically isolated digital outputs
- 4 Non isolated 12 bit Analog outputs (user programmable as current 0-20mA, current 4-20mA or voltage 0-10V)
- 4 Non isolated (4 differential or 8 single ended channels) 12bit Analog inputs with different types of input
- 1 Dedicated PT100 channel-input for general usage or compensation of thermocouples.
- Support for fast counter inputs

4.2 CoDeSys Support for UIM05

In order to use UIM05 hardware with the SCM03-C/SCM11-C Internal Controllers, the proper I/O boards must be selected in the PLC Configuration.

Support for UIM05 consists of seven I/O boards as shown in Figure 3.

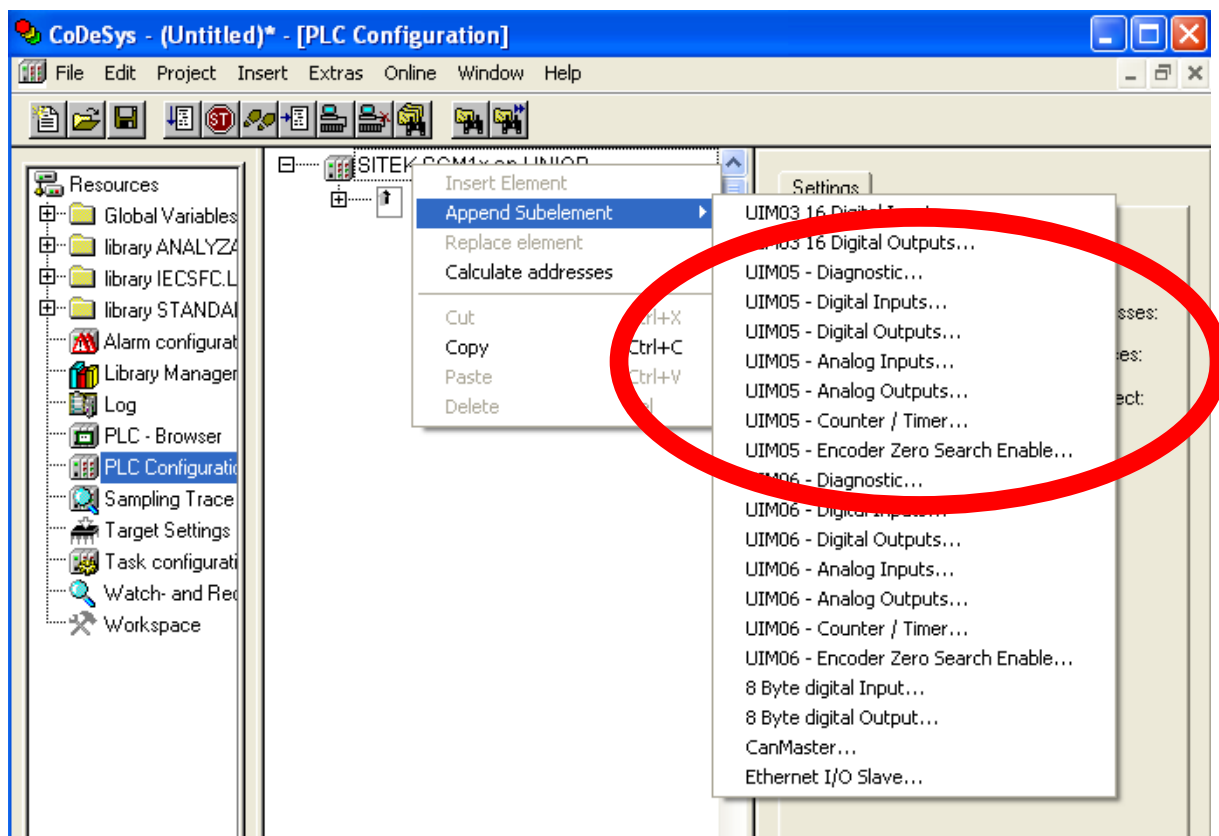


Figure 3

4.3 Configuration of Analog Inputs

The UIM05 Analog Input board has several parameters that have to be properly configured according to the operation mode requested for each channel.

For all the four channels it is required to specify the operating mode and the full-scale limit.

Each channel can be used for:

- 1 Voltage differential measure, or
- 2 Voltage single-ended measures, or
- 1 resistance measure, or
- 1 current measure

Figure 4 shows the configuration of the four Analog Inputs Couples:

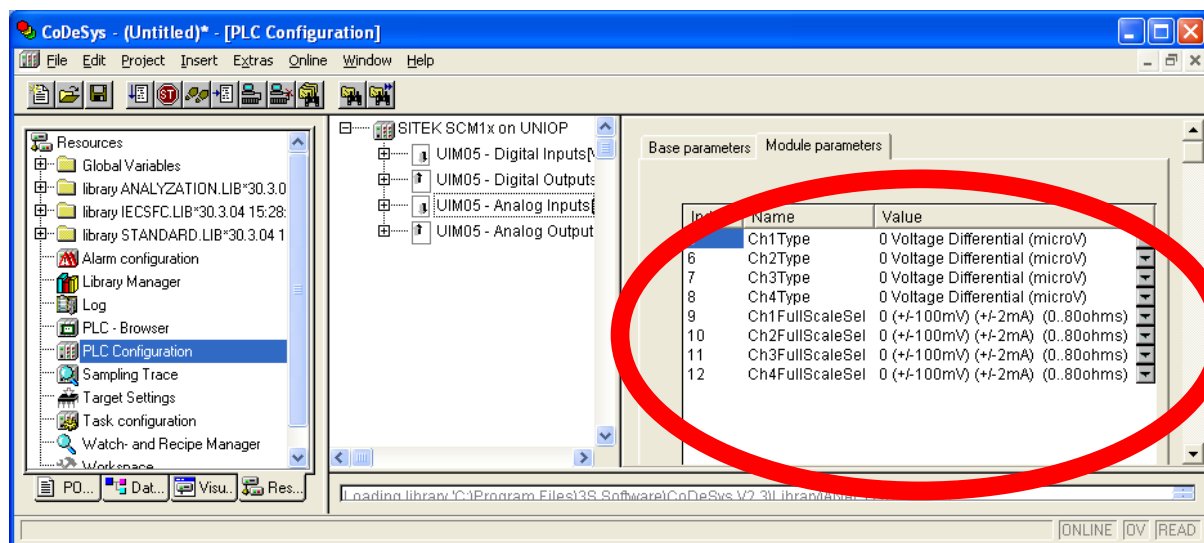


Figure 4

All the four channels are independently programmable to execute six different types of measurements. The parameters Ch1Type, Ch2Type, Ch3Type and Ch4Type can be configured like show in Table 1.

MEASURE TYPE		
Parameter value	Measure Mode	Units
0	Voltage Differential	μV
1	Voltage Single Ended	μV
2	Current	μA
3	Resistance 2 wires	$m\Omega$
4	Resistance 3 wires	$m\Omega$
5	Voltage Thermocouple	μV

Table 1

Different Full Scale can be selected for each Channel Couple as shown in Table 2.

FULL SCALE			
Full Scale parameter value	Full Scale for Voltage Measurement	Full Scale for Current Measurement	Full Scale for Resistance Measurement
0	+ / - 100mV	+/-2mA	0 - 80 Ω
1	+ / - 500mV	+/-10mA	0 - 400 Ω
2	+ / - 1V	+/-20mA	0 - 900 Ω
3	+ / - 5V	+/-20mA	0 - 8K Ω
4	+ / - 10V	+/-20mA	0 - 1M Ω

Table 2

Table 3 shows the different meaning assumed by the nine channels of the Analog Input board depending on the measure mode selected in the configuration parameters.

CH	Board Signal	MODE			
		VOLTAGE DIFFERENTIAL	VOLTAGE SINGLE ENDED	2/3 WIRES RESISTANCE	CURRENT
1	Ana. Inp. Couple 1	Diff. measure	Single Ended (CH+)	Res. Measure	Current Measure
2	Ana. Inp. Couple 1	Nothing	Single Ended (CH-)	Nothing	Nothing
3	Ana. Inp. Couple 2	Diff. measure	Single Ended (CH+)	Res. measure	Current Measure
4	Ana. Inp. Couple 2	Nothing	Single Ended (CH-)	Nothing	Nothing
5	Ana. Inp. Couple 3	Diff. measure	Single Ended (CH+)	Res. measure	Current Measure
6	Ana. Inp. Couple 3	Nothing	Single Ended (CH-)	Nothing	Nothing
7	Ana. Inp. Couple 4	Diff. measure	Single Ended (CH+)	Res. measure	Current Measure
8	Ana. Inp. Couple 4	Nothing	Single Ended (CH-)	Nothing	Nothing
9	Compensat . PT100	Res. Measure	-	-	

Table 3

The 9th channel is an input channel dedicated to thermocouple cold junction compensation. Please refer to the hardware description for additional details.

All the configuration parameters of the UIM05 Analog Input board can be easily changed run time using the EXOR_IO_CTRL function with the following Function Codes:

Function Code	Argument	Description
0	0 ÷ 4	Set Analog Input Full Scale for Channel 1
1	0 ÷ 4	Set Analog Input Full Scale for Channel 2
2	0 ÷ 4	Set Analog Input Full Scale for Channel 3
3	0 ÷ 4	Set Analog Input Full Scale for Channel 4
4	0 ÷ 5	Set Analog Input Mode for Channel 1
5	0 ÷ 5	Set Analog Input Mode for Channel 2
6	0 ÷ 5	Set Analog Input Mode for Channel 3
7	0 ÷ 5	Set Analog Input Mode for Channel 4

Table 4

Other Function Codes are reserved for factory test procedures and they can not be used.

4.4 Configuration of Analog Outputs

The UIM05 Analog Output board has several parameters that have to be properly configured according to the operation mode you desired for each channel.

For all the four channels it is required to specify the operating mode; the full-scale limit is fixed to a certain value depending on the selected mode.

Each channel can be used for:

- Voltage Output
- Current Output

Figure 5 shows the configuration of the four Analog Outputs channels

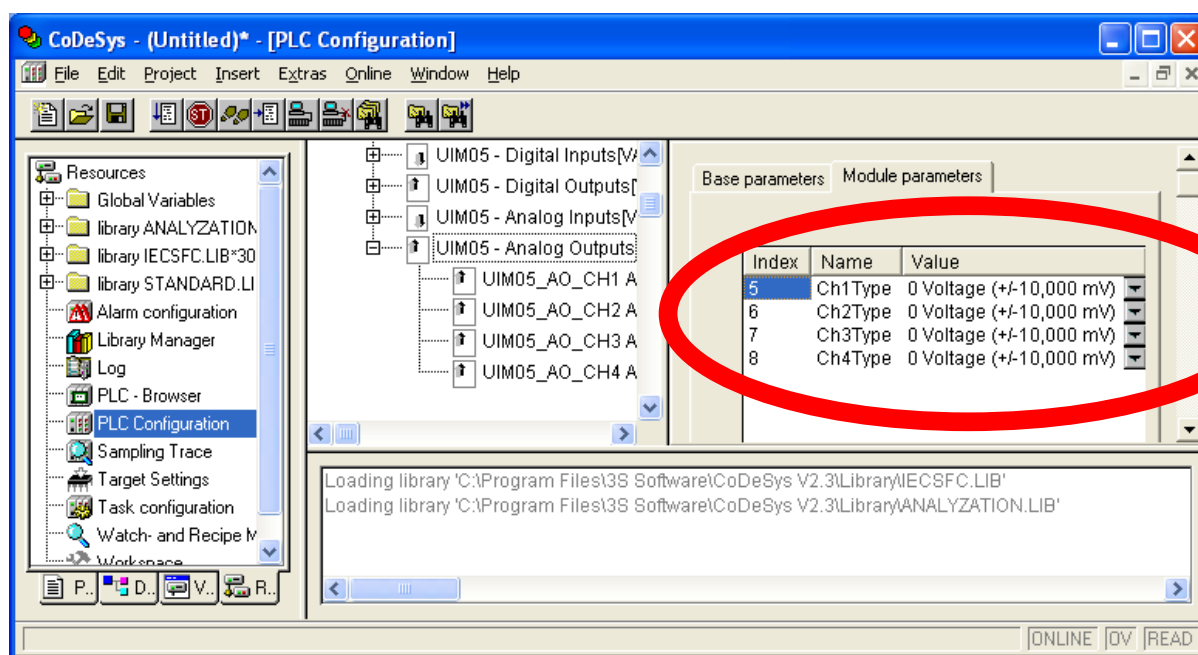


Figure 5

All the four channels are independently programmable to be used like voltage or current outputs. The parameters Ch1Type, Ch2Type, Ch3Type and Ch4Type can be configured as shown in next Table.

Parameter value	Channel Mode	Output Range
0	Voltage Output	$-10.000 \div 10.000 [mV]$
1	Current Output	$0 \div 20.000 [\mu A]$

Table 5

The output range is fixed as specified in the previous table. The value written by the PLC program to the output channels is an integer value between 0 and 10.000 in case of voltage and between 0 and 20.000 in case of current. Units are specified in the previous Table 5.

All the configuration parameters of the UIM05 Analog Output board can be easily changed run time using the EXOR_IO_CTRL function with Function Codes listed in the next table:

Function Code	Argument	Description
10	0 ÷ 1	Set Analog Output Mode Channel 1
11	0 ÷ 1	Set Analog Output Mode Channel 2
12	0 ÷ 1	Set Analog Output Mode Channel 3
13	0 ÷ 1	Set Analog Output Mode Channel 4

Table 6

Other Function Codes are reserved for factory test procedures and they can not be used.

4.5 Digital Input and Digital Output Configuration

UIM05 has 20 digital inputs as shown in Figure 6.

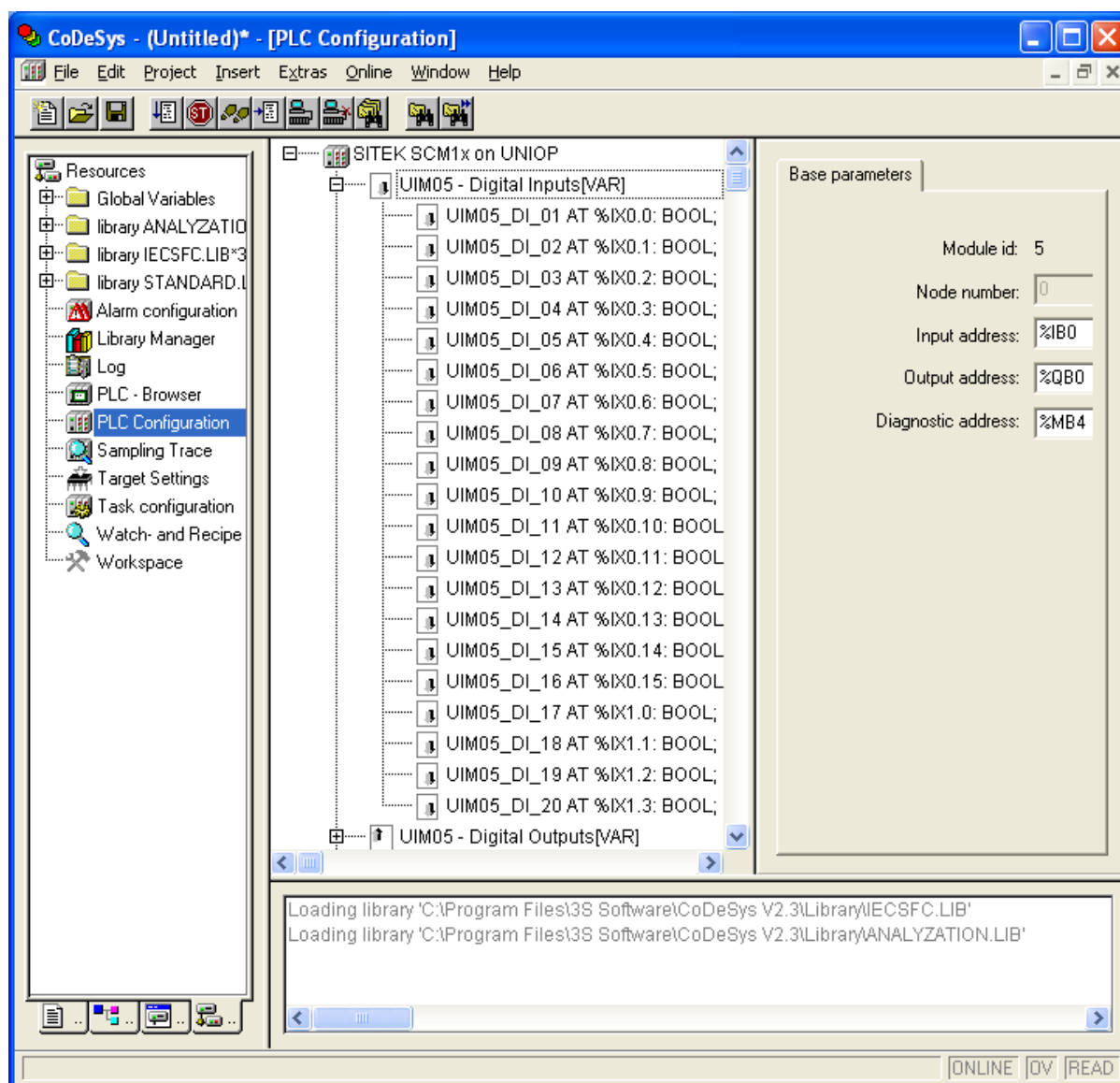


Figure 6

UIM05 has 12 digital outputs as shown in Figure 7.

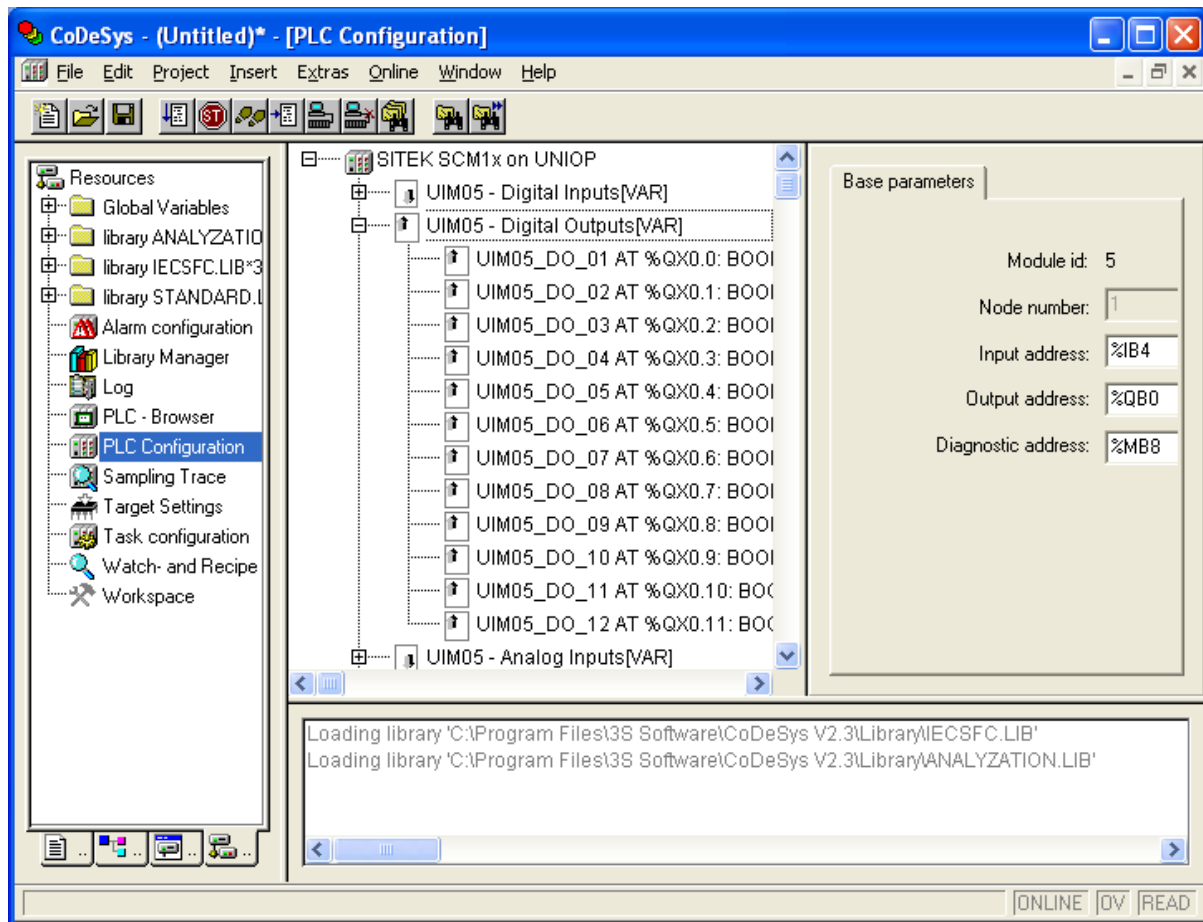


Figure 7

4.6 Counter/Timer Inputs

The UIM05 board features four counter/timer inputs.

Each channel of Counter/Timer type consumes up to 4 digital inputs. In case all the 4 Counter/Timer inputs are enabled, 4 digital inputs are still free for standard operation. Please refer to UIM05 hardware manual for additional specification and wiring diagrams.

For each counter/timer input you want to use, a “UIM05 - Counter/Timer” board has to be setup in the PLC Configuration. Figure 8 shows an example of possible configuration with 2 channels enabled.

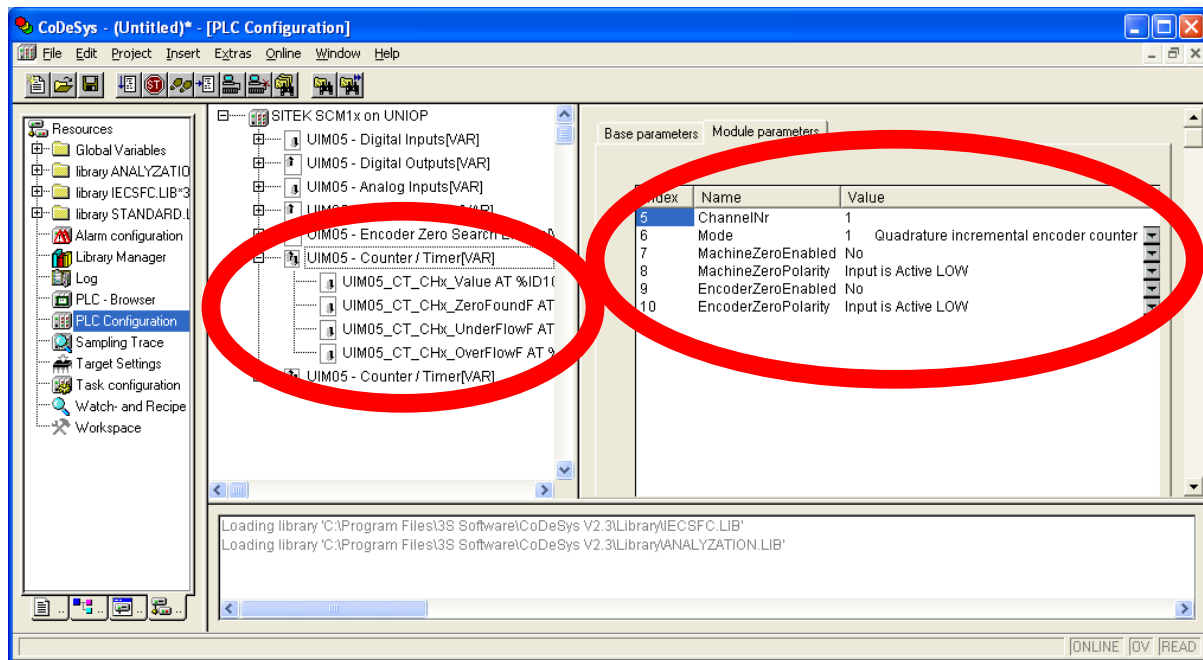


Figure 8

The parameter "**ChannelNr**" specifies the number of the associated counter/timer input; allowed range is 1...4.

The board outputs channels have the following meaning:

- Channel 1: Counter/Frequency Value
- Channel 2: ZeroFound Flag
- Channel 3: Underflow Flag
- Channel 4: Overflow Flag

Board parameters have different options and they can be selected at design time.

An explanation of the parameters follows in Table 7, Table 8, Table 9, Table 10 and Table 11.

Parameter Name	Value	Description
Mode	0	Counter/Timer not active
	1	Quadrature incremental encoder counter
	2	Normal Counting
	3	Gated Counting
	4	Frequency Measurement

Table 7

MachineZeroEnabledF	false	Corresponding terminal block is used as normal digital input
	true	Corresponding terminal block is used as Machine Zero Input

Table 8

MachineZeroPolarityF	false	Means Input is active LOW
	true	Means Input is active HIGH

Table 9

EncoderZeroEnabledF	false	Corresponding terminal block is used as normal digital input
	true	Corresponding terminal block is used as Encoder Zero Input

Table 10

EncoderZeroPolarityF	false	Means Input is active LOW
	true	Means Input is active HIGH

Table 11

These parameters can also be changed run-time with EXOR_IO_CTRL function with the following Function Codes:

Function Code	Argument	Description
100	0...4	Set Mode
101	0...1	Set MachineZeroEnabledF
102	0...1	Set MachineZeroPolarityF
103	0...1	Set EncoderZeroEnabledF
104	0...1	Set EncoderZeroPolarityF

Table 12

Other Function Codes are reserved and cannot be used.

4.6.1 Encoder Input

When input is attached to an incremental encoder, then at power up the Encoder Zero Search procedure is usually performed.

The user program should handle the procedure enabling the Zero Search using the channels of the “UIM05 – Encoder Zero Search Enable” board.

The four channels of this board enable the Zero searching process on the corresponding encoder inputs.

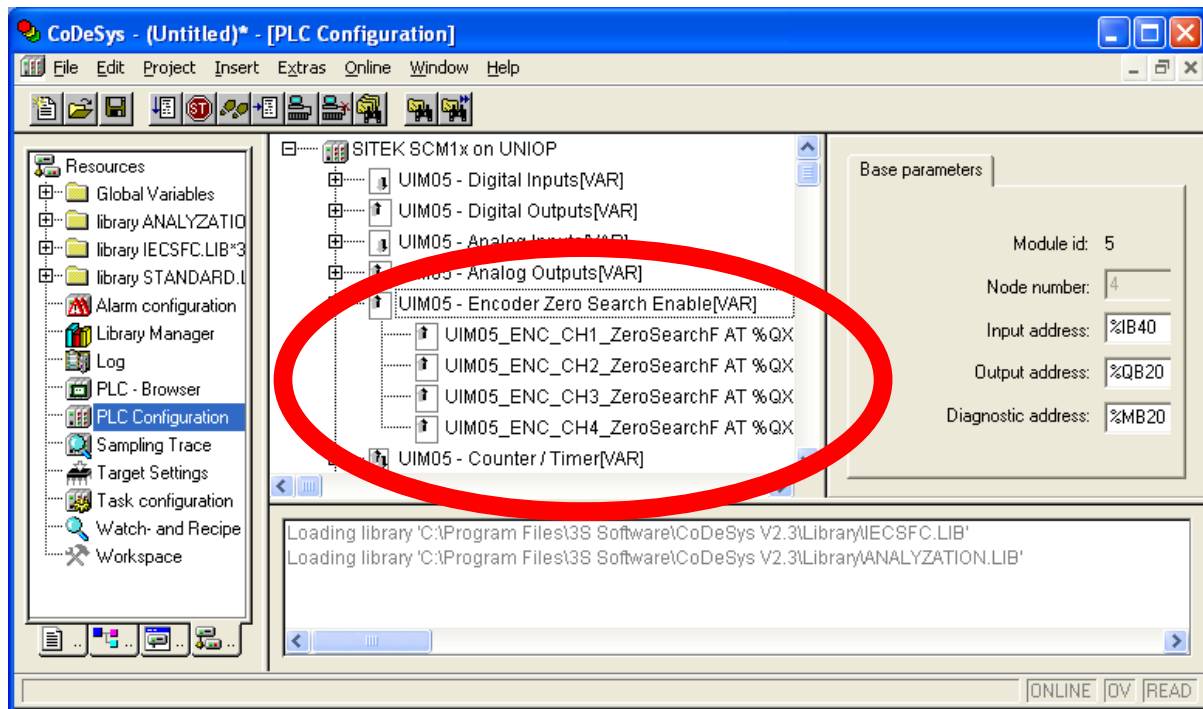


Figure 9

4.7 Diagnostic

UIM05 is able to report the following diagnostic information using the “UIM05 - Diagnostic” board. The 2 outputs of this board are:

- Missing +24V Flag
- Output short circuit

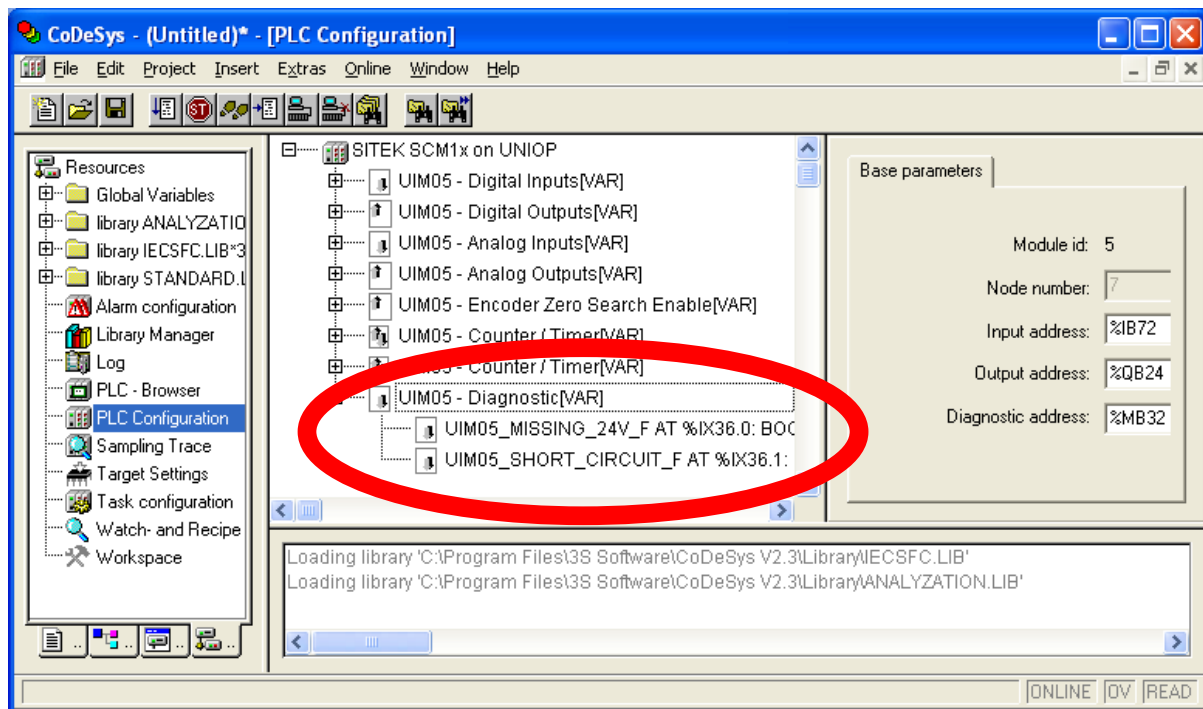


Figure 10

5 UIM06

5.1 Overview

This document provides a description of the UIM06 local I/O module designed for use in the UniOP panels. The technical note includes a technical description of the hardware and of the ISaGRAF support for the I/O board.

UIM06 is general purpose (multifunction) I/O board, compatible with all UniOP CPU boards; please note it can only be mounted on hardware type –0050 and later. UIM06 should satisfy most of the typical process I/O signals. The main feature of the UIM06 is the programmability. Due to the high level of integration, UIM06 offers a “one-board solution” for most typical I/O configurations.

The current version of UIM06 board provides the following:

- 20 Optically isolated digital inputs
- 20 Optically isolated digital outputs
- 2 Non isolated 12 bit Analog outputs (user programmable as current 0-20mA, current 4-20mA or voltage 0-10V)
- 8 Non isolated (4 differential or 8 single-ended channels) 14bit Analog inputs with different types of input
- Support for fast counter inputs

5.2 CoDeSys Support for UIM06

In order to use UIM06 hardware with the SCM03 Internal Controller, the proper I/O boards have to be chosen in the PLC Configuration.

Support for UIM06 consists of seven I/O boards as shown in Figure 11.

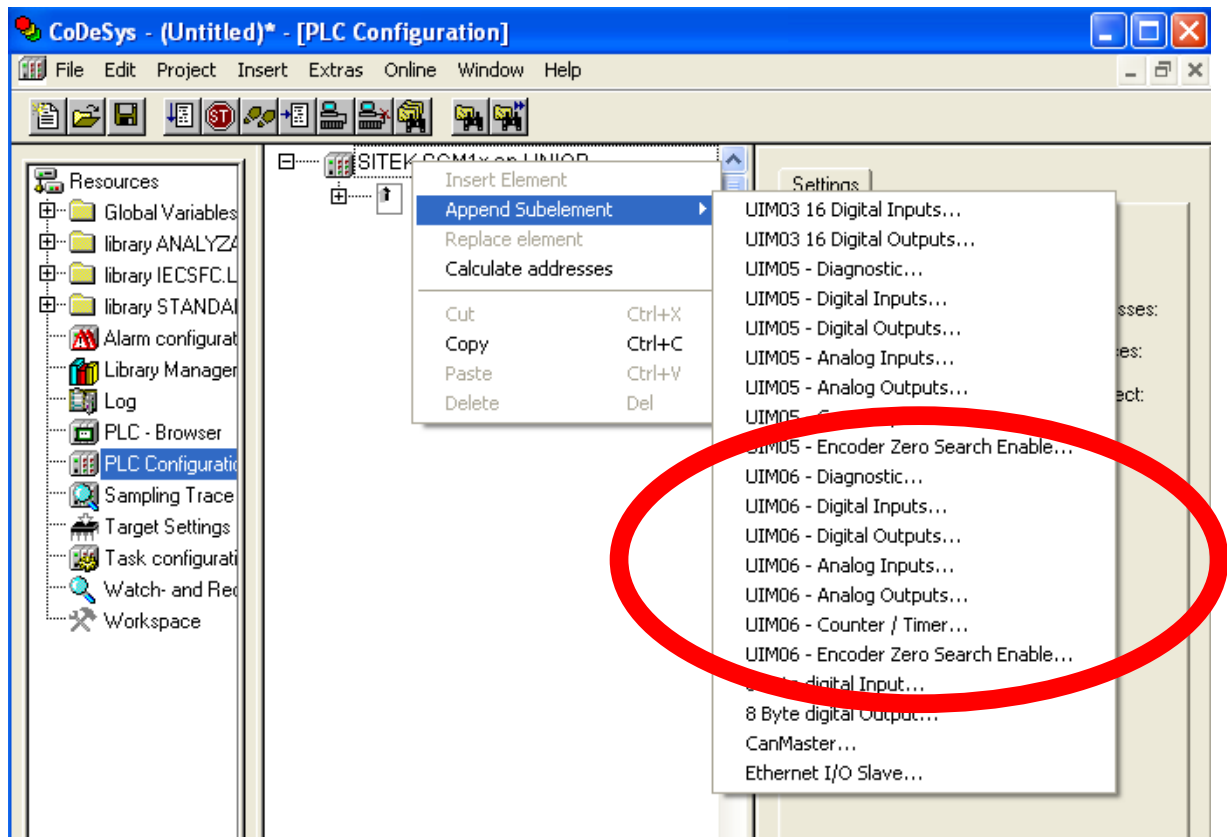


Figure 11

5.3 Configuration of Analog Inputs

The UIM06 Analog Input board has several parameters that must be properly configured to obtain the requested operation mode for each channel.

For all the four channels it is required to specify the operating mode and the full-scale limit.

Each channel can be used for:

- 1 Voltage differential measure, or
- 2 Voltage single ended measures, or
- 1 resistance measure, or
- 1 current measure

The Figure 12 shows the configuration of the four Analog Inputs Couples.

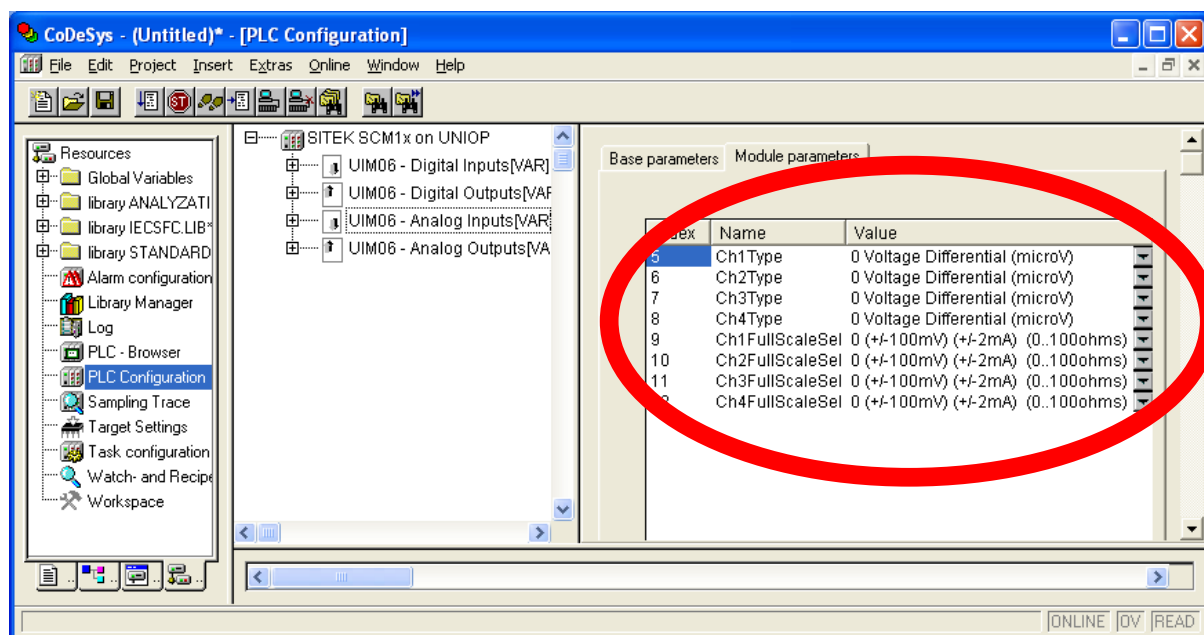


Figure 12

All the four channels are independently programmable to execute seven different types of measurements. The parameters Ch1Type, Ch2Type, Ch3Type and Ch4Type can be configured like show in Table 13.

Parameter value	Measure Mode	Units
0	Voltage Differential	μV
1	Voltage Single Ended	μV
2	Current	μA
3	Resistance 2 wires	$m\Omega$
4	Resistance 3 wires	$m\Omega$
5	Resistance 4 wires	$m\Omega$
6	Voltage Thermocouple	μV

Table 13

Different Full Scale can be selected for each Channel Couple as shown in next Table.

FULL SCALE			
Full Scale parameter value	Full Scale for Voltage Measurement	Full Scale for Current Measurement	Full Scale for Resistance Measurement
0	+ / - 100mV	+/-2mA	0 - 100 Ω (range extends to 0 - 220 Ω when 4 wires is selected)
1	+ / - 500mV	+/-10mA	0 - 500 Ω
2	+ / - 1V	+/-20mA	0 - 1K Ω
3	+ / - 5V	+/-20mA	0 - 20K Ω
4	+ / - 10V	+/-20mA	0..1M Ω

Table 14

Table 15 shows the different meaning assumed by the nine channels of the Analog Input board depending on the measure mode selected in the configuration parameters.

CH	Board Signal	MODE			
		VOLTAGE DIFFERENTIAL	VOLTAGE SINGLE ENDED	2/3/4 WIRES RESISTANCE	CURRENT
1	Ana. Inp. Couple 1	Diff. measure	Single Ended (CH+)	Res. Measure ⁽¹⁾	Current Measure
2	Ana. Inp. Couple 1	Nothing	Single Ended (CH-)	Nothing	Nothing
3	Ana. Inp. Couple 2	Diff. measure	Single Ended (CH+)	Res. Measure ⁽²⁾	Current Measure
4	Ana. Inp. Couple 2	Nothing	Single Ended (CH-)	Nothing	Nothing
5	Ana. Inp. Couple 3	Diff. measure	Single Ended (CH+)	Res. Measure ⁽³⁾	Current Measure
6	Ana. Inp. Couple 3	Nothing	Single Ended (CH-)	Nothing	Nothing
7	Ana. Inp. Couple 4	Diff. measure	Single Ended (CH+)	Res. Measure ⁽⁴⁾	Current Measure
8	Ana. Inp. Couple 4	Nothing	Single Ended (CH-)	Nothing	Nothing

Table 15

All the configuration parameters of the UIM06 Analog Input board can be easily changed run time using the EXOR_IO_CTRL function with the following Function Codes:

Function Code	Argument	Description
0	0 ÷ 4	Set Analog Input Full Scale for Channel 1
1	0 ÷ 4	Set Analog Input Full Scale for Channel 2
2	0 ÷ 4	Set Analog Input Full Scale for Channel 3
3	0 ÷ 4	Set Analog Input Full Scale for Channel 4
4	0 ÷ 6	Set Analog Input Mode for Channel 1
5	0 ÷ 6	Set Analog Input Mode for Channel 2
6	0 ÷ 6	Set Analog Input Mode for Channel 3
7	0 ÷ 6	Set Analog Input Mode for Channel 4

Table 16

Other Function Codes are reserved for factory test procedures and they can not be used.

5.4 Analog Output Configuration

The UIM06 Analog Output board has several parameters that have to be properly configured according to the operation mode you desired for each channel.

For all the four channels it is required to specify the operating mode; the full-scale limit is fixed to a certain value depending on the selected mode.

Each channel can be used for:

- Voltage Output
- Current Output

¹ Open circuit return value: 2147483647mΩ, signal error response value: -2147483648mΩ

² Open circuit return value: 2147483647mΩ, signal error response value: -2147483648mΩ

³ Open circuit return value: 2147483647mΩ, signal error response value: -2147483648mΩ

⁴ Open circuit return value: 2147483647mΩ, signal error response value: -2147483648mΩ

The following picture shows the configuration of the 2 Analog Outputs:

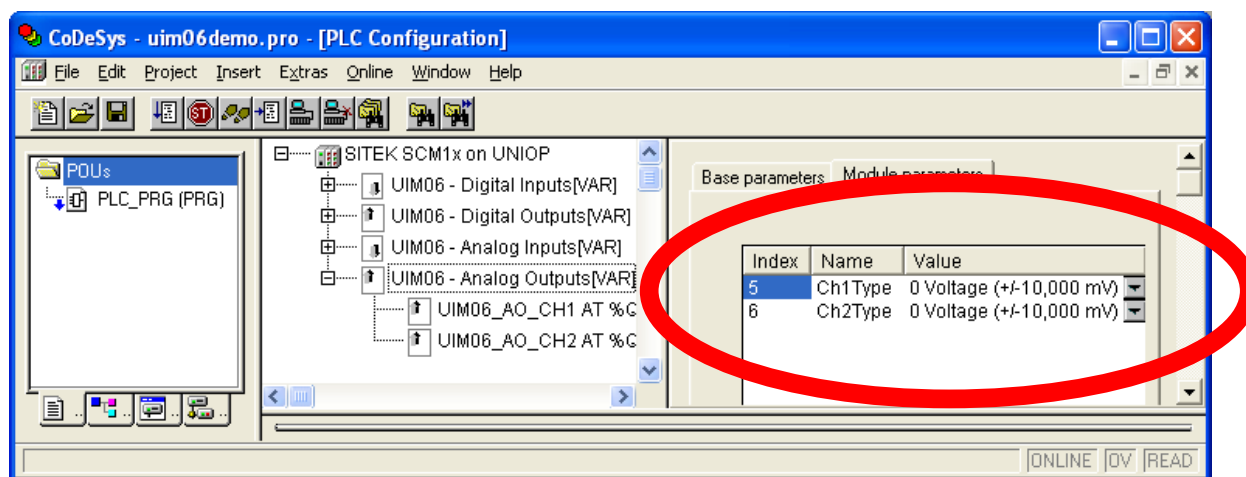


Figure 13

Both channels are independently programmable to be used like voltage or current outputs. The parameters Ch1Type and Ch2Type can be configured as shown in Table 17.

Parameter value	Channel Mode	Output Range
0	Voltage Output	$-10.000 \div 10.000[mV]$
1	Current Output	$0 \div 20.000[\mu A]$

Table 17

The output range is fixed and specified in the previous table. The value written by the PLC program to the output channels is an integer value between 0 and 10.000 in case of voltage and between 0 and 20.000 in case of current. Units are specified in the previous Table.

All the configuration parameters of the UIM06 Analog Output board can be easily changed run time using the EXOR_IO_CTRL function with Function Codes listed in the next table:

Function Code	Argument	Description
10	$0 \div 1$	Set Analog Output Mode Channel 1
11	$0 \div 1$	Set Analog Output Mode Channel 2

Table 18

Other Function Codes are reserved for factory test procedures and they can not be used.

5.5 Digital Input and Digital Output Configuration

UIM06 has 20 digital inputs as shown in the figure below:

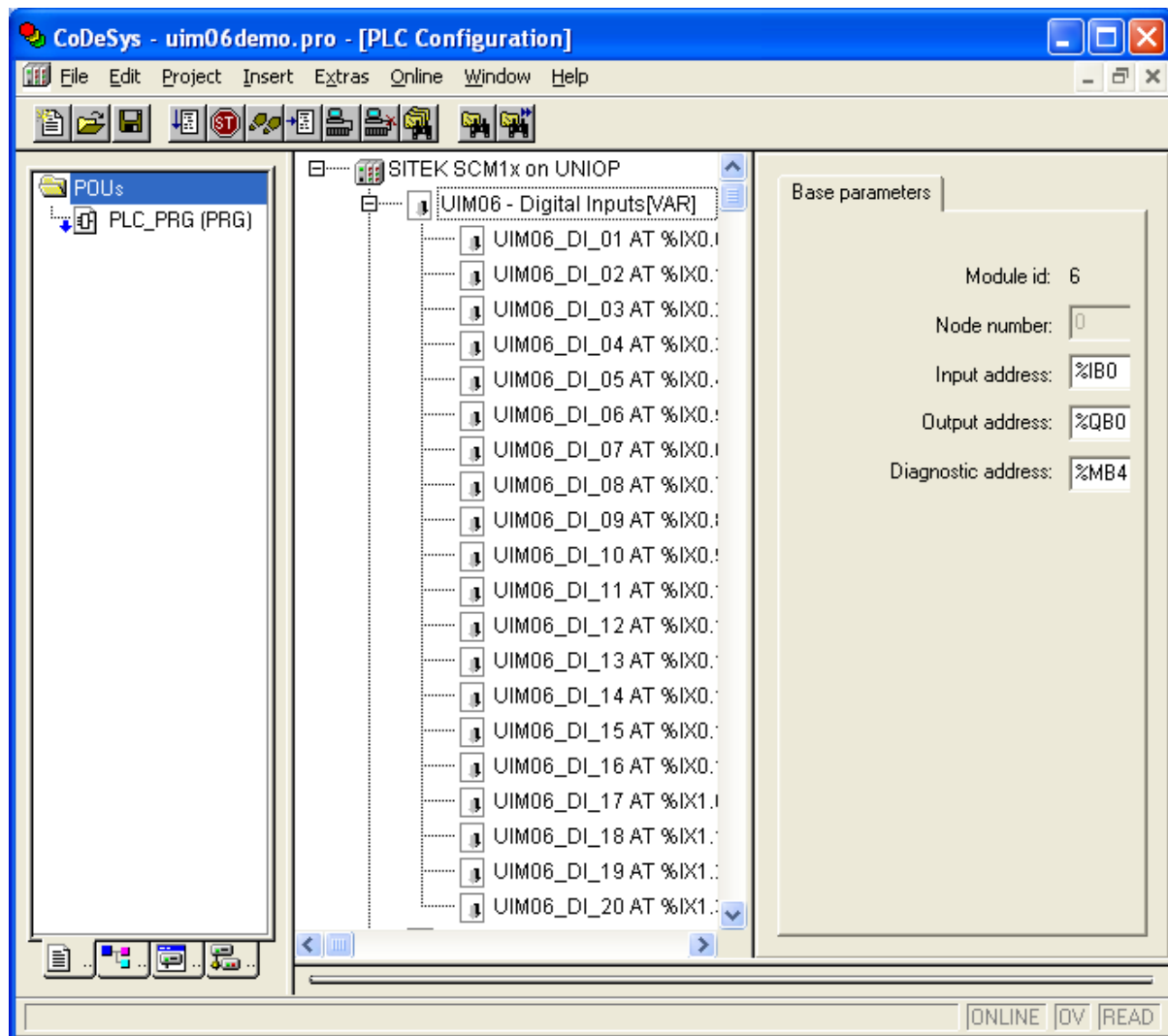


Figure 14

UIM06 has 20 digital outputs as shown in the figure below:

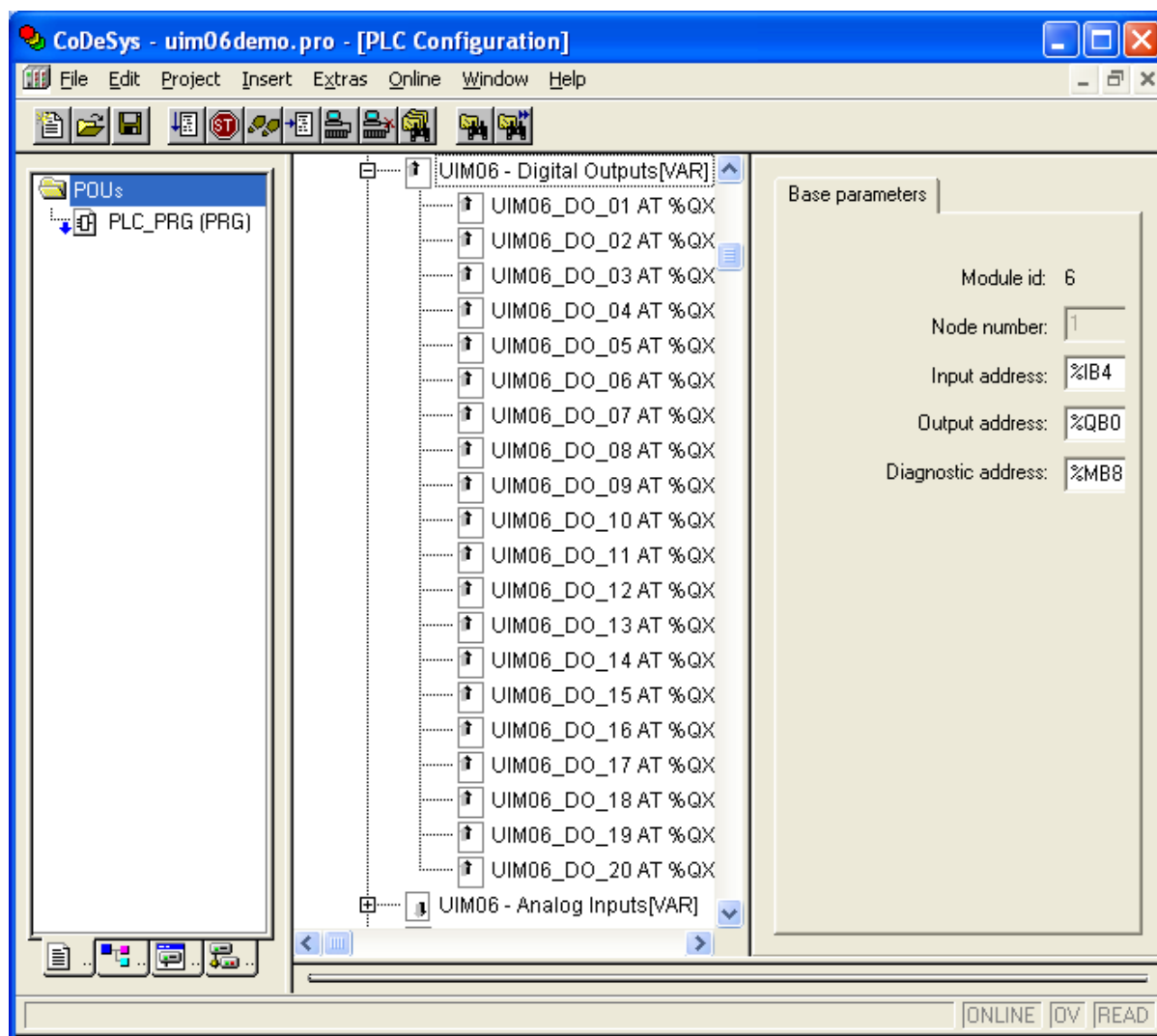


Figure 15

5.6 Counter/Timers Input

The UIM06 board features four counter/timer inputs.

Each channel of Counter/Timer type consumes up to 4 digital inputs. In case all the 4 Counter/Timer inputs are enabled, 4 digital inputs are still free for standard operation. Please refer to UIM06 hardware manual for additional specification and wiring diagrams.

For each counter/timer input you want to use a “UIM06 - Counter/Timer” board has to be configured in the ISaGRAF I/O rack. Next picture shows an example of possible configuration with 2 channels enabled.

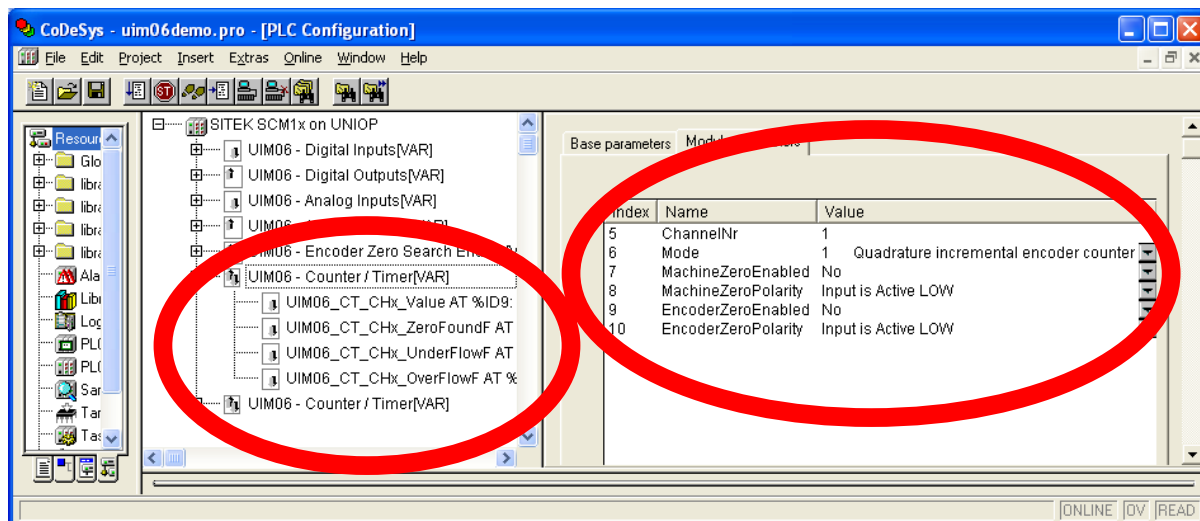


Figure 16

The parameter "**Channel**" specifies the number of the associated counter/timer input; allowed range is 1 - 4.

The board outputs channels have the following meaning:

Channel 1: Counter/Frequency Value

Channel 2: ZeroFound Flag

Channel 3: Underflow Flag

Channel 4: Overflow Flag

Board parameters have different options and they can be selected at design time.

An explanation of the parameters follows in next five Tables.

Parameter Name	Value	Description
Mode	0	Counter/Timer not active
	1	Quadrature incremental encoder counter
	2	Normal Counting
	3	Gated Counting
	4	Frequency Measurement

Table 19

MachineZeroEnabledF	false	Corresponding terminal block is used as normal digital input
	true	Corresponding terminal block is used as Machine Zero Input

Table 20

MachineZeroPolarityF	false	Means Input is active LOW
	true	Means Input is active HIGH

Table 21

EncoderZeroEnabledF	false	Corresponding terminal block is used as normal digital input
	true	Corresponding terminal block is used as Encoder Zero Input

Table 22

EncoderZeroPolarityF	false	Means Input is active LOW
	true	Means Input is active HIGH

Table 23

These parameters can also be changed run-time with EXOR_IO_CTRL function with the following Function Codes:

Function Code	Argument	Description
100	0...4	Set Mode
101	0...1	Set MachineZeroEnabledF
102	0...1	Set MachineZeroPolarityF
103	0...1	Set EncoderZeroEnabledF
104	0...1	Set EncoderZeroPolarityF

Table 24

Other Function Codes are reserved and cannot be used.

5.6.1 Encoder Input

When input is attached to an incremental encoder, then at power up the Encoder Zero Search procedure is usually performed.

The user program should handle the procedure enabling the Zero Search using the channels of the “UIM06 – Encoder Zero Search Enable” board.

The 4 channels of this board enable the Zero searching process on the corresponding encoder inputs.

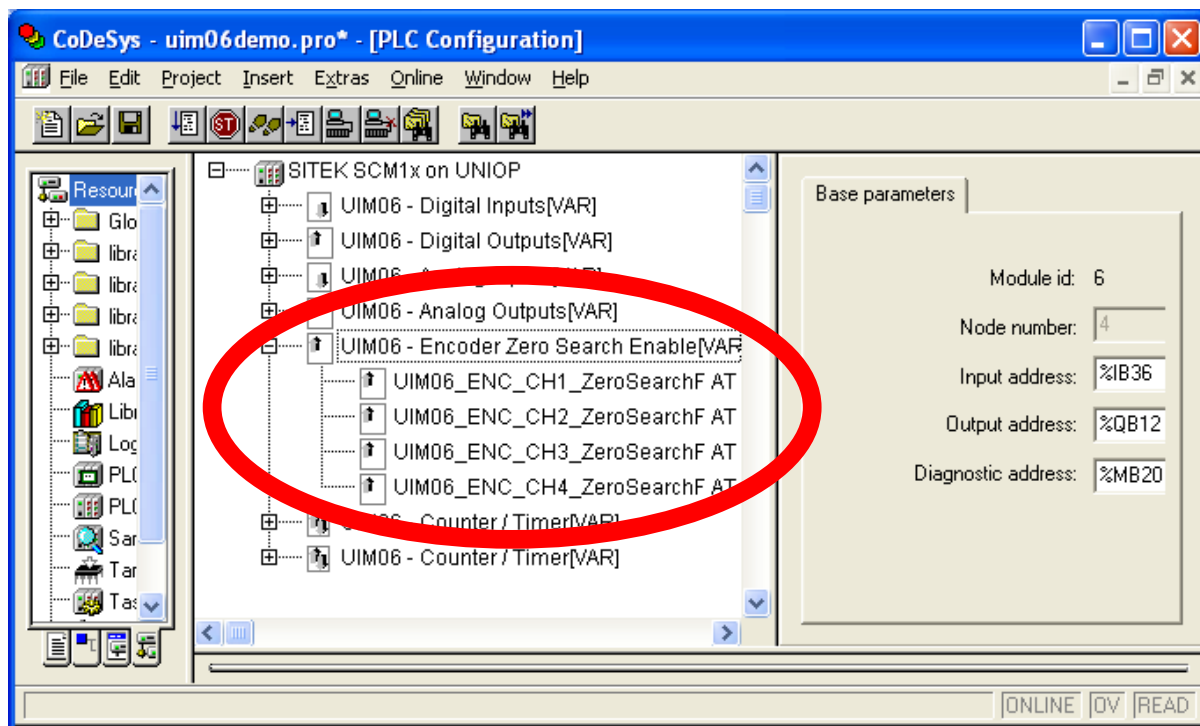


Figure 17

5.7 Diagnostic

UIM06 is able to report the following diagnostic information using the “UIM05 - Diagnostic” board.
The 4 outputs of this board are:

- Missing +24V Flag
- Output short circuit digital outputs #1 - #8
- Output short circuit digital outputs #9 - #16
- Output short circuit digital outputs #17 - #20

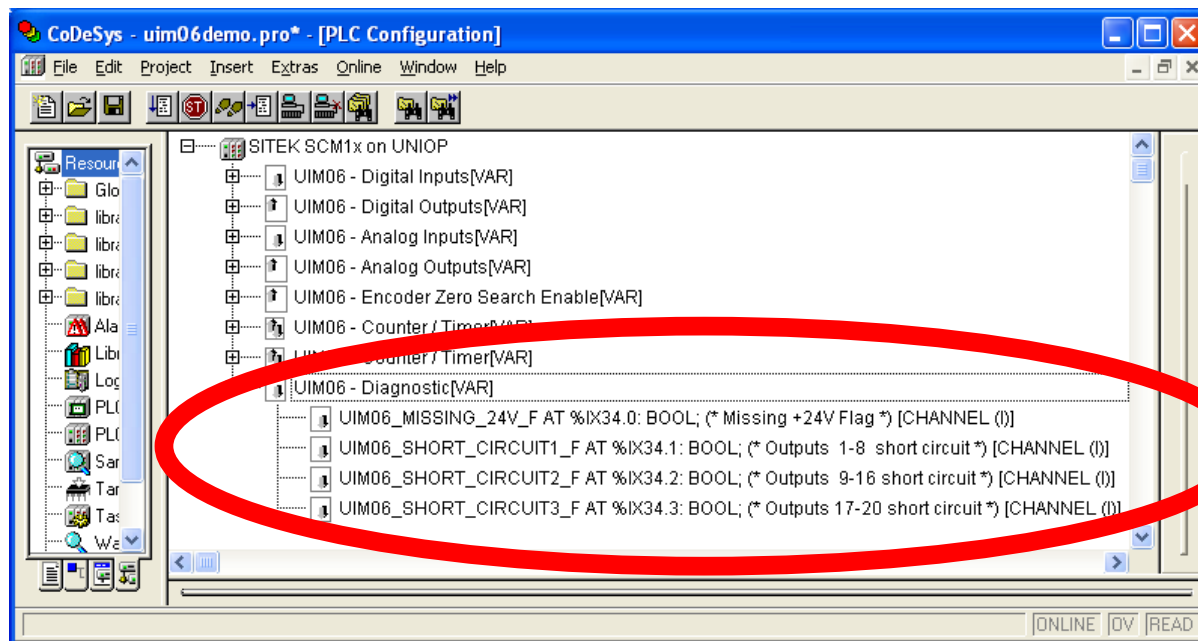


Figure 18