

# CrossFire™ SX

## CODESYS Developers Guide



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# 1. Introduction

## 1.1. Background

CrossFire SX is a freely programmable 32-bit I/O controller, designed for use in Agricultural and Construction equipment. It offers 38 I/O channels, fully versatile and configurable in software. Crossfire SX, CODESYS is freely programmable through CODESYS with full support for CANopen Master, CANopen Slave and J1939.

The purpose of this document is to describe the usage of the CODESYS runtime for CrossFire SX.

### Overview:

- 32-bit safety CPU, Texas Instruments TMS570 ARM Cortex R4, 180 MHz
- 4 4A outputs, 12 2A outputs, 16 inputs, 2 H-bridge, 4 node-id digital inputs
- 3 CAN with full support for CANopen Master, CANopen Slave and J1939
- CODESYS version: 3.5
- Debug interface: RS232, 115.2 kbps
- Retain memory: 640 bytes stored in FRAM
- Available RAM: 256kB divided between runtime and user application External SRAM available as option
- FLASH available to CODESYS application: 1.5MB
- Extensive supervision functions including external watchdog and feedback of current, frequency and duty cycle and measurement of internal voltages and temperatures for improved safety

## 1.2. References

- [1] CrossFire SX - Technical Manual.docx
- [2] CrossFire SX – Firmware upgrade instructions.docx
- [3] CODESYS V3, Installation and Start.pdf
- [4] CODESYS online help
- [5] <https://www.codesys.com/>
- [6] <http://store.codesys.com>
- [7] <http://support.crosscontrol.com>

## 1.3. History

Rev	Date	Author	Changes
0.1	2016-06-02	Fredrik Wahlström	First draft
0.2	2017-01-23	Carl-Magnus Moon	
0.3	2017-03-08	Mattias Lång	Update with new template

## 2. Installation

### 2.1. Software installation

Please read the CrossFire SX - Technical Manual.docx for information about mechanical and electrical installation of CrossFire SX as well as electrical characteristics.

CrossFire SX, CODESYS comes preinstalled with CODESYS runtime. To start developing with CODESYS it is necessary to install the correct version of the CODESYS IDE on your PC. The CODESYS IDE version should match the version of the CODESYS runtime on the CrossFire SX. As of writing this manual, the correct version is 3.5SP10. CODESYS IDE can be downloaded from 3S (<http://store.codesys.com>) or CrossControl support site (<http://support.crosscontrol.com/>).

It is also necessary to install the CrossFire SX device description file into CODESYS device repository. This is done from CODESYS IDE by selecting Tools/Device Repository and clicking “Install...”. Browse for the CF\_SX\_V3.5.10.0.devdesc.xml file. CF\_SX\_V3.5.10.0.devdesc.xml can be downloaded from CrossControl support site <http://support.crosscontrol.com>.

### 2.2. Very Important!

After downloading an application the outputs will be shut off due to the idle task watchdog will expire. It is necessary to perform a “reset warm” command from CODESYS IDE to activate them again.

It is not possible to change port settings after the first PLC cycle. In case this is needed, the soft\_restart\_node command must be used. Performing a “reset warm” or restarting the unit is also possible.

### 2.3. Software Upgrade

It is possible to upgrade the firmware of the CrossFire SX with the SX Config Tool. It is also possible to download a CODESYS application with this tool. More information about this is available in the CrossFire SX – Firmware upgrade instructions.docx.

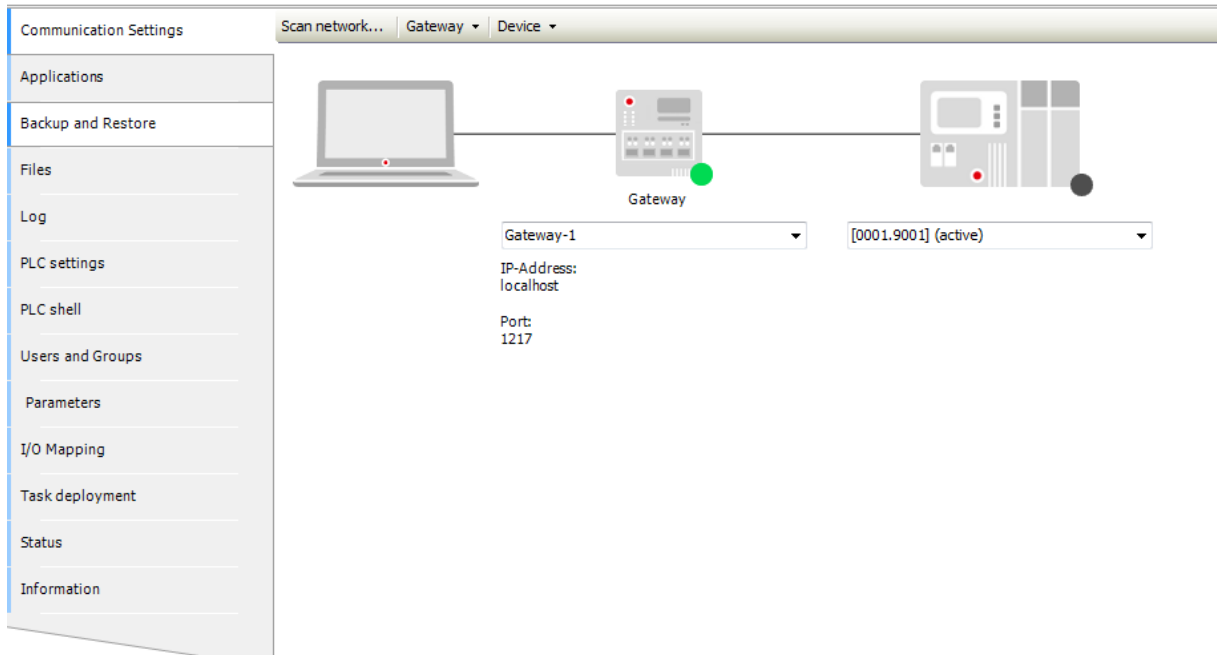
### 2.4. LED

The Red/Green LED is mainly controlled by the user application. During boot up the LED is used to indicate start-up errors. Please read the technical manual for full details.

Color	Meaning
Amber	No or incompatible application.
Blinking red	Startup tests failed.

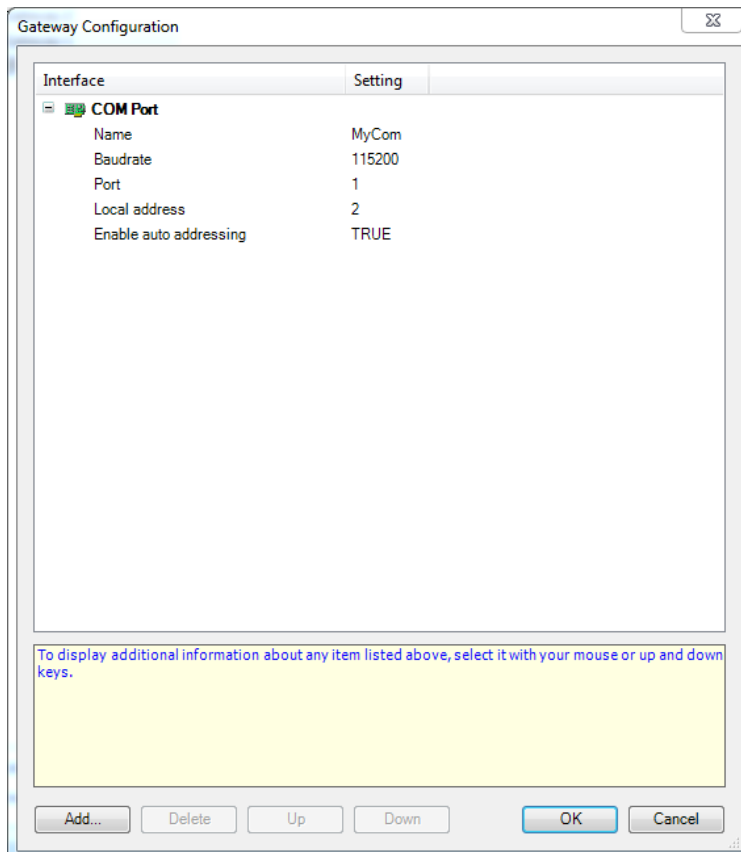
### 2.5. Connecting to the target

CrossFire SX is connected to the PC with the RS232 connection. To be able to connect to the CrossFire SX through the serial connection, it is necessary to configure the local gateway. This is done by going to the Communication Settings tab in CODESYS IDE. Select “Configure the local Gateway” from the Gateway menu.



Baudrate should be set to 115200. Port should be set up to the number of PC serial port that is used (COM1, COM2...). Auto Addressing should be enabled. Name can be set to anything desired.

The settings shall look like the following screenshot.



If any of the configuration settings are missing click “Add...” and select “Add configuration setting..”. Make sure to restart the gateway after changing configuration. This can be done by right clicking on the gateway in the system tray and selecting “Stop Gateway” followed by “Start Gateway”.

When the gateway is configured, select the gateway and click “Scan Network” to scan for CrossFire SX units. When the unit is found make sure to select CrossFire SX as active.

In case of problems, check the cabling carefully and also the gateway settings. In case of using an external USB to serial cable, try another brand.

In case a non-working CODESYS application has been downloaded to the unit by mistake, it might be necessary to download a working CODESYS application through the boot loader using the CrossFire SX Config Tool.

After downloading an application the outputs will be shut off due to the idle task watchdog will expire. It is necessary to perform a “reset warm” command from CODESYS IDE to start them again.

It is also possible to download a CODEYS application to the unit using CrossFire SX Config Tool. The CrossFire SX Config Tool downloads the application over the CAN bus using the CANopen protocol. More information about this is available in the CrossFire SX – Firmware upgrade instructions.docx.

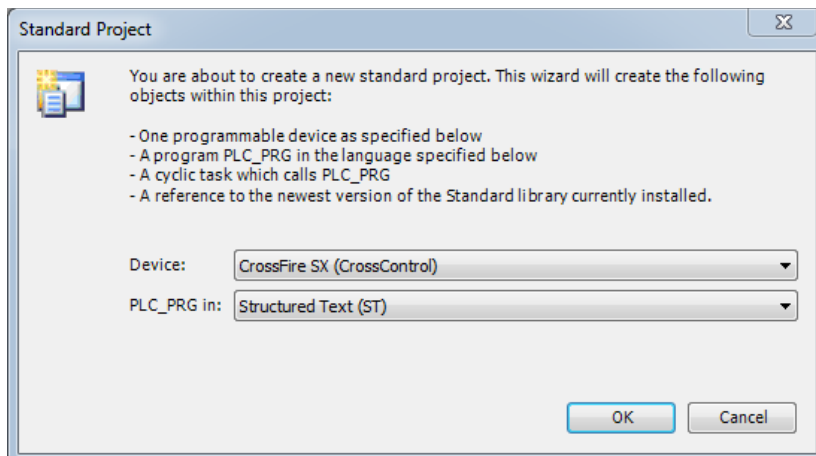
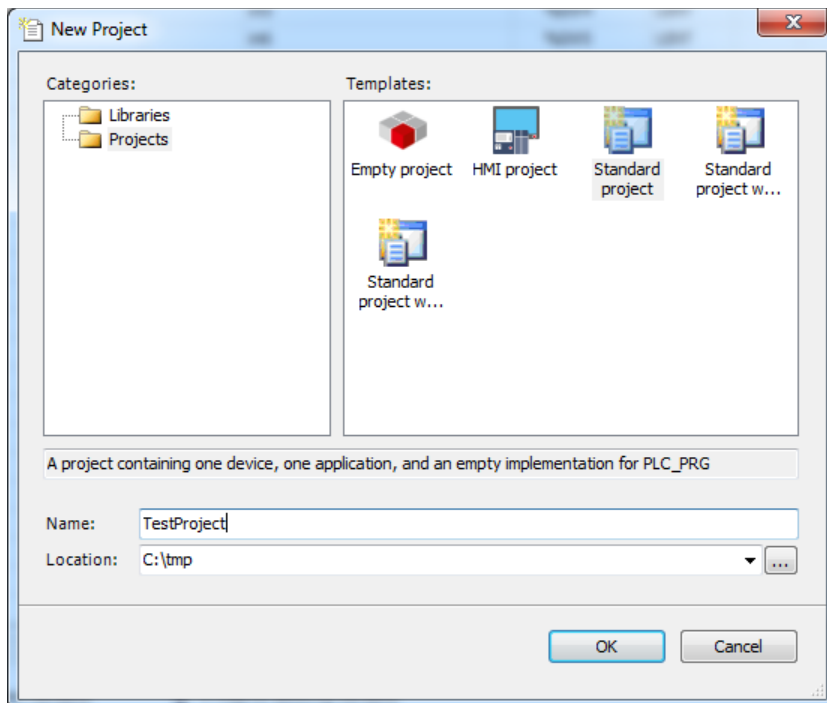
## 3. Programming CrossFire SX

### 3.1. Writing an application in CODESYS

CODESYS programming in general is not described in this manual. The reader should instead read the manuals and online-help that were installed together with CODESYS.

### 3.2. Creating a new project in CODESYS

Start CODESYS IDE. Select “New Project...” from the File menu. Select “Standard Project”. Select “CrossFire SX” in the Device list. If CrossFire SX is not available in the list, the CrossFire SX device description file needs to be installed first. Select desired programming language for PLC\_PRG. Click ok and a new empty project will be created.



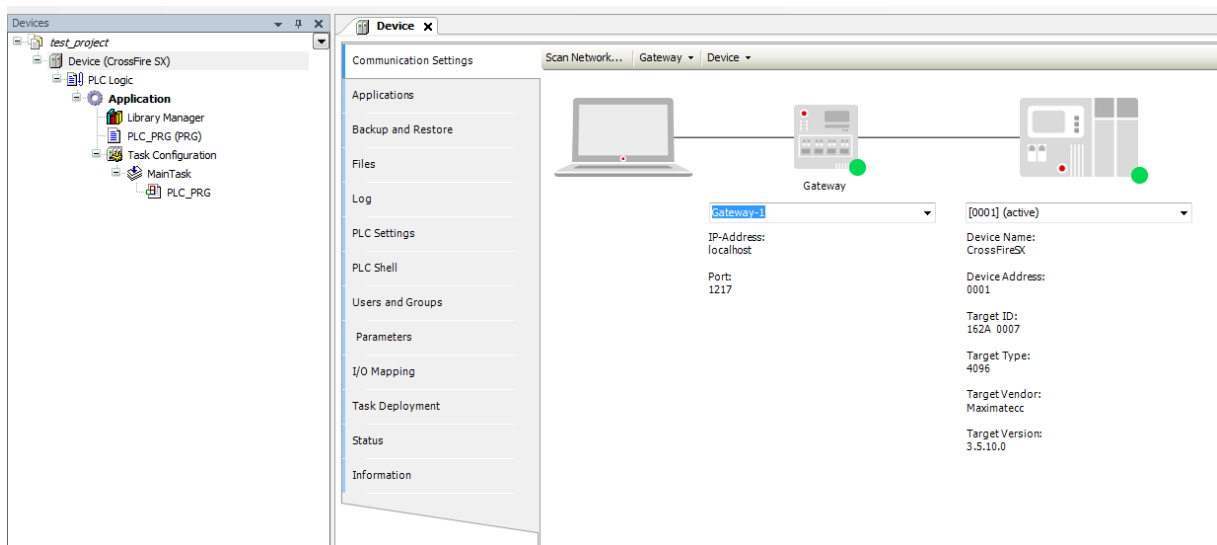
Often it is easier to use the supplied template project instead of creating a completely empty project. In the template project all IO is already mapped to variables. Also a number of enums and

structs are predefined to make programming easier. The template project can be downloaded from CrossControl support site ([support.crosscontrol.com](http://support.crosscontrol.com)).

### 3.3. The Device Tree

The device tree is a very important part of a CODESYS project. To the device tree additional items such as PRGs, FBs, FUNs, tasks and can buses can be added.

When selecting the CrossFire SX device in the device tree, a large number of setting tabs will be available, usually to the right of the device tree.



### 3.4. Accessing the I/O on CrossFire SX

The I/O on CrossFire SX can be found in the I/O Mapping tab of the CrossFire SX device. As the I/O is configurable, both configuration settings and actual I/O data is available. Also status information is available. Make sure to make use of the status information as this can make the complete system much more safe and tolerant against errors.



Variable	Mapping	Channel	Address	Type	Unit	Description
		in1	%IW0	UINT		
		in2	%IW1	UINT		
		in3	%IW2	UINT		
		in4	%IW3	UINT		
		in5	%IW4	UINT		
		in6	%IW5	UINT		
		in7	%IW6	UINT		
		in8	%IW7	UINT		
		in9	%IW8	UINT		
		in10	%IW9	UINT		
		in11	%IW10	UINT		
		in12	%IW11	UINT		
		in13	%IW12	UINT		
		in14	%IW13	UINT		
		in15	%IW14	UINT		
		in16	%IW15	UINT		
		out_status1	%IW16			
		out_status2	%IW22			
		out_status3	%IW28			
		out_status4	%IW34			
		out_status5	%IW40			
		out_status6	%IW46			
		out_status7	%IW52			
		out_status8	%IW58			
		out_status9	%IW64			
		out_status10	%IW70			

= Create new variable      = Map to existing variable

Note that only I/O that is mapped to a variable and is actually used will be updated during debugging. It is possible to change this behavior in the PLC Settings tab. Change the setting “Always update variables” to “Enabled1” or “Enabled2”. Changing this behavior will make debugging easier. However, the performance will be worse as data will be copied that is not used; therefore this setting is not recommended if high performance is needed.

Application for I/O handling:

**PLC settings**

Update IO while in stop

Behaviour for outputs in Stop:  ...

Always update variables:

**Bus cycle options**

Bus cycle task:

**Additional settings**

Generate force variables for IO mapping     Enable Diagnosis for devices

Show I/O warnings as errors

### 3.5. CrossFire SX I/O list

Below, all I/O of CrossFire SX will be described

#### in1-in16

The 16 inputs of the CrossFire SX are accessible through the in1-in16 channels. The value available here depends on the input configuration.

Mode	Nominal Range	Comment
Not Used	0	
0-5V	0-5000mV	
0-10V	0-10000mV	
0-32V	0-32000mV	
4-20mA	0-20000uA	
Digital	0,1	
Encoder	0-16777215steps (24-bit)	For encoder inputs the value must be read as the combined value from both inputs used. The value has 24-bit resolution. LSB will be located at the lowest port number, MSB at the highest port number.
Frequency	0-20000Hz	

Note that the values read might be slightly above the nominal range.

#### Out\_status1-out\_status16

The outputs of CrossFire SX have a number of built in protection functions. It is possible to read the status of the 16 outputs of the CrossFire SX through the out\_status1-out\_status16 parameters. The following status is available:

Parameter	Nominal Range	Comment
Current Feedback	0-4000mA	The current sourced by the port. Mainly used for PWMi but can also be used in the other modes.
Current Feedback STM32	-	Only to be used by CrossControl
Status Bits	bit 0: Short to GND bit 1: Reserved bit 2: Reserved bit 3: Thermal warning bit 4: Charge pump under-voltage lockout bit 5: Over current bit 6: Reserved bit 7: Reserved	Status bits indicating different errors on the port.
Duty Cycle	0-1000 (0-100% in 0.1% steps)	The duty cycle feedback if PWM mode is used
Frequency	0-20000Hz	The frequency feedback if PWM mode is used
Digital	0,1	Mainly used in digital mode but can also be used in other modes

The Short to GND, Change pump under voltage lockout and Over current errors will shut down the output. Use the `retry_after_output_failure` parameter to activate the output again. Thermal warning error is just an indication; port will not be shut down automatically. It is not recommended to use output for longer periods with thermal warning bit active.

Please note that all the above status is measured values and might differ slightly from the expected value. It is recommended to test the feedback functions in a real world application. The values read might be slightly above the nominal range.

### **hbridge\_status1-hbridge\_status2**

Status information for the two H-bridge outputs

Status is a bitmask and can be a combination of the following:

Bit 0: current limiting is active (motor is still running but motor current is reduced by the drive-circuit)

Bit 1: general fault indication from drive circuit

Bit 2: over current on high side

### **VOLTAGE\_...**

The supply voltages supervised on the CrossFire SX board

VOLTAGE_UOGA	The voltage on output group A
VOLTAGE_UOGB	The voltage on output group B
VOLTAGE_VCOMP	The voltage supply for the comparators used by digital inputs.
VOLTAGE_3V0	3.0V reference voltage used for current regulation.
VOLTAGE_2V8	2.8V supply used as digital threshold level
VOLTAGE_6V5	6.5V supply used to power sensor supply voltage tracking regulator.
VOLTAGE_SENSORSUPPLY5V	Sensor supply output voltage 0-42.5V range.
VOLTAGE_5V14	5.14V supply for TMS570 AD-converter analog rail (this is not VREF)
VOLTAGE_ADC_SENSOR_HIRES	Sensor supply output voltage 0-8.33V range.

To make it easier for the programmer, a bit mask indicating voltage errors are available in the `voltage_error` parameter. The exact voltages can be interesting for debug or logging purposes but is not needed to detect voltage errors.

### **OGA\_HB\_HS, OGA\_HB\_LS, OGB\_HB\_HS, OGB\_HB\_LS**

These parameters contain the current (in mA) going through the two H-bridges. Note that this value is only accurate at 100% duty cycle so this value is mainly intended to see if a connected motor is running or not. There are two values available, one for low side (GND) and one for high side (VBAT).

OGA_HB_HS	Current for H-bridge 1 on high side
OGA_HB_LS	Current for H-bridge 1 on low side
OGB_HB_HS	Current for H-bridge 2 on high side
OGB_HB_LS	Current for H-bridge 2 on low side

### **TEMP\_...**

There are four temperature sensors on the CrossFire SX board. They are available through these feedback signals. Values read are in degrees Celsius. Values might be negative.

TEMP_OGA	Temperature in output group A
TEMP_OGB	Temperature in output group B
TEMP_POWERIN	Temperature in the power stage
TEMP_STM32	Temperature on the current control processors

The over\_temp bitmask is also available to make it easier to detect temperature errors. The actual temperatures are mainly interesting for debug or logging purposes.

### node\_id\_pins

Returns the node id from the four node-id pins. These digital inputs are intended to set the CANopen node id but can also be used for other purposes.

These pins are also used by the CANopen bootloader to decide which node id will be used during software upgrade. The node id from the node id pins can be overridden in software. If writing a non-zero value to FRAM, the value from FRAM will be used instead.

CANopen Node ID	A3	A2	A1	A0
1	0	0	0	0
2	0	0	0	1
3	0	0	1	0
4	0	0	1	1
....				
16	1	1	1	1

- State 0 is reached by wiring corresponding ID pin to GND.
- State 1 is reached by leaving corresponding ID pin disconnected.
- Note, if no pins have been connected to GND then the Node ID will be set to 16.

### watchdog\_status

This parameter returns the status of the external watchdog.

Bit 0-3 contains the following:

Value	Status
0	WATCHDOG_STAND_BY_STATE
3	WATCHDOG_RESET_STATE
4	WATCHDOG_SAFE_STATE
5	WATCHDOG_ACTIVE_STATE
7	WATCHDOG_DIAG_STATE

During normal operation the watchdog will be in WATCHDOG\_ACTIVE\_STATE state.

Bit 7: contains a flag telling if the idle task watchdog has expired. The idle task watchdog will expire if the idle task is not run as expected. This usually means the system is over loaded or the idle task watchdog time is too low.

### fw\_upgrade\_pin

This parameter returns the status of the firmware upgrade pin. This pin is mainly used by the boot loader to decide if it should stay in boot mode but can also be read from application. 0 means pin is set to GND, 1 means pin is set to VBAT.

### system\_versions

This parameter returns the versions of the different software parts of the system. The version numbers are read as 32-bit hex values. For instance 1.0.1.0 is encoded as 0x01000100

Boot_Version	Version of boot loader
CODESYS_RT_Version	Version of CODESYS runtime
STM32_OGA_Version	Version in current control processor for output group A
STM32_OGB_Version	Version in current control processor for output group B

### voltage\_error

This parameter indicates a problem with the supply voltages on the CrossFire SX. There are five voltages that are supervised. In case of an error on any of them, the corresponding bit will be set in the bitmask. Note that also voltages not supervised are available in the bitmask. It is also possible to read the exact voltage using the VOLTAGE\_... channels.

Bit	Voltage	Supervised
0	ADC_3V_AD	Yes
1	ADC_UOGA	No
2	ADC_VCOMP	Yes
3	ADC_REF_TEMP	No
4	ADC_6V5	No
5	ADC_UOGB	No
6	ADC_SENSOR	No
7	ADC_2V8_REF	Yes
8	ADC_5V14_AD	Yes
9	ADC_SENSOR_HIRES	Yes

The CrossFire SX will NOT be automatically shut down in case of errors of any of these. It is highly recommended that the application programmer reads this status bits and takes appropriate action in case of error.

### over\_current\_4\_20

The inputs are switched off in case of over current in 4-20mA mode. Over current is detected at roughly 25mA. This bit mask contains which inputs have been switched off. A switched off input is indicated with a '1' and a working input is indicated by '0'. The inputs will be switched on again automatically after 300ms. If there is still over current they will be switched off again.

### unit\_status

This parameter returns generic unit status information

- Bit 0: Over temperature has been detected and outputs has been shut off.

- Bit1: Error reading temp sensor 1
- Bit2: Error reading temp sensor 2
- Bit3: Error reading temp sensor 3
- Bit4: Error reading temp sensor 4
- Bit5: Error when setting input configuration. All inputs have been shut off.

Bit 0 is set if over temperature has been detected. Over temperature is calculated as a combination of all temperature sensors. If this happens, outputs will be shut off automatically. Outputs can only be enabled again by sending the restart command or restarting the unit.

Bit 1-4 is set if the corresponding temperature sensor cannot be read due to some hardware or software error. The user must decide if it is better to continue running or shut down in this case. No automatic shutdown will be performed.

Bit 5 indicates an error in the circuits controlling the input modes. If this is detected all inputs are automatically shut off and will return 0.

### **node\_id\_can0\_read**

At start up the node-id read from FRAM can be read here. It is recommended to copy this value to an internal variable the first loop turn. This new variable can be mapped to the corresponding output parameter and can be changed when desired causing the new value to be stored into FRAM.

### **baudrate\_can0\_read**

At start up the baudrate read from FRAM can be read here. It is recommended to copy this value to an internal variable the first loop turn. This new variable can be mapped to the corresponding output parameter and can be changed when desired causing the new value to be stored into FRAM.

### **production\_test\_result**

Only to be used by CrossControl.

### **production\_test\_done**

Only to be used by CrossControl.

### **out1-out16**

These channels are used to control the outputs of the CrossFire SX. How the value is used depends on the mode of the output.

Mode	Range
Not used	-
PWM	0-1000 (0-100% in 0.1% steps)
PWMi	0-4000mA for 4A outputs, 0-2000mA for 2A outputs
Digital	0,1

## hbridge1-hbridge2

These channels control the two H-bridges. The H-bridge always operates at 20 kHz PWM frequency.

Parameter	Range
Direction	0: stop 1: forward 2: backward 3: brake
Speed	0-1000 (0-100% in 0.1% steps)

## status\_led\_control

Controls the red/green status LED.

Value	Color
0	Off
1	Green
2	Red
3	Amber (red + green)

## retry\_after\_output\_failure

This is a bitmask where each of the 16 outputs uses one bit. Setting a bit to 1 clears the errors of the corresponding output. It is necessary to set the bit back to 0 to be able to clear the error again.

## supply\_shutoff

For safety reasons it is possible to shut of the supply voltages to Output Group A (OGA), Output Group B (OGB) and sensor supply. Setting a bit to '1' shuts off the output group. This can be done if the user application detects a severe error and tries to shut of an output but through the feedback channels can see that this fails. Then the complete group can be switched off instead.

bit 0: Shut off Group A

bit 1: Shut off Group B

bit 2: Shut of Sensor Supply

## reset\_encoder

This is a bitmask used to reset the encoder value. Bit 0 corresponds to port 1 and 2, bit 1 corresponds to port 3 and 4 and so on. This parameter must be set back to 0 to be able to reset encoder again.

## baudrate\_can0\_write

The value supplied here will be stored to FRAM. This value will be used by the boot loader in case of a software upgrade. It is possible to read the value stored the next boot.

## node\_id\_can0\_write

The value supplied here will be stored to FRAM. This value will be used by the boot loader in case of a software upgrade. It is possible to read the value stored the next boot.

**idletask\_watchdogtime**

This parameter sets the watchdog time for supervising the idle task. Default value is 80ms. This value can be increased if the idle task is expected to run very slow or decreased if faster switch off time is required.

**calibration**

Only to be used by CrossControl.

**soft\_restart\_node**

Setting this parameter to 0x1234 performs a soft restart of the CrossFire SX. All port setting changes will take effect and output errors are cleared. It is necessary to set the value back to 0 before a new soft restart can be performed.

**production\_test\_command**

Only to be used by CrossControl.

**in\_config1...in\_config16**

Configuration of input 1-16. All inputs have the same configuration possibilities. The following settings are available:

Setting	Values
Mode	0 = Not Used 1 = 0-5V 2 = 0-10V 3 = 0-32V 4 = 4-20mA 5 = Digital 6 = Encoder 7 = Frequency
Bias	0 = No Bias 1 = Pull Up 2 = Pull Down

For encoder mode two inputs must be combined. Only adjacent ports may be combined, for instance port 1 and port 2 or port 3 and port 4.

It is not possible to change port settings after the first PLC cycle. In case this is needed, the `soft_restart_node` command must be used.

**out\_config1...out\_config16**

Configuration of output 1-16. The following settings are available:

Setting	Values	Comment
Mode	0 = Not used 1 = PWM 2 = PWMi 3 = Digital	



PWM Frequency	50-400Hz	
Dither Frequency	25-400Hz in predefined steps	
Dither Amplitude	0-400mA	
P	0-5000	
I	0-100	
D	-	Not used - Reserved
A	0-255	Soft start parameter A, read system manual for more information
B	0-255	Soft start parameter B, read system manual for more information

PID parameters can be changed to optimize current control (PWMi) for specific valves. In most cases this is not needed.

Output 1,2,9,10 are rated for 4A. The other outputs are rated for 2A. The 4A outputs are designed to be able to drive capacitive load like LED lamps. The 2A outputs can drive some capacitive load but with limitations. Over current detection level is roughly 2200mA for 2A outputs and 5000mA for 4A outputs. Read the system manual for more information.

Note that it is not possible to change port settings after the first PLC cycle. In case this is needed, the `soft_restart_node` command must be used.

### **hbridge\_config1...hbridge\_config2**

Configuration of H-bridge 1 and 2.

The H-bridge has two outputs. Depending on if forward or backward command is given, output A is connected to low side (LS) and output B to high side (HS) or vice versa. In case of the brake command, both outputs are connected to LS.

It is possible to set two current limits for the H-bridge. One is measured on LS and one on HS. If the LS current limit is exceeded, the current is limited but not shut off. If the current limit on HS is exceeded the output is turned off. It is recommended to set the current limit on HS higher than the LS limit. The HS limit is mainly intended to protect against short circuit between HS and GND. The LS limit is mainly intended to reduce inrush current.

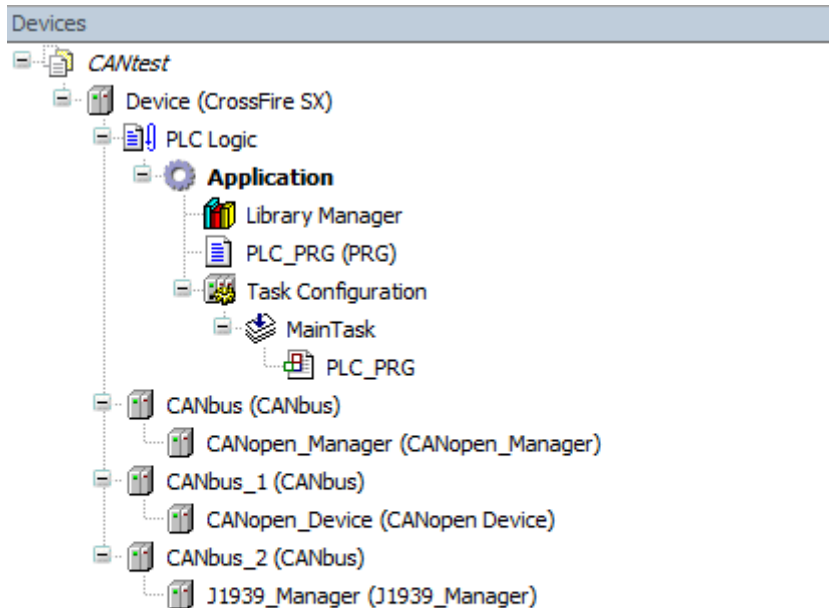
It is recommended to use both outputs from the H-bridge (not connecting directly to GND) to get full protection and current limitation.

Current Limit LS	0-20000	mA
Current Limit HS	0-25000	mA

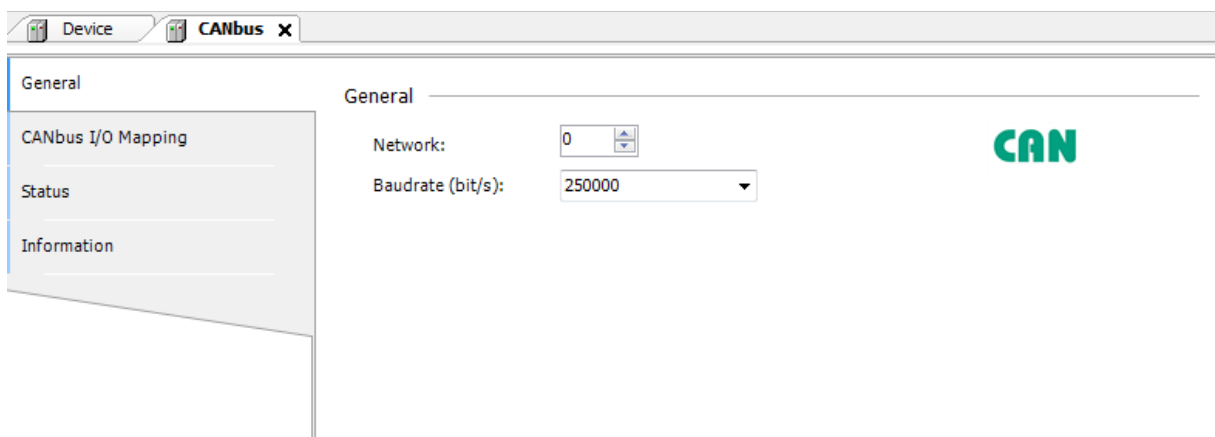
### **3.6. Accessing the CAN bus**

CrossFire SX supports three CAN buses. The user can add up to three CAN bus devices to the CODESYS device tree. All three CAN buses are individually configurable regarding baud rate, node-id (if applicable) and bus protocol.

The CANo bus is also used by the boot-loader. The baud rate and nod-id used by the bootloader is programmable through the IO device.



The Network and Baudrate can be set in the CANbus settings dialog. Network 0 corresponds to CAN1, network 1 to CAN2 and network 2 to CAN3. The Baudrate can be hard coded by selecting the Baudrate in the menu. For CAN1 (network 0) It is also possible to select “Use current setting”. In case “Use current setting” is used the Baudrate is read from FRAM at start up. For the other CAN buses this setting will have no effect. To write the desired value to FRAM, the baudrate\_cano IO parameter in the IO driver is used. The reason for having this special handling for CAN0 is that CAN0 is also used by the boot loader.



### 3.7. Debugging in CODESYS

To make it easier to debug an application, the built in CODEYS debugger can be used. From the debug menu it is possible to set breakpoints and step in the code. It is also possible to right click in the left edge of the code editor to set breakpoints.

It is also possible to force variable values from the I/O mapping dialog.

### 3.8. Creating a boot project

When downloading an application to the CrossFire SX, it is automatically stored to flash memory. There is no need to create a boot project as on for instance Linux based systems.

### 3.9. Retain memory

CrossFire SX has a built in retain memory of 640 bytes. Retains will be automatically stored to FRAM by a low priority background task, so it is necessary to not overload the system to make this work. To make sure that variables are located in the retain segment, they should be declared with the VAR RETAIN keywords.

To make sure that the retain memory is not made corrupt at a sudden power loss; a double buffering algorithm is used. This means that if a sudden power loss happens, only the latest changes will be lost.

The retain memory is protected by a crc checksum checked at start up. If the checksum is not correct, the retain memory will be cleared. It is recommended that the user application uses a magic byte or checksum to be able to detect a cleared persistent memory and to set default values for all variables stored in retain memory.

Writing retains is a relatively slow operation. Only values that have been changed will be written. It is therefore recommended to not change variables located in retain memory continuously if not necessary. It is also recommended to not put variables in retain memory that does not need to be there. The FRAM can handle almost unlimited writes so the risk of corrupting the FRAM by writing to much is minimal.

### 3.10. Task configuration

CrossFire SX supports two cyclic tasks and three freewheeling tasks up to a total of four tasks. Cyclic tasks are executed by a timer at a very precise interval. Cyclic tasks also have a configurable priority and might abort each other if a higher priority cyclic task needs to run. Freewheeling tasks execute when there is no cyclic task to execute.

It is very important to configure the tasks in a correct way to get good performance and not to overload the processor. Make sure to not load the processor to 100% by your own tasks as there is also background job that needs to be done. Background job mainly consists of writing persistent data to FRAM but also to perform internal diagnostics of the unit. The CODESYS task monitor is very good to be able to see how the tasks execute on the target.

To make sure that your tasks perform well, it is recommended to use the CODEYS watchdog to supervise your tasks. By doing this you can take appropriate action if your tasks are blocked or is not running as fast as expected. Appropriate action might be to send an emergency CAN message or shut down the outputs.

There is also a watchdog supervising that the background task gets to run (idle task watchdog). This watchdog is also adjustable by the user through the IO driver.

The min cycle time that is possible to set for a cyclic task is 10ms.

## Technical Support

Contact your reseller or supplier for help with possible problems with your CrossFire™ SX. In order to get the best help, you should have access to your CrossFire™ SX and be prepared with the following information before you contact support.

- Part number and serial number of the unit, which you find on the brand label
- Date of purchase, which is found on the invoice
- Installed software versions
- The conditions and circumstances under which the problem arises
- LED indicator colors and blink patterns
- EMCY object error codes (if possible)
- Description of external equipment which is connected to the CrossFire™ SX

## Trade Mark, etc.

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