

Yocto-Maxi-IO-V2

User's guide

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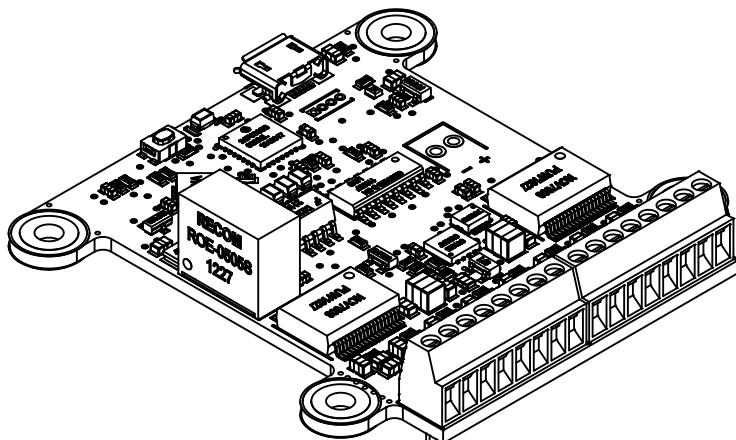
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1. Introduction

The Yocto-Maxi-IO-V2 is a 57x58mm electronic module that provides 8 digital inputs/outputs (I/Os), electrically isolated from the USB bus. Each I/O bit can be configured individually as a simple input, an open-drain input (internal pull-up), a TTL/CMOS-like output or an open-drain output (open collector).

Without external power source, each I/O pin can receive or produce a digital signal at 3V or 5V levels (low current). With an external power source, the device can work with voltages up to 28V and deliver up to 250mA per channel, which makes it possible to drive small relays for instance.



The Yocto-Maxi-IO-V2 module

The Yocto-Maxi-IO-V2 is not in itself a complete product. It is a component intended to be integrated into a solution used in laboratory equipments, or in industrial process-control equipments, or for similar applications in domestic and commercial environments. In order to use it, you must at least install it in a protective enclosure and connect it to a host computer.

Yoctopuce thanks you for buying this Yocto-Maxi-IO-V2 and sincerely hopes that you will be satisfied with it. The Yoctopuce engineers have put a large amount of effort to ensure that your Yocto-Maxi-IO-V2 is easy to install anywhere and easy to drive from a maximum of programming languages. If you are nevertheless disappointed with this module, or if you need additional information, do not hesitate to contact Yoctopuce support:

E-mail address:

support@yoctopuce.com

Web site:

www.yoctopuce.com

Postal address:

Chemin des Journaliers, 1

ZIP code, city:	1236 Cartigny
Country:	Switzerland

1.1. Safety Information

The Yocto-Maxi-IO-V2 is designed to meet the requirements of IEC 61010-1:2010 safety standard. It does not create any serious hazards to the operator and surrounding area, even in single fault condition, as long as it is integrated and used according to the instructions contained in this documentation, and in this section in particular.

Protective enclosure

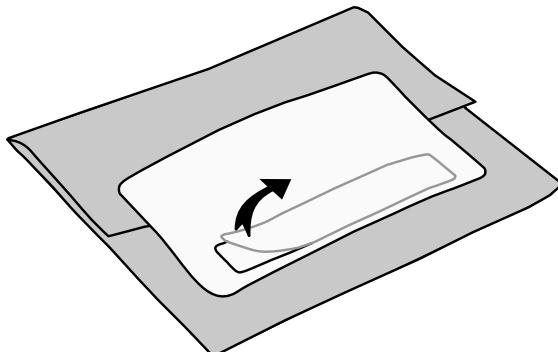
The Yocto-Maxi-IO-V2 should not be used without a protective enclosure, because of the accessible bare electronic components. For optimal safety, it should be put into a non-metallic, non-inflammable enclosure, resistant to a mechanical stress level of 5 J. For instance, use a polycarbonate (e.g. LEXAN) enclosure rated IK08 with a IEC 60695-11-10 flammability rating of V-1 or better. Using a lower quality enclosure may require specific warnings for the operator and/or compromise conformity with the safety standard.

Maintenance

If a damage is observed on the electronic board or on the enclosure, it should be replaced in order to ensure continued safety of the equipment, and to prevent damaging other parts of the system due to overload that a short circuit could cause.

Identification

In order to ease the maintenance and the identification of risks during maintenance, you should affixate the water-resistant identification label provided together with the electronic board as close as possible to the device. If the device is put in a dedicated enclosure, the identification label should be affixated on the outside of the enclosure. This label is resistant to humidity, and can hand rubbing with a piece of cloth soaked with water.



Identification label is integrated in the package label.

Application

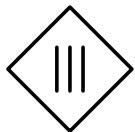
The safety standard applied is intended to cover laboratory equipment, industrial process-control equipment and similar applications in residential or commercial environment. If you intend to use the Yocto-Maxi-IO-V2 for another kind of application, you should check the safety regulations according to the standard applicable to your application.

In particular, the Yocto-Maxi-IO-V2 is *not* certified for use in medical environments or for life-support applications.

Environment

The Yocto-Maxi-IO-V2 is *not* certified for use in hazardous locations, explosive environments, or life-threatening applications. Environmental ratings are provided below.

IEC 61140 Protection Class III



The Yocto-Maxi-IO-V2 has been designed to work with safety extra-low voltages only. Do not exceed voltages indicated in this manual, and never connect to the Yocto-Maxi-IO-V2 terminal blocks any wire that could be connected to the mains.

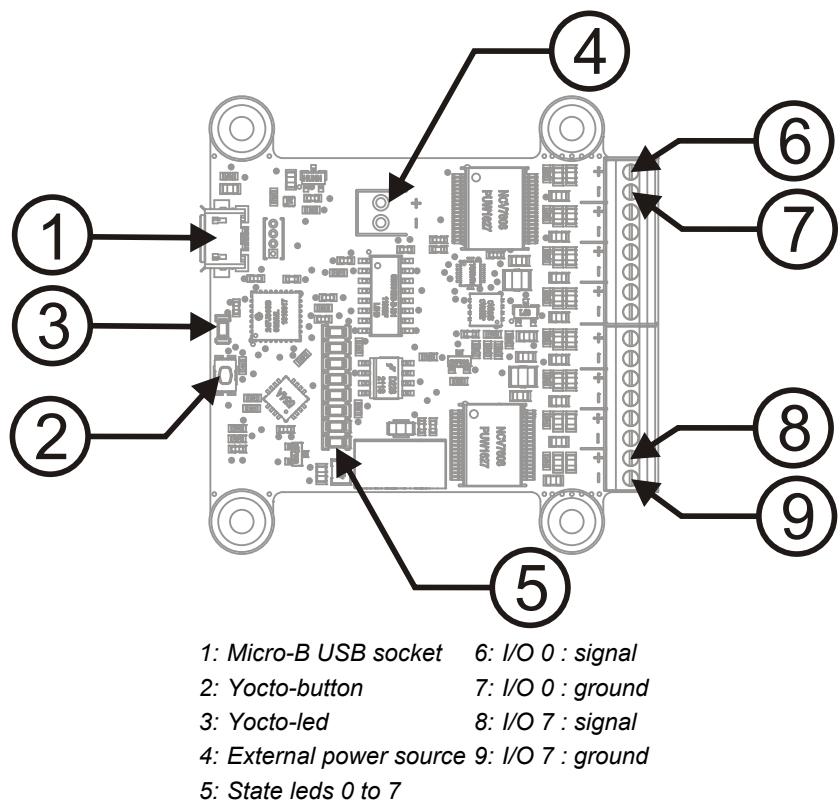
1.2. Environmental conditions

Yoctopuce devices have been designed for indoor use in a standard office or laboratory environment (IEC 60664 *pollution degree 2*): air pollution is expected to be limited and mainly non-conductive. Relative humidity is expected to be between 10% and 90% RH, non condensing. Use in environments with significant solid pollution or conductive pollution requires a protection from such pollution using an IP67 or IP68 enclosure. The products are designed for use up to altitude 2000m.

All Yoctopuce devices are warranted to perform according to their documentation and technical specifications under normal temperature conditions according to IEC61010-1, i.e. 5°C to 40°C. In addition, most devices can also be used on an extended temperature range, where some limitations may apply from case to case.

The extended operating temperature range for the Yocto-Maxi-IO-V2 is -30...85°C. This temperature range has been determined based on components manufacturer recommendations, and on controlled environment tests performed during a limited duration (1h). If you plan to use the Yocto-Maxi-IO-V2 in harsh environments for a long period of time, we strongly advise you to run extensive tests before going to production.

2. Presentation



2.1. Common elements

All Yocto-modules share a number of common functionalities.

USB connector

Yoctopuce modules all come with a USB 2.0 micro-B socket. Warning: the USB connector is simply soldered in surface and can be pulled out if the USB plug acts as a lever. In this case, if the tracks stayed in position, the connector can be soldered back with a good iron and using flux to avoid bridges. Alternatively, you can solder a USB cable directly in the 1.27mm-spaced holes near the connector.

If you plan to use a power source other than a standard USB host port to power the device through the USB connector, that power source must respect the assigned values of USB 2.0 specifications:

- **Voltage min.:** 4.75 V DC
- **Voltage max.:** 5.25 V DC
- **Over-current protection:** 5.0 A max.

A higher voltage is likely to destroy the device. The behaviour with a lower voltage is not specified, but it can result in firmware corruption.

Yocto-button

The Yocto-button has two functionalities. First, it can activate the Yocto-beacon mode (see below under Yocto-led). Second, if you plug in a Yocto-module while keeping this button pressed, you can then reprogram its firmware with a new version. Note that there is a simpler UI-based method to update the firmware, but this one works even in case of severely damaged firmware.

Yocto-led

Normally, the Yocto-led is used to indicate that the module is working smoothly. The Yocto-led then emits a low blue light which varies slowly, mimicking breathing. The Yocto-led stops breathing when the module is not communicating any more, as for instance when powered by a USB hub which is disconnected from any active computer.

When you press the Yocto-button, the Yocto-led switches to Yocto-beacon mode. It starts flashing faster with a stronger light, in order to facilitate the localization of a module when you have several identical ones. It is indeed possible to trigger off the Yocto-beacon by software, as it is possible to detect by software that a Yocto-beacon is on.

The Yocto-led has a third functionality, which is less pleasant: when the internal software which controls the module encounters a fatal error, the Yocto-led starts emitting an SOS in Morse¹. If this happens, unplug and re-plug the module. If it happens again, check that the module contains the latest version of the firmware, and, if it is the case, contact Yoctopuce support².

Current sensor

Each Yocto-module is able to measure its own current consumption on the USB bus. Current supply on a USB bus being quite critical, this functionality can be of great help. You can only view the current consumption of a module by software.

Serial number

Each Yocto-module has a unique serial number assigned to it at the factory. For Yocto-Maxi-IO-V2 modules, this number starts with MAXIO02. The module can be software driven using this serial number. The serial number cannot be modified.

Logical name

The logical name is similar to the serial number: it is a supposedly unique character string which allows you to reference your module by software. However, in the opposite of the serial number, the logical name can be modified at will. The benefit is to enable you to build several copies of the same project without needing to modify the driving software. You only need to program the same logical name in each copy. Warning: the behavior of a project becomes unpredictable when it contains several modules with the same logical name and when the driving software tries to access one of these modules through its logical name. When leaving the factory, modules do not have an assigned logical name. It is yours to define.

¹ short-short-short long-long-long short-short-short

² support@yoctopuce.com

2.2. Specific elements

The I/O terminal

For each of the eight I/Os, there are two studs on the I/O terminal, one for the signal and the other for ground. Beware, ground is common to the eight channels, which means that the eight ground studs are connected together. Make particularly sure to not inverse signal and ground when doing the connections.

The input/output circuit is a safety extra low voltage (SELV) circuit. It should not be presented with voltages exceeding 28V, nor connected to mains circuits.

The Yocto-Maxi-IO-V2 endurance to surge and lightning transients has not been tested. If you intend to use the Yocto-Maxi-IO-V2 with wires longer than 30m or running outside, you should perform this testing yourself (see IEC 61000-4-5).

Active state leds

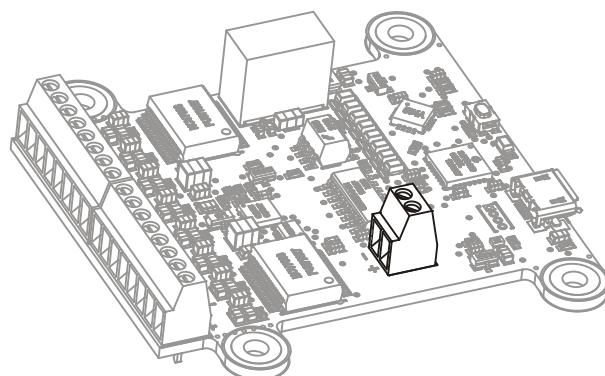
For each I/O, there is a green led, lighted when the logical level of the corresponding I/O is at 1.

External power source terminal

The Yocto-Maxi-IO-V2 can power its I/Os with 3V or 5V (taken from the USB bus), but it can also work with higher voltages: indeed, it supports up to 28V, for both input and output. But this voltage must then be provided by an external power supply connected to the external power supply port.

Caution: when the selected power source is 3V or 5V taken from the USB bus, this voltage will also appear on the external power supply port. You can use it to power a very low power external digital circuit, but be aware that the total current budget for this and all output channels is 100mA only.

The module is designed so that you can solder the external power source cable directly on the module. However, you can use a terminal³ to make your project easier to disassemble.



You can solder on the board a terminal for the external power source.

The external power circuit is a safety extra low voltage (SELV) circuit. It should not be presented with voltages exceeding 28V, nor connected to mains circuits.

2.3. Limitation

When powered only by the USB bus, the Yocto-Maxi-IO-V2 can only be used for purely digital communications (logical levels, for example CMOS or TTL). Be aware of the following limitations:

- The device can only source 100mA in total when powered by the USB bus.
- When the selected voltage is 5V, the effective voltage is actually approximately 4.8V, or even less when the USB bus voltage is below 5V.

³ For example, the MPT 0.5/2-2,54 terminal from [Phoenix Contact](#).

- For digital inputs, the threshold between 0 and 1 is around 2V, regardless of the supply voltage. Depending on environmental conditions, the threshold may vary +/-1V.
- For open-drain 3V input, it is required to add an external pull-up.

If you need to drive higher current, or to use a different voltage, for instance to drive a relay, you should provide an external power supply. With an external power supply, each channel can drive up to 28V and 250mA (output impedance: approx 10 Ohms).

2.4. Functional isolation

The Yocto-Maxi-IO-V2 is designed as two distinct electrical circuits, separated by a functional isolation. This isolation plays no role for the operator safety, since both circuits of the Yocto-Maxi-IO-V2 work with safety extra low voltages (SELV) and are accessible without risk at any time. The isolation has been added in excess of safety requirements, to improve the reliability and the ease of use of the Yocto-Maxi-IO-V2, allowing both circuits to work with different reference grounds.

Although the isolation plays no role for security, it has been designed according to the rules that would apply for a supplementary isolation on a secondary circuit. Its specifications of the functional isolation are as follows⁴:

- **Isolation voltage⁵**: 1kV
- **Clearance distance**: 1mm
- **Creepage distance**: 1mm
- **Material group**: Cat IIIa (FR4)

There is no electrical isolation between the four inputs/outputs of the Yocto-Maxi-IO-V2, and they all share the same signaling voltage. If you connect multiple appliances to the same Yocto-Maxi-IO-V2, make sure they share the same ground and the same signaling voltage.

2.5. Optional accessories

The accessories below are not necessary to use the Yocto-Maxi-IO-V2 module but might be useful depending on your project. These are mostly common products that you can buy from your favorite hacking store. To save you the tedious job of looking for them, most of them are also available on the Yoctopuce shop.

Screws and spacers

In order to mount the Yocto-Maxi-IO-V2 module, you can put small screws in the 3mm assembly holes, with a screw head no larger than 8mm. The best way is to use threaded spacers, which you can then mount wherever you want. You can find more details on this topic in the chapter about assembly and connections.

Micro-USB hub

If you intend to put several Yoctopuce modules in a very small space, you can connect them directly to a micro-USB hub. Yoctopuce builds a USB hub particularly small for this purpose (down to 20mmx36mm), on which you can directly solder a USB cable instead of using a USB plug. For more details, see the micro-USB hub information sheet.

YoctoHub-Ethernet, YoctoHub-Wireless and YoctoHub-GSM

You can add network connectivity to your Yocto-Maxi-IO-V2, thanks to the YoctoHub-Ethernet, the YoctoHub-Wireless and the YoctoHub-GSM which provides respectively Ethernet, WiFi and GSM connectivity. All of them can drive up to three devices and behave exactly like a regular computer running a *VirtualHub*.

⁴ This description of the isolation applies to the latest revision of the product. Earlier revisions of the product might have smaller clearance and creepage distance. In order to get the clearance and creepage distance for an older device, contact Yoctopuce support and provide either the serial number of the device or the purchase reference.

⁵ Nominal value, not tested

1.27mm (or 1.25mm) connectors

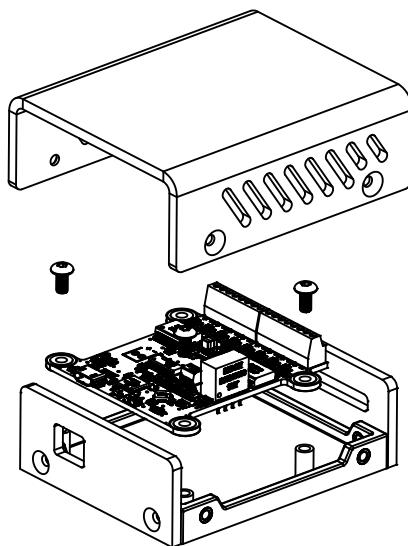
In case you wish to connect your Yocto-Maxi-IO-V2 to a Micro-hub USB or a YoctoHub without using a bulky USB connector, you can use the four 1.27mm pads just behind the USB connector. There are two options.

You can mount the Yocto-Maxi-IO-V2 directly on the hub using screw and spacers, and connect it using 1.27mm board-to-board connectors. To prevent shortcuts, it is best to solder the female connector on the hub and the male connector on the Yocto-Maxi-IO-V2.

You can also use a small 4-wires cable with a 1.27mm connector. 1.25mm works as well, it does not make a difference for 4 pins. This makes it possible to move the device a few inches away. Don't put it too far away if you use that type of cable, because as the cable is not shielded, it may cause undesirable electromagnetic emissions.

Enclosure

Your Yocto-Maxi-IO-V2 has been designed to be installed as is in your project. Nevertheless, Yoctopuce sells enclosures specifically designed for Yoctopuce devices. More details are available on the Yoctopuce web site⁶. The suggested enclosure model for your Yocto-Maxi-IO-V2 is the YoctoBox-MaxiIO-Transp.



You can install your Yocto-Maxi-IO-V2 in an optional enclosure

⁶ <http://www.yoctopuce.com/EN/products/category/enclosures>

3. First steps

By design, all Yoctopuce modules are driven the same way. Therefore, user's guides for all the modules of the range are very similar. If you have already carefully read through the user's guide of another Yoctopuce module, you can jump directly to the description of the module functions.

3.1. Prerequisites

In order to use your Yocto-Maxi-IO-V2 module, you should have the following items at hand.

A computer

Yoctopuce modules are intended to be driven by a computer (or possibly an embedded microprocessor). You will write the control software yourself, according to your needs, using the information provided in this manual.

Yoctopuce provides software libraries to drive its modules for the following operating systems: Windows, macOS X, Linux, and Android. Yoctopuce modules do not require installing any specific system driver, as they leverage the standard HID driver¹ provided with every operating system.

Windows versions currently supported are: Windows XP, Windows 2003, Windows Vista, Windows 7, Windows 8 and Windows 10. Both 32 bit and 64 bit versions are supported. The programming library is also available for the Universal Windows Platform (UWP), which is supported by all flavors of Windows 10, including Windows 10 IoT. Yoctopuce is frequently testing its modules on Windows 7 and Windows 10.

MacOS versions currently supported are: Mac OS X 10.9 (Maverick), 10.10 (Yosemite), 10.11 (El Capitan), macOS 10.12 (Sierra), macOS 10.13 (High Sierra) and macOS 10.14 (Mojave). Yoctopuce is frequently testing its modules on macOS 10.14.

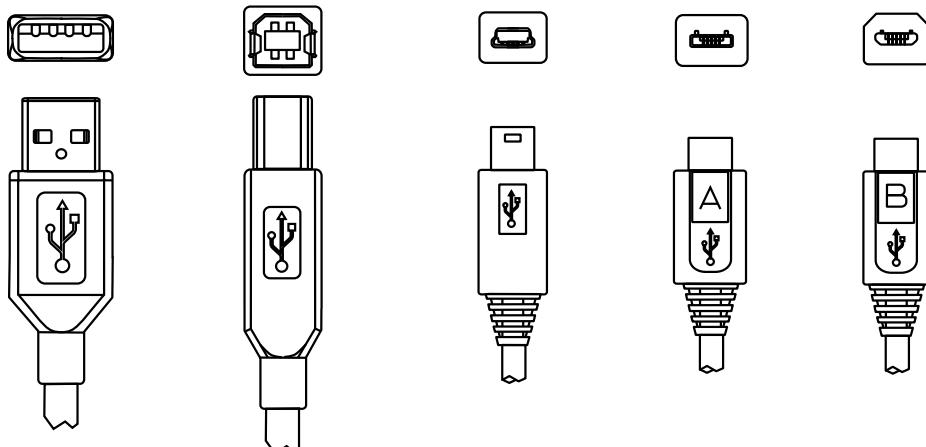
Linux kernels currently supported are the 2.6 branch, the 3.x branch and the 4.x branch. Other versions of the Linux kernel, and even other UNIX variants, are very likely to work as well, as Linux support is implemented through the standard **libusb** API. Yoctopuce is frequently testing its modules on Linux kernel 4.15 (Ubuntu 18.04 LTS).

Android versions currently supported are: Android 3.1 and later. Moreover, it is necessary for the tablet or phone to support the *Host USB* mode. Yoctopuce is frequently testing its modules on Android 7.x on a Samsung Galaxy A6 with the Java for Android library.

¹ The HID driver is the one that takes care of the mouse, the keyboard, etc.

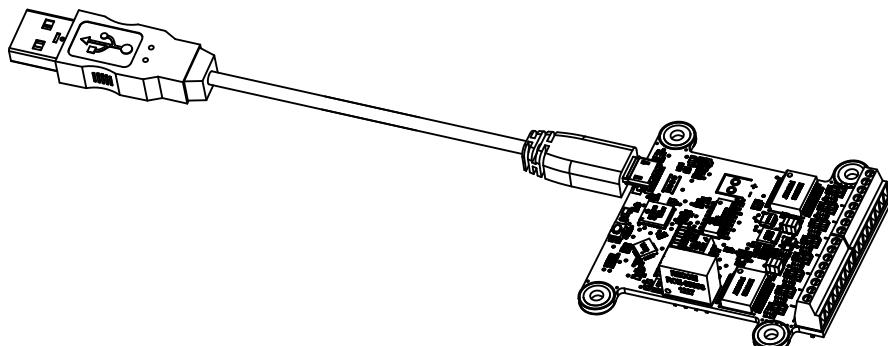
A USB 2.0 cable, type A-micro B

USB 2.0 connectors exist in three sizes: the "standard" size that you probably use to connect your printer, the very common mini size to connect small devices, and finally the micro size often used to connect mobile phones, as long as they do not exhibit an apple logo. All USB modules manufactured by Yoctopuce use micro size connectors.



The most common USB 2.0 connectors: A, B, Mini B, Micro A, Micro B²

To connect your Yocto-Maxi-IO-V2 module to a computer, you need a USB 2.0 cable of type A-micro B. The price of this cable may vary a lot depending on the source, look for it under the name *USB 2.0 A to micro B Data cable*. Make sure not to buy a simple USB charging cable without data connectivity. The correct type of cable is available on the Yoctopuce shop.



You must plug in your Yocto-Maxi-IO-V2 module with a USB 2.0 cable of type A - micro B

If you insert a USB hub between the computer and the Yocto-Maxi-IO-V2 module, make sure to take into account the USB current limits. If you do not, be prepared to face unstable behaviors and unpredictable failures. You can find more details on this topic in the chapter about assembly and connections.

3.2. Testing USB connectivity

At this point, your Yocto-Maxi-IO-V2 should be connected to your computer, which should have recognized it. It is time to make it work.

Go to the Yoctopuce web site and download the *Virtual Hub* software³. It is available for Windows, Linux, and Mac OS X. Normally, the Virtual Hub software serves as an abstraction layer for languages which cannot access the hardware layers of your computer. However, it also offers a succinct interface to configure your modules and to test their basic functions. You access this interface with a simple web browser⁴. Start the *Virtual Hub* software in a command line, open your

² Although they existed for some time, Mini A connectors are not available anymore http://www.usb.org/developers/Deprecation_Announcement_052507.pdf

³ www.yoctopuce.com/EN/virtualhub.php

⁴ The interface is tested on Chrome, FireFox, Safari, Edge et IE 11.

preferred web browser and enter the URL <http://127.0.0.1:4444>. The list of the Yoctopuce modules connected to your computer is displayed.

Serial	Logical Name	Description	Action
VIRTHUB0-1521ca755	VirtualHub		configure view log file
MAXIIO02-90E10	Yocto-Maxi-IO-V2		configure view log file beacon

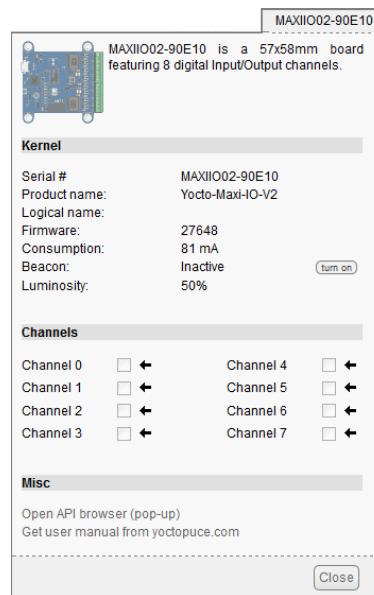
Module list as displayed in your web browser

3.3. Localization

You can then physically localize each of the displayed modules by clicking on the **beacon** button. This puts the Yocto-led of the corresponding module in Yocto-beacon mode. It starts flashing, which allows you to easily localize it. The second effect is to display a little blue circle on the screen. You obtain the same behavior when pressing the Yocto-button of the module.

3.4. Test of the module

The first item to check is that your module is working well: click on the serial number corresponding to your module. This displays a window summarizing the properties of your Yocto-Maxi-IO-V2.

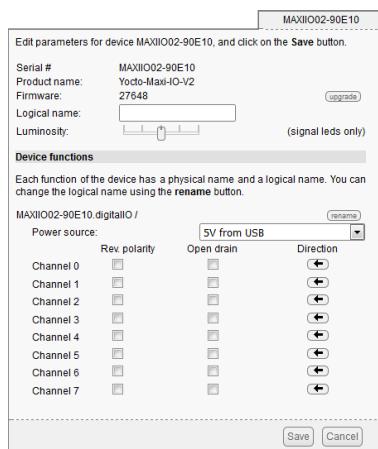


Properties of the Yocto-Maxi-IO-V2 module

This window allows you, among other things, to test the inputs/outputs of the module. For channels configured as inputs, the selected boxes correspond to the logical level 1. You can modify the logical level of the outputs by selecting the corresponding boxes.

3.5. Configuration

When, in the module list, you click on the **configure** button corresponding to your module, the configuration window is displayed.



Yocto-Maxi-IO-V2 module configuration.

Firmware

The module firmware can easily be updated with the help of the interface. Firmware destined for Yoctopuce modules are available as .byn files and can be downloaded from the Yoctopuce web site.

To update a firmware, simply click on the **upgrade** button on the configuration window and follow the instructions. If the update fails for one reason or another, unplug and re-plug the module and start the update process again. This solves the issue in most cases. If the module was unplugged while it was being reprogrammed, it does probably not work anymore and is not listed in the interface. However, it is always possible to reprogram the module correctly by using the *Virtual Hub* software⁵ in command line⁶.

Logical name of the module

The logical name is a name that you choose, which allows you to access your module, in the same way a file name allows you to access its content. A logical name has a maximum length of 19 characters. Authorized characters are A..Z, a..z, 0..9, _, and -. If you assign the same logical name to two modules connected to the same computer and you try to access one of them through this logical name, behavior is undetermined: you have no way of knowing which of the two modules answers.

Luminosity

This parameter allows you to act on the maximal intensity of the leds of the module. This enables you, if necessary, to make it a little more discreet, while limiting its power consumption. Note that this parameter acts on all the signposting leds of the module, including the Yocto-led. If you connect a module and no led turns on, it may mean that its luminosity was set to zero.

Logical names of functions

Each Yoctopuce module has a serial number and a logical name. In the same way, each function on each Yoctopuce module has a hardware name and a logical name, the latter can be freely chosen by the user. Using logical names for functions provides a greater flexibility when programming modules.

I/O configuration

The only function of the Yocto-Maxi-IO-V2 is *DigitalIO*, corresponding to the eight I/Os. Each I/O can work in one of four distinct modes:

- **Simple input:** The Yocto-Maxi-IO-V2 simply measures the voltage between the ground and the corresponding input. If the voltage is below 2V, the logical level of the input stays 0. From 2V, the logical level changes to 1.

⁵ www.yoctopuce.com/EN/virtualhub.php

⁶ More information available in the virtual hub documentation

- **Open drain input:** The Yocto-Maxi-IO-V2 provides a median voltage to the "signal" stud and detects whether an external device connects the signal to the ground. This enables you, among other things, to read the state of a simple switch connected directly between signal and ground. The logical level stays at 1 as long as the signal voltage stays above 2V. Grounding the signal (voltage below 2V) makes the logical level go to 0.
- **Simple output:** The Yocto-Maxi-IO-V2 provides the corresponding output with a voltage reflecting its logical level.
- **Open drain output:** It is the mirror image of the open drain input. An external device provides a voltage on the signal stud. If the logical level of the output goes to zero, the Yocto-Maxi-IO-V2 grounds the signal (with an impedance smaller than 10 Ohm). It is up to the external device to detect the corresponding voltage drop.

The configuration is saved in the flash memory of the Yocto-Maxi-IO-V2. This means that it resists shutdown. The Yocto-Maxi-IO-V2 is delivered with its eight channels configured in simple input mode.

Reverse logic

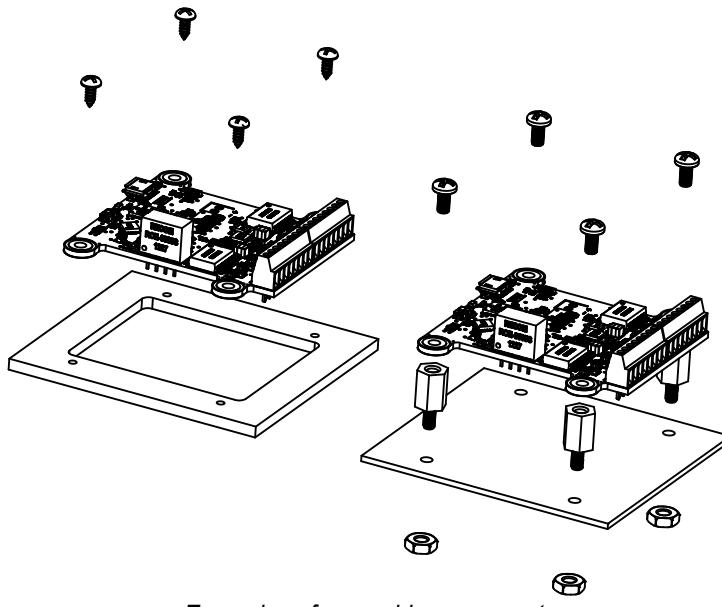
Each I/O can work in reverse mode: the logical level is simply reversed compared to the standard mode. This functionality is particularly useful for the pulse function. It enables you to perform reverse pulses.

4. Assembly and connections

This chapter provides important information regarding the use of the Yocto-Maxi-IO-V2 module in real-world situations. Make sure to read it carefully before going too far into your project if you want to avoid pitfalls.

4.1. Fixing

While developing your project, you can simply let the module hang at the end of its cable. Check only that it does not come in contact with any conducting material (such as your tools). When your project is almost at an end, you need to find a way for your modules to stop moving around.



Examples of assembly on supports

The Yocto-Maxi-IO-V2 module contains 3mm assembly holes. You can use these holes for screws. The screw head diameter must not be larger than 8mm or they will damage the module circuits. Make sure that the lower surface of the module is not in contact with the support. We recommend using spacers, but other methods are possible. Nothing prevents you from fixing the module with a glue gun; it will not be good-looking, but it will hold.

4.2. USB power distribution

Although USB means *Universal Serial BUS*, USB devices are not physically organized as a flat bus but as a tree, using point-to-point connections. This has consequences on power distribution: to make it simple, every USB port must supply power to all devices directly or indirectly connected to it. And USB puts some limits.

In theory, a USB port provides 100mA, and may provide up to 500mA if available and requested by the device. In the case of a hub without external power supply, 100mA are available for the hub itself, and the hub should distribute no more than 100mA to each of its ports. This is it, and this is not much. In particular, it means that in theory, it is not possible to connect USB devices through two cascaded hubs without external power supply. In order to cascade hubs, it is necessary to use self-powered USB hubs, that provide a full 500mA to each support.

In practice, USB would not have been as successful if it was really so picky about power distribution. As it happens, most USB hub manufacturers have been doing savings by not implementing current limitation on ports: they simply connect the computer power supply to every port, and declare themselves as *self-powered hub* even when they are taking all their power from the USB bus (in order to prevent any power consumption check in the operating system). This looks a bit dirty, but given the fact that computer USB ports are usually well protected by a hardware current limitation around 2000mA, it actually works in every day life, and seldom makes hardware damage.

What you should remember: if you connect Yoctopuce modules through one, or more, USB hub without external power supply, you have no safe-guard and you depend entirely on your computer manufacturer attention to provide as much current as possible on the USB ports, and to detect overloads before they lead to problems or to hardware damages. When modules are not provided enough current, they may work erratically and create unpredictable bugs. If you want to prevent any risk, do not cascade hubs without external power supply, and do not connect peripherals requiring more than 100mA behind a bus-powered hub.

In order to help you controlling and planning overall power consumption for your project, all Yoctopuce modules include a built-in current sensor that indicates (with 5mA precision) the consumption of the module on the USB bus.

Note also that the USB cable itself may also cause power supply issues, in particular when the wires are too thin or when the cable is too long¹. Good cables are usually made using AWG 26 or AWG 28 wires for data lines and AWG 24 wires for power.

4.3. Electromagnetic compatibility (EMI)

Connection methods to integrate the Yocto-Maxi-IO-V2 obviously have an impact on the system overall electromagnetic emissions, and therefore also impact the conformity with international standards.

When we perform reference measurements to validate the conformity of our products with IEC CISPR 11, we do not use any enclosure but connect the devices using a shielded USB cable, compliant with USB 2.0 specifications: the cable shield is connected to both connector shells, and the total resistance from shell to shell is under 0.6Ω . The USB cable length is 3m, in order to expose one meter horizontally, one meter vertically and keep the last meter close to the host computer within a ferrite bead.

If you use a non-shielded USB cable, or an improperly shielded cable, your system will work perfectly well but you may not remain in conformity with the emission standard. If you are building a system made of multiple devices connected using 1.27mm pitch connectors, or with a sensor moved away from the device CPU, you can generally recover the conformity by using a metallic enclosure acting as an external shield.

¹ www.yoctopuce.com/EN/article/usb-cables-size-matters

Still on the topic of electromagnetic compatibility, the maximum supported length of the USB cable is 3m. In addition to the voltage drop issue mentionned above, using longer wires would require to run extra tests to assert compatibility with the electromagnetic immunity standards.

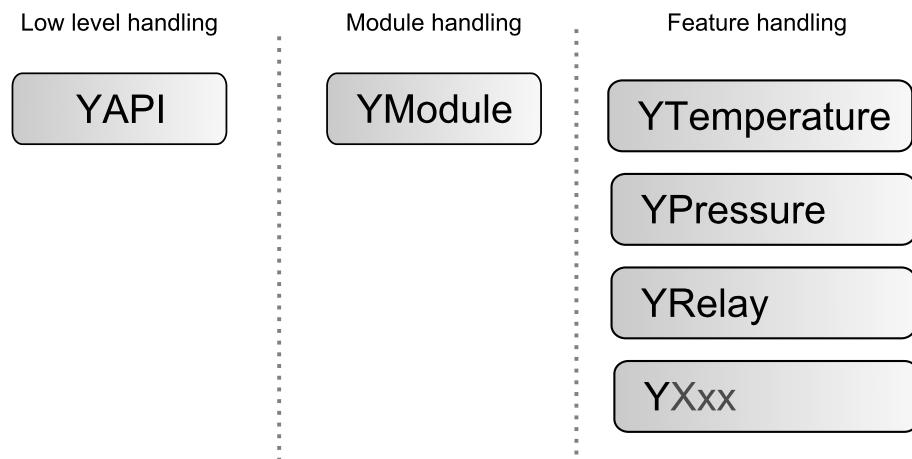
5. Programming, general concepts

The Yoctopuce API was designed to be at the same time simple to use and sufficiently generic for the concepts used to be valid for all the modules in the Yoctopuce range, and this in all the available programming languages. Therefore, when you have understood how to drive your Yocto-Maxi-IO-V2 with your favorite programming language, learning to use another module, even with a different language, will most likely take you only a minimum of time.

5.1. Programming paradigm

The Yoctopuce API is object oriented. However, for simplicity's sake, only the basics of object programming were used. Even if you are not familiar with object programming, it is unlikely that this will be a hinderance for using Yoctopuce products. Note that you will never need to allocate or deallocate an object linked to the Yoctopuce API: it is automatically managed.

There is one class per Yoctopuce function type. The name of these classes always starts with a Y followed by the name of the function, for example `YTemperature`, `YRelay`, `YPressure`, etc.. There is also a `YModule` class, dedicated to managing the modules themselves, and finally there is the static `YAPI` class, that supervises the global workings of the API and manages low level communications.



Structure of the Yoctopuce API.

The `YSensor` class

Each Yoctopuce sensor function has its dedicated class: `YTemperature` to measure the temperature, `YVoltage` to measure a voltage, `YRelay` to drive a relay, etc. However there is a special class that can do more: `YSensor`.

The YSensor class is the parent class for all Yoctopuce sensors, and can provide access to any sensor, regardless of its type. It includes methods to access all common functions. This makes it easier to create applications that use many different sensors. Moreover, if you create an application based on YSensor, it will work with all Yoctopuce sensors, even those which do not yet exist.

Programmation

In the Yoctopuce API, priority was put on the ease of access to the module functions by offering the possibility to make abstractions of the modules implementing them. Therefore, it is quite possible to work with a set of functions without ever knowing exactly which module are hosting them at the hardware level. This tremendously simplifies programming projects with a large number of modules.

From the programming stand point, your Yocto-Maxi-IO-V2 is viewed as a module hosting a given number of functions. In the API, these functions are objects which can be found independently, in several ways.

Access to the functions of a module

Access by logical name

Each function can be assigned an arbitrary and persistent logical name: this logical name is stored in the flash memory of the module, even if this module is disconnected. An object corresponding to an Xxx function to which a logical name has been assigned can then be directly found with this logical name and the YXxx.FindXxx method. Note however that a logical name must be unique among all the connected modules.

Access by enumeration

You can enumerate all the functions of the same type on all the connected modules with the help of the classic enumeration functions *FirstXxx* and *nextXxxx* available for each YXxx class.

Access by hardware name

Each module function has a hardware name, assigned at the factory and which cannot be modified. The functions of a module can also be found directly with this hardware name and the YXxx.FindXxx function of the corresponding class.

Difference between *Find* and *First*

The YXxx.FindXxxx and YXxx.FirstXxxx methods do not work exactly the same way. If there is no available module, YXxx.FirstXxxx returns a null value. On the opposite, even if there is no corresponding module, YXxx.FindXxxx returns a valid object, which is not online but which could become so if the corresponding module is later connected.

Function handling

When the object corresponding to a function is found, its methods are available in a classic way. Note that most of these subfunctions require the module hosting the function to be connected in order to be handled. This is generally not guaranteed, as a USB module can be disconnected after the control software has started. The *isOnline* method, available in all the classes, is then very helpful.

Access to the modules

Even if it is perfectly possible to build a complete project while making a total abstraction of which function is hosted on which module, the modules themselves are also accessible from the API. In fact, they can be handled in a way quite similar to the functions. They are assigned a serial number at the factory which allows you to find the corresponding object with *YModule.Find()*. You can also assign arbitrary logical names to the modules to make finding them easier. Finally, the *YModule* class contains the *YModule.FirstModule()* and *nextModule()* enumeration methods allowing you to list the connected modules.

Functions/Module interaction

From the API standpoint, the modules and their functions are strongly uncorrelated by design. Nevertheless, the API provides the possibility to go from one to the other. Thus, the `get_module()` method, available for each function class, allows you to find the object corresponding to the module hosting this function. Inversely, the `YModule` class provides several methods allowing you to enumerate the functions available on a module.

5.2. The Yocto-Maxi-IO-V2 module

The Yocto-Maxi-IO-V2 module provides a single instance of the `DigitalIO` function, where each bit maps to one of the eight input/outputs present on the module.

module : Module

attribute	type	modifiable ?
productName	String	read-only
serialNumber	String	read-only
logicalName	String	modifiable
productId	Hexadecimal number	read-only
productRelease	Hexadecimal number	read-only
firmwareRelease	String	read-only
persistentSettings	Enumerated	modifiable
luminosity	0..100%	modifiable
beacon	On/Off	modifiable
upTime	Time	read-only
usbCurrent	Used current (mA)	read-only
rebootCountdown	Integer	modifiable
userVar	Integer	modifiable

digitalIO : DigitalIO

attribute	type	modifiable ?
logicalName	String	modifiable
advertisedValue	String	modifiable
portState	Bitfield	modifiable
portDirection	Bitfield	modifiable
portOpenDrain	Bitfield	modifiable
portPolarity	Bitfield	modifiable
portDiags	DigitalIO port error bits	read-only
portSize	Integer	read-only
outputVoltage	Enumerated	modifiable
command	String	modifiable

5.3. Module

Global parameters control interface for all Yoctopuce devices

The `YModule` class can be used with all Yoctopuce USB devices. It can be used to control the module global parameters, and to enumerate the functions provided by each module.

productName

Character string containing the commercial name of the module, as set by the factory.

serialNumber

Character string containing the serial number, unique and programmed at the factory. For a Yocto-Maxi-IO-V2 module, this serial number always starts with MAXIIO02. You can use the serial number to access a given module by software.

logicalName

Character string containing the logical name of the module, initially empty. This attribute can be modified at will by the user. Once initialized to a non-empty value, it can be used to access a given module. If two modules with the same logical name are in the same project, there is no way to determine which one answers when one tries accessing by logical name. The logical name is limited to 19 characters among A..Z,a..z,0..9,_, and -.

productId

USB device identifier of the module, preprogrammed to 121 at the factory.

productRelease

Release number of the module hardware, preprogrammed at the factory. The original hardware release returns value 1, revision B returns value 2, etc.

firmwareRelease

Release version of the embedded firmware, changes each time the embedded software is updated.

persistentSettings

State of persistent module settings: loaded from flash memory, modified by the user or saved to flash memory.

luminosity

Lighting strength of the informative leds (e.g. the Yocto-Led) contained in the module. It is an integer value which varies between 0 (LEDs turned off) and 100 (maximum led intensity). The default value is 50. To change the strength of the module LEDs, or to turn them off completely, you only need to change this value.

beacon

Activity of the localization beacon of the module.

upTime

Time elapsed since the last time the module was powered on.

usbCurrent

Current consumed by the module on the USB bus, in milli-amps.

rebootCountdown

Countdown to use for triggering a reboot of the module.

userVar

32bit integer variable available for user storage.

5.4. DigitalIO

digital IO port control interface, available for instance in the Yocto-IO or the Yocto-Maxi-IO-V2

The `YDigitalIO` class allows you drive a Yoctopuce digital input/output port. It can be used to setup the direction of each channel, to read the state of each channel and to switch the state of each channel configures as an output. You can work on all channels at once, or one by one. Most functions use a binary representation for channels where bit 0 matches channel #0 , bit 1 matches channel #1 and so on. If you are not familiar with numbers binary representation, you will find more information here: https://en.wikipedia.org/wiki/Binary_number#Representation. It is also possible to automatically generate short pulses of

a determined duration. Electrical behavior of each I/O can be modified (open drain and reverse polarity).

logicalName

Character string containing the logical name of the digital IO port, initially empty. This attribute can be modified at will by the user. Once initialized to an non-empty value, it can be used to access the digital IO port directly. If two digital IO ports with the same logical name are used in the same project, there is no way to determine which one answers when one tries accessing by logical name. The logical name is limited to 19 characters among A..Z,a..z,0..9,_, and -.

advertisedValue

Short character string summarizing the current state of the digital IO port, that is automatically advertised up to the parent hub. For a digital IO port, the advertised value is the port state, in hexadecimal.

portState

Digital IO port state: bit 0 represents input 0, and so on.

portDirection

IO direction of each bit of the port. 0 makes a bit an input, 1 makes it an output. By default, all bits are configured as input.

portOpenDrain

Electrical interface for each bit of the port. 0 makes a bit a regular input/output, 1 makes it an open-drain (open-collector) input/output.

portPolarity

Polarity inversion for each bit of the port. Bits set to 1 reverse the I/O working.

portDiags

Port state diagnostics (Yocto-IO and Yocto-MaxiO-V2 only). Bit 0 indicates a shortcut on output 0, etc. Bit 8 indicates a power failure, and bit 9 signals overheating (overcurrent). During normal use, all diagnostic bits should stay clear.

portSize

Number of bits implemented in the I/O port.

outputVoltage

Voltage source used to drive output bits.

command

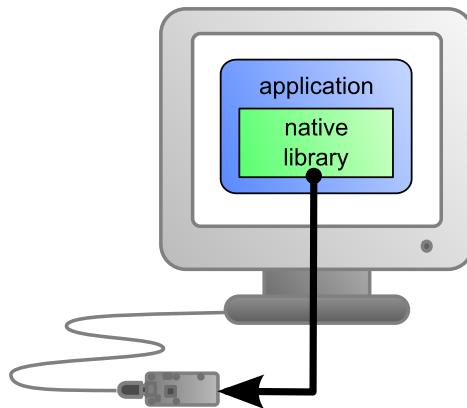
Magic attribute used to send a command to the I/O port. If a command is not interpreted as expected, check the device logs.

5.5. What interface: Native, DLL or Service ?

There are several methods to control your Yoctopuce module by software.

Native control

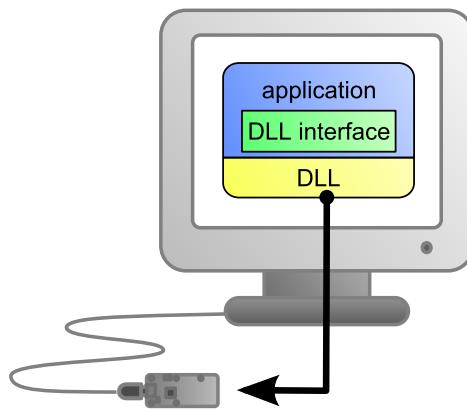
In this case, the software driving your project is compiled directly with a library which provides control of the modules. Objectively, it is the simplest and most elegant solution for the end user. The end user then only needs to plug the USB cable and run your software for everything to work. Unfortunately, this method is not always available or even possible.



The application uses the native library to control the locally connected module

Native control by DLL

Here, the main part of the code controlling the modules is located in a DLL. The software is compiled with a small library which provides control of the DLL. It is the fastest method to code module support in a given language. Indeed, the "useful" part of the control code is located in the DLL which is the same for all languages: the effort to support a new language is limited to coding the small library which controls the DLL. From the end user stand point, there are few differences: one must simply make sure that the DLL is installed on the end user's computer at the same time as the main software.

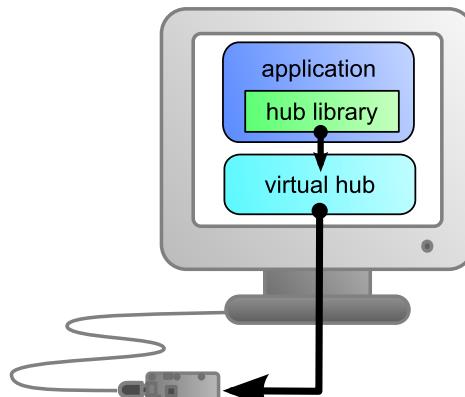


The application uses the DLL to natively control the locally connected module

Control by service

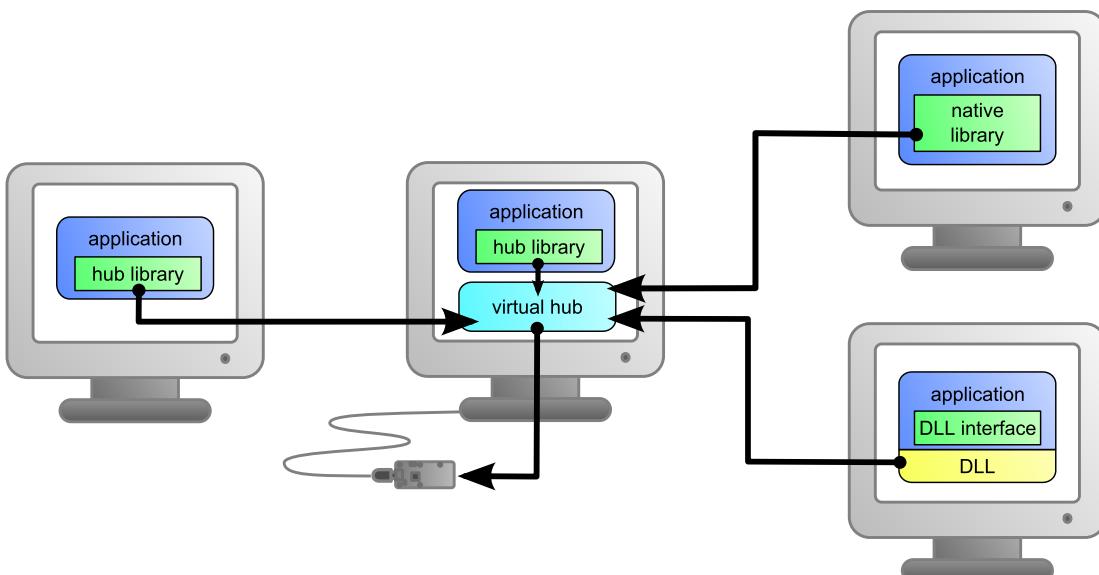
Some languages do simply not allow you to easily gain access to the hardware layers of the machine. It is the case for Javascript, for instance. To deal with this case, Yoctopuce provides a solution in the form of a small piece of software called *VirtualHub*¹. It can access the modules, and your application only needs to use a library which offers all necessary functions to control the modules via this VirtualHub. The end users will have to start the VirtualHub before running the project control software itself, unless they decide to install the hub as a service/deamon, in which case the VirtualHub starts automatically when the machine starts up.

¹ www.yoctopuce.com/EN/virtualhub.php



The application connects itself to the VirtualHub to gain access to the module

The service control method comes with a non-negligible advantage: the application does not need to run on the machine on which the modules are connected. The application can very well be located on another machine which connects itself to the service to drive the modules. Moreover, the native libraries and DLL mentioned above are also able to connect themselves remotely to one or several machines running VirtualHub.



When a VirtualHub is used, the control application does not need to reside on the same machine as the module.

Whatever the selected programming language and the control paradigm used, programming itself stays strictly identical. From one language to another, functions bear exactly the same name, and have the same parameters. The only differences are linked to the constraints of the languages themselves.

Language	Native	Native with DLL	VirtualHub
Command line	✓	-	✓
Python	-	✓	✓
C++	✓	✓	✓
C# .Net	-	✓	✓
C# UWP	✓	-	✓
LabVIEW	-	✓	✓
Java	-	✓	✓
Java for Android	✓	-	✓
TypeScript	-	-	✓
JavaScript / ECMAScript	-	-	✓
PHP	-	-	✓
VisualBasic .Net	-	✓	✓
Delphi	-	✓	✓
Objective-C	✓	-	✓

Support methods for different languages

Limitations of the Yoctopuce libraries

Natives et DLL libraries have a technical limitation. On the same computer, you cannot concurrently run several applications accessing Yoctopuce devices directly. If you want to run several projects on the same computer, make sure your control applications use Yoctopuce devices through a *VirtualHub* software. The modification is trivial: it is just a matter of parameter change in the `yRegisterHub()` call.

5.6. High-level or low-level API ?

Depending on your needs and your preferences, it is possible to use the Yoctopuce programming library using high-level functions or low-level functions.

High-level functions refer to functions and objects specialized for each module, including methods providing explicit access to each function and attribute.

Low-level functions refer to very generic functions providing device-independent access to modules, but that do not provide any abstraction on top to access the individual functions and attributes.

The main advantage of using high-level functions is that they make it possible to write code that is generally simpler and less error-prone². The price to pay for this code simplification is that you need to read the documentation of these functions and classes in order to use them. This is the information that you find in the next chapters.

The advantage of low-level functions is that they allow experienced developers to quickly implement specific tasks without relying too much on a third-party library. In the case of Yoctopuce modules, providing a REST API, it is even possible to entirely bypass Yoctopuce software libraries and communicate directly by HTTP with the modules. You can find more details on these low-level functions and on their use in a separate document available shortly on the Yoctopuce web site.

² Another advantage of Yoctopuce high-level functions is that they are almost portable from one language to the other, since the Yoctopuce library uses as much as possible the same function names, class names and constant names for all languages.

6. Using the Yocto-Maxi-IO-V2 in command line

When you want to perform a punctual operation on your Yocto-Maxi-IO-V2, such as reading a value, assigning a logical name, and so on, you can obviously use the Virtual Hub, but there is a simpler, faster, and more efficient method: the command line API.

The command line API is a set of executables, one by type of functionality offered by the range of Yoctopuce products. These executables are provided pre-compiled for all the Yoctopuce officially supported platforms/OS. Naturally, the executable sources are also provided¹.

6.1. Installing

Download the command line API². You do not need to run any setup, simply copy the executables corresponding to your platform/OS in a directory of your choice. You may add this directory to your PATH variable to be able to access these executables from anywhere. You are all set, you only need to connect your Yocto-Maxi-IO-V2, open a shell, and start working by typing for example:

```
C:\>YDigitalIO any set_portDirection 255  
C:\>YDigitalIO any set_portState 255
```

To use the command API on Linux, you need either have root privileges or to define an *udev* rule for your system. See the *Troubleshooting* chapter for more details.

6.2. Use: general description

All the command line API executables work on the same principle. They must be called the following way

```
C:\>Executable [options] [target] command [parameter]
```

[options] manage the global workings of the commands, they allow you, for instance, to pilot a module remotely through the network, or to force the module to save its configuration after executing the command.

[target] is the name of the module or of the function to which the command applies. Some very generic commands do not need a target. You can also use the aliases "any" and "all", or a list of names separated by commas without space.

¹ If you want to recompile the command line API, you also need the C++ API.

² <http://www.yoctopuce.com/EN/libraries.php>

command is the command you want to run. Almost all the functions available in the classic programming APIs are available as commands. You need to respect neither the case nor the underlined characters in the command name.

[parameters] logically are the parameters needed by the command.

At any time, the command line API executables can provide a rather detailed help. Use for instance:

```
C:\>executable /help
```

to know the list of available commands for a given command line API executable, or even:

```
C:\>executable command /help
```

to obtain a detailed description of the parameters of a command.

6.3. Control of the DigitalIO function

To control the DigitalIO function of your Yocto-Maxi-IO-V2, you need the YDigitalIO executable file.

For instance, you can launch:

```
C:\>YDigitalIO any set_portDirection 255  
C:\>YDigitalIO any set_portState 255
```

This example uses the "any" target to indicate that we want to work on the first DigitalIO function found among all those available on the connected Yoctopuce modules when running. This prevents you from having to know the exact names of your function and of your module.

But you can use logical names as well, as long as you have configured them beforehand. Let us imagine a Yocto-Maxi-IO-V2 module with the MAXIO02-123456 serial number which you have called "*MyModule*", and its digitalIO function which you have renamed "*MyFunction*". The five following calls are strictly equivalent (as long as *MyFunction* is defined only once, to avoid any ambiguity).

```
C:\>YDigitalIO MAXIO02-123456.digitalIO describe  
C:\>YDigitalIO MAXIO02-123456.MyFunction describe  
C:\>YDigitalIO MyModule.digitalIO describe  
C:\>YDigitalIO MyModule.MyFunction describe  
C:\>YDigitalIO MyFunction describe
```

To work on all the DigitalIO functions at the same time, use the "all" target.

```
C:\>YDigitalIO all describe
```

For more details on the possibilities of the YDigitalIO executable, use:

```
C:\>YDigitalIO /help
```

6.4. Control of the module part

Each module can be controlled in a similar way with the help of the YModule executable. For example, to obtain the list of all the connected modules, use:

```
C:\>YModule inventory
```

You can also use the following command to obtain an even more detailed list of the connected modules:

```
C:\>YModule all describe
```

Each `xxx` property of the module can be obtained thanks to a command of the `get_xxxx()` type, and the properties which are not read only can be modified with the `set_xxx()` command. For example:

```
C:\>YModule MAXII002-12346 set_logicalName MonPremierModule
C:\>YModule MAXII002-12346 get_logicalName
```

Changing the settings of the module

When you want to change the settings of a module, simply use the corresponding `set_xxx` command. However, this change happens only in the module RAM: if the module restarts, the changes are lost. To store them permanently, you must tell the module to save its current configuration in its nonvolatile memory. To do so, use the `saveToFlash` command. Inversely, it is possible to force the module to forget its current settings by using the `revertFromFlash` method. For example:

```
C:\>YModule MAXII002-12346 set_logicalName MonPremierModule
C:\>YModule MAXII002-12346 saveToFlash
```

Note that you can do the same thing in a single command with the `-s` option.

```
C:\>YModule -s MAXII002-12346 set_logicalName MonPremierModule
```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

6.5. Limitations

The command line API has the same limitation than the other APIs: there can be only one application at a given time which can access the modules natively. By default, the command line API works in native mode.

You can easily work around this limitation by using a Virtual Hub: run the `VirtualHub3` on the concerned machine, and use the executables of the command line API with the `-r` option. For example, if you use:

```
C:\>YModule inventory
```

you obtain a list of the modules connected by USB, using a native access. If another command which accesses the modules natively is already running, this does not work. But if you run a Virtual Hub, and you give your command in the form:

```
C:\>YModule -r 127.0.0.1 inventory
```

it works because the command is not executed natively anymore, but through the Virtual Hub. Note that the Virtual Hub counts as a native application.

³ <http://www.yoctopuce.com/EN/virtualhub.php>

7. Using the Yocto-Maxi-IO-V2 with Python

Python is an interpreted object oriented language developed by Guido van Rossum. Among its advantages is the fact that it is free, and the fact that it is available for most platforms, Windows as well as UNIX. It is an ideal language to write small scripts on a napkin. The Yoctopuce library is compatible with Python 2.6+ and 3+. It works under Windows, Mac OS X, and Linux, Intel as well as ARM. The library was tested with Python 2.6 and Python 3.2. Python interpreters are available on the Python web site¹.

7.1. Source files

The Yoctopuce library classes² for Python that you will use are provided as source files. Copy all the content of the *Sources* directory in the directory of your choice and add this directory to the *PYTHONPATH* environment variable. If you use an IDE to program in Python, refer to its documentation to configure it so that it automatically finds the API source files.

7.2. Dynamic library

A section of the low-level library is written in C, but you should not need to interact directly with it: it is provided as a DLL under Windows, as a .so files under UNIX, and as a .dylib file under Mac OS X. Everything was done to ensure the simplest possible interaction from Python: the distinct versions of the dynamic library corresponding to the distinct operating systems and architectures are stored in the *cdll* directory. The API automatically loads the correct file during its initialization. You should not have to worry about it.

If you ever need to recompile the dynamic library, its complete source code is located in the Yoctopuce C++ library.

In order to keep them simple, all the examples provided in this documentation are console applications. Naturally, the libraries function in a strictly identical manner if you integrate them in an application with a graphical interface.

7.3. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a Python code snippet to use the DigitalIO function.

¹ <http://www.python.org/download/>

² www.yoctopuce.com/EN/libraries.php

```
[...]
# Enable detection of USB devices
errmsg=YRefParam()
YAPI.RegisterHub("usb",errmsg)
[...]

# Retrieve the object used to interact with the device
digitalio = YDigitalIO.FindDigitalIO("MAXIIO02-123456.digitalIO")

# Hot-plug is easy: just check that the device is online
if digitalio.isOnline():
    # Use digitalio.set_state()
    [...]
[...]
```

Let's look at these lines in more details.

YAPI.RegisterHub

The `yAPI.RegisterHub` function initializes the Yoctopuce API and indicates where the modules should be looked for. When used with the parameter "usb", it will use the modules locally connected to the computer running the library. If the initialization does not succeed, this function returns a value different from `YAPI.SUCCESS` and `errmsg` contains the error message.

YDigitalIO.FindDigitalIO

The `YDigitalIO.FindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number *MAXIIO02-123456* which you have named "*MyModule*", and for which you have given the `digitalIO` function the name "*MyFunction*". The following five calls are strictly equivalent, as long as "*MyFunction*" is defined only once.

```
digitalio = YDigitalIO.FindDigitalIO("MAXIIO02-123456.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MAXIIO02-123456.MyFunction")
digitalio = YDigitalIO.FindDigitalIO("MyModule.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MyModule.MyFunction")
digitalio = YDigitalIO.FindDigitalIO("MyFunction")
```

`YDigitalIO.FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `YDigitalIO.FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YDigitalIO.FindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Launch Python and open the corresponding sample script provided in the directory **Examples/Doc-GettingStarted-Yocto-Maxi-IO-V2** of the Yoctopuce library.

In this example, you will recognize the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

```
#!/usr/bin/python
# -*- coding: utf-8 -*-
import os, sys

from yocto_api import *
```

```

from yocto_digitalio import *

def usage():
    scriptname = os.path.basename(sys.argv[0])
    print("Usage:")
    print(scriptname + ' <serial_number>')
    print(scriptname + ' <logical_name>')
    print(scriptname + ' any')
    print('Example:')
    print(scriptname + ' any')
    sys.exit()

def die(msg):
    sys.exit(msg + ' (check USB cable)')

if len(sys.argv) < 2:
    usage()
target = sys.argv[1].upper()

# Setup the API to use local USB devices
errmsg = YRefParam()
if YAPI.RegisterHub("usb", errmsg) != YAPI.SUCCESS:
    sys.exit("init error" + errmsg.value)

if target == 'ANY':
    # retreive any Relay then find its serial #
    io = YDigitalIO.FirstDigitalIO()
    if io is None:
        die('No module connected')
    m = io.get_module()
    target = m.get_serialNumber()

print('using ' + target)
io = YDigitalIO.FindDigitalIO(target + '.digitalIO')

if not (io.isOnline()):
    die('device not connected')

# lets configure the channels direction
# bits 0..3 as output
# bits 4..7 as input
io.set_portDirection(0x0F)
io.set_portPolarity(0)  # polarity set to regular
io.set_portOpenDrain(0) # No open drain

print("Channels 0..3 are configured as outputs and channels 4..7")
print("are configured as inputs, you can connect some inputs to ")
print("outputs and see what happens")

outputdata = 0
while io.isOnline():
    inputdata = io.getPortState() # read port values
    line = "" # display port state value as binary
    for i in range(0, 8):
        if (inputdata & (128 >> i)) > 0:
            line += '1'
        else:
            line += '0'
    print(" port value = " + line)
    outputdata = (outputdata + 1) % 16 # cycle ouput 0..15
    io.set_portState(outputdata) # We could have used set_bitState as well
    YAPI.Sleep(1000, errmsg)

print("Module disconnected")
YAPI.FreeAPI()

```

7.4. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

#!/usr/bin/python
# -*- coding: utf-8 -*-
import os, sys

from yocto_api import *

def usage():
    sys.exit("usage: demo <serial or logical name> [ON/OFF]")

errmsg = YRefParam()
if YAPI.RegisterHub("usb", errmsg) != YAPI.SUCCESS:
    sys.exit("RegisterHub error: " + str(errmsg))

if len(sys.argv) < 2:
    usage()

m = YModule.FindModule(sys.argv[1]) # use serial or logical name

if m.isOnline():
    if len(sys.argv) > 2:
        if sys.argv[2].upper() == "ON":
            m.set_beacon(YModule.BEACON_ON)
        if sys.argv[2].upper() == "OFF":
            m.set_beacon(YModule.BEACON_OFF)

        print("serial:      " + m.get_serialNumber())
        print("logical name: " + m.get_logicalName())
        print("luminosity:   " + str(m.get_luminosity()))
        if m.get_beacon() == YModule.BEACON_ON:
            print("beacon:      ON")
        else:
            print("beacon:      OFF")
        print("upTime:       " + str(m.get_upTime() / 1000) + " sec")
        print("USB current:  " + str(m.get_usbCurrent()) + " mA")
        print("logs:\n" + m.get_lastLogs())
    else:
        print(sys.argv[1] + " not connected (check identification and USB cable)")
YAPI.FreeAPI()

```

Each property `xxxx` of the module can be read thanks to a method of type `YModule.get_xxxx()`, and properties which are not read-only can be modified with the help of the `YModule.set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `YModule.set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `YModule.saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `YModule.revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```

#!/usr/bin/python
# -*- coding: utf-8 -*-
import os, sys

from yocto_api import *

def usage():
    sys.exit("usage: demo <serial or logical name> <new logical name>")

if len(sys.argv) != 3:
    usage()

errmsg = YRefParam()
if YAPI.RegisterHub("usb", errmsg) != YAPI.SUCCESS:
    sys.exit("RegisterHub error: " + str(errmsg))

m = YModule.FindModule(sys.argv[1]) # use serial or logical name

```

```

if m.isOnline():
    newname = sys.argv[2]
    if not YAPI.CheckLogicalName(newname):
        sys.exit("Invalid name (" + newname + ")")
    m.set_logicalName(newname)
    m.saveToFlash() # do not forget this
    print("Module: serial= " + m.get_serialNumber() + " / name= " + m.get_logicalName())
else:
    sys.exit("not connected (check identification and USB cable")
YAPI.FreeAPI()

```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `YModule.saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `YModule.yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not null. Below a short example listing the connected modules.

```

#!/usr/bin/python
# -*- coding: utf-8 -*-
import os, sys

from yocto_api import *

errmsg = YRefParam()

# Setup the API to use local USB devices
if YAPI.RegisterHub("usb", errmsg) != YAPI.SUCCESS:
    sys.exit("init error" + str(errmsg))

print('Device list')

module = YModule.FirstModule()
while module is not None:
    print(module.get_serialNumber() + ' (' + module.get_productName() + ')')
    module = module.nextModule()
YAPI.FreeAPI()

```

7.5. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.

- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value, a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the `errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

8. Using Yocto-Maxi-IO-V2 with C++

C++ is not the simplest language to master. However, if you take care to limit yourself to its essential functionalities, this language can very well be used for short programs quickly coded, and it has the advantage of being easily ported from one operating system to another. Under Windows, all the examples and the project models are tested with Microsoft Visual Studio 2010 Express, freely available on the Microsoft web site¹. Under Mac OS X, all the examples and project models are tested with XCode 4, available on the App Store. Moreover, under Max OS X and under Linux, you can compile the examples using a command line with GCC using the provided GNUmakefile. In the same manner under Windows, a Makefile allows you to compile examples using a command line, fully knowing the compilation and linking arguments.

Yoctopuce C++ libraries² are integrally provided as source files. A section of the low-level library is written in pure C, but you should not need to interact directly with it: everything was done to ensure the simplest possible interaction from C++. The library is naturally also available as binary files, so that you can link it directly if you prefer.

You will soon notice that the C++ API defines many functions which return objects. You do not need to deallocate these objects yourself, the API does it automatically at the end of the application.

In order to keep them simple, all the examples provided in this documentation are console applications. Naturally, the libraries function in a strictly identical manner if you integrate them in an application with a graphical interface. You will find in the last section of this chapter all the information needed to create a wholly new project linked with the Yoctopuce libraries.

8.1. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a C++ code snippet to use the DigitalIO function.

```
#include "yocto_api.h"
#include "yocto_digitalio.h"

[...]
// Enable detection of USB devices
String errmsg;
YAPI::RegisterHub("usb", errmsg);
[...]

// Retrieve the object used to interact with the device
```

¹ <http://www.microsoft.com/visualstudio/en-us/products/2010-editions/visual-cpp-express>

² www.yoctopuce.com/EN/libraries.php

```

YDigitalIO *digitalio;
digitalio = YDigitalIO::FindDigitalIO("MAXIO02-123456.digitalIO");

// Hot-plug is easy: just check that the device is online
if(digitalio->isOnline())
{
    // Use digitalio->set_state()
    [...]
}

```

Let's look at these lines in more details.

yocto_api.h et yocto_digitalio.h

These two include files provide access to the functions allowing you to manage Yoctopuce modules. `yocto_api.h` must always be used, `yocto_digitalio.h` is necessary to manage modules containing a digital IO port, such as Yocto-Maxi-IO-V2.

YAPI::RegisterHub

The `YAPI::RegisterHub` function initializes the Yoctopuce API and indicates where the modules should be looked for. When used with the parameter "usb", it will use the modules locally connected to the computer running the library. If the initialization does not succeed, this function returns a value different from `YAPI_SUCCESS` and `errmsg` contains the error message.

YDigitalIO::FindDigitalIO

The `YDigitalIO::FindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIO02-123456` which you have named "`MyModule`", and for which you have given the `digitalIO` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```

YDigitalIO *digitalio = YDigitalIO::FindDigitalIO("MAXIO02-123456.digitalIO");
YDigitalIO *digitalio = YDigitalIO::FindDigitalIO("MAXIO02-123456.MyFunction");
YDigitalIO *digitalio = YDigitalIO::FindDigitalIO("MyModule.digitalIO");
YDigitalIO *digitalio = YDigitalIO::FindDigitalIO("MyModule.MyFunction");
YDigitalIO *digitalio = YDigitalIO::FindDigitalIO("MyFunction");

```

`YDigitalIO::FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `YDigitalIO::FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YFindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Launch your C++ environment and open the corresponding sample project provided in the directory **Examples/Doc-GettingStarted-Yocto-Maxi-IO-V2** of the Yoctopuce library. If you prefer to work with your favorite text editor, open the file `main.cpp`, and type `make` to build the example when you are done.

In this example, you will recognize the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

```

#include "yocto_api.h"
#include "yocto_digitalio.h"
#include <iostream>

```

```

#include <ctype.h>
#include <stdlib.h>

using namespace std;

static void usage(void)
{
    cout << "usage: demo <serial_number> " << endl;
    cout << "           demo <logical_name> " << endl;
    cout << "           demo any          (use any discovered device)" << endl;
    u64 now = YAPI::GetTickCount();
    while (YAPI::GetTickCount() - now < 3000) {
        // wait 3 sec to show the message
    }
    exit(1);
}

int main(int argc, const char * argv[])
{
    string errmsg;
    string target;
    YDigitalIO *io;

    if (argc < 2) {
        usage();
    }
    target = (string) argv[1];

    // Setup the API to use local USB devices
    if (YAPI::RegisterHub("usb", errmsg) != YAPI::SUCCESS) {
        cerr << "RegisterHub error: " << errmsg << endl;
        return 1;
    }

    if (target == "any") {
        // try to find the first available digital IO feature
        io = YDigitalIO::FirstDigitalIO();
        if (io == NULL) {
            cout << "No module connected (check USB cable)" << endl;
            return 1;
        }
    } else {
        io = YDigitalIO::FindDigitalIO(target + ".digitalIO");
    }

    // make sure the device is here
    if (!io->isOnline()) {
        cout << "Module not connected (check identification and USB cable)" << endl;
        return 1;
    }

    // lets configure the channels direction
    // bits 0..3 as output
    // bits 4..7 as input

    io->set_portDirection(0x0F);
    io->set_portPolarity(0); // polarity set to regular
    io->set_portOpenDrain(0); // No open drain

    cout << "Channels 0..3 are configured as outputs and channels 4..7" << endl;
    cout << "are configred as inputs, you can connect some inputs to" << endl;
    cout << "outputs and see what happens" << endl;

    int outputdata = 0;
    while (io->isOnline()) {
        int inputdata = io->get_portState(); // read port values
        string line = ""; // display port value as binary
        for (int i = 0; i < 8; i++) {
            if (inputdata & (128 >> i))
                line = line + '1';
            else
                line = line + '0';
        }
        cout << "port value = " << line << endl;
        outputdata = (outputdata + 1) % 16; // cycle ouput 0..15
        io->set_portState(outputdata); // We could have used set_bitState as well
        YAPI::Sleep(1000, errmsg);
    }
}

```

```

cout << "Module disconnected" << endl;
YAPI::FreeAPI();
}

```

8.2. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

#include <iostream>
#include <stdlib.h>

#include "yocto_api.h"

using namespace std;

static void usage(const char *exe)
{
    cout << "usage: " << exe << " <serial or logical name> [ON/OFF]" << endl;
    exit(1);
}

int main(int argc, const char * argv[])
{
    string      errmsg;

    // Setup the API to use local USB devices
    if(YAPI::RegisterHub("usb", errmsg) != YAPI::SUCCESS) {
        cerr << "RegisterHub error: " << errmsg << endl;
        return 1;
    }

    if(argc < 2)
        usage(argv[0]);

    YModule *module = YModule::FindModule(argv[1]); // use serial or logical name

    if (module->isOnline()) {
        if (argc > 2) {
            if (string(argv[2]) == "ON")
                module->set_beacon(Y_BEACON_ON);
            else
                module->set_beacon(Y_BEACON_OFF);
        }
        cout << "serial:      " << module->get_serialNumber() << endl;
        cout << "logical name: " << module->get_logicalName() << endl;
        cout << "luminosity:   " << module->get_luminosity() << endl;
        cout << "beacon:       ";
        if (module->get_beacon() == Y_BEACON_ON)
            cout << "ON" << endl;
        else
            cout << "OFF" << endl;
        cout << "upTime:        " << module->get_upTime() / 1000 << " sec" << endl;
        cout << "USB current:   " << module->get_usbCurrent() << " mA" << endl;
        cout << "Logs:" << endl << module->get_lastLogs() << endl;
    } else {
        cout << argv[1] << " not connected (check identification and USB cable)"
            << endl;
    }
    YAPI::FreeAPI();
    return 0;
}

```

Each property `xxx` of the module can be read thanks to a method of type `get_xxxx()`, and properties which are not read-only can be modified with the help of the `set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```
#include <iostream>
#include <stdlib.h>

#include "yocto_api.h"

using namespace std;

static void usage(const char *exe)
{
    cerr << "usage: " << exe << " <serial> <newLogicalName>" << endl;
    exit(1);
}

int main(int argc, const char * argv[])
{
    string      errmsg;

    // Setup the API to use local USB devices
    if(YAPI::RegisterHub("usb", errmsg) != YAPI::SUCCESS) {
        cerr << "RegisterHub error: " << errmsg << endl;
        return 1;
    }

    if(argc < 2)
        usage(argv[0]);

    YModule *module = YModule::FindModule(argv[1]); // use serial or logical name

    if (module->isOnline()) {
        if (argc >= 3) {
            string newname = argv[2];
            if (!yCheckLogicalName(newname)) {
                cerr << "Invalid name (" << newname << ")" << endl;
                usage(argv[0]);
            }
            module->set_logicalName(newname);
            module->saveToFlash();
        }
        cout << "Current name: " << module->get_logicalName() << endl;
    } else {
        cout << argv[1] << " not connected (check identification and USB cable)"
            << endl;
    }
    YAPI::FreeAPI();
    return 0;
}
```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not NULL. Below a short example listing the connected modules.

```
#include <iostream>
```

```
#include "yocto_api.h"

using namespace std;

int main(int argc, const char * argv[])
{
    string     errmsg;
    // Setup the API to use local USB devices
    if(YAPI::RegisterHub("usb", errmsg) != YAPI::SUCCESS) {
        cerr << "RegisterHub error: " << errmsg << endl;
        return 1;
    }

    cout << "Device list: " << endl;

    YModule *module = YModule::FirstModule();
    while (module != NULL) {
        cout << module->get_serialNumber() << " ";
        cout << module->get_productName() << endl;
        module = module->nextModule();
    }
    YAPI::FreeAPI();
    return 0;
}
```

8.3. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.
- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value, a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the `errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

8.4. Integration variants for the C++ Yoctopuce library

Depending on your needs and on your preferences, you can integrate the library into your projects in several distinct manners. This section explains how to implement the different options.

Integration in source format (recommended)

Integrating all the sources of the library into your projects has several advantages:

- It guarantees the respect of the compilation conventions of your project (32/64 bits, inclusion of debugging symbols, unicode or ASCII characters, etc.);
- It facilitates debugging if you are looking for the cause of a problem linked to the Yoctopuce library;
- It reduces the dependencies on third party components, for example in the case where you would need to recompile this project for another architecture in many years;
- It does not require the installation of a dynamic library specific to Yoctopuce on the final system, everything is in the executable.

To integrate the source code, the easiest way is to simply include the `Sources` directory of your Yoctopuce library into your **IncludePath**, and to add all the files of this directory (including the sub-directory `yapi`) to your project.

For your project to build correctly, you need to link with your project the prerequisite system libraries, that is:

- For Windows: the libraries are added automatically
- For Mac OS X: **IOKit.framework** and **CoreFoundation.framework**
- For Linux: **libm**, **libpthread**, **libusb1.0**, and **libstdc++**

Integration as a static library

With the integration of the Yoctopuce library as a static library, you do not need to install a dynamic library specific to Yoctopuce, everything is in the executable.

To use the static library, you must first compile it using the shell script `build.sh` on UNIX, or `build.bat` on Windows. This script, located in the root directory of the library, detects the OS and recompiles all the corresponding libraries as well as the examples.

Then, to integrate the static Yoctopuce library to your project, you must include the `Sources` directory of the Yoctopuce library into your **IncludePath**, and add the sub-directory `Binaries/...` corresponding to your operating system into your **libPath**.

Finally, for your project to build correctly, you need to link with your project the Yoctopuce library and the prerequisite system libraries:

- For Windows: **yocto-static.lib**
- For Mac OS X: **libyocto-static.a**, **IOKit.framework**, and **CoreFoundation.framework**
- For Linux: **libyocto-static.a**, **libm**, **libpthread**, **libusb1.0**, and **libstdc++**.

Note, under Linux, if you wish to compile in command line with GCC, it is generally advisable to link system libraries as dynamic libraries, rather than as static ones. To mix static and dynamic libraries on the same command line, you must pass the following arguments:

```
gcc (...) -Wl,-Bstatic -lyocto-static -Wl,-Bdynamic -lm -lpthread -lusb-1.0 -lstdc++
```

Integration as a dynamic library

Integration of the Yoctopuce library as a dynamic library allows you to produce an executable smaller than with the two previous methods, and to possibly update this library, if a patch reveals itself necessary, without needing to recompile the source code of the application. On the other hand, it is an integration mode which systematically requires you to copy the dynamic library on the target machine where the application will run (**yocto.dll** for Windows, **libyocto.so.1.0.1** for Mac OS X and Linux).

To use the dynamic library, you must first compile it using the shell script `build.sh` on UNIX, or `build.bat` on Windows. This script, located in the root directory of the library, detects the OS and recompiles all the corresponding libraries as well as the examples.

Then, To integrate the dynamic Yoctopuce library to your project, you must include the `Sources` directory of the Yoctopuce library into your **IncludePath**, and add the sub-directory `Binaries/...` corresponding to your operating system into your **LibPath**.

Finally, for your project to build correctly, you need to link with your project the dynamic Yoctopuce library and the prerequisite system libraries:

- For Windows: **yocto.lib**
- For Mac OS X: **libyocto**, **IOKit.framework**, and **CoreFoundation.framework**
- For Linux: **libyocto**, **libm**, **lpthread**, **libusb1.0**, and **libstdc++**.

With GCC, the command line to compile is simply:

```
gcc (...) -lyocto -lm -lpthread -lusb-1.0 -lstdc++
```

9. Using Yocto-Maxi-IO-V2 with C#

C# (pronounced C-Sharp) is an object-oriented programming language promoted by Microsoft, it is somewhat similar to Java. Like Visual-Basic and Delphi, it allows you to create Windows applications quite easily. All the examples and the project models are tested with Microsoft C# 2010 Express, freely available on the Microsoft web site¹.

Our programming library is also compatible with *Mono*, the open source version of C# that also works on Linux and MacOS. You will find on our web site various articles that describe how to configure Mono to use our library.

9.1. Installation

Download the Visual C# Yoctopuce library from the Yoctopuce web site². There is no setup program, simply copy the content of the zip file into the directory of your choice. You mostly need the content of the `Sources` directory. The other directories contain the documentation and a few sample programs. All sample projects are Visual C# 2010, projects, if you are using a previous version, you may have to recreate the projects structure from scratch.

9.2. Using the Yoctopuce API in a Visual C# project

The Visual C#.NET Yoctopuce library is composed of a DLL and of source files in Visual C#. The DLL is not a .NET DLL, but a classic DLL, written in C, which manages the low level communications with the modules³. The source files in Visual C# manage the high level part of the API. Therefore, you need both this DLL and the .cs files of the `Sources` directory to create a project managing Yoctopuce modules.

Configuring a Visual C# project

The following indications are provided for Visual Studio Express 2010, but the process is similar for other versions. Start by creating your project. Then, on the *Solution Explorer* panel, right click on your project, and select "Add" and then "Add an existing item".

A file selection window opens. Select the `yocto_api.cs` file and the files corresponding to the functions of the Yoctopuce modules that your project is going to manage. If in doubt, select all the files.

¹ <http://www.microsoft.com/visualstudio/en-us/products/2010-editions/visual-csharp-express>

² www.yoctopuce.com/EN/libraries.php

³ The sources of this DLL are available in the C++ API

You then have the choice between simply adding these files to your project, or to add them as links (the **Add** button is in fact a scroll-down menu). In the first case, Visual Studio copies the selected files into your project. In the second case, Visual Studio simply keeps a link on the original files. We recommend you to use links, which makes updates of the library much easier.

Then add in the same manner the `yapi.dll` DLL, located in the `Sources/dll` directory⁴. Then, from the **Solution Explorer** window, right click on the DLL, select **Properties** and in the **Properties** panel, set the **Copy to output folder** to **always**. You are now ready to use your Yoctopuce modules from Visual Studio.

In order to keep them simple, all the examples provided in this documentation are console applications. Naturally, the libraries function in a strictly identical manner if you integrate them in an application with a graphical interface.

9.3. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a C# code snippet to use the DigitalIO function.

```
[...]
// Enable detection of USB devices
string errmsg = "";
YAPI.RegisterHub("usb", errmsg);
[...]

// Retrieve the object used to interact with the device
YDigitalIO digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO");

// Hot-plug is easy: just check that the device is online
if (digitalio.isOnline())
{
    // Use digitalio.set_state()
    [...]
}
```

Let's look at these lines in more details.

YAPI.RegisterHub

The `YAPI.RegisterHub` function initializes the Yoctopuce API and indicates where the modules should be looked for. When used with the parameter "`usb`", it will use the modules locally connected to the computer running the library. If the initialization does not succeed, this function returns a value different from `YAPI.SUCCESS` and `errmsg` contains the error message.

YDigitalIO.FindDigitalIO

The `YDigitalIO.FindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIO02-123456` which you have named "`MyModule`", and for which you have given the `digitalio` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO");
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.MyFunction");
digitalio = YDigitalIO.FindDigitalIO("MyModule.digitalIO");
digitalio = YDigitalIO.FindDigitalIO("MyModule.MyFunction");
digitalio = YDigitalIO.FindDigitalIO("MyFunction");
```

`YDigitalIO.FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

⁴ Remember to change the filter of the selection window, otherwise the DLL will not show.

isOnline

The `isOnline()` method of the object returned by `YDigitalIO.FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_portState

The `set_portState()` method of the object returned by `YDigitalIO.FindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Launch Microsoft Visual C# and open the corresponding sample project provided in the directory **Examples/Doc-GettingStarted-Yocto-Maxi-IO-V2** of the Yoctopuce library.

In this example, you will recognize the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;

namespace ConsoleApplication1
{
    class Program
    {
        static void usage()
        {
            string execname = System.AppDomain.CurrentDomain.FriendlyName;
            Console.WriteLine("Usage:");
            Console.WriteLine(execname + " <serial_number>");
            Console.WriteLine(execname + " <logical_name>");
            Console.WriteLine(execname + " any");
            System.Threading.Thread.Sleep(2500);
            Environment.Exit(0);
        }

        static void Main(string[] args)
        {
            string errmsg = "";
            string target;
            YDigitalIO io;

            if (args.Length < 1) usage();
            target = args[0].ToUpper();

            if (YAPI.RegisterHub("usb", ref errmsg) != YAPI.SUCCESS) {
                Console.WriteLine("RegisterHub error: " + errmsg);
                Environment.Exit(0);
            }

            if (target == "ANY") {
                io = YDigitalIO.FirstDigitalIO();
                if (io == null) {
                    Console.WriteLine("No module connected (check USB cable) ");
                    Environment.Exit(0);
                }
            } else io = YDigitalIO.FindDigitalIO(target + ".digitalIO");

            // lets configure the channels direction
            // bits 0..3 as output
            // bits 4..7 as input
            io.set_portDirection(0x0F);
            io.set_portPolarity(0); // polarity set to regular
            io.set_portOpenDrain(0); // No open drain
            Console.WriteLine("Channels 0..3 are configured as outputs and channels 4..7");
            Console.WriteLine("are configred as inputs, you can connect some inputs to");
            Console.WriteLine("outputs and see what happens");
            int outputdata = 0;
            while (io.isOnline()) {
                int inputdata = io.get_portState(); // read port values
                string line = ""; // display port value as binary
```

```

        for (int i = 0; i < 8; i++) {
            if ((inputdata & (128 >> i)) > 0) {
                line = line + '1';
            } else {
                line = line + '0';
            }
        }
        Console.WriteLine("port value = " + line);
        outputdata = (outputdata + 1) % 16; // cycle output 0..15
        io.set_portState(outputdata); // We could have used set_bitState as well
        YAPI.Sleep(1000, ref errmsg);
    }
    YAPI.FreeAPI();
}
}
}

```

9.4. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;

namespace ConsoleApplication1
{
    class Program
    {
        static void usage()
        {
            string execname = System.AppDomain.CurrentDomain.FriendlyName;
            Console.WriteLine("Usage:");
            Console.WriteLine(execname + " <serial or logical name> [ON/OFF]");
            System.Threading.Thread.Sleep(2500);
            Environment.Exit(0);
        }

        static void Main(string[] args)
        {
            YModule m;
            string errmsg = "";

            if (YAPI.RegisterHub("usb", ref errmsg) != YAPI.SUCCESS) {
                Console.WriteLine("RegisterHub error: " + errmsg);
                Environment.Exit(0);
            }

            if (args.Length < 1) usage();

            m = YModule.FindModule(args[0]); // use serial or logical name

            if (m.isOnline()) {
                if (args.Length >= 2) {
                    if (args[1].ToUpper() == "ON") {
                        m.set_beacon(YModule.BEACON_ON);
                    }
                    if (args[1].ToUpper() == "OFF") {
                        m.set_beacon(YModule.BEACON_OFF);
                    }
                }

                Console.WriteLine("serial:      " + m.get_serialNumber());
                Console.WriteLine("logical name: " + m.get_logicalName());
                Console.WriteLine("luminosity:   " + m.get_luminosity().ToString());
                Console.WriteLine("beacon:       ");
                if (m.get_beacon() == YModule.BEACON_ON)
                    Console.WriteLine("ON");
                else

```

```

        Console.WriteLine("OFF");
        Console.WriteLine("upTime: " + (m.get_upTime() / 1000).ToString() + " sec");
        Console.WriteLine("USB current: " + m.get_usbCurrent().ToString() + " mA");
        Console.WriteLine("Logs:\r\n" + m.get_lastLogs());

    } else {
        Console.WriteLine(args[0] + " not connected (check identification and USB cable)");
    }
    YAPI.FreeAPI();
}
}
}
```

Each property `xxx` of the module can be read thanks to a method of type `YModule.get_xxxx()`, and properties which are not read-only can be modified with the help of the `YModule.set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `YModule.set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `YModule.saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `YModule.revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;

namespace ConsoleApplication1
{
    class Program
    {
        static void usage()
        {
            string execname = System.AppDomain.CurrentDomain.FriendlyName;
            Console.WriteLine("Usage:");
            Console.WriteLine("usage: demo <serial or logical name> <new logical name>");
            System.Threading.Thread.Sleep(2500);
            Environment.Exit(0);
        }

        static void Main(string[] args)
        {
            YModule m;
            string errmsg = "";
            string newname;

            if (args.Length != 2) usage();

            if (YAPI.RegisterHub("usb", ref errmsg) != YAPI.SUCCESS) {
                Console.WriteLine("RegisterHub error: " + errmsg);
                Environment.Exit(0);
            }

            m = YModule.FindModule(args[0]); // use serial or logical name

            if (m.isOnline()) {
                newname = args[1];
                if (!YAPI.CheckLogicalName(newname)) {
                    Console.WriteLine("Invalid name (" + newname + ")");
                    Environment.Exit(0);
                }

                m.set_logicalName(newname);
                m.saveToFlash(); // do not forget this

                Console.Write("Module: serial= " + m.get_serialNumber());
                Console.WriteLine(" / name= " + m.get_logicalName());
            } else {
                Console.WriteLine("not connected (check identification and USB cable");
            }
        }
    }
}
```

```
        }
        YAPI.FreeAPI();
    }
}
```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `YModule.saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `YModule.yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not `null`. Below a short example listing the connected modules.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;

namespace ConsoleApplication1
{
    class Program
    {
        static void Main(string[] args)
        {
            YModule m;
            string errmsg = "";

            if (YAPI.RegisterHub("usb", ref errmsg) != YAPI.SUCCESS) {
                Console.WriteLine("RegisterHub error: " + errmsg);
                Environment.Exit(0);
            }

            Console.WriteLine("Device list");
            m = YModule.FirstModule();
            while (m != null) {
                Console.WriteLine(m.get_serialNumber() + " (" + m.get_productName() + ")");
                m = m.nextModule();
            }
            YAPI.FreeAPI();
        }
    }
}
```

9.5. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.
- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value, a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

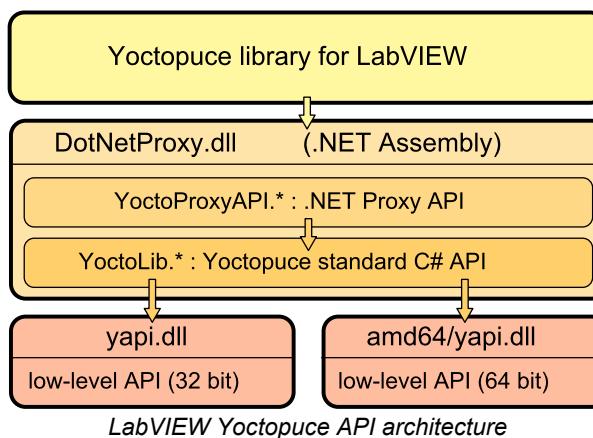
When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the `errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

10. Using the Yocto-Maxi-IO-V2 with LabVIEW

LabVIEW is edited by National Instruments since 1986. It is a graphic development environment: rather than writing lines of code, the users draw their programs, somewhat like a flow chart. LabVIEW was designed mostly to interface measuring tools, hence the *Virtual Instruments* name for LabVIEW programs. With visual programming, drawing complex algorithms becomes quickly fastidious. The LabVIEW Yoctopuce library was thus designed to make it as easy to use as possible. In other words, LabVIEW being an environment extremely different from other languages supported by Yoctopuce, there are major differences between the LabVIEW API and the other APIs.

10.1. Architecture

The LabVIEW library is based on the Yoctopuce DotNetProxy library contained in the *DotNetProxyLibrary.dll* DLL. In fact, it is this *DotNetProxy* library which takes care or most of the work by relying on the C# library which, in turn, uses the low level library coded in *yapi.dll* (32bits) and *amd64\yapi.dll* (64bits).



You must therefore imperatively distribute the *DotNetProxyLibrary.dll*, *yapi.dll*, and *amd64\yapi.dll* with your LabVIEW applications using the Yoctopuce API.

If need be, you can find the low level API sources in the C# library and the *DotNetProxyLibrary.dll* sources in the *DotNetProxy* library.

10.2. Compatibility

Firmware

For the LabVIEW Yoctopuce library to work correctly with your Yoctopuce modules, these modules need to have firmware 37120, or higher.

LabVIEW for Linux and MacOS

At the time of writing, the LabVIEW Yoctopuce API has been tested under Windows only. It is therefore most likely that it simply does not work with the Linux and MacOS versions of LabVIEW.

LabVIEW NXG

The LabVIEW Yoctopuce library uses many techniques which are not yet available in the new generation of LabVIEW. The library is therefore absolutely not compatible with LabVIEW NXG.

About DotNewProxyLibrary.dll

In order to be compatible with as many versions of Windows as possible, including Windows XP, the *DotNetProxyLibrary.dll* library is compiled in .NET 3.5, which is available by default on all the Windows versions since XP.

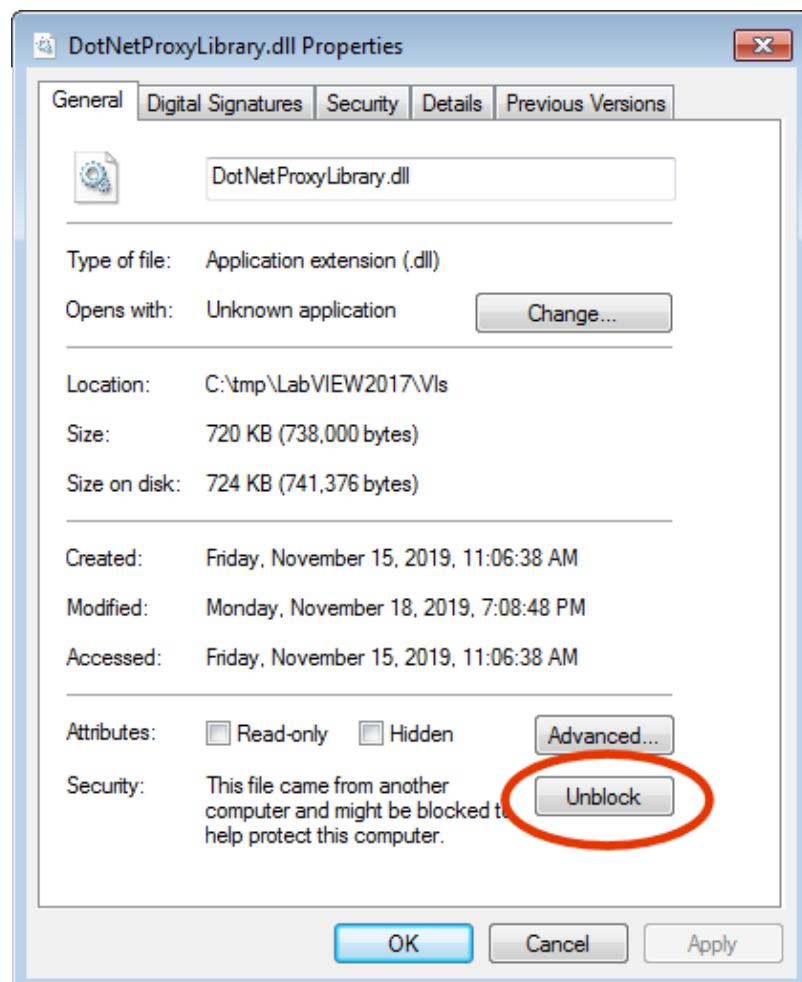
10.3. Installation

Download the LabVIEW library from the Yoctopuce web site¹. It is a ZIP file in which there is a distinct directory for each version of LabVIEW. Each of these directories contains two subdirectories: the first one contains programming examples for each Yoctopuce product; the second one, called *VIs*, contains all the VIs of the API and the required DLLs.

Depending on Windows configuration and the method used to copy the *DotNetProxyLibrary.dll* on your system, Windows may block it because it comes from an other computer. This may happen when the library zip file is uncompressed with Window's file explorer. If the DLL is blocked, LabVIEW will not be able to load it and an error 1386 will occur whenever any of the Yoctopuce VIs is executed.

There are two ways to fix this. The simplest is to unblock the file with the Windows file explorer: *right click / properties* on the *DotNetProxyLibrary.dll* file, and click on the *unblock* button. But this has to be done each time a new version of the DLL is copied on your system.

¹ <http://www.yoctopuce.com/EN/libraries.php>



Unblock the DotNetProxyLibrary DLL.

Alternatively, one can modify the LabVIEW configuration by creating, in the same directory as the *labview.exe* executable, an XML file called *labview.exe.config* containing the following code:

```
<?xml version ="1.0"?>
<configuration>
  <runtime>
    <loadFromRemoteSources enabled="true" />
  </runtime>
</configuration>
```

Make sure to select the correct directory depending on the LabVIEW version you are using (32 bits vs. 64 bits). You can find more information about this file on the National Instruments web site.²

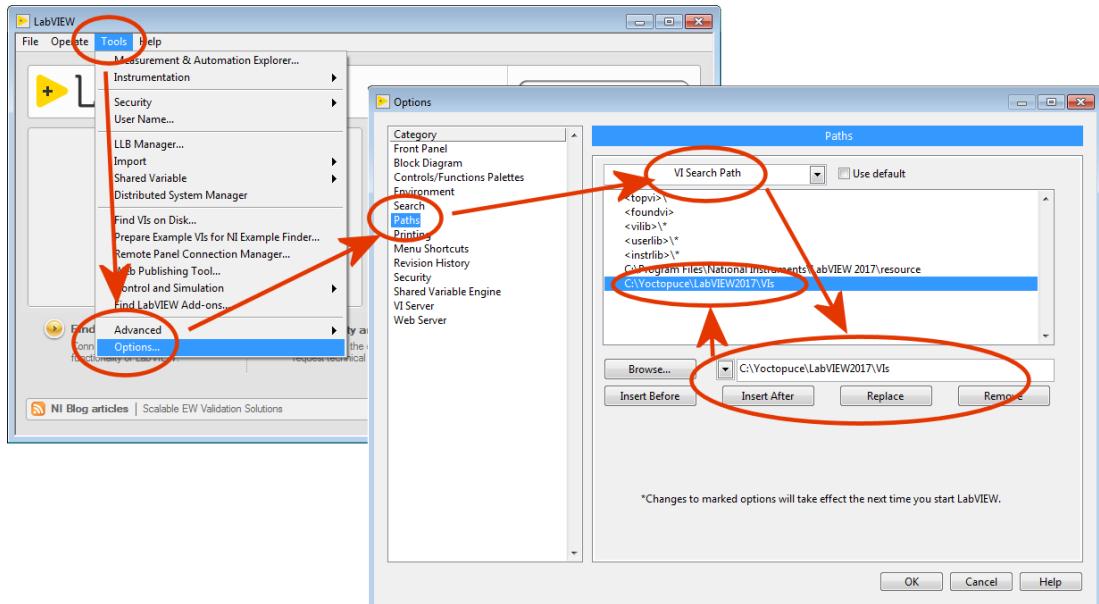
To install the LabVIEW Yoctopuce API, there are several methods.

Method 1 : "Take-out" installation

The simplest way to use the Yoctopuce library is to copy the content of the *VIs* directory wherever you want and to use the VIs in LabVIEW with a simple drag-n-drop operation.

To use the examples provided with the API, it is simpler if you add the directory of Yoctopuce VIs into the list of where LabVIEW must look for VIs that it has not found. You can access this list through the *Tools > Options > Paths > VI Search Path* menu.

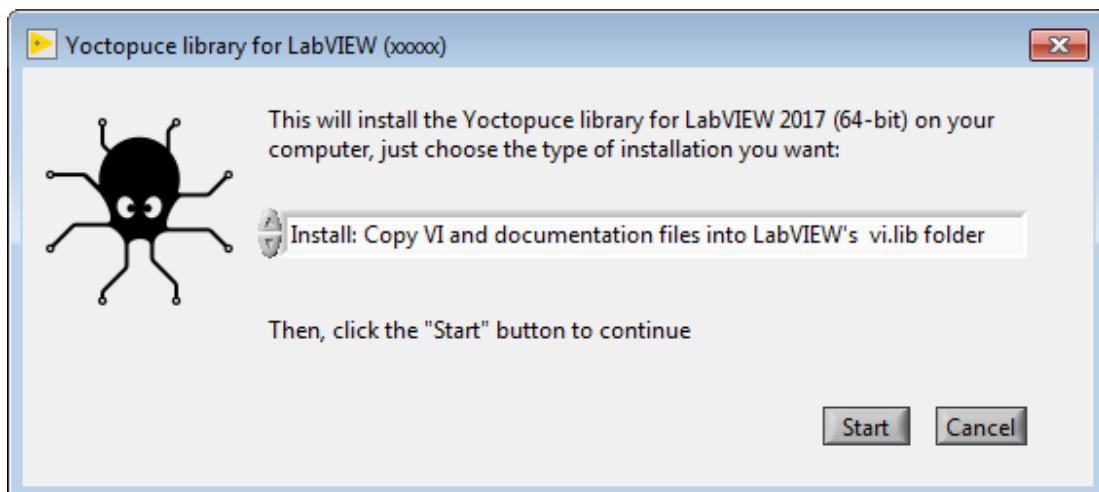
² <https://knowledge.ni.com/KnowledgeArticleDetails?id=kA00Z000000P8XnSAK>



Configuring the "VI Search Path"

Method 2 : Provided installer

In each LabVIEW folder of the Library, you will find a VI named "*Install.vi*", just open the one matching your LabVIEW version.



The provider installer

This installer provide 3 installation options:

Install: Keep VI and documentation files where they are.

With this option, VI files are keep in the place where the library has been unzipped. So you will have to make sure these files are not deleted as long as you need them. Here is what the installer will do if that option is chosen:

- All references to Yoctopuce any library paths will be removed from the *viSearchPath* option in the *labview.ini* file.
- A *dir.mnu* palette file referring to VIs in the install folder will be created in *C:\Program Files xx\National Instruments\LabVIEW 20xx\vi.lib\addons\Yoctopuce*
- A reference to the VIs source install path will inserted into the *viSearchPath* option in the *labview.ini* file.

Install: Copy VI and documentation files into LabVIEW's vi.lib folder

In that case all required files are copied inside the LabVIEW's installation folder, so you will be able to delete the installation folder once the original installation is complete. Note that programming examples won't be copied. Here is the exact behaviour of the installer in that case:

- All references to Yoctopuce library paths will be removed from *viSearchPath* in *labview.ini* file
- All VIs, DLLs, and documentation files will be copied into:
C:\Program Files xx\National Instruments\LabVIEW 20xx\vi.lib\Yoctopuce
- VIs will be patched with the path to copied documentation files
- A dir.mnu palette file referring to copied VIs will be created in
C:\Program Files xx\National Instruments\LabVIEW 20xx\vi.lib\addons\Yoctopuce

Uninstall Yoctopuce Library

this option is meant to remove the LabVIEW library from your LabVIEW installation, here is how it is done:

- All references to Yoctopuce library paths will be removed from *viSearchPath* in *labview.ini* file
- Following folders, if exists, will be removed:
C:\Program Files xx\National Instruments\LabVIEW 20xx\vi.lib\addons\Yoctopuce
C:\Program Files xx\National Instruments\LabVIEW 20xx\vi.lib\Yoctopuce

In any case, if the *labview.ini* file needs to be modified, a backup copy will be made beforehand.

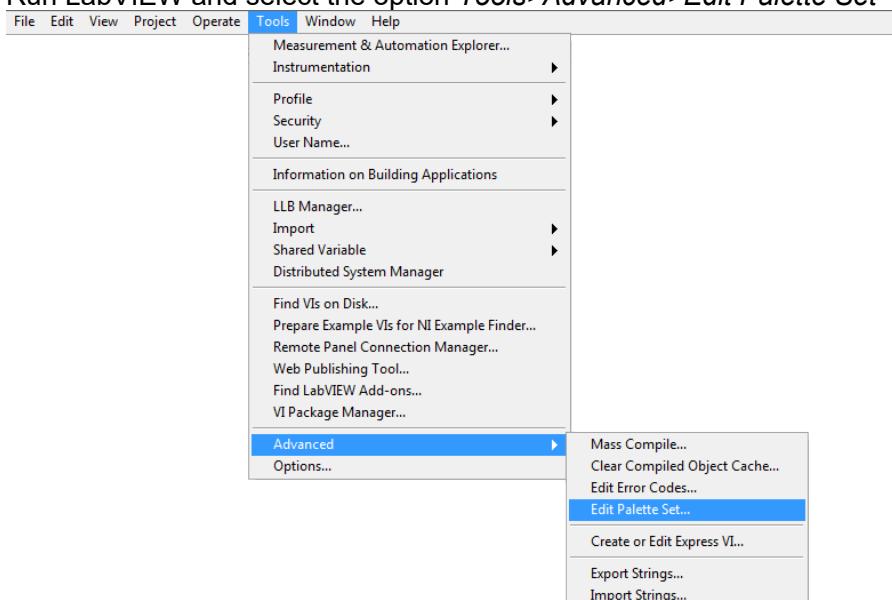
The installer identifies Yoctopuce VIs library folders by checking the presence of the *YRegisterHub.vi* file in said folders.

Once the installation is complete, a Yoctopuce palette will appear in *Functions/Addons* menu.

Method 3 : Installation in a LabVIEW palette (ancillary method)

The steps to manually install the VIs directly in the LabVIEW palette are somewhat more complex. You can find the detailed procedure on the National Instruments web site ³, but here is a summary:

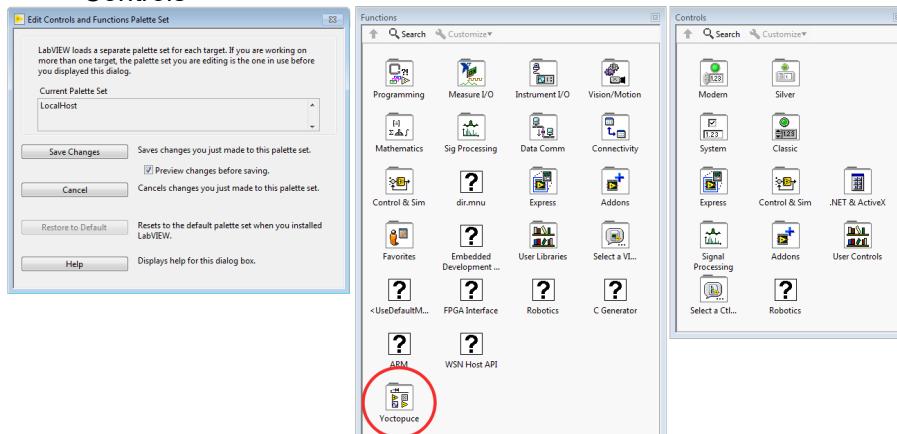
1. Create a *Yoctopuce/API* directory in the C:\Program Files\National Instruments\LabVIEW xxxx \vi.lib directory and copy all the VIs and DLLs of the *VIs* directory into it.
2. Create a *Yoctopuce* directory in the C:\Program Files\National Instruments\LabVIEW xxxx \menus\Categories directory.
3. Run LabVIEW and select the option *Tools>Advanced>Edit Palette Set*



³ <https://forums.ni.com/t5/Developer-Center-Resources/Creating-a-LabVIEW-Palette/ta-p/3520557>

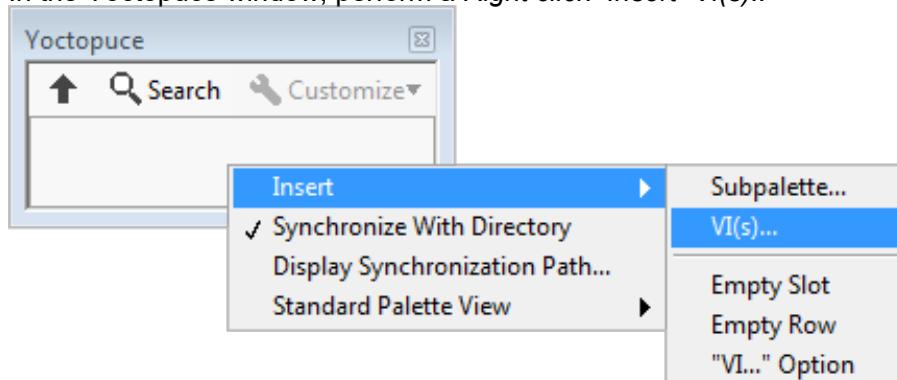
Three windows pop up:

- "Edit Controls and Functions Palette Set"
- "Functions"
- "Controls"

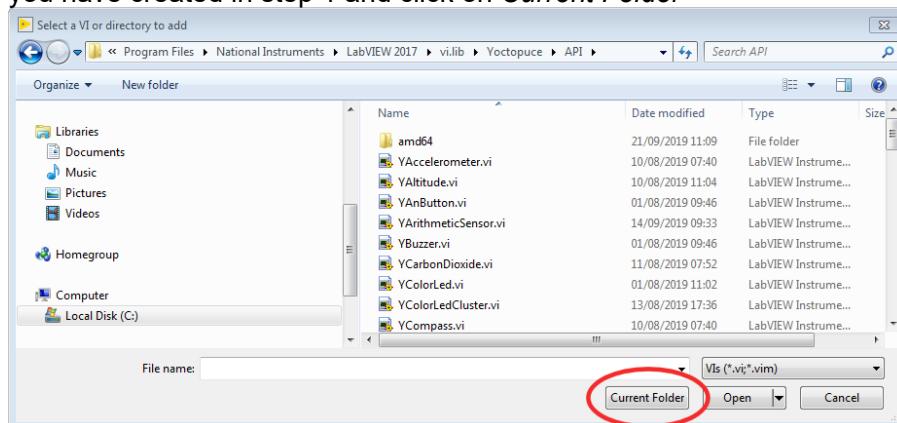


In the *Function* window, there is a *Yoctopuce* icon. Double-click it to create an empty "Yoctopuce" window.

4. In the Yoctopuce window, perform a *Right click>Insert>Vi(s)..*

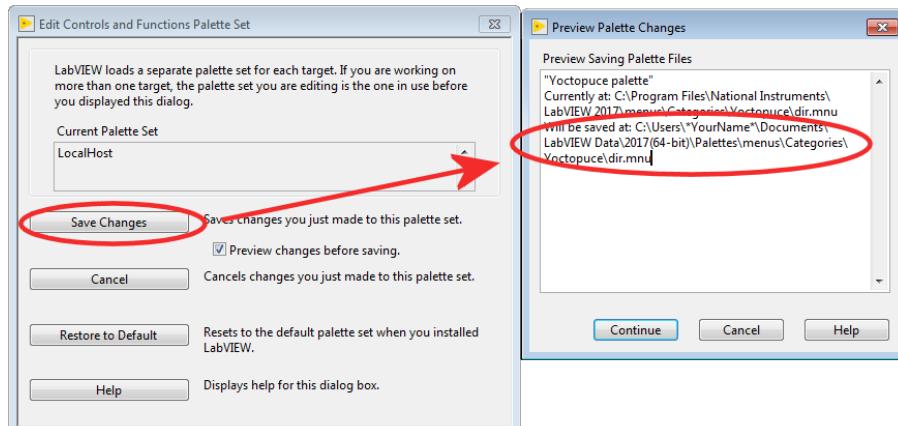


in order to open a file chooser. Put the file chooser in the *vi.lib\Yoctopuce\API* directory that you have created in step 1 and click on *Current Folder*



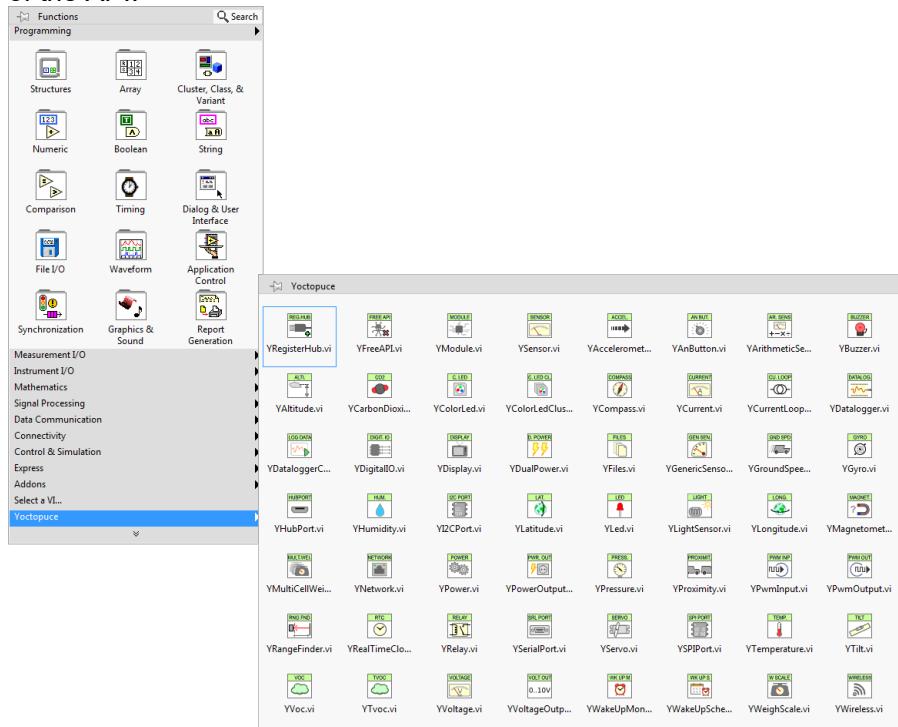
All the Yoctopuce VIs now appear in the Yoctopuce window. By default, they are sorted by alphabetical order, but you can arrange them as you see fit by moving them around with the mouse. For the palette to be easy to use, we recommend to reorganize the icons over 8 columns.

5. In the "Edit Controls and Functions Palette Set" window, click on the "Save Changes" button, the window indicates that it has created a *dir.mnu* file in your Documents directory.



Copy this file in the "menus\Categories\Yoctopuce" directory that you have created in step 2.

6. Restart LabVIEW, the LabVIEW palette now contains a Yoctopuce sub-palette with all the VIs of the API.

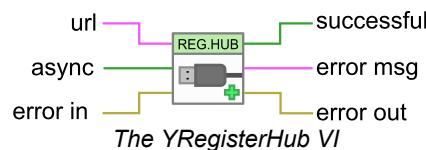


10.4. Presentation of Yoctopuce VIs

The LabVIEW Yoctopuce library contains one VI per class of the Yoctopuce API, as well as a few special VIs. All the VIs have the traditional connectors *Error IN* and *Error Out*.

YRegisterHub

The **YRegisterHub** VI is used to initialize the API. You must imperatively call this VI once before you do anything in relation with Yoctopuce modules.



The `YRegisterHub` VI takes a `url` parameter which can be:

- The "usb" character string to indicate that you wish to work with local modules, directly connected by USB
- An IP address to indicate that you wish to work with modules which are available through a network connection. This IP address can be that of a YoctoHub⁴ or even that of a machine on which the VirtualHub⁵ application is running.

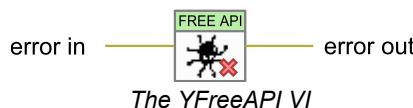
In the case of an IP address, the `YRegisterHub` VI tries to contact this address and generates an error if it does not succeed, unless the `async` parameter is set to TRUE. If `async` is set to TRUE, no error is generated and Yoctopuce modules corresponding to that IP address become automatically available as soon as the said machine can be reached.

If everything went well, the `successful` output contains the value TRUE. In the opposite case, it contains the value FALSE and the `error msg` output contains a string of characters with a description of the error.

You can use several `YRegisterHub` VIs with distinct URLs if you so wish. However, on the same machine, there can be only one process accessing local Yoctopuce modules directly by USB (`url` set to "usb"). You can easily work around this limitation by running the VirtualHub software on the local machine and using the "127.0.0.1" url.

YFreeAPI

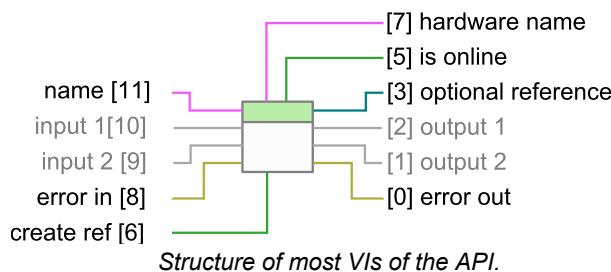
The `YFreeAPI` VI enables you to free resources allocated by the Yoctopuce API.



You must call the `YFreeAPI` VI when your code is done with the Yoctopuce API. Otherwise, direct USB access (`url` set to "usb") could stay locked after the execution of your VI, and stay so for as long as LabVIEW is not completely closed.

Structure of the VIs corresponding to a class

The other VIs correspond to each function/class of the Yoctopuce API, they all have the same structure:



- Connector [11]: `name` must contain the hardware name or the logical name of the intended function.
- Connectors [10] and [9]: input parameters depending on the nature of the VI.
- Connectors [8] and [0] : `error in` and `error out`.
- Connector [7] : Unique hardware name of the found function.
- Connector [5] : `is online` contains TRUE if the function is available, FALSE otherwise.
- Connectors [2] and [1]: output values depending on the nature of the VI.
- Connector [6]: If this input is set to TRUE, connector [3] contains a reference to the `Proxy` objects implemented by the VI⁶. This input is initialized to FALSE by default.

⁴ www.yoctopuce.com/EN/products/category/extensions-and-networking

⁵ <http://www.yoctopuce.com/EN/virtualhub.php>

⁶ see section *Using Proxy objects*

- Connector [3]: Reference on the *Proxy* object implemented by the VI if input [6] is TRUE. This object enables you to access additional features.

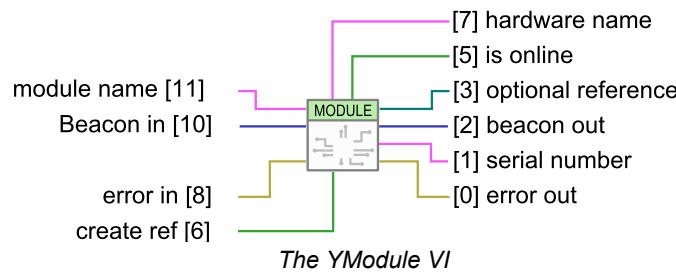
You can find the list of functions available on your Yocto-Maxi-IO-V2 in chapter *Programming, general concepts*.

If the desired function (parameter *name*) is not available, this does not generate an error, but the *is online* output contains FALSE and all the other outputs contain the value "N/A" whenever possible. If the desired function becomes available later in the life of your program, *is online* switches to TRUE automatically.

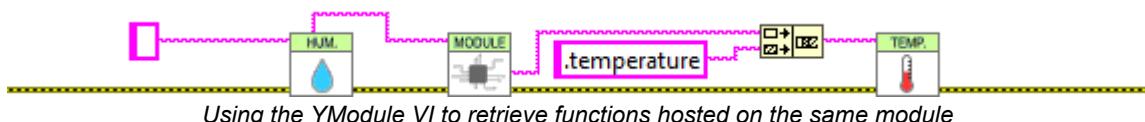
If the *name* parameter contains an empty string, the VI targets the first available function of the same type. If no function is available, *is online* is set to FALSE.

The YModule VI

The YModule VI enables you to interface with the "module" section of each Yoctopuce module. It enables you to drive the module led and to know the serial number of the module.

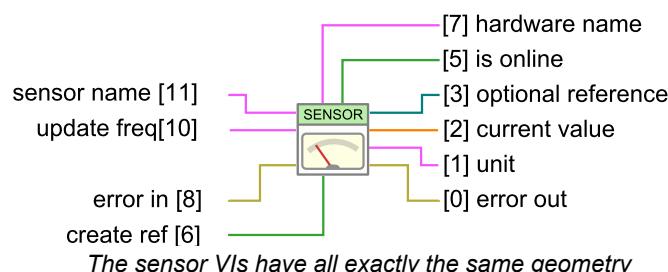


The *name* input works slightly differently from other VIs. If it is called with a *name* parameter corresponding to a function name, the YModule VI finds the *Module* function of the module hosting the function. You can therefore easily find the serial number of the module of any function. This enables you to build the name of other functions which are located on the same module. The following example finds the first available YHumidity function and builds the name of the YTTemperature function located on the same module. The examples provided with the Yoctopuce API make extensive use of this technique.



The sensor VIs

All the VIs corresponding to Yoctopuce sensors have exactly the same geometry. Both outputs enable you to retrieve the value measured by the corresponding sensor as well the unit used.

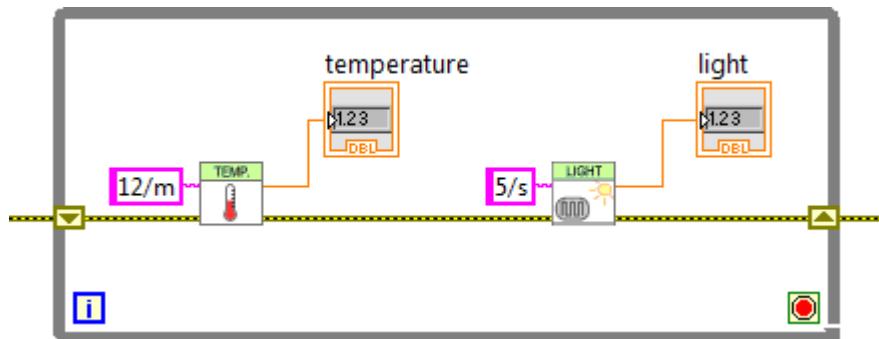


The *update freq* input parameter is a character string enabling you to configure the way in which the output value is updated:

- "auto" : The VI value is updated as soon as the sensor detects a significant modification of the value. It is the default behavior.
- "x/s": The VI value is updated x times per second with the current value of the sensor.

- "x/m","x/h": The VI value is updated x times per minute (resp. hour) with the average value over the latest period. Note, maximum frequencies are (60/m) and (3600/h), for higher frequencies use the (x/s) syntax.

The update frequency of the VI is a parameter managed by the physical Yoctopuce module. If several VIs try to change the frequency of the same sensor, the valid configuration is that of the latest call. It is however possible to set different update frequencies to different sensors on the same Yoctopuce module.

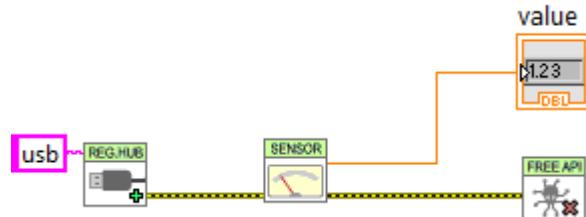


Changing the update frequency of the same module

The update frequency of the VI is completely independent from the sampling frequency of the sensor, which you usually cannot modify. It is useless and counterproductive to define an update frequency higher than the sensor sampling frequency.

10.5. Functioning and use of VIs

Here is one of the simplest example of VIs using the Yoctopuce API.

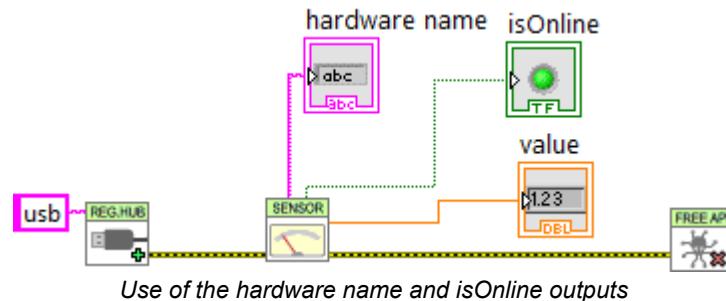


Minimal example of use of the LabVIEW Yoctopuce API

This example is based on the `YSensor` VI which is a generic VI enabling you to interface any sensor function of a Yoctopuce module. You can replace this VI by any other from the Yoctopuce API, they all have the same geometry and work in the same way. This example is limited to three actions:

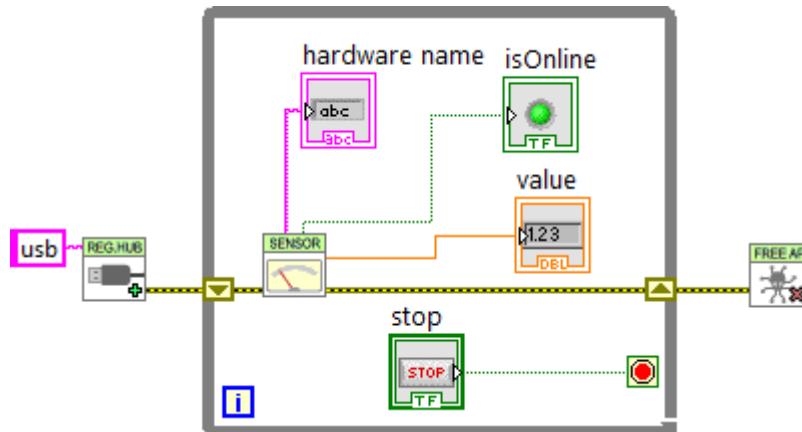
1. It initializes the API in native ("usb") mode with the `YRegisterHub` VI.
2. It displays the value of the first Yoctopuce sensor it finds thanks to the `YSensor` VI.
3. It frees the API thanks to the `YFreeAPI` VI.

This example automatically looks for an available sensor. If there is such a sensor, we can retrieve its name through the `hardware name` output and the `isOnline` output equals TRUE. If there is no available sensor, the VI does not generate an error but emulates a ghost sensor which is "offline". However, if later in the life of the application, a sensor becomes available because it has been connected, `isOnline` switches to TRUE and the `hardware name` contains the name of the sensor. We can therefore easily add a few indicators in the previous example to know how the executions goes.



Use of the hardware name and isOnline outputs

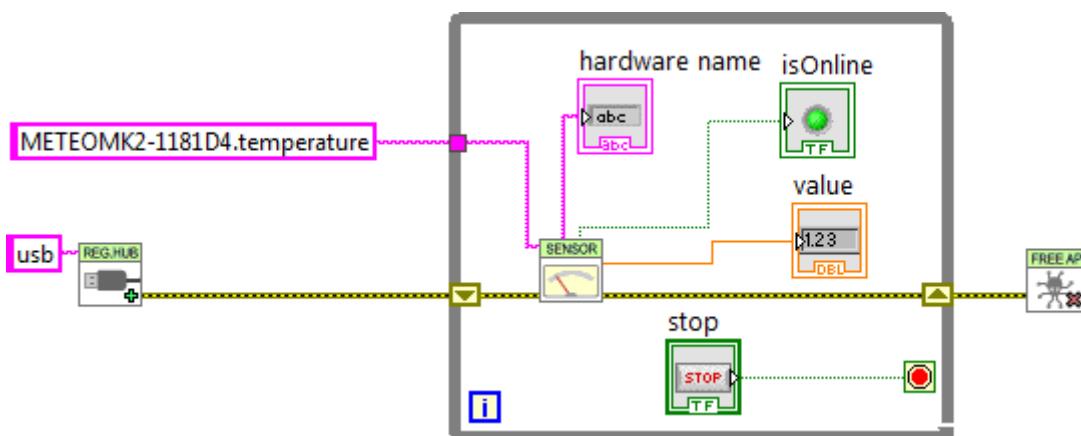
The VIs of the Yoctopuce API are actually an entry door into the library. Internally, this mechanism works independently of the Yoctopuce VIs. Indeed, most communications with electronic modules are managed automatically as background tasks. Therefore, you do not necessarily need to take any specific care to use Yoctopuce VIs, you can for example use them in a non-delayed loop without creating any specific problem for the API.



The Yoctopuce VIs can be used in a non-delayed loop

Note that the YRegisterHub VI is not inside the loop. The YRegisterHub VI is used to initialize the API. Unless you have several URLs that you need to register, it is better to call the YRegisterHub VI only once.

When the *name* parameter is initialized to an empty string, the Yoctopuce VIs automatically look for a function they can work with. This is very handy when you know that there is only one function of the same type available and when you do not want to manage its name. If the *name* parameter contains a hardware name or a logical name, the VI looks for the corresponding function. If it does not find it, it emulates an *offline* function while it waits for the true function to become available.

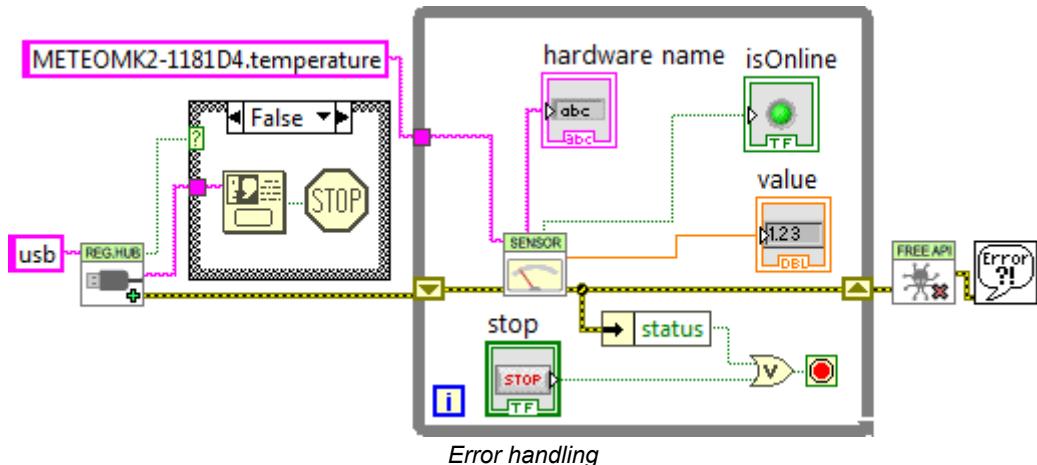


Using names to identify the functions to be used

Error handling

The LabVIEW Yoctopuce API is coded to handle errors as smoothly as possible: for example, if you use a VI to access a function which does not exist, the *isOnline* output is set to FALSE, the other outputs are set to *Nan*, and thus the inputs do not have any impact. Fatal errors are propagated through the traditional *error in*, *error out* channel.

However, the *YRegisterHub* VI manages connection errors slightly differently. In order to make them easier to manage, connection errors are signaled with *Success* and *error msg* outputs. If there is an issue during a call to the *YRegisterHub* VI, *Success* contains FALSE and *error msg* contains a description of the error.

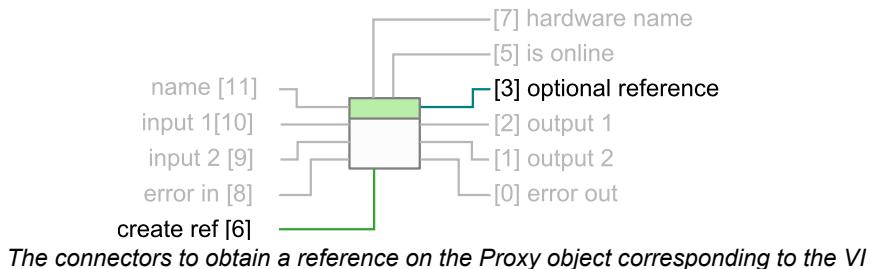


The most common error message is "*Another process is already using yAPI*". It means that another application, LabVIEW or other, already uses the API in native USB mode. For technical reasons, the native USB API can be used by only one application at the same time on the same machine. You can easily work around this limitation by using the network mode.

10.6. Using Proxy objects

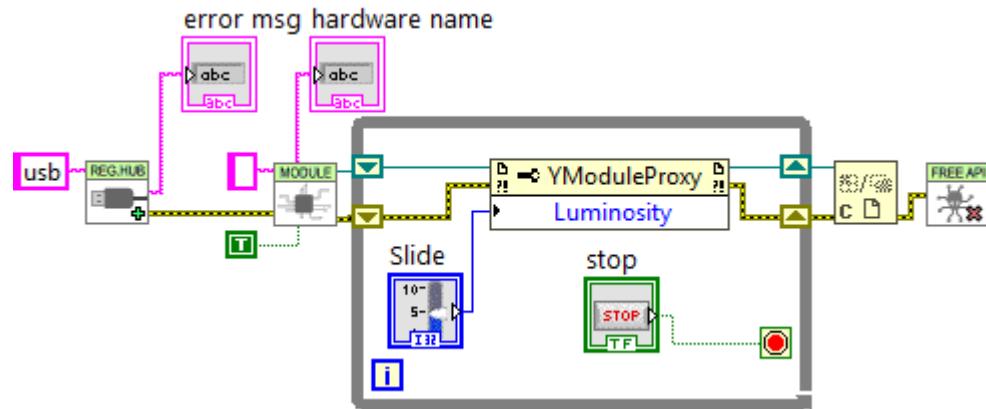
The Yoctopuce API contains hundreds of methods, functions, and properties. It was not possible, or desirable, to create a VI for each of them. Therefore, there is a VI per class that shows the two properties that Yoctopuce deemed the most useful, but this does not mean that the rest is not available.

Each VI corresponding to a class has two connectors *create ref* and *optional ref* which enable you to obtain a reference on the *Proxy* object of the *.NET Proxy API* on which the LabVIEW library is built.



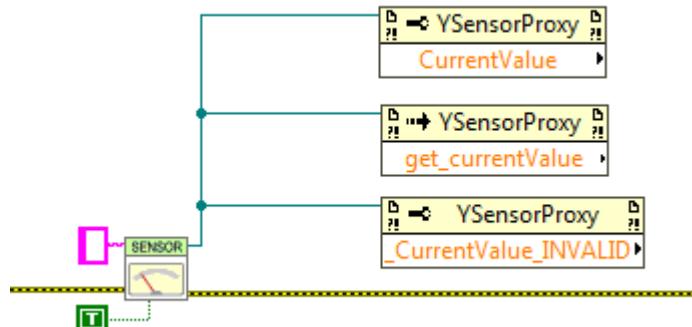
To obtain this reference, you only need to set *optional ref* to TRUE. Note, it is essential to close all references created in this way, otherwise you risk to quickly saturate the computer memory.

Here is an example which uses this technique to change the luminosity of the leds of a Yoctopuce module.



Regulating the luminosity of the leds of a module

Note that each reference allows you to obtain properties (*property nodes*) as well as methods (*invoke nodes*). By convention, properties are optimized to generate a minimum of communication with the modules. Therefore, we recommend to use them rather than the corresponding `get_xxx` and `set_xxx` methods which might seem equivalent but which are not optimized. Properties also enable you to retrieve the various constants of the API, prefixed with the "_" character. For technical reasons, the `get_xxx` and `set_xxx` methods are not all available as properties.

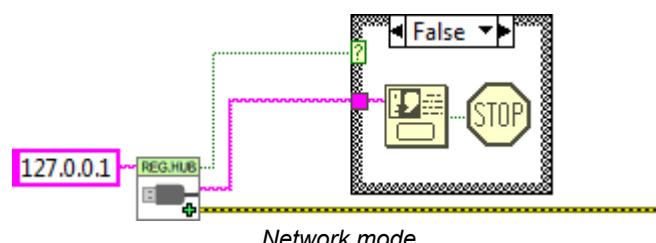


Property and Invoke nodes: Using properties, methods and constants

You can find a description of all the available properties, functions, and methods in the documentation of the *.NET Proxy API*.

Network mode

On a given machine, there can be only one process accessing local Yoctopuce modules directly by USB (url set to "usb"). It is however possible that multiple process connect in parallel to YoctoHubs⁷ or to a machine on which *VirtualHub*⁸ is running, including the local machine. Therefore, if you use the local address of your machine (127.0.0.1) and if a VirtualHub runs on it, you can work around the limitation which prevents using the native USB API in parallel.

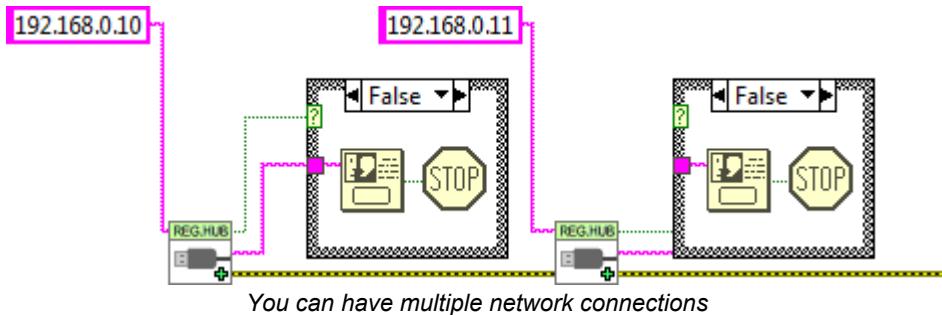


Network mode

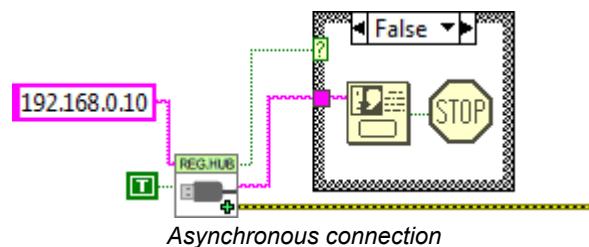
⁷ <https://www.yoctopuce.com/EN/products/category/extensions-and-networking>

⁸ www.yoctopuce.com/EN/virtualhub.php

In the same way, there is no limitation on the number of network interfaces to which the API can connect itself in parallel. This means that it is quite possible to make multiple calls to the YRegisterHub VI. This is the only case where it is useful to call the YRegisterHub VI several times in the life of the application.



By default, the YRegisterHub VI tries to connect itself on the address given as parameter and generates an error (*success=FALSE*) when it cannot do so because nobody answers. But if the *async* parameter is initialized to TRUE, no error is generated when the connection does not succeed. If the connection becomes possible later in the life of the application, the corresponding modules are automatically made available.

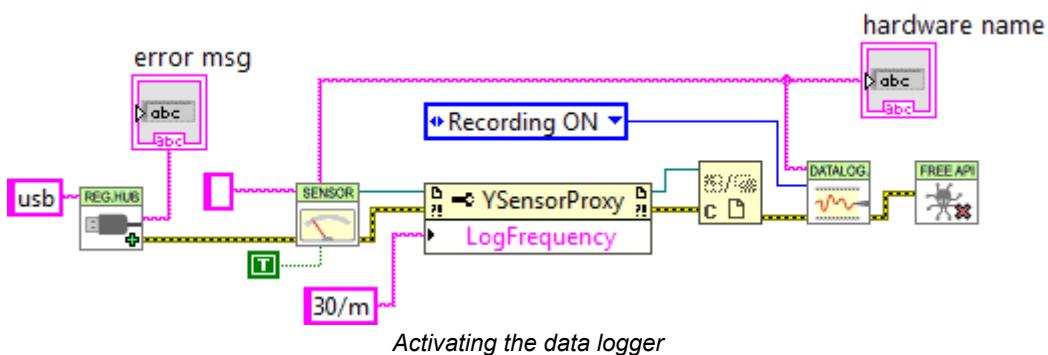


10.7. Managing the data logger

Almost all the Yoctopuce sensors have a data logger which enables you to store the measures of the sensors in the non-volatile memory of the module. You can configure the data logger with the VirtualHub, but also with a little bit of LabVIEW code.

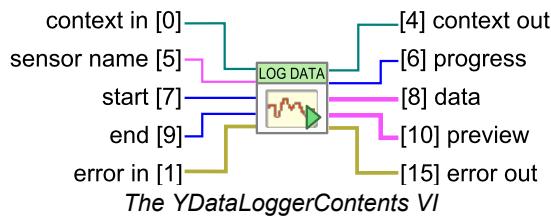
Logging

To do so, you must configure the logging frequency by using the "LogFrequency" property which you can reach with a reference on the *Proxy* object of the sensor you are using. Then, you must turn the data logger on thanks to the YDataLogger VI. Note that, like with the YModule VI, you can obtain the YDataLogger VI corresponding to a module with its own name, but also with the name of any of the functions available on the same module.



Reading

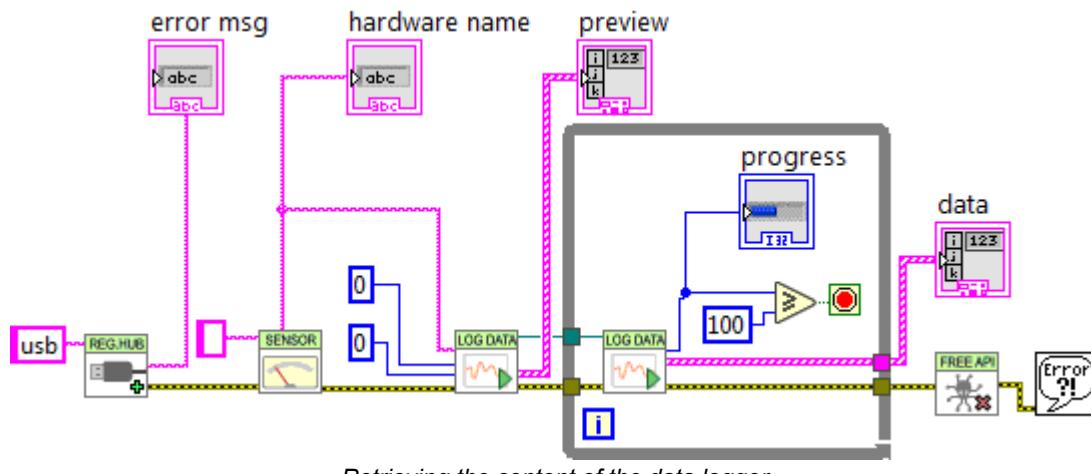
You can retrieve the data in the data logger with the YDataLoggerContents VI.



Retrieving the data from the logger of a Yoctopuce module is a slow process which can take up to several tens of seconds. Therefore, we designed the VI enabling this operation to work iteratively.

As a first step, you must call the VI with a sensor name, a start date, and an end date (UTC UNIX timestamp). The (0,0) pair enables you to obtain the complete content of the data logger. This first call enables you to obtain a summary of the data logger content and a context.

As a second step, you must call the *YDataLoggerContents* VI in a loop with the context parameter, until the *progress* output reaches the 100 value. At this time, the data output represents the content of the data logger.



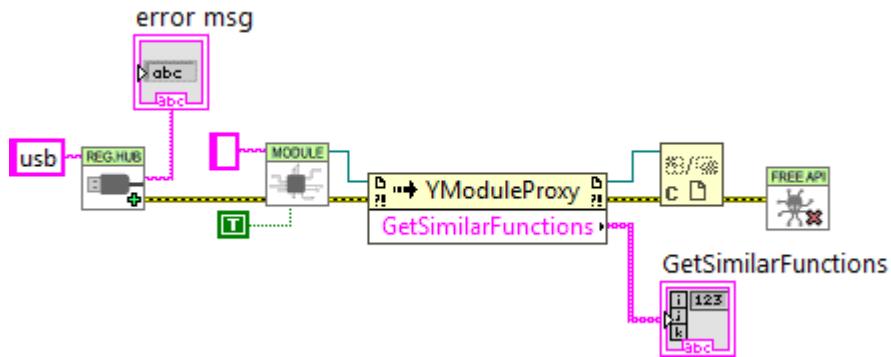
The results and the summary are returned as an array of structures containing the following fields:

- *startTime*: beginning of the measuring period
- *endTime*: end of the measuring period
- *averageValue*: average value for the period
- *minValue*: minimum value over the period
- *maxValue*: maximum value over the period

Note that if the logging frequency is superior to 1Hz, the data logger stores only current values. In this case, *averageValue*, *minValue*, and *maxValue* share the same value.

10.8. Function list

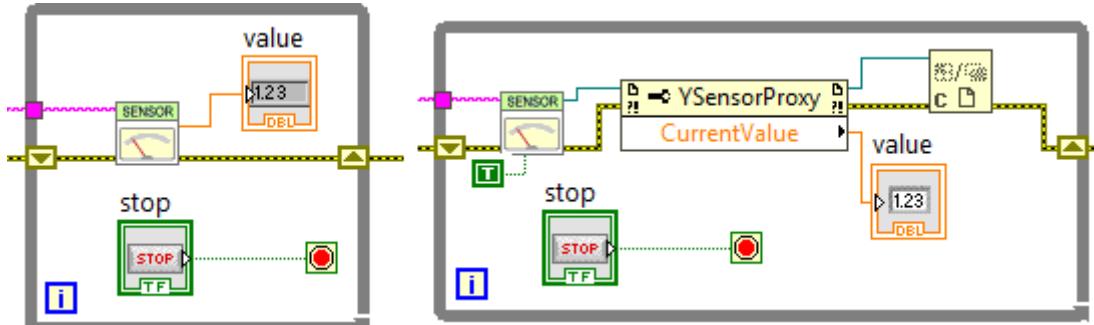
Each VI corresponding to an object of the *Proxy API* enables you to list all the functions of the same class with the *getSimilarfunctions()* method of the corresponding *Proxy* object. Thus, you can easily perform an inventory of all the connected modules, of all the connected sensors, of all the connected relays, and so on.



Retrieving the list of all the modules which are connected

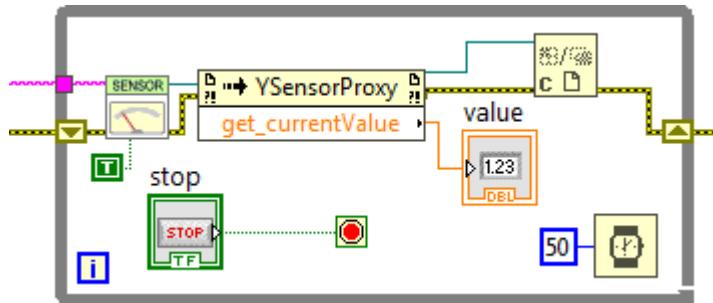
10.9. A word on performances

The LabVIEW Yoctopuce API is optimized so that all the VIs and .NET Proxy API object properties generate a minimum of communication with Yoctopuce modules. Thus, you can use them in loops without taking any specific precaution: you *do not have to* slow down the loops with a timer.



These two loops generate little USB communication and do not need to be slowed down

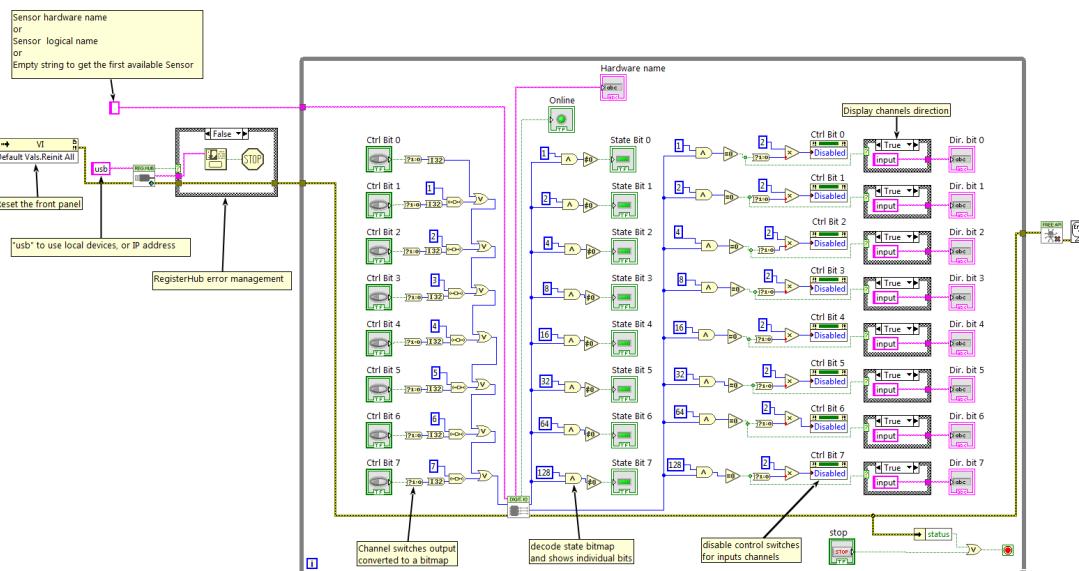
However, almost all the methods of the available Proxy objects initiate a communication with the Yoctopuce modules each time they are called. You should therefore avoid calling them too often without purpose.



This loop, using a method, must be slowed down

10.10. A full example of a LabVIEW program

Here is a full example of how to use the Yocto-Maxi-IO-V2 in LabVIEW. After a call to the *RegisterHub* VI, the *YDigitalIO* VI finds the first available DigitalIO interface and displays value and direction for each bit. Switches allow to toggle each bit value. Switches for input bits are automatically disabled. When the application is about to shut down, it frees the Yoctopuce API, thanks to the *YFreeAPI* VI.



Example of Yocto-Maxi-IO-V2 usage in LabVIEW.

If you read this documentation on screen, you can zoom on the image above. You can also find this example in the LabVIEW Yoctopuce library.

10.11. Differences from other Yoctopuce APIs

Yoctopuce does everything it can to maintain a strong coherence between its different programming libraries. However, LabVIEW being clearly apart as an environment, there are, as a consequence, important differences from the other libraries.

These differences were introduced to make the use of modules as easy as possible and requiring a minimum of LabVIEW code.

YFreeAPI

In the opposite to other languages, you must absolutely free the native API by calling the `YFreeAPI` VI when your code does not need to use the API anymore. If you forget this call, the native API risks to stay locked for the other applications until LabVIEW is completely closed.

Properties

In the opposite to classes of the other APIs, classes available in LabVIEW implement *properties*. By convention, these properties are optimized to generate a minimum of communication with the modules while automatically refreshing. By contrast, methods of type `get_xxx` and `set_xxx` systematically generate communications with the Yoctopuce modules and must be called sparingly.

Callback vs. Properties

There is no callback in the LabVIEW Yoctopuce API, the VIs automatically refresh: they are based on the properties of the *.NET Proxy API* objects.

11. Using the Yocto-Maxi-IO-V2 with Java

Java is an object oriented language created by Sun Microsystem. Beside being free, its main strength is its portability. Unfortunately, this portability has an excruciating price. In Java, hardware abstraction is so high that it is almost impossible to work directly with the hardware. Therefore, the Yoctopuce API does not support native mode in regular Java. The Java API needs a Virtual Hub to communicate with Yoctopuce devices.

11.1. Getting ready

Go to the Yoctopuce web site and download the following items:

- The Java programming library¹
- The VirtualHub software² for Windows, Mac OS X or Linux, depending on your OS

The library is available as source files as well as a *jar* file. Decompress the library files in a folder of your choice, connect your modules, run the VirtualHub software, and you are ready to start your first tests. You do not need to install any driver.

In order to keep them simple, all the examples provided in this documentation are console applications. Naturally, the libraries function in a strictly identical manner if you integrate them in an application with a graphical interface.

11.2. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a Java code snippet to use the DigitalIO function.

```
[...]
// Get access to your device, through the VirtualHub running locally
YAPI.RegisterHub("127.0.0.1");
[...]

// Retrieve the object used to interact with the device
digitalio = YDigitalIO.FindDigitalIO("MAXIIO02-123456.digitalIO");

// Hot-plug is easy: just check that the device is online
if (digitalio.isOnline())
{
```

¹ www.yoctopuce.com/EN/libraries.php

² www.yoctopuce.com/EN/virtualhub.php

```
// Use digitalio.set_state()
[...]
}
```

Let us look at these lines in more details.

YAPI.RegisterHub

The `yAPI.RegisterHub` function initializes the Yoctopuce API and indicates where the modules should be looked for. The parameter is the address of the Virtual Hub able to see the devices. If the initialization does not succeed, an exception is thrown.

YDigitalIO.FindDigitalIO

The `YDigitalIO.FindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIO02-123456` which you have named "`MyModule`", and for which you have given the `digitalIO` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.MyFunction")
digitalio = YDigitalIO.FindDigitalIO("MyModule.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MyModule.MyFunction")
digitalio = YDigitalIO.FindDigitalIO("MyFunction")
```

`YDigitalIO.FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `YDigitalIO.FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YDigitalIO.FindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Launch your Java environment and open the corresponding sample project provided in the directory **Examples/Doc-GettingStarted-Yocto-Maxi-IO-V2** of the Yoctopuce library.

In this example, you will recognize the functions explained above, but this time used with all the side materials needed to make it work nicely as a small demo.

```
import com.yoctopuce.YoctoAPI.*;

public class Demo {

    public static void main(String[] args) {
        try {
            // setup the API to use local VirtualHub
            YAPI.RegisterHub("127.0.0.1");
        } catch (YAPI_Exception ex) {
            System.out.println("Cannot contact VirtualHub on 127.0.0.1 (" +
                ex.getLocalizedMessage() + ")");
            System.out.println("Ensure that the VirtualHub application is running");
            System.exit(1);
        }

        YDigitalIO io;
        if (args.length > 0) {
            io = YDigitalIO.FindDigitalIO(args[0]+ ".digitalIO");
```

```

    } else {
        io = YDigitalIO.FirstDigitalIO();
    }
    if (io == null) {
        System.out.println("No module connected (check USB cable)");
        System.exit(1);
    }

    try {
        // lets configure the channels direction
        // bits 0..3 as output
        // bits 4..7 as input
        io.set_portDirection(0x0F);
        io.set_portPolarity(0); // polarity set to regular
        io.set_portOpenDrain(0); // No open drain
        System.out.println("Channels 0..3 are configured as outputs and channels 4..7"
);
        System.out.println("are configred as inputs, you can connect some inputs to");
        System.out.println("ouputs and see what happens");
        int outputdata = 0;
        while (io.isOnline()) {
            outputdata = (outputdata + 1) % 16; // cycle ouput 0..15
            io.set_portState(outputdata); // we could have used set_bitState as well
            YAPI.Sleep(1000);
            int inputdata = io.get_portState(); // read port values
            String line = ""; // display port value value as binary
            for (int i = 0; i < 8; i++) {

                if ((inputdata & (128 >> i)) > 0) {
                    line = line + '1';
                } else {
                    line = line + '0';
                }
            }
            System.out.println("port value = "+line);
        }
    } catch (YAPI_Exception ex) {
        System.out.println("Module " + io.describe() + " disconnected (check
identification and USB cable)");
    }
    YAPI.FreeAPI();
}
}

```

11.3. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```
import com.yoctopuce.YoctoAPI.*;
import java.util.logging.Level;
import java.util.logging.Logger;

public class Demo {

    public static void main(String[] args)
    {
        try {
            // setup the API to use local VirtualHub
            YAPI.RegisterHub("127.0.0.1");
        } catch (YAPI_Exception ex) {
            System.out.println("Cannot contact VirtualHub on 127.0.0.1 (" +
ex.getLocalizedMessage() + ")");
            System.out.println("Ensure that the VirtualHub application is running");
            System.exit(1);
        }
        System.out.println("usage: demo [serial or logical name] [ON/OFF]");

        YModule module;
        if (args.length == 0) {
            module = YModule.FirstModule();
            if (module == null) {

```

```

        System.out.println("No module connected (check USB cable)");
        System.exit(1);
    }
} else {
    module = YModule.FindModule(args[0]); // use serial or logical name
}

try {
    if (args.length > 1) {
        if (args[1].equalsIgnoreCase("ON")) {
            module.setBeacon(YModule.BEACON_ON);
        } else {
            module.setBeacon(YModule.BEACON_OFF);
        }
    }
    System.out.println("serial: " + module.get_serialNumber());
    System.out.println("logical name: " + module.get_logicalName());
    System.out.println("luminosity: " + module.get_luminosity());
    if (module.get_beacon() == YModule.BEACON_ON) {
        System.out.println("beacon: ON");
    } else {
        System.out.println("beacon: OFF");
    }
    System.out.println("upTime: " + module.get_upTime() / 1000 + " sec");
    System.out.println("USB current: " + module.get_usbCurrent() + " mA");
    System.out.println("logs:\n" + module.get_lastLogs());
} catch (YAPI_Exception ex) {
    System.out.println(args[1] + " not connected (check identification and USB
cable)");
}
YAPI.FreeAPI();
}
}

```

Each property `xxx` of the module can be read thanks to a method of type `YModule.get_xxxx()`, and properties which are not read-only can be modified with the help of the `YModule.set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `YModule.set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `YModule.saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `YModule.revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```

import com.yoctopuce.YoctoAPI.*;

public class Demo {

    public static void main(String[] args)
    {
        try {
            // setup the API to use local VirtualHub
            YAPI.RegisterHub("127.0.0.1");
        } catch (YAPI_Exception ex) {
            System.out.println("Cannot contact VirtualHub on 127.0.0.1 (" +
ex.getLocalizedMessage() + ")");
            System.out.println("Ensure that the VirtualHub application is running");
            System.exit(1);
        }

        if (args.length != 2) {
            System.out.println("usage: demo <serial or logical name> <new logical name>");
            System.exit(1);
        }

        YModule m;
        String newname;

        m = YModule.FindModule(args[0]); // use serial or logical name

```

```

try {
    newname = args[1];
    if (!YAPI.CheckLogicalName(newname))
    {
        System.out.println("Invalid name (" + newname + ")");
        System.exit(1);
    }

    m.set_logicalName(newname);
    m.saveToFlash(); // do not forget this

    System.out.println("Module: serial= " + m.get_serialNumber());
    System.out.println(" / name= " + m.get_logicalName());
} catch (YAPI_Exception ex) {
    System.out.println("Module " + args[0] + "not connected (check identification
and USB cable)");
    System.out.println(ex.getMessage());
    System.exit(1);
}

YAPI.FreeAPI();
}
}

```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `YModule.saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `YModule.yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not null. Below a short example listing the connected modules.

```

import com.yoctopuce.YoctoAPI.*;

public class Demo {

    public static void main(String[] args)
    {
        try {
            // setup the API to use local VirtualHub
            YAPI.RegisterHub("127.0.0.1");
        } catch (YAPI_Exception ex) {
            System.out.println("Cannot contact VirtualHub on 127.0.0.1 (" +
ex.getLocalizedMessage() + ")");
            System.out.println("Ensure that the VirtualHub application is running");
            System.exit(1);
        }

        System.out.println("Device list");
        YModule module = YModule.FirstModule();
        while (module != null) {
            try {
                System.out.println(module.get_serialNumber() + " (" +
module.get_productName() + ")");
            } catch (YAPI_Exception ex) {
                break;
            }
            module = module.nextModule();
        }
        YAPI.FreeAPI();
    }
}

```

11.4. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software.

In the Java API, error handling is implemented with exceptions. Therefore you must catch and handle correctly all exceptions that might be thrown by the API if you do not want your software to crash as soon as you unplug a device.

12. Using the Yocto-Maxi-IO-V2 with Android

To tell the truth, Android is not a programming language, it is an operating system developed by Google for mobile appliances such as smart phones and tablets. But it so happens that under Android everything is programmed with the same programming language: Java. Nevertheless, the programming paradigms and the possibilities to access the hardware are slightly different from classical Java, and this justifies a separate chapter on Android programming.

12.1. Native access and VirtualHub

In the opposite to the classical Java API, the Java for Android API can access USB modules natively. However, as there is no VirtualHub running under Android, it is not possible to remotely control Yoctopuce modules connected to a machine under Android. Naturally, the Java for Android API remains perfectly able to connect itself to a VirtualHub running on another OS.

12.2. Getting ready

Go to the Yoctopuce web site and download the Java for Android programming library¹. The library is available as source files, and also as a jar file. Connect your modules, decompress the library files in the directory of your choice, and configure your Android programming environment so that it can find them.

To keep them simple, all the examples provided in this documentation are snippets of Android applications. You must integrate them in your own Android applications to make them work. However, you can find complete applications in the examples provided with the Java for Android library.

12.3. Compatibility

In an ideal world, you would only need to have a smart phone running under Android to be able to make Yoctopuce modules work. Unfortunately, it is not quite so in the real world. A machine running under Android must fulfil to a few requirements to be able to manage Yoctopuce USB modules natively.

¹ www.yoctopuce.com/EN/libraries.php

Android 4.x

Android 4.0 (api 14) and following are officially supported. Theoretically, support of USB *host* functions since Android 3.1. But be aware that the Yoctopuce Java for Android API is regularly tested only from Android 4 onwards.

USB host support

Naturally, not only must your machine have a USB port, this port must also be able to run in *host* mode. In *host* mode, the machine literally takes control of the devices which are connected to it. The USB ports of a desktop computer, for example, work in *host* mode. The opposite of the *host* mode is the *device* mode. USB keys, for instance, work in *device* mode: they must be controlled by a *host*. Some USB ports are able to work in both modes, they are OTG (*On The Go*) ports. It so happens that many mobile devices can only work in *device* mode: they are designed to be connected to a charger or a desktop computer, and nothing else. It is therefore highly recommended to pay careful attention to the technical specifications of a product working under Android before hoping to make Yoctopuce modules work with it.

Unfortunately, having a correct version of Android and USB ports working in *host* mode is not enough to guaranty that Yoctopuce modules will work well under Android. Indeed, some manufacturers configure their Android image so that devices other than keyboard and mass storage are ignored, and this configuration is hard to detect. As things currently stand, the best way to know if a given Android machine works with Yoctopuce modules consists in trying.

Supported hardware

The library is tested and validated on the following machines:

- Samsung Galaxy S3
- Samsung Galaxy Note 2
- Google Nexus 5
- Google Nexus 7
- Acer Iconia Tab A200
- Asus Transformer Pad TF300T
- Kurio 7

If your Android machine is not able to control Yoctopuce modules natively, you still have the possibility to remotely control modules driven by a VirtualHub on another OS, or a YoctoHub².

12.4. Activating the USB port under Android

By default, Android does not allow an application to access the devices connected to the USB port. To enable your application to interact with a Yoctopuce module directly connected on your tablet on a USB port, a few additional steps are required. If you intend to interact only with modules connected on another machine through the network, you can ignore this section.

In your `AndroidManifest.xml`, you must declare using the "USB Host" functionality by adding the `<uses-feature android:name="android.hardware.usb.host" />` tag in the manifest section.

```
<manifest ...>
  ...
  <uses-feature android:name="android.hardware.usb.host" />;
  ...
</manifest>
```

When first accessing a Yoctopuce module, Android opens a window to inform the user that the application is going to access the connected module. The user can deny or authorize access to the device. If the user authorizes the access, the application can access the connected device as long as

² Yoctohubs are a plug and play way to add network connectivity to your Yoctopuce devices. more info on <http://www.yoctopuce.com/EN/products/category/extensions-and-networking>

it stays connected. To enable the Yoctopuce library to correctly manage these authorizations, you must provide a pointer on the application context by calling the `EnableUSBHost` method of the `YAPI` class before the first USB access. This function takes as arguments an object of the `android.content.Context` class (or of a subclass). As the `Activity` class is a subclass of `Context`, it is simpler to call `YAPI.EnableUSBHost(this)`; in the method `onCreate` of your application. If the object passed as parameter is not of the correct type, a `YAPI_Exception` exception is generated.

```
...
@Override
public void onCreate(Bundle savedInstanceState) {
    super.onCreate(savedInstanceState);
    try {
        // Pass the application Context to the Yoctopuce Library
        YAPI.EnableUSBHost(this);
    } catch (YAPI_Exception e) {
        Log.e("Yocto",e.getLocalizedMessage());
    }
}
...
```

Autorun

It is possible to register your application as a default application for a USB module. In this case, as soon as a module is connected to the system, the application is automatically launched. You must add `<action android:name="android.hardware.usb.action.USB_DEVICE_ATTACHED">` in the section `<intent-filter>` of the main activity. The section `<activity>` must have a pointer to an XML file containing the list of USB modules which can run the application.

```
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    ...
    <uses-feature android:name="android.hardware.usb.host" />
    ...
    <application ... >
        <activity
            android:name=".MainActivity" >
            <intent-filter>
                <action android:name="android.intent.action.MAIN" />
                <action android:name="android.hardware.usb.action.USB_DEVICE_ATTACHED" />
                <category android:name="android.intent.category.LAUNCHER" />
            </intent-filter>
            <meta-data
                android:name="android.hardware.usb.action.USB_DEVICE_ATTACHED"
                android:resource="@xml/device_filter" />
        </activity>
    </application>
</manifest>
```

The XML file containing the list of modules allowed to run the application must be saved in the `res/xml` directory. This file contains a list of USB *vendorID* and *deviceID* in decimal. The following example runs the application as soon as a Yocto-Relay or a YoctoPowerRelay is connected. You can find the *vendorID* and the *deviceID* of Yoctopuce modules in the characteristics section of the documentation.

```
<?xml version="1.0" encoding="utf-8"?>

<resources>
    <usb-device vendor-id="9440" product-id="12" />
    <usb-device vendor-id="9440" product-id="13" />
</resources>
```

12.5. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a Java code snippet to use the DigitalIO function.

```
[...]
// Enable detection of USB devices
YAPI.EnableUSBHost(this);
YAPI.RegisterHub("usb");
[...]
// Retrieve the object used to interact with the device
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO");

// Hot-plug is easy: just check that the device is online
if (digitalio.isOnline()) {
    // Use digitalio.set_state()
    [...]
}

[...]
```

Let us look at these lines in more details.

YAPI.EnableUSBHost

The `YAPI.EnableUSBHost` function initializes the API with the Context of the current application. This function takes as argument an object of the `android.content.Context` class (or of a subclass). If you intend to connect your application only to other machines through the network, this function is facultative.

YAPI.RegisterHub

The `yAPI.RegisterHub` function initializes the Yoctopuce API and indicates where the modules should be looked for. The parameter is the address of the virtual hub able to see the devices. If the string "usb" is passed as parameter, the API works with modules locally connected to the machine. If the initialization does not succeed, an exception is thrown.

YDigitalIO.FindDigitalIO

The `YDigitalIO.FindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number *MAXIO02-123456* which you have named "*MyModule*", and for which you have given the `digitalIO` function the name "*MyFunction*". The following five calls are strictly equivalent, as long as "*MyFunction*" is defined only once.

```
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.MyFunction")
digitalio = YDigitalIO.FindDigitalIO("MyModule.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MyModule.MyFunction")
digitalio = YDigitalIO.FindDigitalIO("MyFunction")
```

`YDigitalIO.FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `YDigitalIO.FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YDigitalIO.FindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Launch your Java environment and open the corresponding sample project provided in the directory **Examples//Doc-Examples** of the Yoctopuce library.

In this example, you can recognize the functions explained above, but this time used with all the side materials needed to make it work nicely as a small demo.

```
package com.yoctopuce.doc_examples;

import android.app.Activity;
import android.os.Bundle;
import android.os.Handler;
import android.view.View;
import android.widget.AdapterView;
import android.widget.AdapterView.OnItemSelectedListener;
import android.widget.ArrayAdapter;
import android.widget.Spinner;
import android.widget.TextView;

import com.yoctopuce.YoctoAPI.YAPI;
import com.yoctopuce.YoctoAPI.YAPI_Exception;
import com.yoctopuce.YoctoAPI.YDigitalIO;
import com.yoctopuce.YModule;

public class GettingStarted_Yocto_Maxi_IO extends Activity implements
OnItemSelectedListener {

    private ArrayAdapter<String> aa;
    private String serial = "";
    private Handler handler = null;
    private int _outputdata;

    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.gettingstarted_yocto_maxi_io);
        Spinner my_spin = (Spinner) findViewById(R.id.spinner1);
        my_spin.setOnItemSelectedListener(this);
        aa = new ArrayAdapter<String>(this, android.R.layout.simple_spinner_item);
        aa.setDropDownViewResource(android.R.layout.simple_spinner_dropdown_item);
        my_spin.setAdapter(aa);
        handler = new Handler();
    }

    @Override
    protected void onStart() {
        super.onStart();
        try {
            aa.clear();
            YAPI.EnableUSBHost(this);
            YAPI.RegisterHub("usb");
            YModule module = YModule.FirstModule();
            while (module != null) {
                if (module.getProduct().equals("Yocto-Maxi-IO")) {
                    String serial = module.getSerialNumber();
                    aa.add(serial);
                }
                module = module.nextModule();
            }
        } catch (YAPI_Exception e) {
            e.printStackTrace();
        }
        aa.notifyDataSetChanged();
        handler.postDelayed(r, 500);
    }

    @Override
    protected void onStop() {
        super.onStop();
        handler.removeCallbacks(r);
        YAPI.FreeAPI();
    }

    @Override
    public void onItemSelected(AdapterView<?> parent, View view, int pos, long id) {
```

```

        serial = parent.getItemAtPosition(pos).toString();
    }

@Override
public void onNothingSelected(AdapterView<?> arg0) {
}

final Runnable r = new Runnable() {
    public void run() {
        if (serial != null) {
            YDigitalIO io = YDigitalIO.FindDigitalIO(serial);
            try {

                // lets configure the channels direction
                // bits 0..3 as output
                // bits 4..7 as input
                io.set_portDirection(0x0F);
                io.set_portPolarity(0); // polarity set to regular
                io.set_portOpenDrain(0); // No open drain
                _outputdata = (_outputdata + 1) % 16; // cycle ouput 0..15
                io.set_portState(_outputdata); // We could have used set_bitState as
well

                int inputdata = io.getPortState(); // read port values
                String line = ""; // display port state value as binary
                for (int i = 0; i < 8; i++) {
                    if ((inputdata & (128 >> i)) > 0) {
                        line = line + '1';
                    } else {
                        line = line + '0';
                    }
                }
                TextView view = (TextView) findViewById(R.id.portfield);
                view.setText("port value = " + line);
            } catch (YAPI_Exception e) {
                e.printStackTrace();
            }
        }
        handler.postDelayed(this, 1000);
    }
};

}

```

12.6. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

package com.yoctopuce.doc_examples;

import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.widget.AdapterView;
import android.widget.AdapterView.OnItemSelectedListener;
import android.widget.ArrayAdapter;
import android.widget.Spinner;
import android.widget.Switch;
import android.widget.TextView;

import com.yoctopuce.YoctoAPI.YAPI;
import com.yoctopuce.YoctoAPI.YAPI_Exception;
import com.yoctopuce.YoctoAPI.YModule;

public class ModuleControl extends Activity implements OnItemSelectedListener
{

    private ArrayAdapter<String> aa;
    private YModule module = null;

    @Override
    public void onCreate(Bundle savedInstanceState)
    {

```

```

        super.onCreate(savedInstanceState);
        setContentView(R.layout.modulecontrol);
        Spinner my_spin = (Spinner) findViewById(R.id.spinner1);
        my_spin.setOnItemSelectedListener(this);
        aa = new ArrayAdapter<String>(this, android.R.layout.simple_spinner_item);
        aa.setDropDownViewResource(android.R.layout.simple_spinner_dropdown_item);
        my_spin.setAdapter(aa);
    }

@Override
protected void onStart()
{
    super.onStart();

    try {
        aa.clear();
        YAPI.EnableUSBHost(this);
        YAPI.RegisterHub("usb");
        YModule r = YModule.FirstModule();
        while (r != null) {
            String hwid = r.getHardwareId();
            aa.add(hwid);
            r = r.nextModule();
        }
    } catch (YAPI_Exception e) {
        e.printStackTrace();
    }
    // refresh Spinner with detected relay
    aa.notifyDataSetChanged();
}

@Override
protected void onStop()
{
    super.onStop();
    YAPI.FreeAPI();
}

private void DisplayModuleInfo()
{
    TextView field;
    if (module == null)
        return;
    try {
        field = (TextView) findViewById(R.id.serialfield);
        field.setText(module.getSerialNumber());
        field = (TextView) findViewById(R.id.logicalnamefield);
        field.setText(module.getLogicalName());
        field = (TextView) findViewById(R.id.luminosityfield);
        field.setText(String.format("%d%%", module.getLuminosity()));
        field = (TextView) findViewById(R.id.uptimefield);
        field.setText(module.getUpTime() / 1000 + " sec");
        field = (TextView) findViewById(R.id.usbcurrentfield);
        field.setText(module.getUsbCurrent() + " mA");
        Switch sw = (Switch) findViewById(R.id.beaconswitch);
        sw.setChecked(module.getBeacon() == YModule.BEACON_ON);
        field = (TextView) findViewById(R.id.logs);
        field.setText(module.getLastLogs());
    } catch (YAPI_Exception e) {
        e.printStackTrace();
    }
}

@Override
public void onItemClick(AdapterView<?> parent, View view, int pos, long id)
{
    String hwid = parent.getItemAtPosition(pos).toString();
    module = YModule.FindModule(hwid);
    DisplayModuleInfo();
}

@Override
public void onNothingSelected(AdapterView<?> arg0)
{
}

public void refreshInfo(View view)

```

```

    {
        DisplayModuleInfo();
    }

    public void toggleBeacon(View view)
    {
        if (module == null)
            return;
        boolean on = ((Switch) view).isChecked();

        try {
            if (on) {
                module.setBeacon(YModule.BEACON_ON);
            } else {
                module.setBeacon(YModule.BEACON_OFF);
            }
        } catch (YAPI_Exception e) {
            e.printStackTrace();
        }
    }
}

```

Each property `xxx` of the module can be read thanks to a method of type `YModule.get_xxxx()`, and properties which are not read-only can be modified with the help of the `YModule.set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `YModule.set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `YModule.saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `YModule.revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```

package com.yoctopuce.doc_examples;

import android.app.Activity;
import android.os.Bundle;
import android.view.View;
import android.widget.AdapterView;
import android.widget.AdapterView.OnItemSelectedListener;
import android.widget.ArrayAdapter;
import android.widget.EditText;
import android.widget.Spinner;
import android.widget.TextView;
import android.widget.Toast;

import com.yoctopuce.YoctoAPI.YAPI;
import com.yoctopuce.YoctoAPI.YAPI_Exception;
import com.yoctopuce.YoctoAPI.YModule;

public class SaveSettings extends Activity implements OnItemSelectedListener
{

    private ArrayAdapter<String> aa;
    private YModule module = null;

    @Override
    public void onCreate(Bundle savedInstanceState)
    {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.savesettings);
        Spinner my_spin = (Spinner) findViewById(R.id.spinner1);
        my_spin.setOnItemSelectedListener(this);
        aa = new ArrayAdapter<String>(this, android.R.layout.simple_spinner_item);
        aa.setDropDownViewResource(android.R.layout.simple_spinner_dropdown_item);
        my_spin.setAdapter(aa);
    }

    @Override
    protected void onStart()
    {

```

```

super.onStart();

try {
    aa.clear();
    YAPI.EnableUSBHost(this);
    YAPI.RegisterHub("usb");
    YModule r = YModule.FirstModule();
    while (r != null) {
        String hwid = r.get.hardwareId();
        aa.add(hwid);
        r = r.nextModule();
    }
} catch (YAPI_Exception e) {
    e.printStackTrace();
}
// refresh Spinner with detected relay
aa.notifyDataSetChanged();
}

@Override
protected void onStop()
{
    super.onStop();
    YAPI.FreeAPI();
}

private void DisplayModuleInfo()
{
    TextView field;
    if (module == null)
        return;
    try {
        YAPI.UpdateDeviceList(); // fixme
        field = (TextView) findViewById(R.id.logicalnamefield);
        field.setText(module.getLogicalName());
    } catch (YAPI_Exception e) {
        e.printStackTrace();
    }
}

@Override
public void onItemSelected(AdapterView<?> parent, View view, int pos, long id)
{
    String hwid = parent.getItemAtPosition(pos).toString();
    module = YModule.FindModule(hwid);
    DisplayModuleInfo();
}

@Override
public void onNothingSelected(AdapterView<?> arg0)
{
}

public void saveName(View view)
{
    if (module == null)
        return;

    EditText edit = (EditText) findViewById(R.id.newname);
    String newname = edit.getText().toString();
    try {
        if (!YAPI.CheckLogicalName(newname)) {
            Toast.makeText(getApplicationContext(), "Invalid name (" + newname + ")",
Toast.LENGTH_LONG).show();
            return;
        }
        module.set_logicalName(newname);
        module.saveToFlash(); // do not forget this
        edit.setText("");
    } catch (YAPI_Exception ex) {
        ex.printStackTrace();
    }
    DisplayModuleInfo();
}
}

```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `YModule.saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `YModule.yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not null. Below a short example listing the connected modules.

```
package com.yoctopuce.doc_examples;

import android.app.Activity;
import android.os.Bundle;
import android.util.TypedValue;
import android.view.View;
import android.widget.LinearLayout;
import android.widget.TextView;

import com.yoctopuce.YoctoAPI.YAPI;
import com.yoctopuce.YoctoAPI.YAPI_Exception;
import com.yoctopuce.YoctoAPI.YModule;

public class Inventory extends Activity
{

    @Override
    public void onCreate(Bundle savedInstanceState)
    {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.inventory);
    }

    public void refreshInventory(View view)
    {
        LinearLayout layout = (LinearLayout) findViewById(R.id.inventoryList);
        layout.removeAllViews();

        try {
            YAPI.UpdateDeviceList();
            YModule module = YModule.FirstModule();
            while (module != null) {
                String line = module.get_serialNumber() + " (" + module.get_productName() +
                ")";
                TextView tx = new TextView(this);
                tx.setText(line);
                tx.setTextSize(TypedValue.COMPLEX_UNIT_SP, 20);
                layout.addView(tx);
                module = module.nextModule();
            }
        } catch (YAPI_Exception e) {
            e.printStackTrace();
        }
    }

    @Override
    protected void onStart()
    {
        super.onStart();
        try {
            YAPI.EnableUSBHost(this);
            YAPI.RegisterHub("usb");
        } catch (YAPI_Exception e) {
            e.printStackTrace();
        }
        refreshInventory(null);
    }

    @Override
    protected void onStop()
    {
        super.onStop();
    }
}
```

```
        YAPI.FreeAPI();  
    }  
}
```

12.7. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software.

In the Java API for Android, error handling is implemented with exceptions. Therefore you must catch and handle correctly all exceptions that might be thrown by the API if you do not want your software to crash soon as you unplug a device.

13. Using Yocto-Maxi-IO-V2 with TypeScript

TypeScript is an enhanced version of the JavaScript programming language. It is a syntactic superset with strong typing, therefore increasing the code reliability, but transpiled - aka compiled - into JavaScript for execution in any standard Web browser or Node.js environment.

This Yoctopuce library therefore makes it possible to implement JavaScript applications using strong typing. Similarly to our EcmaScript library, it uses the new asynchronous features introduced in ECMAScript 2017, which are now available in all modern JavaScript environments. Note however that at the time of writing, Web browsers and Node.js cannot use TypeScript code directly, so you must first compile your TypeScript into JavaScript before running it.

The library works both in a Web browser and in Node.js. In order to allow for a static resolution of dependencies, and to avoid ambiguities that can arise when using hybrid environments such as Electron, the choice of the runtime environment must be done explicitly upon import of the library, by referencing in the project either `yocto_api_nodejs.js` or `yocto_api_html.js`.

The library can be integrated in your projects in multiple ways, depending on what best fits your requirements:

- by directly copying the TypeScript library source files into your project, and by adding them to your build script. Only a few files are usually needed to handle most use-cases. You will find TypeScript source files in the `src` subdirectory of our library.
- by using CommonJS module resolution, natively supported by TypeScript, with a package manager such as `npm`. You will find a version of the library transpiled according to CommonJS module standard in the `dist/cjs` subdirectory, including all type definition files (with extension `.d.ts`) and source maps (with extension `.js.map`) enabling source-level error reporting and debugging. We have also published these files on `npmjs` under the name `yoctolib-cjs`.
- by using ECMAScript standard module resolution, also supported by TypeScript, usually referenced by relative path. You will find a version of the library transpiled as an ECMAScript 2015 module in the `dist/esm` subdirectory, including all type definition files (with extension `.d.ts`) and source maps (with extension `.js.map`) enabling source-level error reporting and debugging. We have also published these files on `npmjs` under the name `yoctolib-esm`.

13.1. Using the Yoctopuce library for TypeScript

1. Start by installing TypeScript on your machine if this is not yet done. In order to do so:

- Install on your development machine the official version of Node.js (typically version 10 or more recent). You can download it for free from the official web site: <http://nodejs.org>. Make sure to install it fully, including npm, and add it to the system path.
- Then install TypeScript on your machine using the command line:

```
npm install -g typescript
```

2. Go to the Yoctopuce web site and download the following items:

- The TypeScript programming library¹
- The VirtualHub software² for Windows, Mac OS X, or Linux, depending on your OS. TypeScript and JavaScript are part of those languages which do not generally allow you to directly access to USB peripherals. Therefore the library can only be used to access network-enabled devices (connected through a YoctoHub), or USB devices accessible through Yoctopuce TCP/IP to USB gateway, named *VirtualHub*. No extra driver will be needed, though.

3. Extract the library files in a folder of your choice, and open a command window in the directory where you have installed it. In order to install the few dependencies which are necessary to start the examples, run this command:

```
npm install
```

When the command has run without error, you are ready to explore the examples. They are available in two different trees, depending on the environment that you need to use: `example_html` for running the Yoctopuce library within a Web browser, or `example_nodejs` if you plan to use the library in a Node.js environment.

The method to use for launching the examples depends on the environment. You will find more about it below.

13.2. Refresher on asynchronous I/O in JavaScript

JavaScript is single-threaded by design. In order to handle time-consuming I/O operations, JavaScript relies on asynchronous operations: the I/O call is only triggered but then the code execution flow is suspended. The JavaScript engine is therefore free to handle other pending tasks, such as user interface. Whenever the pending I/O call is completed, the system invokes a callback function with the result of the I/O call to resume execution of the original execution flow.

When used with plain callback functions, as pervasive in Node.js libraries, asynchronous I/O tend to produce code with poor readability, as the execution flow is broken into many disconnected callback functions. Fortunately, the ECMAScript 2015 standard came in with *Promise* objects and a new `async / await` syntax to abstract calls to asynchronous calls:

- a function declared `async` automatically encapsulates its result as a `Promise`
- within an `async` function, any function call prefixed with `await` chains the `Promise` returned by the function with a promise to resume execution of the caller
- any exception during the execution of an `async` function automatically invokes the `Promise` failure continuation

To make a long story short, `async` and `await` make it possible to write TypeScript code with all the benefits of asynchronous I/O, but without breaking the code flow. It is almost like multi-threaded

¹ www.yoctopuce.com/EN/libraries.php

² www.yoctopuce.com/EN/virtualhub.php

execution, except that control switch between pending tasks only happens at places where the `await` keyword appears.

This TypeScript library uses the `Promise` objects and `async` methods, to allow you to use the `await` syntax. To keep it easy to remember, all public methods of the TypeScript library are `async`, i.e. return a `Promise` object, except:

- `GetTickCount()`, because returning a time stamp asynchronously does not make sense...
- `FindModule()`, `FirstModule()`, `nextModule()`, ... because device detection and enumeration always works on internal device lists handled in background, and does not require immediate asynchronous I/O.

In most cases, TypeScript strong typing will remind you to use `await` when calling an asynchronous method.

13.3. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a TypeScript code snippet to use the DigitalIO function.

```
// For Node.js, the library is referenced through the NPM package
// For HTML, we would use instead a relative path (depending on the build environment)
import { YAPI, YErrorMsg, YModule } from 'yoctolib-cjs/yocto_api_nodejs.js';
import { YDigitalIO } from 'yoctolib-cjs/yocto_digitalio.js';

[...]
// Get access to your device, through the VirtualHub running locally
await YAPI.RegisterHub('127.0.0.1');
[...]

// Retrieve the object used to interact with the device
var digitalio: YDigitalIO = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO");

// Check that the module is online to handle hot-plug
if(await digitalio.isOnline())
{
    // Use digitalio.set_state()
    [...]
}
```

Let us look at these lines in more details.

yocto_api and yocto_digitalio import

These two imports provide access to functions allowing you to manage Yoctopuce modules. `yocto_api` is always needed, `yocto_digitalio` is necessary to manage modules containing a digital I/O port, such as Yocto-Maxi-IO-V2. Other imports can be useful in other cases, such as `YModule` which can let you enumerate any type of Yoctopuce device.

In order to properly bind `yocto_api` to the proper network libraries (provided either by Node.js or by the web browser for an HTML application), you must import at least once in your project one of the two variants `yocto_api_nodejs.js` or `yocto_api_html.js`.

Note that this example imports the Yoctopuce library as a CommonJS module, which is the most frequently used with Node.js, but if your project is designed around EcmaScript native modules, you can also replace in the import directive the prefix `yoctolib-cjs` by `yoctolib-esm`.

YAPI.RegisterHub

The `RegisterHub` method allows you to indicate on which machine the Yoctopuce modules are located, more precisely on which machine the VirtualHub software is running. In our case, the `127.0.0.1:4444` address indicates the local machine, port `4444` (the standard port used by Yoctopuce). You can very well modify this address, and enter the address of another machine on which the VirtualHub software is running, or of a YoctoHub. If the host cannot be reached, this function will trigger an exception.

As explained above, using `RegisterHub("usb")` is not supported in TypeScript, because the JavaScript engine has no direct access to USB devices. It needs to go through the `VirtualHub` via a `localhost` connection.

YDigitalIO.FindDigitalIO

The `FindDigitalIO` method allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can also use logical names, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIO02-123456` which you have named "`MyModule`", and for which you have given the `digitalIO` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.MaFonction")
digitalio = YDigitalIO.FindDigitalIO("MonModule.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MonModule.MaFonction")
digitalio = YDigitalIO.FindDigitalIO("MaFonction")
```

`YDigitalIO.FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YDigitalIO.FindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example, for Node.js

Open a command window (a terminal, a shell...) and go into the directory `example_nodejs/Doc-GettingStarted-Yocto-Maxi-IO-V2` within Yoctopuce library for TypeScript. In there, you will find a file named `demo.ts` with the sample code below, which uses the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

If your Yocto-Maxi-IO-V2 is not connected on the host running the browser, replace in the example the address `127.0.0.1` by the IP address of the host on which the Yocto-Maxi-IO-V2 is connected and where you run the `VirtualHub`.

```
import { YAPI, YErrorMsg, YModule } from 'yoctolib-cjs/yocto_api_nodejs.js';
import { YDigitalIO } from 'yoctolib-cjs/yocto_digitalio.js'

let io: YDigitalIO;
let outputdata: number;

async function startDemo(): Promise<void>
{
    await YAPI.LogUnhandledPromiseRejections();

    // Setup the API to use the VirtualHub on local machine
    let errmsg: YErrorMsg = new YErrorMsg();
    if(await YAPI.RegisterHub('127.0.0.1', errmsg) != YAPI.SUCCESS) {
        console.log('Cannot contact VirtualHub on 127.0.0.1: '+errmsg.msg);
        return;
    }

    // Select specified device, or use first available one
    let serial: string = process.argv[process.argv.length-1];
    if (serial[8] != '-') {
        // by default use any connected module suitable for the demo
        let anysensor = YDigitalIO.FirstDigitalIO();
        if (any sensor) {
            let module: YModule = await anysensor.get_module();
            serial = await module.get_serialNumber();
```

```

        } else {
            console.log('No matching sensor connected, check cable !');
            await YAPI.FreeAPI();
            return;
        }
    }
    console.log('Using device ' + serial);

    io = YDigitalIO.FindDigitalIO(serial + '.digitalIO');
    // lets configure the channels direction
    // bits 0..1 as output
    // bits 2..3 as input
    await io.set_portDirection(0x03);
    await io.set_portPolarity(0); // polarity set to regular
    await io.set_portOpenDrain(0); // No open drain
    console.log("Channels 0..1 are configured as outputs and channels 2..3");
    console.log("are configred as inputs, you can connect some inputs to");
    console.log("outputs and see what happens");
    outputdata = 0;
    refresh();
}

async function refresh(): Promise<void>
{
    if (await io.isOnline()) {
        // cycle output 0..3
        outputdata = (outputdata + 1) % 4;
        // We could have used set_bitState as well
        await io.set_portState(outputdata);
        // read port values
        let inputdata: number = await io.getPortState();
        console.log("port value = " + inputdata.toString(2));
    } else {
        console.log('Module not connected');
    }
    setTimeout(refresh, 1000);
}

startDemo();

```

As explained at the beginning of this chapter, you need to have installed the TypeScript compiler on your machine to test these examples, and to install the typescript library dependencies. If you have done that, you can now type the following two commands in the example directory, to finalize the resolution of the example-specific dependencies:

```
npm install
```

You are now ready to start the sample code with Node.js. The easiest way to do it is to use the following command, replacing the [...] by the arguments that you want to pass to the demo code:

```
npm run demo [...]
```

This command, defined in `package.json`, will first start the TypeScript compiler using the simple `tsc` command, then run the transpiled code in Node.js.

The compilation uses the parameters specified in the file `tsconfig.json`, and produces

- a JavaScript file named `demo.js`, that Node.js can run
- a debug file named `demo.js.map`, that will help Node.js to locate the source of errors in the original TypeScript source file rather than reporting them in the JavaScript compiled file.

Note that the `package.json` file in our examples uses a relative reference to the local copy of the library, to avoid duplicating the library in each example. But of course, for your application, you can refer to the package directly in npm repository, by adding it to your project using the command:

```
npm install yoctolib-cjs
```

Same example, but this time running in a browser

If you want to see how to use the library within a browser rather than with Node.js, switch to the directory **example_html/Doc-GettingStarted-Yocto-Maxi-IO-V2**. You will find there an HTML file named `app.html`, and a TypeScript file `app.ts` similar to the code above, but with a few changes since it has to interact through an HTML page rather than through the JavaScript console.

No installation is needed to run this example, as the TypeScript library is referenced using a relative path. However, in order to allow the browser to run the code, the HTML page must be served by a Web server. We therefore provide a simple test server for this purpose, that you can start with the command:

```
npm run app-server
```

This command will compile the TypeScript sample code, make it available via an HTTP server on port 3000 and open a Web browser on this example. If you change the example source code, the TypeScript compiler will automatically be triggered to update the transpiled code and a simple page reload on the browser will make it possible to test the change.

As for the Node.js example, the compilation process will create a source map file which makes it possible to debug the example code in TypeScript source form within the browser debugger. Note that as of the writing of this document, this works on Chromium-based browsers but not yet in Firefox.

13.4. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```
import { YAPI, YErrorMsg, YModule } from 'yoctolib-cjs/yocto_api_nodejs.js';

async function startDemo(args: string[]): Promise<void>
{
    await YAPI.LogUnhandledPromiseRejections();

    // Setup the API to use the VirtualHub on local machine
    let errormsg: YErrorMsg = new YErrorMsg();
    if (await YAPI.RegisterHub('127.0.0.1', errormsg) != YAPI.SUCCESS) {
        console.log('Cannot contact VirtualHub on 127.0.0.1: '+errormsg.msg);
        return;
    }

    // Select the device to use
    let module: YModule = YModule.FindModule(args[0]);
    if(await module.isOnline()) {
        if(args.length > 1) {
            if(args[1] == 'ON') {
                await module.set_beacon(YModule.BEACON_ON);
            } else {
                await module.set_beacon(YModule.BEACON_OFF);
            }
        }
        console.log('serial:      '+await module.get_serialNumber());
        console.log('logical name: '+await module.get_logicalName());
        console.log('luminosity:   '+await module.get_luminosity()+'%');
        console.log('beacon:       '+
                    (await module.get_beacon() == YModule.BEACON_ON ? 'ON' : 'OFF'));
        console.log('upTime:        '+
                    ((await module.get_upTime()/1000)>>0) + ' sec');
        console.log('USB current:  '+await module.get_usbCurrent()+' mA');
        console.log('logs:');
        console.log(await module.get_lastLogs());
    } else {
        console.log("Module not connected (check identification and USB cable)\n");
    }
    await YAPI.FreeAPI();
}

if(process.argv.length < 3) {
    console.log("usage: npm run demo <serial or logicalname> [ ON | OFF ]");
}
```

```

} else {
    startDemo(process.argv.slice(2));
}

```

Each property `xxx` of the module can be read thanks to a method of type `get_xxxx()`, and properties which are not read-only can be modified with the help of the `set_xxx()` method. For more details regarding the used methods, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `set_xxx()` method. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```

import { YAPI, YErrorMsg, YModule } from 'yoctolib-cjs/yocto_api_nodejs.js';

async function startDemo(args: string[]): Promise<void>
{
    await YAPI.LogUnhandledPromiseRejections();

    // Setup the API to use the VirtualHub on local machine
    let errmsg: YErrorMsg = new YErrorMsg();
    if (await YAPI.RegisterHub('127.0.0.1', errmsg) != YAPI.SUCCESS) {
        console.log('Cannot contact VirtualHub on 127.0.0.1: '+errmsg.msg);
        return;
    }

    // Select the device to use
    let module: YModule = YModule.FindModule(args[0]);
    if(await module.isOnline()) {
        if(args.length > 1) {
            let newname: string = args[1];
            if (!await YAPI.CheckLogicalName(newname)) {
                console.log("Invalid name (" + newname + ")");
                process.exit(1);
            }
            await module.set_logicalName(newname);
            await module.saveToFlash();
        }
        console.log('Current name: '+await module.get_logicalName());
    } else {
        console.log("Module not connected (check identification and USB cable)\n");
    }
    await YAPI.FreeAPI();
}

if(process.argv.length < 3) {
    console.log("usage: npm run demo <serial> [newLogicalName]");
} else {
    startDemo(process.argv.slice(2));
}

```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `saveToFlash()` method only 100000 times in the life of the module. Make sure you do not call this method within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `YModule.FirstModule()` method which returns the first module found. Then, you only need to call the `nextModule()` method of this object to find the following modules, and this as long as the returned value is not null. Below a short example listing the connected modules.

```

import { YAPI, YErrorMsg, YModule } from 'yoctolib-cjs/yocto_api_nodejs.js';

async function startDemo(): Promise<void>
{
    await YAPI.LogUnhandledPromiseRejections();

    // Setup the API to use the VirtualHub on local machine
    let errmsg = new YErrorMsg();
    if (await YAPI.RegisterHub('127.0.0.1', errmsg) != YAPI.SUCCESS) {
        console.log('Cannot contact VirtualHub on 127.0.0.1');
        return;
    }
    refresh();
}

async function refresh(): Promise<void>
{
    try {
        let errmsg: YErrorMsg = new YErrorMsg();
        await YAPI.UpdateDeviceList(errmsg);

        let module = YModule.FirstModule();
        while(module) {
            let line: string = await module.get_serialNumber();
            line += '(' + (await module.get_productName()) + ')';
            console.log(line);
            module = module.nextModule();
        }
        setTimeout(refresh, 500);
    } catch(e) {
        console.log(e);
    }
}
startDemo();

```

13.5. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.
- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always

follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value, a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the `errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

14. Using Yocto-Maxi-IO-V2 with JavaScript / EcmaScript

EcmaScript is the official name of the standardized version of the web-oriented programming language commonly referred to as *JavaScript*. This Yoctopuce library take advantages of advanced features introduced in EcmaScript 2017. It has therefore been named *Library for JavaScript / EcmaScript 2017* to differentiate it from the previous *Library for JavaScript*, now deprecated in favor of this new version.

This library provides access to Yoctopuce devices for modern JavaScript engines. It can be used within a browser as well as with Node.js. The library will automatically detect upon initialization whether the runtime environment is a browser or a Node.js virtual machine, and use the most appropriate system libraries accordingly.

Asynchronous communication with the devices is handled across the whole library using Promise objects, leveraging the new EcmaScript 2017 `async / await` non-blocking syntax for asynchronous I/O (see below). This syntax is now available out-of-the-box in most Javascript engines. No transpilation is needed: no Babel, no jspm, just plain Javascript. Here is your favorite engines minimum version needed to run this code. All of them are officially released at the time we write this document.

- Node.js v7.6 and later
- Firefox 52
- Opera 42 (incl. Android version)
- Chrome 55 (incl. Android version)
- Safari 10.1 (incl. iOS version)
- Android WebView 55
- Google V8 Javascript engine v5.5

If you need backward-compatibility with older releases, you can always run Babel to transpile your code and the library to older standards, as described a few paragraphs below.

We don't suggest using `jspm` anymore now that `async / await` are part of the standard.

14.1. Blocking I/O versus Asynchronous I/O in JavaScript

JavaScript is single-threaded by design. That means, if a program is actively waiting for the result of a network-based operation such as reading from a sensor, the whole program is blocked. In browser environments, this can even completely freeze the user interface. For this reason, the use of blocking I/O in JavaScript is strongly discouraged nowadays, and blocking network APIs are getting deprecated everywhere.

Instead of using parallel threads, JavaScript relies on asynchronous I/O to handle operations with a possible long timeout: whenever a long I/O call needs to be performed, it is only triggered and then the code execution flow is terminated. The JavaScript engine is therefore free to handle other pending tasks, such as UI. Whenever the pending I/O call is completed, the system invokes a callback function with the result of the I/O call to resume execution of the original execution flow.

When used with plain callback functions, as pervasive in Node.js libraries, asynchronous I/O tend to produce code with poor readability, as the execution flow is broken into many disconnected callback functions. Fortunately, new methods have emerged recently to improve that situation. In particular, the use of *Promise* objects to abstract and work with asynchronous tasks helps a lot. Any function that makes a long I/O operation can return a *Promise*, which can be used by the caller to chain subsequent operations in the same flow. Promises are part of EcmaScript 2015 standard.

Promise objects are good, but what makes them even better is the new `async` / `await` keywords to handle asynchronous I/O:

- a function declared `async` will automatically encapsulate its result as a *Promise*
- within an `async` function, any function call prefixed with `by await` will chain the *Promise* returned by the function with a promise to resume execution of the caller
- any exception during the execution of an `async` function will automatically invoke the *Promise* failure continuation

Long story made short, `async` and `await` make it possible to write EcmaScript code with all benefits of asynchronous I/O, but without breaking the code flow. It is almost like multi-threaded execution, except that control switch between pending tasks only happens at places where the `await` keyword appears.

We have therefore chosen to write our new EcmaScript library using Promises and `async` functions, so that you can use the friendly `await` syntax. To keep it easy to remember, **all public methods** of the EcmaScript library **are `async`**, i.e. return a *Promise* object, **except**:

- `GetTickCount()`, because returning a time stamp asynchronously does not make sense...
- `FindModule()`, `FirstModule()`, `nextModule()`, ... because device detection and enumeration always work on internal device lists handled in background, and does not require immediate asynchronous I/O.

14.2. Using Yoctopuce library for JavaScript / EcmaScript 2017

JavaScript is one of those languages which do not generally allow you to directly access the hardware layers of your computer. Therefore the library can only be used to access network-enabled devices (connected through a YoctoHub), or USB devices accessible through Yoctopuce TCP/IP to USB gateway, named *VirtualHub*.

Go to the Yoctopuce web site and download the following items:

- The Javascript / EcmaScript 2017 programming library¹
- The *VirtualHub* software² for Windows, Mac OS X or Linux, depending on your OS

Extract the library files in a folder of your choice, you will find many of examples in it. Connect your modules and start the *VirtualHub* software. You do not need to install any driver.

Using the official Yoctopuce library for node.js

Start by installing the latest Node.js version (v7.6 or later) on your system. It is very easy. You can download it from the official web site: <http://nodejs.org>. Make sure to install it fully, including npm, and add it to the system path.

¹ www.yoctopuce.com/EN/libraries.php

² www.yoctopuce.com/EN/virtualhub.php

To give it a try, go into one of the example directory (for instance `example_nodejs/Doc-Inventory`). You will see that it include an application description file (`package.json`) and a source file (`demo.js`). To download and setup the libraries needed by this example, just run:

```
npm install
```

Once done, you can start the example file using:

```
node demo.js
```

Using a local copy of the Yoctopuce library with node.js

If for some reason you need to make changes to the Yoctopuce library, you can easily configure your project to use the local copy in the `lib/` subdirectory rather than the official npm package. In order to do so, simply type the following command in your project directory:

```
npm link ../../lib
```

Using the Yoctopuce library within a browser (HTML)

For HTML examples, it is even simpler: there is nothing to install. Each example is a single HTML file that you can open in a browser to try it. In this context, loading the Yoctopuce library is no different from any standard HTML script include tag.

Using the Yoctoluce library on older JavaScript engines

If you need to run this library on older JavaScript engines, you can use Babel³ to transpile your code and the library into older JavaScript standards. To install Babel with typical settings, simply use:

```
npm install -g babel-cli
npm install babel-preset-env
```

You would typically ask Babel to put the transpiled files in another directory, named `compat` for instance. Your files and all files of the Yoctopuce library should be transpiled, as follow:

```
babel --presets env demo.js --out-dir compat/
babel --presets env ../../lib --out-dir compat/
```

Although this approach is based on node.js toolchain, it actually works as well for transpiling JavaScript files for use in a browser. The only thing that you cannot do so easily is transpiling JavaScript code embedded directly in an HTML page. You have to use an external script file for using EcmaScript 2017 syntax with Babel.

Babel has many smart features, such as a watch mode that will automatically refresh transpiled files whenever the source file is changed, but this is beyond the scope of this note. You will find more in Babel documentation.

Backward-compatibility with the old JavaScript library

This new library is not fully backward-compatible with the old JavaScript library, because there is no way to transparently map the old blocking API to the new asynchronous API. The method names however are the same, and old synchronous code can easily be made asynchronous just by adding the proper `await` keywords before the method calls. For instance, simply replace:

```
beaconState = module.getBeacon();
```

by

³ <http://babeljs.io>

```
beaconState = await module.get_beacon();
```

Apart from a few exceptions, most XXX_async redundant methods have been removed as well, as they would have introduced confusion on the proper way of handling asynchronous behaviors. It is however very simple to get an `async` method to invoke a callback upon completion, using the returned Promise object. For instance, you can replace:

```
module.get_beacon_async(callback, myContext);
```

by

```
module.get_beacon().then(function(res) { callback(myContext, module, res); });
```

In some cases, it might be desirable to get a sensor value using a method identical to the old synchronous methods (without using Promises), even if it returns a slightly outdated cached value since I/O is not possible. For this purpose, the EcmaScript library introduce new classes called *synchronous proxies*. A synchronous proxy is an object that mirrors the most recent state of the connected class, but can be read using regular synchronous function calls. For instance, instead of writing:

```
async function logInfo(module)
{
    console.log('Name: '+await module.get_logicalName());
    console.log('Beacon: '+await module.get_beacon());
}

...
logInfo(myModule);
...
```

you can use:

```
function logInfoProxy(moduleSyncProxy)
{
    console.log('Name: '+moduleSyncProxy.get_logicalName());
    console.log('Beacon: '+moduleSyncProxy.get_beacon());
}

logInfoSync(await myModule.get_syncProxy());
```

You can also rewrite this last asynchronous call as:

```
myModule.get_syncProxy().then(logInfoProxy);
```

14.3. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a JavaScript code snippet to use the DigitalIO function.

```
// For Node.js, we use function require()
// For HTML, we would use <script src="...">;
require('yoctolib-es2017/yocto_api.js');
require('yoctolib-es2017/yocto_digitalio.js');

[...]
// Get access to your device, through the VirtualHub running locally
await YAPI.RegisterHub('127.0.0.1');
[...]

// Retrieve the object used to interact with the device
var digitalio = YDigitalIO.FindDigitalIO("MAXIO002-123456.digitalIO");

// Check that the module is online to handle hot-plug
```

```

if(await digitalio.isOnline())
{
    // Use digitalio.set_state()
    [...]
}

```

Let us look at these lines in more details.

yocto_api and yocto_digitalio import

These two import provide access to functions allowing you to manage Yoctopuce modules. `yocto_api` is always needed, `yocto_digitalio` is necessary to manage modules containing a digital IO port, such as Yocto-Maxi-IO-V2. Other imports can be useful in other cases, such as `YModule` which can let you enumerate any type of Yoctopuce device.

YAPI.RegisterHub

The `RegisterHub` method allows you to indicate on which machine the Yoctopuce modules are located, more precisely on which machine the VirtualHub software is running. In our case, the `127.0.0.1:4444` address indicates the local machine, port `4444` (the standard port used by Yoctopuce). You can very well modify this address, and enter the address of another machine on which the VirtualHub software is running, or of a YoctoHub. If the host cannot be reached, this function will trigger an exception.

YDigitalIO.FindDigitalIO

The `FindDigitalIO` method allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can also use logical names, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIO02-123456` which you have named "`MyModule`", and for which you have given the `digitalIO` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```

digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.MaFonction")
digitalio = YDigitalIO.FindDigitalIO("MonModule.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MonModule.MaFonction")
digitalio = YDigitalIO.FindDigitalIO("MaFonction")

```

`YDigitalIO.FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YDigitalIO.FindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example, for Node.js

Open a command window (a terminal, a shell...) and go into the directory `example_nodejs/Doc-GettingStarted-Yocto-Maxi-IO-V2` within Yoctopuce library for JavaScript / EcmaScript 2017. In there, you will find a file named `demo.js` with the sample code below, which uses the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

If your Yocto-Maxi-IO-V2 is not connected on the host running the browser, replace in the example the address `127.0.0.1` with the IP address of the host on which the Yocto-Maxi-IO-V2 is connected and where you run the VirtualHub.

```

"use strict";

require('yocolib-es2017/yocto_api.js');
require('yocolib-es2017/yocto_digitalio.js');

let io, outputdata;

async function startDemo() {
    await YAPI.LogUnhandledPromiseRejections();
    await YAPI.DisableExceptions();

    // Setup the API to use the VirtualHub on local machine
    let errmsg = new YErrorMsg();
    if (await YAPI.RegisterHub('127.0.0.1', errmsg) != YAPI.SUCCESS) {
        console.log('Cannot contact VirtualHub on 127.0.0.1: ' + errmsg.msg);
        return;
    }

    // Select specified device, or use first available one
    let serial = process.argv[process.argv.length - 1];
    if (serial[8] != '-') {
        // by default use any connected module suitable for the demo
        let anysensor = YDigitalIO.FirstDigitalIO();
        if (anysensor) {
            let module = await anysensor.module();
            serial = await module.get_serialNumber();
        } else {
            console.log('No matching sensor connected, check cable !');
            return;
        }
    }
    console.log('Using device ' + serial);

    io = YDigitalIO.FindDigitalIO(serial + '.digitalIO');
    // lets configure the channels direction
    // bits 0..3 as output
    // bits 4..7 as input
    await io.set_portDirection(0x0F);
    await io.set_portPolarity(0); // polarity set to regular
    await io.set_portOpenDrain(0); // No open drain
    console.log("Channels 0..3 are configured as outputs and channels 4..7");
    console.log("are configred as inputs, you can connect some inputs to");
    console.log("outputs and see what happens");
    outputdata = 0;
    refresh();
}

async function refresh() {
    if (await io.isOnline()) {
        outputdata = (outputdata + 1) % 16; // cycle output 0..15
        await io.set_portState(outputdata); // We could have used set_bitState as well
        let inputdata = await io.get_portState(); // read port values
        let line = ""; // display port value as binary
        for (let i = 0; i < 8; i++) {
            if ((inputdata & (128 >> i)) > 0) {
                line = line + '1';
            } else {
                line = line + '0';
            }
        }
        console.log("port value = " + line);
    } else {
        console.log('Module not connected');
    }
    setTimeout(refresh, 1000);
}

startDemo();

```

As explained at the beginning of this chapter, you need to have Node.js v7.6 or later installed to try this example. When done, you can type the following two commands to automatically download and install the dependencies for building this example:

```
npm install
```

You can start the sample code within Node.js using the following command, replacing the [...] by the arguments that you want to pass to the demo code:

```
node demo.js [...]
```

Same example, but this time running in a browser

If you want to see how to use the library within a browser rather than with Node.js, switch to the directory **example_html/Doc-GettingStarted-Yocto-Maxi-IO-V2**. You will find there a single HTML file, with a JavaScript section similar to the code above, but with a few changes since it has to interact through an HTML page rather than through the JavaScript console.

```
<!DOCTYPE html>
<html>
<head>
<meta charset="UTF-8">
<title>Hello World</title>
<script src="../../lib/yocto_api.js"></script>
<script src="../../lib/yocto_temperature.js"></script>
<script>
    let io, outputdata;

    async function startDemo() {
        await YAPI.LogUnhandledPromiseRejections();
        await YAPI.DisableExceptions();

        // Setup the API to use the VirtualHub on local machine
        let errmsg = new YErrorMsg();
        if (await YAPI.RegisterHub('127.0.0.1', errmsg) != YAPI.SUCCESS) {
            alert('Cannot contact VirtualHub on 127.0.0.1: ' + errmsg.msg);
            return;
        }

        // Select specified device, or use first available one
        let serial = document.getElementById('serial').value;
        if (serial[8] != '-') {
            // by default use any connected module suitable for the demo
            let anysensor = YDigitalIO.FirstDigitalIO();
            if (anysensor) {
                let module = await anysensor.module();
                serial = await module.get_serialNumber();
            }
        }

        io = YDigitalIO.FindDigitalIO(serial + '.digitalIO');
        // lets configure the channels direction
        // bits 0..3 as output
        // bits 4..7 as input
        await io.set_portDirection(0x0F);
        await io.set_portPolarity(0); // polarity set to regular
        await io.set_portOpenDrain(0); // No open drain
        outputdata = 0;
        refresh();
    }

    async function refresh() {
        if (await io.isOnline()) {
            document.getElementById('msg').value = '';
            outputdata = (outputdata + 1) % 16; // cycle output 0..15
            await io.set_portState(outputdata); // We could have used set_bitState as well
            let inputdata = await io.get_portState(); // read port values
            let line = ""; // display port value as binary
            for (let i = 0; i < 8; i++) {
                if ((inputdata & (128 >> i)) > 0) {
                    line = line + '1';
                } else {
                    line = line + '0';
                }
            }
            document.getElementById('state').value = line;
        } else {
            document.getElementById('msg').value = 'Module not connected';
        }
        setTimeout(refresh, 1000);
    }
}
```

```

startDemo();
</script>
</head>
Module to use: <input id='serial'>
<input id='msg' style='color:red; border:none;' readonly><br>
<p>Channels 0..3 are configured as outputs and channels 4..7
are configred as inputs, you can connect some inputs to
outputs and see what happens</p>
Port value : <input id='state' style='border:none;' readonly><br>
<body>
</body>
</html>

```

No installation is needed to run this example, all you have to do is open the HTML file using a web browser,

14.4. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

"use strict";

require('yoctolib-es2017/yocto_api.js');

async function startDemo(args)
{
    await YAPI.LogUnhandledPromiseRejections();

    // Setup the API to use the VirtualHub on local machine
    let errmsg = new YErrorMsg();
    if(await YAPI.RegisterHub('127.0.0.1', errmsg) != YAPI.SUCCESS) {
        console.log('Cannot contact VirtualHub on 127.0.0.1: '+errmsg.msg);
        return;
    }

    // Select the relay to use
    let module = YModule.FindModule(args[0]);
    if(await module.isOnline()) {
        if(args.length > 1) {
            if(args[1] == 'ON') {
                await module.set_beacon(YModule.BEACON_ON);
            } else {
                await module.set_beacon(YModule.BEACON_OFF);
            }
        }
        console.log('serial:      '+await module.get_serialNumber());
        console.log('logical name: '+await module.get_logicalName());
        console.log('luminosity:   '+await module.get_luminosity()+'%');
        console.log('beacon:       '+(await module.get_beacon())==YModule.BEACON_ON
?'ON':'OFF'));
        console.log('upTime:        '+parseInt(await module.get_upTime()/1000)+' sec');
        console.log('USB current:  '+await module.get_usbCurrent()+' mA');
        console.log('logs:');
        console.log(await module.get_lastLogs());
    } else {
        console.log("Module not connected (check identification and USB cable)\n");
    }
    await YAPI.FreeAPI();
}

if(process.argv.length < 2) {
    console.log("usage: node demo.js <serial or logicalname> [ ON | OFF ]");
} else {
    startDemo(process.argv.slice(2));
}

```

Each property `xxx` of the module can be read thanks to a method of type `get_xxxx()`, and properties which are not read-only can be modified with the help of the `set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```
"use strict";

require('yoctolib-es2017/yocto_api.js');

async function startDemo(args)
{
    await YAPI.LogUnhandledPromiseRejections();

    // Setup the API to use the VirtualHub on local machine
    let errmsg = new YErrorMsg();
    if(await YAPI.RegisterHub('127.0.0.1', errmsg) != YAPI.SUCCESS) {
        console.log('Cannot contact VirtualHub on 127.0.0.1: '+errmsg.msg);
        return;
    }

    // Select the relay to use
    let module = YModule.FindModule(args[0]);
    if(await module.isOnline()) {
        if(args.length > 1) {
            let newname = args[1];
            if (!await YAPI.CheckLogicalName(newname)) {
                console.log("Invalid name (" + newname + ")");
                process.exit(1);
            }
            await module.set_logicalName(newname);
            await module.saveToFlash();
        }
        console.log('Current name: '+await module.get_logicalName());
    } else {
        console.log("Module not connected (check identification and USB cable)\n");
    }
    await YAPI.FreeAPI();
}

if(process.argv.length < 2) {
    console.log("usage: node demo.js <serial> [newLogicalName]");
} else {
    startDemo(process.argv.slice(2));
}
```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `YModule.FirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not `null`. Below a short example listing the connected modules.

```
"use strict";

require('yoctolib-es2017/yocto_api.js');

async function startDemo()
{
    await YAPI.LogUnhandledPromiseRejections();
    await YAPI.DisableExceptions();
```

```
// Setup the API to use the VirtualHub on local machine
let errmsg = new YErrorMsg();
if (await YAPI.RegisterHub('127.0.0.1', errmsg) != YAPI.SUCCESS) {
    console.log('Cannot contact VirtualHub on 127.0.0.1');
    return;
}
refresh();

async function refresh()
{
    try {
        let errmsg = new YErrorMsg();
        await YAPI.UpdateDeviceList(errmsg);

        let module = YModule.FirstModule();
        while(module) {
            let line = await module.get_serialNumber();
            line += '(' + (await module.get_productName()) + ')';
            console.log(line);
            module = module.nextModule();
        }
        setTimeout(refresh, 500);
    } catch(e) {
        console.log(e);
    }
}

try {
    startDemo();
} catch(e) {
    console.log(e);
}
```

14.5. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.
- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value,

a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the `errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

15. Using Yocto-Maxi-IO-V2 with PHP

PHP is, like Javascript, an atypical language when interfacing with hardware is at stakes. Nevertheless, using PHP with Yoctopuce modules provides you with the opportunity to very easily create web sites which are able to interact with their physical environment, and this is not available to every web server. This technique has a direct application in home automation: a few Yoctopuce modules, a PHP server, and you can interact with your home from anywhere on the planet, as long as you have an internet connection.

PHP is one of those languages which do not allow you to directly access the hardware layers of your computer. Therefore you need to run a virtual hub on the machine on which your modules are connected.

To start your tests with PHP, you need a PHP 5.3 (or more) server¹, preferably locally on your machine. If you wish to use the PHP server of your internet provider, it is possible, but you will probably need to configure your ADSL router for it to accept and forward TCP request on the 4444 port.

15.1. Getting ready

Go to the Yoctopuce web site and download the following items:

- The PHP programming library²
- The VirtualHub software³ for Windows, Mac OS X, or Linux, depending on your OS

Decompress the library files in a folder of your choice accessible to your web server, connect your modules, run the VirtualHub software, and you are ready to start your first tests. You do not need to install any driver.

15.2. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a PHP code snippet to use the DigitalIO function.

```
include('yocto_api.php');
include('yocto_digitalio.php');
```

¹ A couple of free PHP servers: easyPHP for Windows, MAMP for Mac OS X.

² www.yoctopuce.com/EN/libraries.php

³ www.yoctopuce.com/EN/virtualhub.php

```
[...]
// Get access to your device, through the VirtualHub running locally
$YAPI::RegisterHub('http://127.0.0.1:4444/', $errmsg);
[...]

// Retrieve the object used to interact with the device
$digitalio = YDigitalIO::FindDigitalIO("MAXIIO02-123456.digitalIO");

// Check that the module is online to handle hot-plug
if($digitalio->isOnline())
{
    // Use $digitalio->set_state()
    [...]
}
```

Let's look at these lines in more details.

yocto_api.php and yocto_digitalio.php

These two PHP includes provides access to the functions allowing you to manage Yoctopuce modules. `yocto_api.php` must always be included, `yocto_digitalio.php` is necessary to manage modules containing a digital IO port, such as Yocto-Maxi-IO-V2.

YAPI::RegisterHub

The `YAPI::RegisterHub` function allows you to indicate on which machine the Yoctopuce modules are located, more precisely on which machine the VirtualHub software is running. In our case, the `127.0.0.1:4444` address indicates the local machine, port `4444` (the standard port used by Yoctopuce). You can very well modify this address, and enter the address of another machine on which the VirtualHub software is running.

YDigitalIO::FindDigitalIO

The `YDigitalIO::FindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIIO02-123456` which you have named "`MyModule`", and for which you have given the `digitalIO` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```
$digitalio = YDigitalIO::FindDigitalIO("MAXIIO02-123456.digitalIO");
$digitalio = YDigitalIO::FindDigitalIO("MAXIIO02-123456.MyFunction");
$digitalio = YDigitalIO::FindDigitalIO("MyModule.digitalIO");
$digitalio = YDigitalIO::FindDigitalIO("MyModule.MyFunction");
$digitalio = YDigitalIO::FindDigitalIO("MyFunction");
```

`YDigitalIO::FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `YDigitalIO::FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YFindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Open your preferred text editor⁴, copy the code sample below, save it with the Yoctopuce library files in a location which is accessible to your web server, then use your preferred web browser to access

⁴ If you do not have a text editor, use Notepad rather than Microsoft Word.

this page. The code is also provided in the directory **Examples/Doc-GettingStarted-Yocto-Maxi-IO-V2** of the Yoctopuce library.

In this example, you will recognize the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

```
<HTML>
<HEAD>
<TITLE>Hello World</TITLE>
</HEAD>
<BODY>
<FORM name='myform' method='get'>
<?php
    include('yocto_api.php');
    include('yocto_digitalio.php');

    // Use explicit error handling rather than exceptions
    YAPI::DisableExceptions();

    // Setup the API to use the VirtualHub on local machine
    if(YAPI::RegisterHub('http://127.0.0.1:4444/',$errmsg) != YAPI::SUCCESS) {
        die("Cannot contact VirtualHub on 127.0.0.1");
    }

    @$serial = $_GET['serial'];
    if ($serial != '') {
        // Check if a specified module is available online
        $io = YDigitalIO::FindDigitalIO("$serial.digitalIO");
        if (!$io->isOnline()) {
            die("Module not connected (check serial and USB cable)");
        }
    } else {
        // or use any connected module suitable for the demo
        // (note that the order of enumeration may vary)
        $io = YDigitalIO::FirstDigitalIO();
        if(is_null($io)) {
            die("No module connected (check USB cable)");
        } $serial = $io->module()->get_serialnumber();
    }

    // make sure the device is here
    if (!$io->isOnline())
        die("Module not connected (check identification and USB cable)");

    // lets configure the channels direction
    // bits 0..3 as output
    // bits 4..7 as input
    $io->set_portDirection(0x0F);
    $io->set_portPolarity(0); // polarity set to regular
    $io->set_portOpenDrain(0); // No open drain

    @$outputdata = intval($_GET['outputdata']);
    $outputdata = ($outputdata + 1) % 16; // cycle output 0..15
    $io->set_portState($outputdata); // We could have used set_bitState as well
    ySleep(50, $errmsg); // make sure the set is processed before the get
    $inputdata = $io->get_portState(); // read port values
    $line = ""; // display port value as binary
    for ($i = 0; $i < 8; $i++)
        if (($inputdata & (128 >> $i))>0) $line = $line . '1'; else $line = $line . '0';

    Print("Module to use: <input name='serial' value='$serial'><br>");
    Print("<input type='hidden' name='outputdata' value='$outputdata'><br>");
    YAPI::FreeAPI();

    // trigger auto-refresh after one second
    Print("<script language='javascript1.5' type='text/JavaScript'>\n");
    Print("setInterval('window.myform.submit()',1000);");
    Print("</script>\n");

?
<p>
Channels 0..3 are configured as outputs and channels 4..7
are configured as inputs, you can connect some inputs to
outputs and see what happens
</p>
```

```
<p>Port value: <?php Print($line); ?></p>

<input type='submit'>
</FORM>

</BODY>
</HTML>
```

15.3. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```
<HTML>
<HEAD>
<TITLE>Module Control</TITLE>
</HEAD>
<BODY>
<FORM method='get'>
<?php
    include('yocto_api.php');

    // Use explicit error handling rather than exceptions
    YAPI::DisableExceptions();

    // Setup the API to use the VirtualHub on local machine
    if(YAPI::RegisterHub('http://127.0.0.1:4444/',$errmsg) != YAPI::SUCCESS) {
        die("Cannot contact VirtualHub on 127.0.0.1 : ".$errmsg);
    }

    @$serial = $_GET['serial'];
    if ($serial != '') {
        // Check if a specified module is available online
        $module = YModule::FindModule("$serial");
        if (!$module->isOnline()) {
            die("Module not connected (check serial and USB cable)");
        }
    } else {
        // or use any connected module suitable for the demo
        $module = YModule::FirstModule();
        if($module) { // skip VirtualHub
            $module = $module->nextModule();
        }
        if(is_null($module)) {
            die("No module connected (check USB cable)");
        } else {
            $serial = $module->get_serialnumber();
        }
    }
    Print("Module to use: <input name='serial' value='".$serial."><br>");

    if (isset($_GET['beacon'])) {
        if ($_GET['beacon']=='ON')
            $module->set_beacon(Y_BEACON_ON);
        else
            $module->set_beacon(Y_BEACON_OFF);
    }
    printf('serial: %s<br>', $module->get_serialNumber());
    printf('logical name: %s<br>', $module->get_logicalName());
    printf('luminosity: %s<br>', $module->get_luminosity());
    print('beacon: ');
    if($module->get_beacon() == Y_BEACON_ON) {
        printf("<input type='radio' name='beacon' value='ON' checked>ON ");
        printf("<input type='radio' name='beacon' value='OFF'>OFF<br>");
    } else {
        printf("<input type='radio' name='beacon' value='ON'>ON ");
        printf("<input type='radio' name='beacon' value='OFF' checked>OFF<br>");
    }
    printf('upTime: %s sec<br>', intval($module->get_upTime()/1000));
    printf('USB current: %mA<br>', $module->get_usbCurrent());
    printf('logs:<br><pre>%s</pre>', $module->get_lastLogs());
    YAPI::FreeAPI();
}
```

```
?>
<input type='submit' value='refresh'>
</FORM>
</BODY>
</HTML>
```

Each property `xxx` of the module can be read thanks to a method of type `get_xxxx()`, and properties which are not read-only can be modified with the help of the `set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```
<HTML>
<HEAD>
<TITLE>save settings</TITLE>
<BODY>
<FORM method='get'>
<?php
    include('yocto_api.php');

    // Use explicit error handling rather than exceptions
    YAPI::DisableExceptions();

    // Setup the API to use the VirtualHub on local machine
    if(YAPI::RegisterHub('http://127.0.0.1:4444/',$errmsg) != YAPI::SUCCESS) {
        die("Cannot contact VirtualHub on 127.0.0.1");
    }

    @$serial = $_GET['serial'];
    if ($serial != '') {
        // Check if a specified module is available online
        $module = YModule::FindModule("$serial");
        if (!$module->isOnline()) {
            die("Module not connected (check serial and USB cable)");
        }
    } else {
        // or use any connected module suitable for the demo
        $module = YModule::FirstModule();
        if($module) { // skip VirtualHub
            $module = $module->nextModule();
        }
        if(is_null($module)) {
            die("No module connected (check USB cable)");
        } else {
            $serial = $module->get_serialnumber();
        }
    }
    Print("Module to use: <input name='serial' value='$serial'><br>");

    if (isset($_GET['newname'])) {
        $newname = $_GET['newname'];
        if (!yCheckLogicalName($newname))
            die('Invalid name');
        $module->set_logicalName($newname);
        $module->saveToFlash();
    }
    printf("Current name: %s<br>", $module->get_logicalName());
    print("New name: <input name='newname' value='' maxlength=19><br>");
    YAPI::FreeAPI();
?>
<input type='submit'>
</FORM>
</BODY>
</HTML>
```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not `NULL`. Below a short example listing the connected modules.

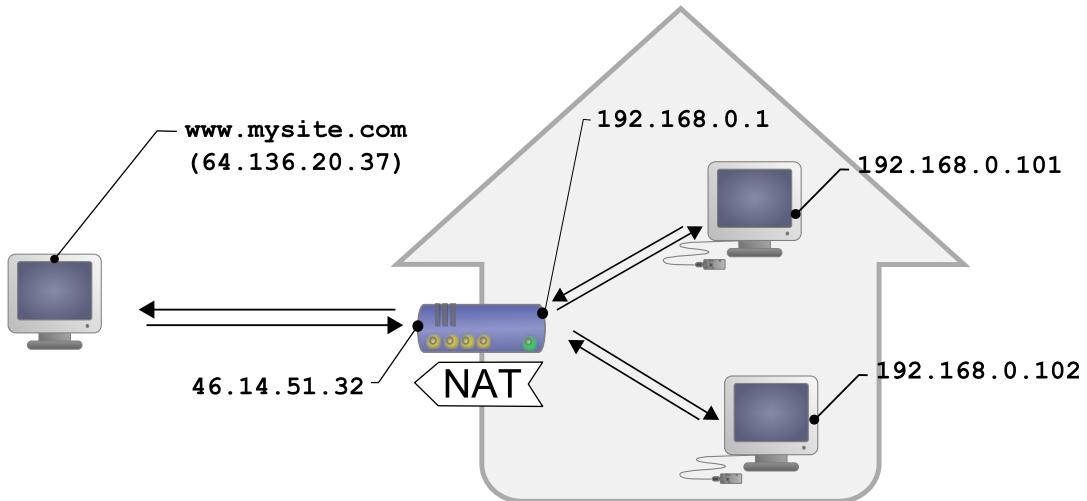
```
<HTML>
<HEAD>
    <TITLE>inventory</TITLE>
</HEAD>
<BODY>
<H1>Device list</H1>
<TT>
<?php
    include('yocto_api.php');
    YAPI::RegisterHub("http://127.0.0.1:4444/");
    $module = YModule::FirstModule();
    while (!is_null($module)) {
        printf("%s (%s)<br>", $module->get_serialNumber(),
               $module->get_productName());
        $module=$module->nextModule();
    }
    YAPI::FreeAPI();
?>
</TT>
</BODY>
</HTML>
```

15.4. HTTP callback API and NAT filters

The PHP library is able to work in a specific mode called *HTTP callback Yocto-API*. With this mode, you can control Yoctopuce devices installed behind a NAT filter, such as a DSL router for example, and this without needing to open a port. The typical application is to control Yoctopuce devices, located on a private network, from a public web site.

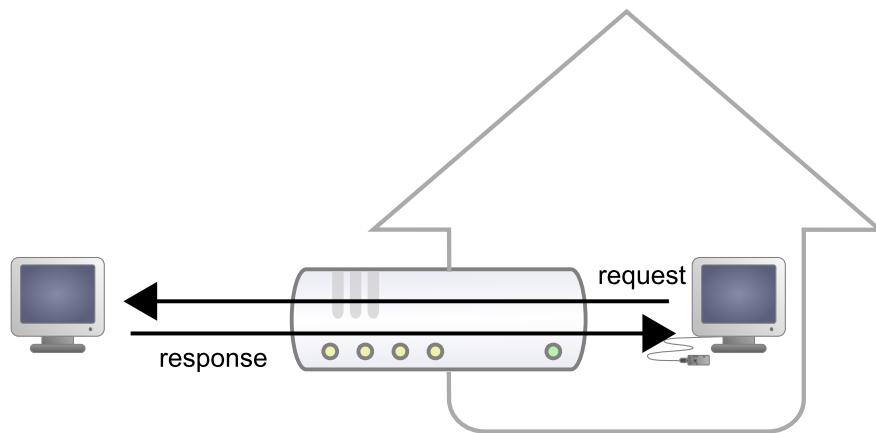
The NAT filter: advantages and disadvantages

A DSL router which translates network addresses (NAT) works somewhat like a private phone switchboard (a PBX): internal extensions can call each other and call the outside; but seen from the outside, there is only one official phone number, that of the switchboard itself. You cannot reach the internal extensions from the outside.

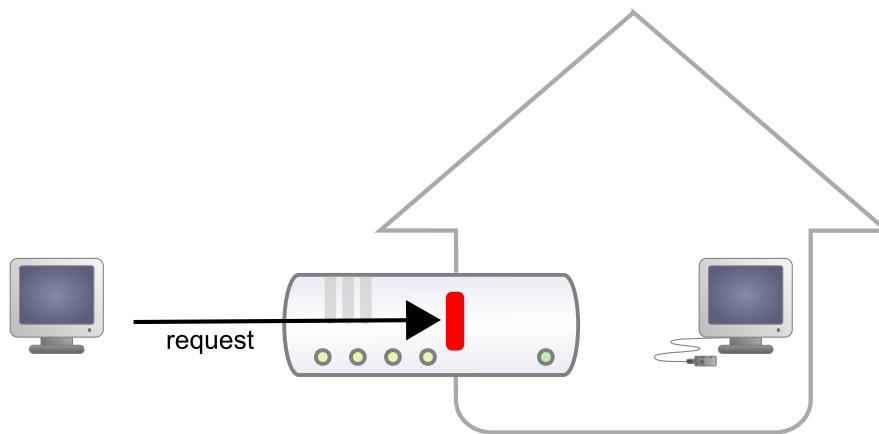


Typical DSL configuration: LAN machines are isolated from the outside by the DSL router

Transposed to the network, we have the following: appliances connected to your home automation network can communicate with one another using a local IP address (of the 192.168.xxx.yyy type), and contact Internet servers through their public address. However, seen from the outside, you have only one official IP address, assigned to the DSL router only, and you cannot reach your network appliances directly from the outside. It is rather restrictive, but it is a relatively efficient protection against intrusions.



Responses from request from LAN machines are routed.

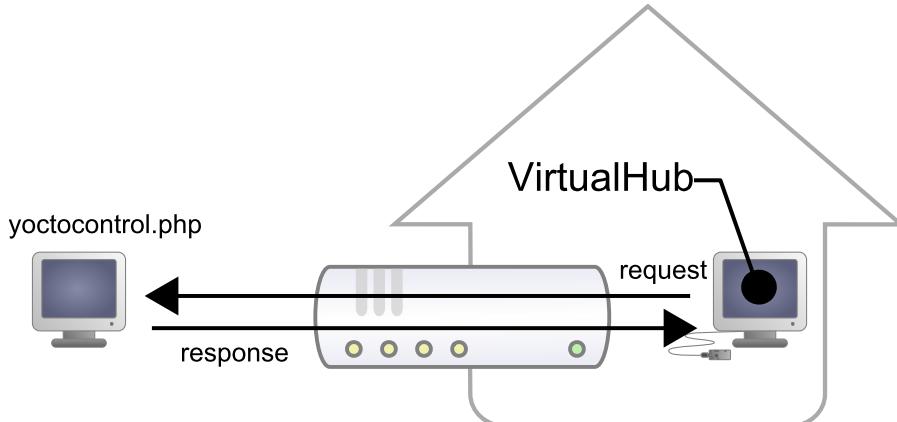


But requests from the outside are blocked.

Seeing Internet without being seen provides an enormous security advantage. However, this signifies that you cannot, *a priori*, set up your own web server at home to control a home automation installation from the outside. A solution to this problem, advised by numerous home automation system dealers, consists in providing outside visibility to your home automation server itself, by

adding a routing rule in the NAT configuration of the DSL router. The issue of this solution is that it exposes the home automation server to external attacks.

The HTTP callback API solves this issue without having to modify the DSL router configuration. The module control script is located on an external site, and it is the *VirtualHub* which is in charge of calling it a regular intervals.



The HTTP callback API uses the VirtualHub which initiates the requests.

Configuration

The callback API thus uses the *VirtualHub* as a gateway. All the communications are initiated by the *VirtualHub*. They are thus outgoing communications and therefore perfectly authorized by the DSL router.

You must configure the *VirtualHub* so that it calls the PHP script on a regular basis. To do so:

1. Launch a *VirtualHub*
2. Access its interface, usually 127.0.0.1:4444
3. Click on the **configure** button of the line corresponding to the *VirtualHub* itself
4. Click on the **edit** button of the **Outgoing callbacks** section

Serial	Logical Name	Description	Action
VIRTHUB0-7d1a86fb0	VirtualHub		configure view log file
RELAYH11-00055	Yocto-PowerRelay		configure view log file beacon
TMPSENS1-05E7F	Yocto-Temperature		configure view log file beacon

Click on the "configure" button on the first line

VIRTHUB0-7d1a86fb09

Edit parameters for VIRTHUB0-7d1a86fb09, and click on the Save button.

Serial #	VIRTHUB0-7d1a86fb09
Product name:	VirtualHub
Software version:	10789
Logical name:	<input type="text"/>

Incoming connections

Authentication to read information from the devices: NO [edit](#)

Authentication to make changes to the devices: NO [edit](#)

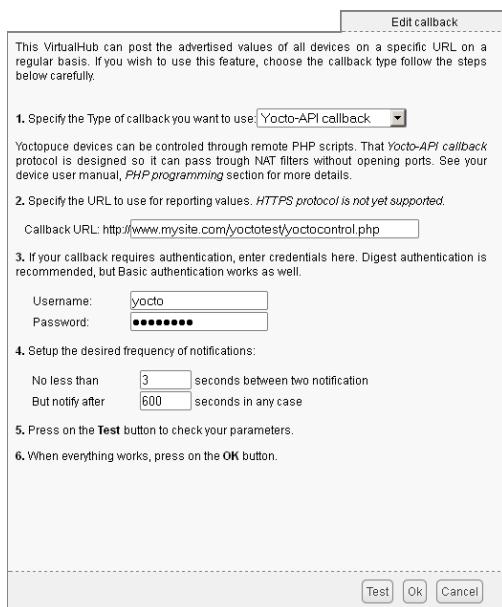
Outgoing callbacks

Callback URL: octoHub [edit](#)

Delay between callbacks: min: 3 [s] max: 600 [s]

[Save](#) [Cancel](#)

Click on the "edit" button of the "Outgoing callbacks" section



And select "Yocto-API callback".

You then only need to define the URL of the PHP script and, if need be, the user name and password to access this URL. Supported authentication methods are *basic* and *digest*. The second method is safer than the first one because it does not allow transfer of the password on the network.

Usage

From the programmer standpoint, the only difference is at the level of the *yRegisterHub* function call. Instead of using an IP address, you must use the *callback* string (or *http://callback* which is equivalent).

```
include("yocto_api.php");
yRegisterHub("callback");
```

The remainder of the code stays strictly identical. On the *VirtualHub* interface, at the bottom of the configuration window for the HTTP callback API , there is a button allowing you to test the call to the PHP script.

Be aware that the PHP script controlling the modules remotely through the HTTP callback API can be called only by the *VirtualHub*. Indeed, it requires the information posted by the *VirtualHub* to function. To code a web site which controls Yoctopuce modules interactively, you must create a user interface which stores in a file or in a database the actions to be performed on the Yoctopuce modules. These actions are then read and run by the control script.

Common issues

For the HTTP callback API to work, the PHP option *allow_url_fopen* must be set. Some web site hosts do not set it by default. The problem then manifests itself with the following error:

```
error: URL file-access is disabled in the server configuration
```

To set this option, you must create, in the repertory where the control PHP script is located, an *.htaccess* file containing the following line:

```
php_flag "allow_url_fopen" "On"
```

Depending on the security policies of the host, it is sometimes impossible to authorize this option at the root of the web site, or even to install PHP scripts receiving data from a POST HTTP. In this case, place the PHP script in a subdirectory.

Limitations

This method that allows you to go through NAT filters cheaply has nevertheless a price. Communications being initiated by the *VirtualHub* at a more or less regular interval, reaction time to an event is clearly longer than if the Yoctopuce modules were driven directly. You can configure the reaction time in the specific window of the *VirtualHub*, but it is at least of a few seconds in the best case.

The *HTTP callback Yocto-API* mode is currently available in PHP, EcmaScript (Node.JS) and Java only.

15.5. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.
- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value, a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the `errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

16. Using Yocto-Maxi-IO-V2 with Visual Basic .NET

VisualBasic has long been the most favored entrance path to the Microsoft world. Therefore, we had to provide our library for this language, even if the new trend is shifting to C#. All the examples and the project models are tested with Microsoft VisualBasic 2010 Express, freely available on the Microsoft web site¹.

16.1. Installation

Download the Visual Basic Yoctopuce library from the Yoctopuce web site². There is no setup program, simply copy the content of the zip file into the directory of your choice. You mostly need the content of the `Sources` directory. The other directories contain the documentation and a few sample programs. All sample projects are Visual Basic 2010, projects, if you are using a previous version, you may have to recreate the projects structure from scratch.

16.2. Using the Yoctopuce API in a Visual Basic project

The Visual Basic.NET Yoctopuce library is composed of a DLL and of source files in Visual Basic. The DLL is not a .NET DLL, but a classic DLL, written in C, which manages the low level communications with the modules³. The source files in Visual Basic manage the high level part of the API. Therefore, you need both this DLL and the .vb files of the `Sources` directory to create a project managing Yoctopuce modules.

Configuring a Visual Basic project

The following indications are provided for Visual Studio Express 2010, but the process is similar for other versions. Start by creating your project. Then, on the *Solution Explorer* panel, right click on your project, and select "Add" and then "Add an existing item".

A file selection window opens. Select the `yocto_api.vb` file and the files corresponding to the functions of the Yoctopuce modules that your project is going to manage. If in doubt, select all the files.

You then have the choice between simply adding these files to your project, or to add them as links (the **Add** button is in fact a scroll-down menu). In the first case, Visual Studio copies the selected files into your project. In the second case, Visual Studio simply keeps a link on the original files. We recommend you to use links, which makes updates of the library much easier.

¹ <http://www.microsoft.com/visualstudio/en-us/products/2010-editions/visual-basic-express>

² www.yoctopuce.com/EN/libraries.php

³ The sources of this DLL are available in the C++ API

Then add in the same manner the `yapi.dll`, located in the `Sources/dll` directory⁴. Then, from the **Solution Explorer** window, right click on the DLL, select **Properties** and in the **Properties** panel, set the **Copy to output folder** to **always**. You are now ready to use your Yoctopuce modules from Visual Studio.

In order to keep them simple, all the examples provided in this documentation are console applications. Naturally, the libraries function in a strictly identical manner if you integrate them in an application with a graphical interface.

16.3. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a Visual Basic code snippet to use the `DigitalIO` function.

```
[...]
' Enable detection of USB devices
Dim errmsg As String errmsg
YAPI.RegisterHub("usb", errmsg)
[...]

' Retrieve the object used to interact with the device
Dim digitalio As YDigitalIO
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO")

' Hot-plug is easy: just check that the device is online
If (digitalio.isOnline()) Then
    ' Use digitalio.set_state()
    [...]
End If

[...]
```

Let's look at these lines in more details.

YAPI.RegisterHub

The `YAPI.RegisterHub` function initializes the Yoctopuce API and indicates where the modules should be looked for. When used with the parameter "`usb`", it will use the modules locally connected to the computer running the library. If the initialization does not succeed, this function returns a value different from `YAPI_SUCCESS` and `errmsg` contains the error message.

YDigitalIO.FindDigitalIO

The `YDigitalIO.FindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIO02-123456` which you have named "`MyModule`", and for which you have given the `DigitalIO` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.MyFunction")
digitalio = YDigitalIO.FindDigitalIO("MyModule.digitalIO")
digitalio = YDigitalIO.FindDigitalIO("MyModule.MyFunction")
digitalio = YDigitalIO.FindDigitalIO("MyFunction")
```

`YDigitalIO.FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `YDigitalIO.FindDigitalIO` allows you to know if the corresponding module is present and in working order.

⁴ Remember to change the filter of the selection window, otherwise the DLL will not show.

set_state

The `set_portState()` method of the object returned by `yFindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Launch Microsoft VisualBasic and open the corresponding sample project provided in the directory **Examples/Doc-GettingStarted-Yocto-Maxi-IO-V2** of the Yoctopuce library.

In this example, you will recognize the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

```
Module Module1

    Private Sub Usage()
        Dim execname = System.AppDomain.CurrentDomain.FriendlyName
        Console.WriteLine("Usage:")
        Console.WriteLine(execname + " <serial_number>")
        Console.WriteLine(execname + " <logical_name>")
        Console.WriteLine(execname + " any")
        System.Threading.Thread.Sleep(2500)
    End
    End Sub

    Sub Main()
        Dim argv() As String = System.Environment.GetCommandLineArgs()
        Dim errmsg As String = ""
        Dim target As String
        Dim io As YDigitalIO
        Dim outputdata As Integer
        Dim inputdata As Integer
        Dim line As String

        If argv.Length < 2 Then Usage()

        target = argv(1)

        REM Setup the API to use local USB devices
        If (YAPI.RegisterHub("usb", errmsg) <> YAPI_SUCCESS) Then
            Console.WriteLine("RegisterHub error: " + errmsg)
        End
        End If

        If target = "any" Then
            io = YDigitalIO.FirstDigitalIO()
            If io Is Nothing Then
                Console.WriteLine("No module connected (check USB cable) ")
            End
            End If
        Else
            io = YDigitalIO.FindDigitalIO(target + ".digitalIO")
        End If

        If (Not io.isOnline()) Then
            Console.WriteLine("Module not connected (check identification and USB cable)")
        End
        End If

        REM lets configure the channels direction
        REM bits 0..3 as output
        REM bits 4..7 as input
        io.set_portDirection(&HF)
        io.set_portPolarity(0) REM polarity set to regular
        io.set_portOpenDrain(0) REM No open drain

        Console.WriteLine("Channels 0..3 are configured as outputs and channels 4..7")
        Console.WriteLine("are configred as inputs, you can connect some inputs to")
        Console.WriteLine("outputs and see what happens")

        While (io.isOnline())
            inputdata = io.get_portState() REM read port values
            line = "" REM display port state value as binary
        End
    End Sub
End
```

```

For i As Integer = 0 To 7 Step 1
    If CBool((inputdata And (128 >> i))) Then
        line = line + "1"
    Else
        line = line + "0"
    End If
Next
Console.WriteLine("port value = " + line)
outputdata = (outputdata + 1) Mod 16 REM cycle output 0..15
io.set_portState(outputdata) REM We could have used set_bitState as well
YAPI.Sleep(1000, errmsg)
End While
Console.WriteLine("Module disconnected")
YAPI.FreeAPI()
End Sub

End Module

```

16.4. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

Imports System.IO
Imports System.Environment

Module Module1

Sub usage()
    Console.WriteLine("usage: demo <serial or logical name> [ON/OFF]")
    End
End Sub

Sub Main()
    Dim argv() As String = System.Environment.GetCommandLineArgs()
    Dim errmsg As String = ""
    Dim m As ymodule

    If (YAPI.RegisterHub("usb", errmsg) <> YAPI_SUCCESS) Then
        Console.WriteLine("RegisterHub error:" + errmsg)
        End
    End If

    If argv.Length < 2 Then usage()

    m = YModule.FindModule(argv(1)) REM use serial or logical name
    If (m.isOnline()) Then
        If argv.Length > 2 Then
            If argv(2) = "ON" Then m.set_beacon(Y_BEACON_ON)
            If argv(2) = "OFF" Then m.set_beacon(Y_BEACON_OFF)
        End If
        Console.WriteLine("serial:      " + m.get_serialNumber())
        Console.WriteLine("logical name: " + m.get_logicalName())
        Console.WriteLine("luminosity:   " + Str(m.get_luminosity()))
        Console.WriteLine("beacon:       ")
        If (m.get_beacon() = Y_BEACON_ON) Then
            Console.WriteLine("ON")
        Else
            Console.WriteLine("OFF")
        End If
        Console.WriteLine("upTime:      " + Str(m.get_upTime() / 1000) + " sec")
        Console.WriteLine("USB current: " + Str(m.get_usbCurrent()) + " mA")
        Console.WriteLine("Logs:")
        Console.WriteLine(m.get_lastLogs())
    Else
        Console.WriteLine(argv(1) + " not connected (check identification and USB cable)")
    End If
    YAPI.FreeAPI()
End Sub

End Module

```

Each property `xxx` of the module can be read thanks to a method of type `get_xxxx()`, and properties which are not read-only can be modified with the help of the `set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```
Module Module1

    Sub usage()
        Console.WriteLine("usage: demo <serial or logical name> <new logical name>")
        End
    End Sub

    Sub Main()
        Dim argv() As String = System.Environment.GetCommandLineArgs()
        Dim errmsg As String = ""
        Dim newname As String
        Dim m As YModule

        If (argv.Length <> 3) Then usage()

        REM Setup the API to use local USB devices
        If YAPI.RegisterHub("usb", errmsg) <> YAPI_SUCCESS Then
            Console.WriteLine("RegisterHub error: " + errmsg)
            End
        End If

        m = YModule.FindModule(argv(1)) REM use serial or logical name
        If m.isOnline() Then
            newname = argv(2)
            If (Not YAPI.CheckLogicalName(newname)) Then
                Console.WriteLine("Invalid name (" + newname + ")")
                End
            End If
            m.set_logicalName(newname)
            m.saveToFlash() REM do not forget this
            Console.Write("Module: serial= " + m.get_serialNumber)
            Console.Write(" / name= " + m.get_logicalName())
        Else
            Console.Write("not connected (check identification and USB cable")
        End If
        YAPI.FreeAPI()
    End Sub

End Module
```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not `Nothing`. Below a short example listing the connected modules.

```

Module Module1

Sub Main()
    Dim M As YModule
    Dim errmsg As String = ""

    REM Setup the API to use local USB devices
    If YAPI.RegisterHub("usb", errmsg) <> YAPI_SUCCESS Then
        Console.WriteLine("RegisterHub error: " + errmsg)
    End
End If

Console.WriteLine("Device list")
M = YModule.FirstModule()
While M IsNot Nothing
    Console.WriteLine(M.get_serialNumber() + " (" + M.get_productName() + ")")
    M = M.nextModule()
End While
YAPI.FreeAPI()
End Sub

End Module

```

16.5. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.
- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value, a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the

`errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

17. Using Yocto-Maxi-IO-V2 with Delphi

Delphi is a descendent of Turbo-Pascal. Originally, Delphi was produced by Borland, Embarcadero now edits it. The strength of this language resides in its ease of use, as anyone with some notions of the Pascal language can develop a Windows application in next to no time. Its only disadvantage is to cost something¹.

Delphi libraries are provided not as VCL components, but directly as source files. These files are compatible with most Delphi versions.²

To keep them simple, all the examples provided in this documentation are console applications. Obviously, the libraries work in a strictly identical way with VCL applications.

You will soon notice that the Delphi API defines many functions which return objects. You do not need to deallocate these objects yourself, the API does it automatically at the end of the application.

17.1. Preparation

Go to the Yoctopuce web site and download the Yoctopuce Delphi libraries³. Uncompress everything in a directory of your choice, add the subdirectory *sources* in the list of directories of Delphi libraries.⁴

By default, the Yoctopuce Delphi library uses the *yapi.dll* DLL, all the applications you will create with Delphi must have access to this DLL. The simplest way to ensure this is to make sure *yapi.dll* is located in the same directory as the executable file of your application.

17.2. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a Delphi code snippet to use the DigitalIO function.

```
uses yocto_api, yocto_digitalio;  
  
var errmsg: string;  
    digitalio: TYDigitalIO;  
  
[...]
```

¹ Actually, Borland provided free versions (for personal use) of Delphi 2006 and 2007. Look for them on the Internet, you may still be able to download them.

² Delphi libraries are regularly tested with Delphi 5 and Delphi XE2.

³ www.yoctopuce.com/EN/libraries.php

⁴ Use the **Tools / Environment options** menu.

```
// Enable detection of USB devices
yRegisterHub('usb',errmsg)
[...]

// Retrieve the object used to interact with the device
digitalio = yFindDigitalIO("MAXIIO02-123456.digitalIO")

// Hot-plug is easy: just check that the device is online
if digitalio.isOnline() then
begin
    // Use digitalio.set_state()
    [...]
end;
[...]
```

Let's look at these lines in more details.

yocto_api and yocto_digitalio

These two units provide access to the functions allowing you to manage Yoctopuce modules. `yocto_api` must always be used, `yocto_digitalio` is necessary to manage modules containing a digital IO port, such as Yocto-Maxi-IO-V2.

yRegisterHub

The `yRegisterHub` function initializes the Yoctopuce API and specifies where the modules should be looked for. When used with the parameter '`'usb'`', it will use the modules locally connected to the computer running the library. If the initialization does not succeed, this function returns a value different from `YAPI_SUCCESS` and `errmsg` contains the error message.

yFindDigitalIO

The `yFindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can also use logical names, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIIO02-123456` which you have named "`MyModule`", and for which you have given the `digitalIO` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```
digitalio := yFindDigitalIO("MAXIIO02-123456.digitalIO");
digitalio := yFindDigitalIO("MAXIIO02-123456.MyFunction");
digitalio := yFindDigitalIO("MyModule.digitalIO");
digitalio := yFindDigitalIO("MyModule.MyFunction");
digitalio := yFindDigitalIO("MyFunction");
```

`yFindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `yFindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `yFindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Launch your Delphi environment, copy the `yapi.dll` DLL in a directory, create a new console application in the same directory, and copy-paste the piece of code below:

In this example, you will recognize the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

```
program helloworld;
{$APPTYPE CONSOLE}
```

```

uses
  SysUtils,
  yocto_api,
  yocto_digitalIO;

procedure usage();
var
  execname,errmsg:string;
begin
  execname := ExtractFileName(paramstr(0));
  WriteLn('Usage:');
  WriteLn(execname + ' <serial_number> ');
  WriteLn(execname + ' <logical_name> ');
  WriteLn(execname + ' any ');
  WriteLn('Example:');
  WriteLn(execname + ' any ');
  ysleep(2500,errmsg);
  halt;
end;

var
errmsg,target:string;
io:TYDigitalIO;
m : TYModule;
outputdata,inputdata,i :integer;
line:string;
begin
  if (paramcount<1) then usage();

  // parse command line
  target := Uppercase(paramstr(1));

  // Setup the API to use local USB devices
  if (YRegisterHub('usb', errmsg) <> YAPI_SUCCESS) then
    begin
      writeln('RegisterHub error: ' + errmsg);
      halt;
    end;

  if (target='ANY') then
    begin
      // try to find the first available digital IO feature
      io := YFirstDigitalIO();
      if (io =nil) then
        begin
          writeln('No module connected (check USB cable)');
          halt;
        end;
      // retreive the hosting device serial
      m := io.get_module();
      target := m.get_serialNumber();
    end;

  Writeln('using ' + target);

  // retreive the right DigitalIO function
  io := YFindDigitalIO(target + '.digitalIO');

  // make sure the device is here
  if not(io.isOnline()) then
    begin
      writeln('Module not connected (check identification and USB cable)');
      halt;
    end;

  // lets configure the channels direction
  // bits 0..3 as output
  // bits 4..7 as input
  io.set_portDirection($0F);
  io.set_portPolarity(0); // polarity set to regular
  io.set_portOpenDrain(0); // No open drain
  // We could have used set_bitXXX to configure channels one by one

  Writeln('Channels 0..3 are configured as inputs and channels 4..7');
  Writeln('are configred as ouputs, you can connect some inputs to');
  Writeln('ouputs and see what happens');

  outputdata := 0;

```

```

while (io.isOnline()) do
begin
  inputdata := io.getPortState(); // read port values
  line:=''; // display value as binary
  for i := 0 to 7 do
    if (inputdata and (128 shr i))>0 then line:=line+'1' else line:=line+'0';
  Writeln('port value = ' + line);
  outputdata := (outputdata +1) mod 16; // cycle output 0..15
  io.set_portState(outputdata); // we could have used set_bitState as well
  ysleep(1000,errmsg);
end;

yFreeAPI();
writeln('Device disconnected');
end.

```

17.3. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

program modulecontrol;
{$APPTYPE CONSOLE}
uses
  SysUtils,
  yocto_api;

const
  serial = 'MAXIIO02-123456'; // use serial number or logical name

procedure refresh(module:Tymodule) ;
begin
  if (module.isOnline())  then
  begin
    Writeln('');
    Writeln('Serial      : ' + module.get_serialNumber());
    Writeln('Logical name : ' + module.get_logicalName());
    Writeln('Luminosity   : ' + intToStr(module.get_luminosity()));
    Write('Beacon      :');
    if (module.get_beacon()=Y_BEACON_ON)  then Writeln('on')
                                              else Writeln('off');
    Writeln('uptime      : ' + intToStr(module.get_upTime() div 1000)+'s');
    Writeln('USB current  : ' + intToStr(module.get_usbCurrent())+'mA');
    Writeln('Logs        : ');
    Writeln(module.get_lastlogs());
    Writeln('');
    Writeln('r : refresh / b:beacon ON / space : beacon off');
  end
  else Writeln('Module not connected (check identification and USB cable)');
end;

procedure beacon(module:Tymodule;state:integer);
begin
  module.set_beacon(state);
  refresh(module);
end;

var
  module : TYModule;
  c      : char;
  errmsg : string;

begin
  // Setup the API to use local USB devices
  if yRegisterHub('usb', errmsg)<>YAPI_SUCCESS then
  begin
    Write('RegisterHub error: '+errmsg);
    exit;
  end;

  module := yFindModule(serial);
  refresh(module);

```

```

repeat
  read(c);
  case c of
    'r': refresh(module);
    'b': beacon(module,Y_BEACON_ON);
    ' ': beacon(module,Y_BEACON_OFF);
  end;
until c = 'x';
yFreeAPI();
end.

```

Each property `xxx` of the module can be read thanks to a method of type `get_xxxx()`, and properties which are not read-only can be modified with the help of the `set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```

program savesettings;
{$APPTYPE CONSOLE}
uses
  SysUtils,
  yocto_api;

const
  serial = 'MAXIIO02-123456'; // use serial number or logical name

var
  module : TYModule;
  errmsg : string;
  newname : string;

begin
  // Setup the API to use local USB devices
  if yRegisterHub('usb', errmsg)<>YAPI_SUCCESS then
  begin
    Write('RegisterHub error: '+errmsg);
    exit;
  end;

  module := yFindModule(serial);
  if (not(module.isOnline)) then
  begin
    writeln('Module not connected (check identification and USB cable)');
    exit;
  end;

  Writeln('Current logical name : '+module.get_logicalName());
  Write('Enter new name : ');
  Readln(newname);
  if (not(yCheckLogicalName(newname))) then
  begin
    writeln('invalid logical name');
    exit;
  end;
  module.set_logicalName(newname);
  module.saveToFlash();
  yFreeAPI();
  writeln('logical name is now : '+module.get_logicalName());
end.

```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short,

you can use the `saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not `nil`. Below a short example listing the connected modules.

```
program inventory;
{$APPTYPE CONSOLE}
uses
  SysUtils,
  yocto_api;

var
  module : TYModule;
  errmsg : string;

begin
  // Setup the API to use local USB devices
  if yRegisterHub('usb', errmsg)<>YAPI_SUCCESS then
  begin
    Write('RegisterHub error: '+errmsg);
    exit;
  end;

  Writeln('Device list');

  module := yFirstModule();
  while module<>nil  do
  begin
    Writeln( module.get_serialNumber()+' ('+module.get_productName()+' )');
    module := module.nextModule();
  end;
  yFreeAPI();
end.
```

17.4. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.
- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every

line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value, a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the `errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

18. Using the Yocto-Maxi-IO-V2 with Universal Windows Platform

Universal Windows Platform (UWP) is not a language per say, but a software platform created by Microsoft. This platform allows you to run a new type of applications: the universal Windows applications. These applications can work on all machines running under Windows 10. This includes computers, tablets, smart phones, XBox One, and also Windows IoT Core.

The Yoctopuce UWP library allows you to use Yoctopuce modules in a universal Windows application and is written in C# in its entirety. You can add it to a Visual Studio 2017¹ project.

18.1. Blocking and asynchronous functions

The Universal Windows Platform does not use the Win32 API but only the Windows Runtime API which is available on all the versions of Windows 10 and for any architecture. Thanks to this library, you can use UWP on all the Windows 10 versions, including Windows 10 IoT Core.

However, using the new UWP API has some consequences: the Windows Runtime API to access the USB ports is asynchronous, and therefore the Yoctopuce library must be asynchronous as well. Concretely, the asynchronous methods do not return a result directly but a Task or Task<> object and the result can be obtained later. Fortunately, the C# language, version 6, supports the `async` and `await` keywords, which simplifies using these functions enormously. You can thus use asynchronous functions in the same way as traditional functions as long as you respect the following two rules:

- The method is declared as asynchronous with the `async` keyword
- The `await` keyword is added when calling an asynchronous function

Example:

```
async Task<int> MyFunction(int val)
{
    // do some long computation
    ...

    return result;
}

int res = await MyFunction(1234);
```

¹ <https://www.visualstudio.com/vs/cordova/vs/>

Our library follows these two rules and can therefore use the `await` notation.

For you not to have to wonder whether a function is asynchronous or not, there is the following convention: **all the public methods** of the UWP library **are asynchronous**, that is that you must call them with the `await` keyword, **except**:

- `GetTickCount()`, because measuring time in an asynchronous manner does not make a lot of sense...
- `FindModule()`, `FirstModule()`, `nextModule()`, ... because detecting and enumerating modules is performed as a background task on internal structures which are managed transparently. It is therefore not necessary to use blocking functions while going through the lists of modules.

18.2. Installation

Download the Yoctopuce library for Universal Windows Platform from the Yoctopuce web site². There is no installation software, simply copy the content of the zip file in a directory of your choice. You essentially need the content of the `Sources` directory. The other directories contain documentation and a few sample programs. Sample projects are Visual Studio 2017 projects. Visual Studio 2017 is available on the Microsoft web site³.

18.3. Using the Yoctopuce API in a Visual Studio project

Start by creating your project. Then, from the **Solution Explorer** panel right click on your project and select **Add then Existing element**.

A file chooser opens: select all the files in the library `Sources` directory.

You then have the choice between simply adding the files to your project or adding them as a link (the **Add** button is actually a drop-down menu). In the first case, Visual Studio copies the selected files into your project. In the second case, Visual Studio simply creates a link to the original files. We recommend to use links, as a potential library update is thus much easier.

The Package.appxmanifest file

By default a Universal Windows application doesn't have access rights to the USB ports. If you want to access USB devices, you must imperatively declare it in the `Package.appxmanifest` file.

Unfortunately, the edition window of this file doesn't allow this operation and you must modify the `Package.appxmanifest` file by hand. In the "Solution Explorer" panel, right click on the `Package.appxmanifest` and select "View Code".

In this XML file, we must add a `DeviceCapability` node in the `Capabilities` node. This node must have a "Name" attribute with a "humaninterfacedevice" value.

Inside this node, you must declare all the modules that can be used. Concretely, for each module, you must add a "Device" node with an "Id" attribute, which has for value a character string "`vidpid:USB_VENDORID_USB_DEVICE_ID`". The Yoctopuce `USB_VENDORID` is `24e0` and you can find the `USB_DEVICE_ID` of each Yoctopuce device in the documentation in the "Characteristics" section. Finally, the "Device" node must contain a "Function" node with the "Type" attribute with a value of "usage:ff00 0001".

For the Yocto-Maxi-IO-V2, here is what you must add in the "Capabilities" node:

```
<DeviceCapability Name="humaninterfacedevice">
    <!-- Yocto-Maxi-IO-V2 -->
    <Device Id="vidpid:24e0 0079">
        <Function Type="usage:ff00 0001" />
```

² www.yoctopuce.com/EN/libraries.php

³ <https://www.visualstudio.com/downloads/>

```
</Device>
</DeviceCapability>
```

Unfortunately, it's not possible to write a rule authorizing all Yoctopuce modules. Therefore, you must imperatively add each module that you want to use.

18.4. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a C# code snippet to use the DigitalIO function.

```
[...]
// Enable detection of USB devices
await YAPI.RegisterHub("usb");
[...]

// Retrieve the object used to interact with the device
YDigitalIO digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO");

// Hot-plug is easy: just check that the device is online
if (await digitalio.isOnline())
{
    // Use digitalio.set_state()
    [...]
}

[...]
```

Let us look at these lines in more details.

YAPI.RegisterHub

The `YAPI.RegisterHub` function initializes the Yoctopuce API and indicates where the modules should be looked for. The parameter is the address of the virtual hub able to see the devices. If the string "usb" is passed as parameter, the API works with modules locally connected to the machine. If the initialization does not succeed, an exception is thrown.

YDigitalIO.FindDigitalIO

The `YDigitalIO.FindDigitalIO` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIO02-123456` which you have named "`MyModule`", and for which you have given the `digitalio` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.digitalIO");
digitalio = YDigitalIO.FindDigitalIO("MAXIO02-123456.MaFonction");
digitalio = YDigitalIO.FindDigitalIO("MonModule.digitalIO");
digitalio = YDigitalIO.FindDigitalIO("MonModule.MaFonction");
digitalio = YDigitalIO.FindDigitalIO("MaFonction");
```

`YDigitalIO.FindDigitalIO` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline()` method of the object returned by `YDigitalIO.FindDigitalIO` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YDigitalIO.FindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

18.5. A real example

Launch Visual Studio and open the corresponding project provided in the directory **Examples/Doc-GettingStarted-Yocto-Maxi-IO-V2** of the Yoctopuce library.

Visual Studio projects contain numerous files, and most of them are not linked to the use of the Yoctopuce library. To simplify reading the code, we regrouped all the code that uses the library in the Demo class, located in the `demo.cs` file. Properties of this class correspond to the different fields displayed on the screen, and the `Run()` method contains the code which is run when the "Start" button is pushed.

In this example, you can recognize the functions explained above, but this time used with all the side materials needed to make it work nicely as a small demo.

```
using System;
using System.Diagnostics;
using System.Threading.Tasks;
using Windows.UI.Xaml.Controls;
using com.yoctopuce.YoctoAPI;

namespace Demo
{
    public class Demo : DemoBase
    {
        public string HubURL { get; set; }
        public string Target { get; set; }
        public string RequestedVoltage { get; set; }

        public override async Task<int> Run()
        {
            try {
                await YAPI.RegisterHub(HubURL);

                YDigitalIO io;

                if (Target.ToLower() == "any") {
                    io = YDigitalIO.FirstDigitalIO();
                    if (io == null) {
                        WriteLine("No module connected (check USB cable) ");
                        return -1;
                    }
                } else io = YDigitalIO.FindDigitalIO(Target + ".digitalIO");

                // lets configure the channels direction
                // bits 0..3 as output
                // bits 4..7 as input
                await io.set_portDirection(0x0F);
                await io.set_portPolarity(0); // polarity set to regular
                await io.set_portOpenDrain(0); // No open drain
                WriteLine("Channels 0..3 are configured as outputs and channels 4..7");
                WriteLine("are configred as inputs, you can connect some inputs to");
                WriteLine("outputs and see what happens");
                int outputdata = 0;
                while (await io.isOnline()) {
                    int inputdata = await io.get_portState(); // read port values
                    string line = ""; // display port value as binary
                    for (int i = 0; i < 8; i++) {
                        if (((inputdata & (128 >> i)) > 0) {
                            line = line + '1';
                        } else {
                            line = line + '0';
                        }
                    }
                    WriteLine("port value = " + line);
                    // cycle ouput 0..15
                    outputdata = (outputdata + 1) % 16;
                    // We could have used set_bitState as well
                    await io.set_portState(outputdata);
                    await YAPI.Sleep(1000);
                }
            } catch (YAPI_Exception ex) {
                WriteLine("error: " + ex.Message);
            }
        }
    }
}
```

```
        YAPI.FreeAPI();
    return 0;
}
}
```

18.6. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

using System;
using System.Diagnostics;
using System.Threading.Tasks;
using Windows.UI.Xaml.Controls;
using com.yoctopuce.YoctoAPI;

namespace Demo
{
    public class Demo : DemoBase
    {

        public string HubURL { get; set; }
        public string Target { get; set; }
        public bool Beacon { get; set; }

        public override async Task<int> Run()
        {
            YModule m;
            string errmsg = "";

            if (await YAPI.RegisterHub(HubURL) != YAPI.SUCCESS) {
                WriteLine("RegisterHub error: " + errmsg);
                return -1;
            }
            m = YModule.FindModule(Target + ".module"); // use serial or logical name
            if (await m.isOnline()) {
                if (Beacon) {
                    await m.set_beacon(YModule.BEACON_ON);
                } else {
                    await m.set_beacon(YModule.BEACON_OFF);
                }

                WriteLine("serial: " + await m.get_serialNumber());
                WriteLine("logical name: " + await m.get_logicalName());
                WriteLine("luminosity: " + await m.get_luminosity());
                Write("beacon: ");
                if (await m.get_beacon() == YModule.BEACON_ON)
                    WriteLine("ON");
                else
                    WriteLine("OFF");
                WriteLine("upTime: " + (await m.get_upTime() / 1000) + " sec");
                WriteLine("USB current: " + await m.get_usbCurrent() + " mA");
                WriteLine("Logs:\r\n" + await m.get_lastLogs());
            } else {
                WriteLine(Target + " not connected on" + HubURL +
                    "(check identification and USB cable)");
            }
            YAPI.FreeAPI();
            return 0;
        }
    }
}

```

Each property `xxx` of the module can be read thanks to a method of type `YModule.get_xxxx()`, and properties which are not read-only can be modified with the help of the `YModule.set_xxx()` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `YModule.set_xxx()` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `YModule.saveToFlash()` method. Inversely, it is possible to force the module to forget its current settings by using the `YModule.revertFromFlash()` method. The short example below allows you to modify the logical name of a module.

```
using System;
using System.Diagnostics;
using System.Threading.Tasks;
using Windows.UI.Xaml.Controls;
using com.yoctopuce.YoctoAPI;

namespace Demo
{
    public class Demo : DemoBase
    {

        public string HubURL { get; set; }
        public string Target { get; set; }
        public string LogicalName { get; set; }

        public override async Task<int> Run()
        {
            try {
                YModule m;

                await YAPI.RegisterHub(HubURL);

                m = YModule.FindModule(Target); // use serial or logical name
                if (await m.isOnline()) {
                    if (!YAPI.CheckLogicalName(LogicalName)) {
                        WriteLine("Invalid name (" + LogicalName + ")");
                        return -1;
                    }

                    await m.set_logicalName(LogicalName);
                    await m.saveToFlash(); // do not forget this
                    Write("Module: serial= " + await m.get_serialNumber());
                    WriteLine(" / name= " + await m.get_logicalName());
                } else {
                    Write("not connected (check identification and USB cable");
                }
            } catch (YAPI_Exception ex) {
                WriteLine("RegisterHub error: " + ex.Message);
            }
            YAPI.FreeAPI();
            return 0;
        }
    }
}
```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `YModule.saveToFlash()` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `YModule.yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not null. Below a short example listing the connected modules.

```
using System;
using System.Diagnostics;
using System.Threading.Tasks;
using Windows.UI.Xaml.Controls;
using com.yoctopuce.YoctoAPI;
```

```

namespace Demo
{
    public class Demo : DemoBase
    {
        public string HubURL { get; set; }

        public override async Task<int> Run()
        {
            YModule m;
            try
            {
                await YAPI.RegisterHub(HubURL);

                WriteLine("Device list");
                m = YModule.FirstModule();
                while (m != null)
                {
                    WriteLine(await m.get_serialNumber()
                        + " (" + await m.get_productName() + ")");
                    m = m.nextModule();
                }
            } catch (YAPI_Exception ex)
            {
                WriteLine("Error:" + ex.Message);
            }
            YAPI.FreeAPI();
            return 0;
        }
    }
}

```

18.7. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software.

In the Universal Windows Platform library, error handling is implemented with exceptions. You must therefore intercept and correctly handle these exceptions if you want to have a reliable project which does not crash as soon as you disconnect a module.

Library thrown exceptions are always of the `YAPI_Exception` type, so you can easily separate them from other exceptions in a `try{...} catch{...}` block.

Example:

```

try {
    ...
} catch (YAPI_Exception ex) {
    Debug.WriteLine("Exception from Yoctopuce lib:" + ex.Message);
} catch (Exception ex) {
    Debug.WriteLine("Other exceptions :" + ex.Message);
}

```


19. Using Yocto-Maxi-IO-V2 with Objective-C

Objective-C is language of choice for programming on Mac OS X, due to its integration with the Cocoa framework. In order to use the Objective-C library, you need XCode version 4.2 (earlier versions will not work), available freely when you run Lion. If you are still under Snow Leopard, you need to be registered as Apple developer to be able to download XCode 4.2. The Yoctopuce library is ARC compatible. You can therefore implement your projects either using the traditional *retain / release* method, or using the *Automatic Reference Counting*.

Yoctopuce Objective-C libraries¹ are integrally provided as source files. A section of the low-level library is written in pure C, but you should not need to interact directly with it: everything was done to ensure the simplest possible interaction from Objective-C.

You will soon notice that the Objective-C API defines many functions which return objects. You do not need to deallocate these objects yourself, the API does it automatically at the end of the application.

In order to keep them simple, all the examples provided in this documentation are console applications. Naturally, the libraries function in a strictly identical manner if you integrate them in an application with a graphical interface. You can find on Yoctopuce blog a detailed example² with video shots showing how to integrate the library into your projects.

19.1. Control of the DigitalIO function

A few lines of code are enough to use a Yocto-Maxi-IO-V2. Here is the skeleton of a Objective-C code snippet to use the DigitalIO function.

```
#import "yocto_api.h"
#import "yocto_digitalio.h"

...
NSError *error;
[YAPI RegisterHub:@"usb": &error]
...
// On récupère l'objet représentant le module (ici connecté en local sur USB)
digitalio = [YDigitalIO FindDigitalIO:@"MAXIO02-123456.digitalIO"];

// Pour gérer le hot-plug, on vérifie que le module est là
if([digitalio isOnline])
{
```

¹ www.yoctopuce.com/EN/libraries.php

² www.yoctopuce.com/EN/article/new-objective-c-library-for-mac-os-x

```
// Utiliser [digitalio set_state]
...
}
```

Let's look at these lines in more details.

yocto_api.h and yocto_digitalio.h

These two import files provide access to the functions allowing you to manage Yoctopuce modules. `yocto_api.h` must always be used, `yocto_digitalio.h` is necessary to manage modules containing a digital IO port, such as Yocto-Maxi-IO-V2.

[YAPI RegisterHub]

The `[YAPI RegisterHub]` function initializes the Yoctopuce API and indicates where the modules should be looked for. When used with the parameter `@"usb"`, it will use the modules locally connected to the computer running the library. If the initialization does not succeed, this function returns a value different from `YAPI_SUCCESS` and `errmsg` contains the error message.

[DigitalIO FindDigitalIO]

The `[DigitalIO FindDigitalIO]` function allows you to find a digital IO port from the serial number of the module on which it resides and from its function name. You can use logical names as well, as long as you have initialized them. Let us imagine a Yocto-Maxi-IO-V2 module with serial number `MAXIO002-123456` which you have named "`MyModule`", and for which you have given the `digitalIO` function the name "`MyFunction`". The following five calls are strictly equivalent, as long as "`MyFunction`" is defined only once.

```
YDigitalIO *digitalio = [DigitalIO FindDigitalIO:@"MAXIO002-123456.digitalIO"];
YDigitalIO *digitalio = [DigitalIO FindDigitalIO:@"MAXIO002-123456.MyFunction"];
YDigitalIO *digitalio = [DigitalIO FindDigitalIO:@"MyModule.digitalIO"];
YDigitalIO *digitalio = [DigitalIO FindDigitalIO:@"MyModule.MyFunction"];
YDigitalIO *digitalio = [DigitalIO FindDigitalIO:@"MyFunction"];
```

`[DigitalIO FindDigitalIO]` returns an object which you can then use at will to control the digital IO port.

isOnline

The `isOnline` method of the object returned by `[DigitalIO FindDigitalIO]` allows you to know if the corresponding module is present and in working order.

set_state

The `set_portState()` method of the object returned by `YDigitalIO.FindDigitalIO` assigns all the outputs at once. The parameter is an integer representing a bitmap: the bit 0 controls the first output, the bit 1 controls the second one, etc..

A real example

Launch Xcode 4.2 and open the corresponding sample project provided in the directory **Examples/Doc-GettingStarted-Yocto-Maxi-IO-V2** of the Yoctopuce library.

In this example, you will recognize the functions explained above, but this time used with all side materials needed to make it work nicely as a small demo.

```
#import <Foundation/Foundation.h>
#import "yocto_api.h"
#import "yocto_digitalio.h"

static void usage(void)
{
    NSLog(@"usage: demo <serial_number> ");
    NSLog(@"      demo <logical_name> ");
    NSLog(@"      demo any      (use any discovered device) ");
    exit(1);
}
```

```

int main(int argc, const char * argv[])
{
    NSError *error;

    @autoreleasepool {

        YDigitalIO    *io;

        // Setup the API to use local USB devices
        if([YAPI RegisterHub:@"usb": &error] != YAPI_SUCCESS) {
            NSLog(@"%@", [error localizedDescription]);
            return 1;
        }

        if (argc > 1  && strcmp(argv[1], "any")) {
            NSString *target = [NSString stringWithUTF8String:argv[1]];
            io = [YDigitalIO FindDigitalIO:[NSString stringWithFormat:@"%@.%@.digitalIO", target]];
        } else {
            io = [YDigitalIO FirstDigitalIO];
        }
        // make sure the device is here
        if (![io isOnline]) {
            NSLog(@"No module connected (check USB cable)");
            usage();
        }
        // lets configure the channels direction
        // bits 0..3 as output
        // bits 4..7 as input

        [io set_portDirection:0x0F];
        [io set_portPolarity:0]; // polarity set to regular
        [io set_portOpenDrain:0]; // No open drain

        NSLog(@"Channels 0..3 are configured as outputs and channels 4..7");
        NSLog(@"are configred as inputs, you can connect some inputs to");
        NSLog(@"outputs and see what happens");

        int outputdata = 0;
        while ([io isOnline]) {
            outputdata = (outputdata + 1) % 16; // cycle ouput 0..15
            [io set_portState:outputdata]; // We could have used set_bitState as well
            [YAPI Sleep:1000:&error];
            int inputdata = [io get_portState]; // read port values
            char line[9]; // display part state value as binary
            for (int i = 0; i < 8 ; i++) {
                if (inputdata & (128 >> i))
                    line[i] = '1';
                else
                    line[i] = '0';
            }
            line[8] = 0;
            NSLog(@"port value = %@", line);
        }
        NSLog(@"Module disconnected");
        [YAPI FreeAPI];
    }
    return 0;
}

```

19.2. Control of the module part

Each module can be controlled in a similar manner, you can find below a simple sample program displaying the main parameters of the module and enabling you to activate the localization beacon.

```

#import <Foundation/Foundation.h>
#import "yocto_api.h"

static void usage(const char *exe)
{
    NSLog(@"usage: %s <serial or logical name> [ON/OFF]\n", exe);
    exit(1);

```

```

}

int main (int argc, const char * argv[])
{
    NSError *error;

    @autoreleasepool {
        // Setup the API to use local USB devices
        if([YAPI RegisterHub:@"usb": &error] != YAPI_SUCCESS) {
            NSLog(@"RegisterHub error: %@", [error localizedDescription]);
            return 1;
        }
        if(argc < 2)
            usage(argv[0]);
        NSString *serial_or_name = [NSString stringWithUTF8String:argv[1]];
        // use serial or logical name
        YModule *module = [YModule FindModule:serial_or_name];
        if ([module isOnline]) {
            if (argc > 2) {
                if (strcmp(argv[2], "ON") == 0)
                    [module setBeacon:Y_BEACON_ON];
                else
                    [module setBeacon:Y_BEACON_OFF];
            }
            NSLog(@"serial:      %@", [module serialNumber]);
            NSLog(@"logical name: %@", [module logicalName]);
            NSLog(@"luminosity:   %d", [module luminosity]);
            NSLog(@"beacon:       ");
            if ([module beacon] == Y_BEACON_ON)
                NSLog(@"ON\n");
            else
                NSLog(@"OFF\n");
            NSLog(@"upTime:      %ld sec\n", [module upTime] / 1000);
            NSLog(@"USB current: %d mA\n", [module usbCurrent]);
            NSLog(@"logs:        %@", [module get_lastLogs]);
        } else {
            NSLog(@"%@", [@"%@ not connected (check identification and USB cable)\n" stringByAppendingString:serial_or_name]);
        }
        [YAPI FreeAPI];
    }
    return 0;
}

```

Each property `xxx` of the module can be read thanks to a method of type `get_xxxx`, and properties which are not read-only can be modified with the help of the `set_xxx:` method. For more details regarding the used functions, refer to the API chapters.

Changing the module settings

When you want to modify the settings of a module, you only need to call the corresponding `set_xxx:` function. However, this modification is performed only in the random access memory (RAM) of the module: if the module is restarted, the modifications are lost. To memorize them persistently, it is necessary to ask the module to save its current configuration in its permanent memory. To do so, use the `saveToFlash` method. Inversely, it is possible to force the module to forget its current settings by using the `revertFromFlash` method. The short example below allows you to modify the logical name of a module.

```

#import <Foundation/Foundation.h>
#import "yocto_api.h"

static void usage(const char *exe)
{
    NSLog(@"usage: %s <serial> <newLogicalName>\n", exe);
    exit(1);
}

int main (int argc, const char * argv[])
{
    NSError *error;

    @autoreleasepool {

```

```

// Setup the API to use local USB devices
if([YAPI RegisterHub:@"usb" :&error] != YAPI_SUCCESS) {
    NSLog(@"%@", [error localizedDescription]);
    return 1;
}

if(argc < 2)
    usage(argv[0]);

NSString *serial_or_name = [NSString stringWithUTF8String:argv[1]];
// use serial or logical name
YModule *module = [YModule FindModule:serial_or_name];

if (module.isOnline) {
    if (argc >= 3) {
        NSString *newname = [NSString stringWithUTF8String:argv[2]];
        if (![YAPI CheckLogicalName:newname]) {
            NSLog(@"Invalid name (%@)\n", newname);
            usage(argv[0]);
        }
        module.logicalName = newname;
        [module saveToFlash];
    }
    NSLog(@"Current name: %@", module.logicalName);
} else {
    NSLog(@"%@ not connected (check identification and USB cable)\n",
          serial_or_name);
}
[YAPI FreeAPI];
}
return 0;
}

```

Warning: the number of write cycles of the nonvolatile memory of the module is limited. When this limit is reached, nothing guarantees that the saving process is performed correctly. This limit, linked to the technology employed by the module micro-processor, is located at about 100000 cycles. In short, you can use the `saveToFlash` function only 100000 times in the life of the module. Make sure you do not call this function within a loop.

Listing the modules

Obtaining the list of the connected modules is performed with the `yFirstModule()` function which returns the first module found. Then, you only need to call the `nextModule()` function of this object to find the following modules, and this as long as the returned value is not NULL. Below a short example listing the connected modules.

```

#import <Foundation/Foundation.h>
#import "yocto_api.h"

int main (int argc, const char * argv[])
{
    NSError *error;

    @autoreleasepool {
        // Setup the API to use local USB devices
        if([YAPI RegisterHub:@"usb" :&error] != YAPI_SUCCESS) {
            NSLog(@"%@", [error localizedDescription]);
            return 1;
        }

        NSLog(@"Device list:\n");

        YModule *module = [YModule FirstModule];
        while (module != nil) {
            NSLog(@"%@", module.serialNumber, module.productName);
            module = [module nextModule];
        }
        [YAPI FreeAPI];
    }
    return 0;
}

```

19.3. Error handling

When you implement a program which must interact with USB modules, you cannot disregard error handling. Inevitably, there will be a time when a user will have unplugged the device, either before running the software, or even while the software is running. The Yoctopuce library is designed to help you support this kind of behavior, but your code must nevertheless be conceived to interpret in the best possible way the errors indicated by the library.

The simplest way to work around the problem is the one used in the short examples provided in this chapter: before accessing a module, check that it is online with the `isOnline` function, and then hope that it will stay so during the fraction of a second necessary for the following code lines to run. This method is not perfect, but it can be sufficient in some cases. You must however be aware that you cannot completely exclude an error which would occur after the call to `isOnline` and which could crash the software. The only way to prevent this is to implement one of the two error handling techniques described below.

The method recommended by most programming languages for unpredictable error handling is the use of exceptions. By default, it is the behavior of the Yoctopuce library. If an error happens while you try to access a module, the library throws an exception. In this case, there are three possibilities:

- If your code catches the exception and handles it, everything goes well.
- If your program is running in debug mode, you can relatively easily determine where the problem happened and view the explanatory message linked to the exception.
- Otherwise... the exception makes your program crash, bang!

As this latest situation is not the most desirable, the Yoctopuce library offers another possibility for error handling, allowing you to create a robust program without needing to catch exceptions at every line of code. You simply need to call the `YAPI.DisableExceptions()` function to commute the library to a mode where exceptions for all the functions are systematically replaced by specific return values, which can be tested by the caller when necessary. For each function, the name of each return value in case of error is systematically documented in the library reference. The name always follows the same logic: a `get_state()` method returns a `ClassName.STATE_INVALID` value, a `get_currentValue` method returns a `ClassName.CURRENTVALUE_INVALID` value, and so on. In any case, the returned value is of the expected type and is not a null pointer which would risk crashing your program. At worst, if you display the value without testing it, it will be outside the expected bounds for the returned value. In the case of functions which do not normally return information, the return value is `YAPI_SUCCESS` if everything went well, and a different error code in case of failure.

When you work without exceptions, you can obtain an error code and an error message explaining the source of the error. You can request them from the object which returned the error, calling the `errType()` and `errMessage()` methods. Their returned values contain the same information as in the exceptions when they are active.

20. Using with unsupported languages

Yoctopuce modules can be driven from most common programming languages. New languages are regularly added, depending on the interest expressed by Yoctopuce product users. Nevertheless, some languages are not, and will never be, supported by Yoctopuce. There can be several reasons for this: compilers which are not available anymore, unadapted environments, etc.

However, there are alternative methods to access Yoctopuce modules from an unsupported programming language.

20.1. Command line

The easiest method to drive Yoctopuce modules from an unsupported programming language is to use the command line API through system calls. The command line API is in fact made of a group of small executables which are easy to call. Their output is also easy to analyze. As most programming languages allow you to make system calls, the issue is solved with a few lines of code.

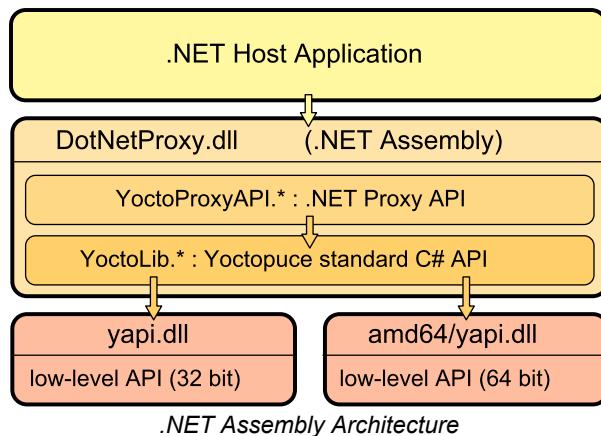
However, if the command line API is the easiest solution, it is neither the fastest nor the most efficient. For each call, the executable must initialize its own API and make an inventory of USB connected modules. This requires about one second per call.

20.2. .NET Assembly

A .NET Assembly enables you to share a set of pre-compiled classes to offer a service, by stating entry points which can be used by third-party applications. In our case, it's the whole Yoctopuce library which is available in the .NET Assembly, so that it can be used in any environment which supports .NET Assembly dynamic loading.

The Yoctopuce library as a .NET Assembly does not contain only the standard C# Yoctopuce library, as this wouldn't have allowed an optimal use in all environments. Indeed, we cannot expect host applications to necessarily offer a thread system or a callback system, although they are very useful to manage plug-and-play events and sensors with a high refresh rate. Likewise, we can't expect from external applications a transparent behavior in cases where a function call in Assembly creates a delay because of network communications.

Therefore, we added to it an additional layer, called *.NET Proxy* library. This additional layer offers an interface very similar to the standard library but somewhat simplified, as it internally manages all the callback mechanisms. Instead, this library offers mirror objects, called *Proxys*, which publish through *Properties* the main attributes of the Yoctopuce functions such as the current measure, configuration parameters, the state, and so on.



The callback mechanism automatically updates the properties of the *Proxys* objects, without the host application needing to care for it. The later can thus, at any time and without any risk of latency, display the value of all properties of Yoctopuce Proxy objects.

Pay attention to the fact that the `yapi.dll` low-level communication library is **not** included in the .NET Assembly. You must therefore keep it together with `DotNetProxyLibrary.dll`. The 32 bit version must be located in the same directory as `DotNetProxyLibrary.dll`, while the 64 bit version must be in a subdirectory `amd64`.

Example of use with MATLAB

Here is how to load our Proxy .NET Assembly in MATLAB and how to read the value of the first sensor connected by USB found on the machine:

```
NET.addAssembly("C:/Yoctopuce/DotNetProxyLibrary.dll");
import YoctoProxyAPI.*;

errmsg = YAPIProxy.RegisterHub("usb");
sensor = YSensorProxy.FindSensor("");
measure = sprintf('%.3f %s', sensor.CurrentValue, sensor.Unit);
```

Example of use in PowerShell

PowerShell commands are a little stranger, but we can recognize the same structure:

```
Add-Type -Path "C:/Yoctopuce/DotNetProxyLibrary.dll"

$errmsg = [YoctoProxyAPI.YAPIProxy]::RegisterHub("usb")
$sensor = [YoctoProxyAPI.YSensorProxy]::FindSensor("")
$measure = "{0:n3} {1}" -f $sensor.CurrentValue, $sensor.Unit
```

Specificities of the .NET Proxy library

With regards to classic Yoctopuce libraries, the following differences in particular should be noted:

No FirstModule/nextModule method

To obtain an object referring to the first found module, we call `YModuleProxy.FindModule("")`. If there is no connected module, this method returns an object with its `module.IsOnline` property set to `False`. As soon as a module is connected, the property changes to `True` and the module hardware identifier is updated.

To list modules, you can call the `module.GetSimilarFunctions()` method which returns an array of character strings containing the identifiers of all the modules which were found.

No callback function

Callback functions are implemented internally and they update the object properties. You can therefore simply poll the properties, without significant performance penalties. Be aware that if you

use one of the function that disables callbacks, the automatic refresh of object properties may not work anymore.

A new method `YAPIProxy.GetLog` makes it possible to retrieve low-level debug logs without using callbacks.

Enumerated types

In order to maximize compatibility with host applications, the .NET Proxy library does not use true .NET enumerated types, but simple integers. For each enumerated type, the library includes public constants named according to the possible values. Contrarily to standard Yoctopuce libraries, numeric values always start from 1, as the value 0 is reserved to return an invalid value, for instance when the device is disconnected.

Invalid numeric results

For all numeric results, rather than using an arbitrary constant, the invalid value returned in case of error is `Nan`. You should therefore use function `isNaN()` to detect this value.

Using .NET Assembly without the Proxy library

If for a reason or another you don't want to use the Proxy library, and if your environment allows it, you can use the standard C# API as it is located in the Assembly, under the `YoctoLib` namespace. Beware however not to mix both types of use: either you go through the Proxy library, or you use the `YoctoLib` version directly, but not both!

CompatibilitÃ©

For the LabVIEW Yoctopuce library to work correctly with your Yoctopuce modules, these modules need to have firmware 37120, or higher.

In order to be compatible with as many versions of Windows as possible, including Windows XP, the `DotNetProxyLibrary.dll` library is compiled in .NET 3.5, which is available by default on all the Windows versions since XP. As of today, we have never met any non-Windows environment able to load a .NET Assembly, so we only ship the low-level communication dll for Windows together with the assembly.

20.3. VirtualHub and HTTP GET

The `VirtualHub` is available on almost all current platforms. It is generally used as a gateway to provide access to Yoctopuce modules from languages which prevent direct access to hardware layers of a computer (JavaScript, PHP, Java, ...).

In fact, the `VirtualHub` is a small web server able to route HTTP requests to Yoctopuce modules. This means that if you can make an HTTP request from your programming language, you can drive Yoctopuce modules, even if this language is not officially supported.

REST interface

At a low level, the modules are driven through a REST API. Thus, to control a module, you only need to perform appropriate requests on the `VirtualHub`. By default, the `VirtualHub` HTTP port is 4444.

An important advantage of this technique is that preliminary tests are very easy to implement. You only need a `VirtualHub` and a simple web browser. If you copy the following URL in your preferred browser, while the `VirtualHub` is running, you obtain the list of the connected modules.

```
http://127.0.0.1:4444/api/services/whitePages.txt
```

Note that the result is displayed as text, but if you request `whitePages.xml`, you obtain an XML result. Likewise, `whitePages.json` allows you to obtain a JSON result. The `html` extension even allows you to display a rough interface where you can modify values in real time. The whole REST API is available in these different formats.

Driving a module through the REST interface

Each Yoctopuce module has its own REST interface, available in several variants. Let us imagine a Yocto-Maxi-IO-V2 with the *MAXIIO02-12345* serial number and the *myModule* logical name. The following URL allows you to know the state of the module.

```
http://127.0.0.1:4444/bySerial/MAXIIO02-12345/api/module.txt
```

You can naturally also use the module logical name rather than its serial number.

```
http://127.0.0.1:4444/byName/myModule/api/module.txt
```

To retrieve the value of a module property, simply add the name of the property below *module*. For example, if you want to know the signposting led luminosity, send the following request:

```
http://127.0.0.1:4444/bySerial/MAXIIO02-12345/api/module/luminosity
```

To change the value of a property, modify the corresponding attribute. Thus, to modify the luminosity, send the following request:

```
http://127.0.0.1:4444/bySerial/MAXIIO02-12345/api/module?luminosity=100
```

Driving the module functions through the REST interface

The module functions can be manipulated in the same way. To know the state of the *digitalIO* function, build the following URL:

```
http://127.0.0.1:4444/bySerial/MAXIIO02-12345/api/digitalIO.txt
```

Note that if you can use logical names for the modules instead of their serial number, you cannot use logical names for functions. Only hardware names are authorized to access functions.

You can retrieve a module function attribute in a way rather similar to that used with the modules. For example:

```
http://127.0.0.1:4444/bySerial/MAXIIO02-12345/api/digitalIO/logicalName
```

Rather logically, attributes can be modified in the same manner.

```
http://127.0.0.1:4444/bySerial/MAXIIO02-12345/api/digitalIO?logicalName=myFunction
```

You can find the list of available attributes for your Yocto-Maxi-IO-V2 at the beginning of the *Programming* chapter.

Accessing Yoctopuce data logger through the REST interface

This section only applies to devices with a built-in data logger.

The preview of all recorded data streams can be retrieved in JSON format using the following URL:

```
http://127.0.0.1:4444/bySerial/MAXIIO02-12345/dataLogger.json
```

Individual measures for any given stream can be obtained by appending the desired function identifier as well as start time of the stream:

```
http://127.0.0.1:4444/bySerial/MAXIIO02-12345/dataLogger.json?id=digitalIO&utc=1389801080
```

20.4. Using dynamic libraries

The low level Yoctopuce API is available under several formats of dynamic libraries written in C. The sources are available with the C++ API. If you use one of these low level libraries, you do not need the *VirtualHub* anymore.

Filename	Platform
libyapi.dylib	Max OS X
libyapi-amd64.so	Linux Intel (64 bits)
libyapi-armel.so	Linux ARM EL (32 bits)
libyapi-armhf.so	Linux ARM HL (32 bits)
libyapi-aarch64.so	Linux ARM (64 bits)
libyapi-i386.so	Linux Intel (32 bits)
yapi64.dll	Windows (64 bits)
yapi.dll	Windows (32 bits)

These dynamic libraries contain all the functions necessary to completely rebuild the whole high level API in any language able to integrate these libraries. This chapter nevertheless restrains itself to describing basic use of the modules.

Driving a module

The three essential functions of the low level API are the following:

```
int yapiInitAPI(int connection_type, char *errmsg);
int yapiUpdateDeviceList(int forceupdate, char *errmsg);
int yapiHTTPRequest(char *device, char *request, char* buffer,int bufsize,int *fullsize,
char *errmsg);
```

The *yapiInitAPI* function initializes the API and must be called once at the beginning of the program. For a USB type connection, the *connection_type* parameter takes value 1. The *errmsg* parameter must point to a 255 character buffer to retrieve a potential error message. This pointer can also point to *null*. The function returns a negative integer in case of error, zero otherwise.

The *yapiUpdateDeviceList* manages the inventory of connected Yoctopuce modules. It must be called at least once. To manage hot plug and detect potential newly connected modules, this function must be called at regular intervals. The *forceupdate* parameter must take value 1 to force a hardware scan. The *errmsg* parameter must point to a 255 character buffer to retrieve a potential error message. This pointer can also point to *null*. The function returns a negative integer in case of error, zero otherwise.

Finally, the *yapiHTTPRequest* function sends HTTP requests to the module REST API. The *device* parameter contains the serial number or the logical name of the module which you want to reach. The *request* parameter contains the full HTTP request (including terminal line breaks). *buffer* points to a character buffer long enough to contain the answer. *bufsize* is the size of the buffer. *fullsize* is a pointer to an integer to which will be assigned the actual size of the answer. The *errmsg* parameter must point to a 255 character buffer to retrieve a potential error message. This pointer can also point to *null*. The function returns a negative integer in case of error, zero otherwise.

The format of the requests is the same as the one described in the *VirtualHub et HTTP GET* section. All the character strings used by the API are strings made of 8-bit characters: Unicode and UTF8 are not supported.

The result returned in the *buffer* variable respects the HTTP protocol. It therefore includes an HTTP header. This header ends with two empty lines, that is a sequence of four ASCII characters 13, 10, 13, 10.

Here is a sample program written in pascal using the *yapi.dll* DLL to read and then update the luminosity of a module.

```
// Dll functions import
function yapiInitAPI(mode:integer;
errmsg : pansichar):integer;cdecl;
```

```

        external 'yapi.dll' name 'yapiInitAPI';
function  yapiUpdateDeviceList(force:integer;errmsg : pansichar):integer;cdecl;
        external 'yapi.dll' name 'yapiUpdateDeviceList';
function  yapiHTTPRequest(device:pansichar;url:pansichar; buffer:pansichar;
buffsize:integer;var fullsize:integer;
errmsg : pansichar):integer;cdecl;
        external 'yapi.dll' name 'yapiHTTPRequest';

var
errmsgBuffer  : array [0..256] of ansichar;
dataBuffer    : array [0..1024] of ansichar;
errmsg,data   : pansichar;
fullsize,p    : integer;

const
serial      = 'MAXII002-12345';
getValue = 'GET /api/module/luminosity HTTP/1.1'#13#10#13#10;
setValue = 'GET /api/module?luminosity=100 HTTP/1.1'#13#10#13#10;

begin
errmsg  := @errmsgBuffer;
data    := @dataBuffer;
// API initialization
if(yapiInitAPI(1,errmsg)<0) then
begin
writeln(errmsg);
halt;
end;

// forces a device inventory
if( yapiUpdateDeviceList(1,errmsg)<0) then
begin
writeln(errmsg);
halt;
end;

// requests the module luminosity
if (yapiHTTPRequest(serial,getValue,data,sizeof(dataBuffer),fullsize,errmsg)<0) then
begin
writeln(errmsg);
halt;
end;

// searches for the HTTP header end
p := pos(#13#10#13#10,data);

// displays the response minus the HTTP header
writeln(copy(data,p+4,length(data)-p-3));

// changes the luminosity
if (yapiHTTPRequest(serial,setValue,data,sizeof(dataBuffer),fullsize,errmsg)<0) then
begin
writeln(errmsg);
halt;
end;
end.

```

Module inventory

To perform an inventory of Yoctopuce modules, you need two functions from the dynamic library:

```

int yapi GetAllDevices(int *buffer,int maxsize,int *neededsize,char *errmsg);
int yapi GetDeviceInfo(int devdesc,yDeviceSt *infos, char *errmsg);

```

The *yapiGetAllDevices* function retrieves the list of all connected modules as a list of handles. *buffer* points to a 32-bit integer array which contains the returned handles. *maxsize* is the size in bytes of the buffer. To *neededsize* is assigned the necessary size to store all the handles. From this, you can deduce either the number of connected modules or that the input buffer is too small. The *errmsg* parameter must point to a 255 character buffer to retrieve a potential error message. This pointer can also point to *null*. The function returns a negative integer in case of error, zero otherwise.

The `yapiGetDeviceInfo` function retrieves the information related to a module from its handle. `devdesc` is a 32-bit integer representing the module and which was obtained through `yapi GetAllDevices`. `infos` points to a data structure in which the result is stored. This data structure has the following format:

Name	Type	Size (bytes)	Description
vendorid	int	4	Yoctopuce USB ID
deviceid	int	4	Module USB ID
devrelease	int	4	Module version
nbinbterfaces	int	4	Number of USB interfaces used by the module
manufacturer	char[]	20	Yoctopuce (null terminated)
productname	char[]	28	Model (null terminated)
serial	char[]	20	Serial number (null terminated)
logicalname	char[]	20	Logical name (null terminated)
firmware	char[]	22	Firmware version (null terminated)
beacon	byte	1	Beacon state (0/1)

The `errormsg` parameter must point to a 255 character buffer to retrieve a potential error message.

Here is a sample program written in pascal using the `yapi.dll` DLL to list the connected modules.

```
// device description structure
type yDeviceSt = packed record
    vendorid      : word;
    deviceid      : word;
    devrelease    : word;
    nbinbterfaces : word;
    manufacturer  : array [0..19] of ansichar;
    productname   : array [0..27] of ansichar;
    serial        : array [0..19] of ansichar;
    logicalname   : array [0..19] of ansichar;
    firmware      : array [0..21] of ansichar;
    beacon        : byte;
end;

// Dll function import
function yapiInitAPI(mode:integer;
                      errormsg : pansichar):integer;cdecl;
                      external 'yapi.dll' name 'yapiInitAPI';

function yapiUpdateDeviceList(force:integer;errormsg : pansichar):integer;cdecl;
                      external 'yapi.dll' name 'yapiUpdateDeviceList';

function yapiGetAllDevices( buffer:pointer;
                           maxsize:integer;
                           var neededsize:integer;
                           errormsg : pansichar):integer; cdecl;
                           external 'yapi.dll' name 'yapiGetAllDevices';

function apiGetDeviceInfo(d:integer; var infos:yDeviceSt;
                          errormsg : pansichar):integer; cdecl;
                          external 'yapi.dll' name 'yapiGetDeviceInfo';

var
  errormsgBuffer : array [0..256] of ansichar;
  dataBuffer     : array [0..127] of integer; // max of 128 USB devices
  errormsg,data  : pansichar;
  neededsize,i   : integer;
  devinfos       : yDeviceSt;

begin
  errormsg := @errormsgBuffer;

  // API initialization
  if(yapiInitAPI(1,errormsg)<0) then
  begin
    writeln(errormsg);
    halt;
  end;
end;
```

```

// forces a device inventory
if( yapiUpdateDeviceList(1,errmsg)<0) then
begin
writeln(errmsg);
halt;
end;

// loads all device handles into dataBuffer
if yapi GetAllDevices(@dataBuffer,sizeof(dataBuffer),neededsize,errmsg)<0 then
begin
writeln(errmsg);
halt;
end;

// gets device info from each handle
for i:=0 to neededsize div sizeof(integer)-1 do
begin
if (apiGetDeviceInfo(dataBuffer[i], devinfos, errmsg)<0) then
begin
writeln(errmsg);
halt;
end;
writeln(pansichar(@devinfos.serial)+ ' ('+pansichar(@devinfos.productname)+') ');
end;

end.

```

VB6 and yapi.dll

Each entry point from the yapi.dll is duplicated. You will find one regular C-decl version and one Visual Basic 6 compatible version, prefixed with `vb6_`.

20.5. Porting the high level library

As all the sources of the Yoctopuce API are fully provided, you can very well port the whole API in the language of your choice. Note, however, that a large portion of the API source code is automatically generated.

Therefore, it is not necessary for you to port the complete API. You only need to port the `yocto_api` file and one file corresponding to a function, for example `yocto_relay`. After a little additional work, Yoctopuce is then able to generate all other files. Therefore, we highly recommend that you contact Yoctopuce support before undertaking to port the Yoctopuce library in another language. Collaborative work is advantageous to both parties.

21. Advanced programming

The preceding chapters have introduced, in each available language, the basic programming functions which can be used with your Yocto-Maxi-IO-V2 module. This chapter presents in a more generic manner a more advanced use of your module. Examples are provided in the language which is the most popular among Yoctopuce customers, that is C#. Nevertheless, you can find complete examples illustrating the concepts presented here in the programming libraries of each language.

To remain as concise as possible, examples provided in this chapter do not perform any error handling. Do not copy them "as is" in a production application.

21.1. Event programming

The methods to manage Yoctopuce modules which we presented to you in preceding chapters were polling functions, consisting in permanently asking the API if something had changed. While easy to understand, this programming technique is not the most efficient, nor the most reactive. Therefore, the Yoctopuce programming API also provides an event programming model. This technique consists in asking the API to signal by itself the important changes as soon as they are detected. Each time a key parameter is modified, the API calls a callback function which you have defined in advance.

Detecting module arrival and departure

Hot-plug management is important when you work with USB modules because, sooner or later, you will have to connect or disconnect a module when your application is running. The API is designed to manage module unexpected arrival or departure in a transparent way. But your application must take this into account if it wants to avoid pretending to use a disconnected module.

Event programming is particularly useful to detect module connection/disconnection. Indeed, it is simpler to be told of new connections rather than to have to permanently list the connected modules to deduce which ones just arrived and which ones left. To be warned as soon as a module is connected, you need three pieces of code.

The callback

The callback is the function which is called each time a new Yoctopuce module is connected. It takes as parameter the relevant module.

```
static void deviceArrival(YModule m)
{
    Console.WriteLine("New module : " + m.get_serialNumber());
}
```

Initialization

You must then tell the API that it must call the callback when a new module is connected.

```
YAPI.RegisterDeviceArrivalCallback(deviceArrival);
```

Note that if modules are already connected when the callback is registered, the callback is called for each of the already connected modules.

Triggering callbacks

A classic issue of callback programming is that these callbacks can be triggered at any time, including at times when the main program is not ready to receive them. This can have undesired side effects, such as dead-locks and other race conditions. Therefore, in the Yoctopuce API, module arrival/departure callbacks are called only when the `UpdateDeviceList()` function is running. You only need to call `UpdateDeviceList()` at regular intervals from a timer or from a specific thread to precisely control when the calls to these callbacks happen:

```
// waiting loop managing callbacks
while (true)
{
    // module arrival / departure callback
    YAPI.UpdateDeviceList(ref errmsg);
    // non active waiting time managing other callbacks
    YAPI.Sleep(500, ref errmsg);
}
```

In a similar way, it is possible to have a callback when a module is disconnected. You can find a complete example implemented in your favorite programming language in the *Examples/Prog-EventBased* directory of the corresponding library.

Be aware that in most programming languages, callbacks must be global procedures, and not methods. If you wish for the callback to call the method of an object, define your callback as a global procedure which then calls your method.

22. Firmware Update

There are multiples way to update the firmware of a Yoctopuce module..

22.1. The VirtualHub or the YoctoHub

It is possible to update the firmware directly from the web interface of the VirtualHub or the YoctoHub. The configuration panel of the module has an "upgrade" button to start a wizard that will guide you through the firmware update procedure.

In case the firmware update fails for any reason, and the module does no start anymore, simply unplug the module then plug it back while maintaining the *Yocto-button* down. The module will boot in "firmware update" mode and will appear in the VirtualHub interface below the module list.

22.2. The command line library

All the command line tools can update Yoctopuce modules thanks to the `downloadAndUpdate` command. The module selection mechanism works like for a traditional command. The [target] is the name of the module that you want to update. You can also use the "any" or "all" aliases, or even a name list, where the names are separated by commas, without spaces.

```
C:\>Executable [options] [target] command [parameters]
```

The following example updates all the Yoctopuce modules connected by USB.

```
C:\>YModule all downloadAndUpdate
ok: Yocto-PowerRelay RELAYH1-266C8 (rev=15430) is up to date.
ok: 0 / 0 hubs in 0.00000s.
ok: 0 / 0 shields in 0.00000s.
ok: 1 / 1 devices in 0.130000s 0.130000s per device.
ok: All devices are now up to date.
C:\>
```

22.3. The Android application Yocto-Firmware

You can update your module firmware from your Android phone or tablet with the [Yocto-Firmware](#) application. This application lists all the Yoctopuce modules connected by USB and checks if a more recent firmware is available on www.yoctopuce.com. If a more recent firmware is available, you can

update the module. The application is responsible for downloading and installing the new firmware while preserving the module parameters.

Please note: while the firmware is being updated, the module restarts several times. Android interprets a USB device reboot as a disconnection and reconnection of the USB device and asks the authorization to use the USB port again. The user must click on *OK* for the update process to end successfully.

22.4. Updating the firmware with the programming library

If you need to integrate firmware updates in your application, the libraries offer you an API to update your modules.¹

Saving and restoring parameters

The `get_allSettings()` method returns a binary buffer enabling you to save a module persistent parameters. This function is very useful to save the network configuration of a YoctoHub for example.

```
YWireless wireless = YWireless.FindWireless("reference");
YModule m = wireless.get_module();
byte[] default_config = m.get_allSettings();
saveFile("default.bin", default_config);
...
```

You can then apply these parameters to other modules with the `set_allSettings()` method.

```
byte[] default_config = loadFile("default.bin");
YModule m = YModule.FirstModule();
while (m != null) {
    if (m.get_productName() == "YoctoHub-Wireless") {
        m.set_allSettings(default_config);
    }
    m = m.next();
}
```

Finding the correct firmware

The first step to update a Yoctopuce module is to find which firmware you must use. The `checkFirmware(path, onlynew)` method of the `YModule` object does exactly this. The method checks that the firmware given as argument (`path`) is compatible with the module. If the `onlynew` parameter is set, this method checks that the firmware is more recent than the version currently used by the module. When the file is not compatible (or if the file is older than the installed version), this method returns an empty string. In the opposite, if the file is valid, the method returns a file access path.

The following piece of code checks that the `c:\\tmp\\METEOMK1.17328.byn` is compatible with the module stored in the `m` variable .

```
YModule m = YModule.FirstModule();
...
...
string path = "c:\\tmp\\METEOMK1.17328.byn";
string newfirm = m.checkFirmware(path, false);
if (newfirm != "") {
    Console.WriteLine("firmware " + newfirm + " is compatible");
}
...
```

¹ The JavaScript, Node.js, and PHP libraries do not yet allow you to update the modules. These functions will be available in a next build.

The argument can be a directory (instead of a file). In this case, the method checks all the files of the directory recursively and returns the most recent compatible firmware. The following piece of code checks whether there is a more recent firmware in the `c:\tmp\` directory.

```
YModule m = YModule.FirstModule();
...
...
string path = "c:\\tmp";
string newfirm = m.checkFirmware(path, true);
if (newfirm != "") {
    Console.WriteLine("firmware " + newfirm + " is compatible and newer");
}
...
```

You can also give the "www.yoctopuce.com" string as argument to check whether there is a more recent published firmware on Yoctopuce's web site. In this case, the method returns the firmware URL. You can use this URL to download the firmware on your disk or use this URL when updating the firmware (see below). Obviously, this possibility works only if your machine is connected to Internet.

```
YModule m = YModule.FirstModule();
...
...
string url = m.checkFirmware("www.yoctopuce.com", true);
if (url != "") {
    Console.WriteLine("new firmware is available at " + url );
}
...
```

Updating the firmware

A firmware update can take several minutes. That is why the update process is run as a background task and is driven by the user code thanks to the `YFirmwareUpdate` class.

To update a Yoctopuce module, you must obtain an instance of the `YFirmwareUpdate` class with the `updateFirmware` method of a `YModule` object. The only parameter of this method is the *path* of the firmware that you want to install. This method does not immediately start the update, but returns a `YFirmwareUpdate` object configured to update the module.

```
string newfirm = m.checkFirmware("www.yoctopuce.com", true);
....
YFirmwareUpdate fw_update = m.updateFirmware(newfirm);
```

The `startUpdate()` method starts the update as a background task. This background task automatically takes care of

1. saving the module parameters
2. restarting the module in "update" mode
3. updating the firmware
4. starting the module with the new firmware version
5. restoring the parameters

The `get_progress()` and `get_progressMessage()` methods enable you to follow the progression of the update. `get_progress()` returns the progression as a percentage (100 = update complete). `get_progressMessage()` returns a character string describing the current operation (deleting, writing, rebooting, ...). If the `get_progress` method returns a negative value, the update process failed. In this case, the `get_progressMessage()` returns an error message.

The following piece of code starts the update and displays the progress on the standard output.

```
YFirmwareUpdate fw_update = m.updateFirmware(newfirm);
....
int status = fw_update.startUpdate();
while (status < 100 && status >= 0) {
```

```

int newstatus = fw_update.get_progress();
if (newstatus != status) {
    Console.WriteLine(status + "% "
        + fw_update.get_progressMessage());
}
YAPI.Sleep(500, ref errmsg);
status = newstatus;
}

if (status < 0) {
    Console.WriteLine("Firmware Update failed: "
        + fw_update.get_progressMessage());
} else {
    Console.WriteLine("Firmware Updated Successfully!");
}

```

An Android characteristic

You can update a module firmware using the Android library. However, for modules connected by USB, Android asks the user to authorize the application to access the USB port.

During firmware update, the module restarts several times. Android interprets a USB device reboot as a disconnection and a reconnection to the USB port, and prevents all USB access as long as the user has not closed the pop-up window. The user has to click on OK for the update process to continue correctly. **You cannot update a module connected by USB to an Android device without having the user interacting with the device.**

22.5. The "update" mode

If you want to erase all the parameters of a module or if your module does not start correctly anymore, you can install a firmware from the "update" mode.

To force the module to work in "update" mode, disconnect it, wait a few seconds, and reconnect it while maintaining the *Yocto-button* down. This will restart the module in "update" mode. This update mode is protected against corruptions and is always available.

In this mode, the module is not detected by the YModule objects anymore. To obtain the list of connected modules in "update" mode, you must use the YAPI.GetAllBootLoaders() function. This function returns a character string array with the serial numbers of the modules in "update" mode.

```
List<string> allBootLoader = YAPI.GetAllBootLoaders();
```

The update process is identical to the standard case (see the preceding section), but you must manually instantiate the YFirmwareUpdate object instead of calling module.updateFirmware(). The constructor takes as argument three parameters: the module serial number, the path of the firmware to be installed, and a byte array with the parameters to be restored at the end of the update (or null to restore default parameters).

```

YFirmwareUpdate fw_update;
fw_update = new YFirmwareUpdate(allBootLoader[0], newfirm, null);
int status = fw_update.startUpdate();
.....

```

23. High-level API Reference

This chapter summarizes the high-level API functions to drive your Yocto-Maxi-IO-V2. Syntax and exact type names may vary from one language to another, but, unless otherwise stated, all the functions are available in every language. For detailed information regarding the types of arguments and return values for a given language, refer to the definition file for this language (`yocto_api.*` as well as the other `yocto_*` files that define the function interfaces).

For languages which support exceptions, all of these functions throw exceptions in case of error by default, rather than returning the documented error value for each function. This is by design, to facilitate debugging. It is however possible to disable the use of exceptions using the `yDisableExceptions()` function, in case you prefer to work with functions that return error values.

This chapter does not repeat the programming concepts described earlier, in order to stay as concise as possible. In case of doubt, do not hesitate to go back to the chapter describing in details all configurable attributes.

23.1. Class YAPI

General functions

These general functions should be used to initialize and configure the Yoctopuce library. In most cases, a simple call to function `yRegisterHub()` should be enough. The module-specific functions `yFind...()` or `yFirst...()` should then be used to retrieve an object that provides interaction with the module.

In order to use the functions described here, you should include:

```

java import com.yoctopuce.YoctoAPI.YAPI;
dnp import YoctoProxyAPI.YAPIProxy
cp #include "yocto_api_proxy.h"
ml import YoctoProxyAPI.YAPIProxy"
js <script type='text/javascript' src='yocto_api.js'></script>
cpp #include "yocto_api.h"
m #import "yocto_api.h"
pas uses yocto_api;
vb yocto_api.vb
cs yocto_api.cs
uwp import com.yoctopuce.YoctoAPI.YModule;
py from yocto_api import *
php require_once('yocto_api.php');
ts in HTML: import { YAPI, YErrorMsg, YModule, YSensor } from '../dist/esm/yocto_api_browser.js';
in Node.js: import { YAPI, YErrorMsg, YModule, YSensor } from 'yoctolib-cjs/yocto_api_nodejs.js';
es in HTML: <script src="../../lib/yocto_api.js"></script>
in node.js: require('yoctolib-es2017/yocto_api.js');
vi YModule.vi

```

Global functions

YAPI.CheckLogicalName(name)

Checks if a given string is valid as logical name for a module or a function.

YAPI.ClearHTTPCallbackCacheDir(bool_removeFiles)

Disables the HTTP callback cache.

YAPI.DisableExceptions()

Disables the use of exceptions to report runtime errors.

YAPI.EnableExceptions()

Re-enables the use of exceptions for runtime error handling.

YAPI.EnableUSBHost(osContext)

This function is used only on Android.

YAPI.FreeAPI()

Waits for all pending communications with Yoctopuce devices to be completed then frees dynamically allocated resources used by the Yoctopuce library.

YAPI.GetAPIVersion()

Returns the version identifier for the Yoctopuce library in use.

YAPI.GetCacheValidity()

Returns the validity period of the data loaded by the library.

YAPI.GetDeviceListValidity()

Returns the delay between each forced enumeration of the used YoctoHubs.

YAPI.GetDIIArchitecture()

Returns the system architecture for the Yoctopuce communication library in use.

YAPI.GetDIIPath()

Returns the paths of the DLLs for the Yoctopuce library in use.

YAPI.GetLog(lastLogLine)

Retrieves Yoctopuce low-level library diagnostic logs.

YAPI.GetNetworkTimeout()

Returns the network connection delay for `yRegisterHub()` and `yUpdateDeviceList()`.

YAPI.GetTickCount()

Returns the current value of a monotone millisecond-based time counter.

YAPI.HandleEvents(errmsg)

Maintains the device-to-library communication channel.

YAPI.InitAPI(mode, errmsg)

Initializes the Yoctopuce programming library explicitly.

YAPI.PreregisterHub(url, errmsg)

Fault-tolerant alternative to `yRegisterHub()`.

YAPI.RegisterDeviceArrivalCallback(arrivalCallback)

Register a callback function, to be called each time a device is plugged.

YAPI.RegisterDeviceRemovalCallback(removalCallback)

Register a callback function, to be called each time a device is unplugged.

YAPI.RegisterHub(url, errmsg)

Setup the Yoctopuce library to use modules connected on a given machine.

YAPI.RegisterHubDiscoveryCallback(hubDiscoveryCallback)

Register a callback function, to be called each time an Network Hub send an SSDP message.

YAPI.RegisterHubWebsocketCallback(ws, errmsg, authpwd)

Variant to `yRegisterHub()` used to initialize Yoctopuce API on an existing Websocket session, as happens for incoming WebSocket callbacks.

YAPI.RegisterLogFunction(logfun)

Registers a log callback function.

YAPI.SelectArchitecture(arch)

Select the architecture or the library to be loaded to access to USB.

YAPI.SetCacheValidity(cacheValidityMs)

Change the validity period of the data loaded by the library.

YAPI.SetDelegate(object)

(Objective-C only) Register an object that must follow the protocol `YDeviceHotPlug`.

YAPI.SetDeviceListValidity(deviceListValidity)

Modifies the delay between each forced enumeration of the used YoctoHubs.

YAPI.SetHTTPCallbackCacheDir(str_directory)

Enables the HTTP callback cache.

YAPI.SetNetworkTimeout(networkMsTimeout)

Modifies the network connection delay for `yRegisterHub()` and `yUpdateDeviceList()`.

YAPI.setTimeout(callback, ms_timeout, args)

Invoke the specified callback function after a given timeout.

YAPI.SetUSBPacketAckMs(pktAckDelay)

Enables the acknowledge of every USB packet received by the Yoctopuce library.

YAPI.Sleep(ms_duration, errmsg)

Pauses the execution flow for a specified duration.

YAPI.TestHub(url, mstimeout, errmsg)

Test if the hub is reachable.

YAPI.TriggerHubDiscovery(errmsg)

Force a hub discovery, if a callback has been registered with `yRegisterHubDiscoveryCallback` it will be called for each network hub that will respond to the discovery.

YAPI.UnregisterHub(url)

Setup the Yoctopuce library to no longer use modules connected on a previously registered machine with `RegisterHub`.

YAPI.UpdateDeviceList(errmsg)

Triggers a (re)detection of connected Yoctopuce modules.

YAPI.UpdateDeviceList_async(callback, context)

Triggers a (re)detection of connected Yoctopuce modules.

YAPI.CheckLogicalName()**YAPI****YAPI.CheckLogicalName()**

Checks if a given string is valid as logical name for a module or a function.

js	<code>function yCheckLogicalName(name)</code>
cpp	<code>bool CheckLogicalName(string name)</code>
m	<code>+ (BOOL) CheckLogicalName : (NSString *) name</code>
pas	<code>boolean yCheckLogicalName(name: string): boolean</code>
vb	<code>function CheckLogicalName(ByVal name As String) As Boolean</code>
cs	<code>static bool CheckLogicalName(string name)</code>
java	<code>boolean CheckLogicalName(String name)</code>
uwp	<code>bool CheckLogicalName(string name)</code>
py	<code>CheckLogicalName(name)</code>
php	<code>function CheckLogicalName(\$name)</code>
ts	<code>async CheckLogicalName(name: string): Promise<boolean></code>
es	<code>async CheckLogicalName(name)</code>

A valid logical name has a maximum of 19 characters, all among A..Z, a..z, 0..9, _, and -. If you try to configure a logical name with an incorrect string, the invalid characters are ignored.

Parameters :

name a string containing the name to check.

Returns :

`true` if the name is valid, `false` otherwise.

YAPI.ClearHTTPCallbackCacheDir()**YAPI****YAPI.ClearHTTPCallbackCacheDir()**

Disables the HTTP callback cache.

```
php function ClearHTTPCallbackCacheDir( $bool_removeFiles)
```

This method disables the HTTP callback cache, and can additionally cleanup the cache directory.

Parameters :

bool_removeFiles True to clear the content of the cache.

Returns :

nothing.

YAPI.DisableExceptions()**YAPI****YAPI.DisableExceptions()**

Disables the use of exceptions to report runtime errors.

js	function yDisableExceptions()
cpp	void DisableExceptions()
m	+ (void) DisableExceptions
pas	yDisableExceptions()
vb	procedure DisableExceptions()
cs	static void DisableExceptions()
uwp	void DisableExceptions()
py	DisableExceptions()
php	function DisableExceptions()
ts	async DisableExceptions(): Promise<void>
es	async DisableExceptions()

When exceptions are disabled, every function returns a specific error value which depends on its type and which is documented in this reference manual.

YAPI.EnableExceptions()**YAPI****YAPI.EnableExceptions()**

Re-enables the use of exceptions for runtime error handling.

js	function yEnableExceptions()
cpp	void EnableExceptions()
m	+ (void) EnableExceptions
pas	yEnableExceptions()
vb	procedure EnableExceptions()
cs	static void EnableExceptions()
uwp	void EnableExceptions()
py	EnableExceptions()
php	function EnableExceptions()
ts	async EnableExceptions(): Promise<void>
es	async EnableExceptions()

Be aware than when exceptions are enabled, every function that fails triggers an exception. If the exception is not caught by the user code, it either fires the debugger or aborts (i.e. crash) the program. On failure, throws an exception or returns a negative error code.

YAPI.EnableUSBHost()**YAPI****YAPI.EnableUSBHost()**

This function is used only on Android.

```
java void EnableUSBHost( Object osContext)
```

Before calling `yRegisterHub("usb")` you need to activate the USB host port of the system. This function takes as argument, an object of class `android.content.Context` (or any subclass). It is not necessary to call this function to reach modules through the network.

Parameters :

osContext an object of class `android.content.Context` (or any subclass).

YAPI.FreeAPI()**YAPI****YAPI.FreeAPI()**

Waits for all pending communications with Yoctopuce devices to be completed then frees dynamically allocated resources used by the Yoctopuce library.

js	function yFreeAPI()
cpp	void FreeAPI()
m	+ (void) FreeAPI
pas	yFreeAPI()
vb	procedure FreeAPI()
cs	static void FreeAPI()
java	void FreeAPI()
uwp	void FreeAPI()
py	FreeAPI()
php	function FreeAPI()
ts	async FreeAPI() : Promise<void>
es	async FreeAPI()
dnp	static void FreeAPI()
cp	static void FreeAPI()

From an operating system standpoint, it is generally not required to call this function since the OS will automatically free allocated resources once your program is completed. However there are two situations when you may really want to use that function: - Free all dynamically allocated memory blocks in order to track a memory leak. - Send commands to devices right before the end of the program. Since commands are sent in an asynchronous way the program could exit before all commands are effectively sent. You should not call any other library function after calling `yFreeAPI()`, or your program will crash.

YAPI.GetAPIVersion()**YAPI****YAPI.GetAPIVersion()**

Returns the version identifier for the Yoctopuce library in use.

<code>js</code>	<code>function yGetAPIVersion()</code>
<code>cpp</code>	<code>string GetAPIVersion()</code>
<code>m</code>	<code>+ (NSString*) GetAPIVersion</code>
<code>pas</code>	<code>string yGetAPIVersion(): string</code>
<code>vb</code>	<code>function GetAPIVersion() As String</code>
<code>cs</code>	<code>static String GetAPIVersion()</code>
<code>java</code>	<code>static String GetAPIVersion()</code>
<code>uwp</code>	<code>static string GetAPIVersion()</code>
<code>py</code>	<code>GetAPIVersion()</code>
<code>php</code>	<code>function GetAPIVersion()</code>
<code>ts</code>	<code>async GetAPIVersion()</code>
<code>es</code>	<code>async GetAPIVersion()</code>
<code>dnp</code>	<code>static string GetAPIVersion()</code>
<code>cp</code>	<code>static string GetAPIVersion()</code>

The version is a string in the form "Major.Minor.Build", for instance "1.01.5535". For languages using an external DLL (for instance C#, VisualBasic or Delphi), the character string includes as well the DLL version, for instance "1.01.5535 (1.01.5439)".

If you want to verify in your code that the library version is compatible with the version that you have used during development, verify that the major number is strictly equal and that the minor number is greater or equal. The build number is not relevant with respect to the library compatibility.

Returns :

a character string describing the library version.

YAPI.GetCacheValidity()**YAPI****YAPI.GetCacheValidity()**

Returns the validity period of the data loaded by the library.

cpp	static u64 GetCacheValidity()
m	+ (u64) GetCacheValidity
pas	u64 yGetCacheValidity() : u64
vb	function GetCacheValidity() As Long
cs	ulong GetCacheValidity()
java	long GetCacheValidity()
uwp	async Task<ulong> GetCacheValidity()
py	GetCacheValidity()
php	function GetCacheValidity()
ts	async GetCacheValidity() : Promise<number>
es	async GetCacheValidity()

This method returns the cache validity of all attributes module functions. Note: This function must be called after `yInitAPI`.

Returns :

an integer corresponding to the validity attributed to the loaded function parameters, in milliseconds

YAPI.GetDeviceListValidity()**YAPI****YAPI.GetDeviceListValidity()**

Returns the delay between each forced enumeration of the used YoctoHubs.

cpp	static int GetDeviceListValidity()
m	+ (int) GetDeviceListValidity
pas	LongInt yGetDeviceListValidity() : LongInt
vb	function GetDeviceListValidity() As Integer
cs	int GetDeviceListValidity()
java	int GetDeviceListValidity()
uwp	async Task<int> GetDeviceListValidity()
py	GetDeviceListValidity()
php	function GetDeviceListValidity()
ts	async GetDeviceListValidity() : Promise<number>
es	async GetDeviceListValidity()

Note: you must call this function after `yInitAPI`.

Returns :

the number of seconds between each enumeration.

YAPI.GetDIIArchitecture()**YAPI****YAPI.GetDIIArchitecture()**

Returns the system architecture for the Yoctopuce communication library in use.

dnp static string **GetDIIArchitecture()**

On Windows, the architecture can be "Win32" or "Win64". On ARM machines, the architecture is "Armhf32" or "Aarch64". On other Linux machines, the architecture is "Linux32" or "Linux64". On MacOS, the architecture is "MacOs32" or "MacOs64".

Returns :

a character string describing the system architecture of the low-level communication library.

YAPI.GetDIIPath()**YAPI****YAPI.GetDIIPath()**

Returns the paths of the DLLs for the Yoctopuce library in use.

dnp static string **GetDIIPath()**

For architectures that require multiple DLLs, in particular when using a .NET assembly DLL, the returned string takes the form "DotNetProxy=/...; yapi=/...;", where the first path corresponds to the .NET assembly DLL and the second path corresponds to the low-level communication library.

Returns :

a character string describing the DLL path.

YAPI.GetLog()**YAPI****YAPI.GetLog()**

Retrieves Yoctopuce low-level library diagnostic logs.

```
dnp static string GetLog( string lastLogLine)  
cp static string GetLog( string lastLogLine)
```

This method allows to progressively retrieve API logs. The interface is line-based: it must be called within a loop until the returned value is an empty string. Make sure to exit the loop when an empty string is returned, as feeding an empty string into the `lastLogLine` parameter for the next call would restart enumerating logs from the oldest message available.

Parameters :

lastLogLine On first call, provide an empty string. On subsequent calls, provide the last log line returned by `GetLog()`.

Returns :

a string with the log line immediately following the one given in argument, if such line exist. Returns an empty string otherwise, when completed.

YAPI.GetNetworkTimeout()**YAPI****YAPI.GetNetworkTimeout()**

Returns the network connection delay for `yRegisterHub()` and `yUpdateDeviceList()`.

<code>cpp</code>	<code>static int GetNetworkTimeout()</code>
<code>m</code>	<code>+int GetNetworkTimeout</code>
<code>pas</code>	<code>LongInt yGetNetworkTimeout(): LongInt</code>
<code>vb</code>	<code>function GetNetworkTimeout() As Integer</code>
<code>cs</code>	<code>int GetNetworkTimeout()</code>
<code>java</code>	<code>int GetNetworkTimeout()</code>
<code>uwp</code>	<code>async Task<int> GetNetworkTimeout()</code>
<code>py</code>	<code>GetNetworkTimeout()</code>
<code>php</code>	<code>function GetNetworkTimeout()</code>
<code>ts</code>	<code>async GetNetworkTimeout(): Promise<number></code>
<code>es</code>	<code>async GetNetworkTimeout()</code>
<code>dnp</code>	<code>static int GetNetworkTimeout()</code>
<code>cp</code>	<code>static int GetNetworkTimeout()</code>

This delay impacts only the YoctoHubs and VirtualHub which are accessible through the network. By default, this delay is of 20000 milliseconds, but depending on your network you may want to change this delay, for example if your network infrastructure is based on a GSM connection.

Returns :

the network connection delay in milliseconds.

YAPI.GetTickCount()**YAPI****YAPI.GetTickCount()**

Returns the current value of a monotone millisecond-based time counter.

js	function yGetTickCount()
cpp	u64 GetTickCount()
m	+(u64) GetTickCount
pas	u64 yGetTickCount(): u64
vb	function GetTickCount() As Long
cs	static ulong GetTickCount()
java	static long GetTickCount()
uwp	static ulong GetTickCount()
py	GetTickCount()
php	function GetTickCount()
ts	GetTickCount(): number
es	GetTickCount()

This counter can be used to compute delays in relation with Yoctopuce devices, which also uses the millisecond as timebase.

Returns :

a long integer corresponding to the millisecond counter.

YAPI.HandleEvents()**YAPI****YAPI.HandleEvents()**

Maintains the device-to-library communication channel.

js	<code>function yHandleEvents(errmsg)</code>
cpp	<code>YRETCODE HandleEvents(string errmsg)</code>
m	<code>+ (YRETCODE) HandleEvents : (NSError**) errmsg</code>
pas	<code>integer yHandleEvents(var errmsg: string): integer</code>
vb	<code>function HandleEvents(ByRef errmsg As String) As YRETCODE</code>
cs	<code>static YRETCODE HandleEvents(ref string errmsg)</code>
java	<code>int HandleEvents()</code>
uwp	<code>async Task<int> HandleEvents()</code>
py	<code>HandleEvents(errmsg=None)</code>
php	<code>function HandleEvents(&\$errmsg)</code>
ts	<code>async HandleEvents(errmsg: YErrorMsg null): Promise<number></code>
es	<code>async HandleEvents(errmsg)</code>

If your program includes significant loops, you may want to include a call to this function to make sure that the library takes care of the information pushed by the modules on the communication channels. This is not strictly necessary, but it may improve the reactivity of the library for the following commands.

This function may signal an error in case there is a communication problem while contacting a module.

Parameters :

`errmsg` a string passed by reference to receive any error message.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

YAPI.InitAPI()**YAPI****YAPI.InitAPI()**

Initializes the Yoctopuce programming library explicitly.

js	<code>function yInitAPI(mode, errmsg)</code>
cpp	<code>YRETCODE InitAPI(int mode, string errmsg)</code>
m	<code>+ (YRETCODE) InitAPI : (int) mode : (NSError**) errmsg</code>
pas	<code>integer yInitAPI(mode: integer, var errmsg: string): integer</code>
vb	<code>function InitAPI(ByVal mode As Integer, ByRef errmsg As String) As Integer</code>
cs	<code>static int InitAPI(int mode, ref string errmsg)</code>
java	<code>int InitAPI(int mode)</code>
uwp	<code>async Task<int> InitAPI(int mode)</code>
py	<code>InitAPI(mode, errmsg=None)</code>
php	<code>function InitAPI(\$mode, &\$errmsg)</code>
ts	<code>async InitAPI(mode: number, errmsg: YErrorMsg): Promise<number></code>
es	<code>async InitAPI(mode, errmsg)</code>

It is not strictly needed to call `yInitAPI()`, as the library is automatically initialized when calling `yRegisterHub()` for the first time.

When `YAPI.DETECT_NONE` is used as detection mode, you must explicitly use `yRegisterHub()` to point the API to the VirtualHub on which your devices are connected before trying to access them.

Parameters :

mode an integer corresponding to the type of automatic device detection to use. Possible values are `YAPI.DETECT_NONE`, `YAPI.DETECT_USB`, `YAPI.DETECT_NET`, and `YAPI.DETECT_ALL`.

errmsg a string passed by reference to receive any error message.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

YAPI.PreregisterHub()**YAPI****YAPI.PreregisterHub()**

Fault-tolerant alternative to `yRegisterHub()`.

<code>js</code>	<code>function yPreregisterHub(url, errmsg)</code>
<code>cpp</code>	<code>YRETCODE PreregisterHub(string url, string errmsg)</code>
<code>m</code>	<code>+ (YRETCODE) PreregisterHub : (NSString *) url : (NSError **) errmsg</code>
<code>pas</code>	<code>integer yPreregisterHub(url: string, var errmsg: string): integer</code>
<code>vb</code>	<code>function PreregisterHub(ByVal url As String,</code> <code> ByRef errmsg As String) As Integer</code>
<code>cs</code>	<code>static int PreregisterHub(string url, ref string errmsg)</code>
<code>java</code>	<code>int PreregisterHub(String url)</code>
<code>uwp</code>	<code>async Task<int> PreregisterHub(string url)</code>
<code>py</code>	<code>PreregisterHub(url, errmsg=None)</code>
<code>php</code>	<code>function PreregisterHub(\$url, &\$errmsg)</code>
<code>ts</code>	<code>async PreregisterHub(url: string, errmsg: YErrorMsg): Promise<number></code>
<code>es</code>	<code>async PreregisterHub(url, errmsg)</code>
<code>dnp</code>	<code>static string PreregisterHub(string url)</code>
<code>cp</code>	<code>static string PreregisterHub(string url)</code>

This function has the same purpose and same arguments as `yRegisterHub()`, but does not trigger an error when the selected hub is not available at the time of the function call. This makes it possible to register a network hub independently of the current connectivity, and to try to contact it only when a device is actively needed.

Parameters :

`url` a string containing either `"usb"`, `"callback"` or the root URL of the hub to monitor
`errmsg` a string passed by reference to receive any error message.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

YAPI.RegisterDeviceArrivalCallback()**YAPI****YAPI.RegisterDeviceArrivalCallback()**

Register a callback function, to be called each time a device is plugged.

```

js   function yRegisterDeviceArrivalCallback( arrivalCallback)
cpp  void RegisterDeviceArrivalCallback( yDeviceUpdateCallback arrivalCallback)
m    +(void) RegisterDeviceArrivalCallback :(yDeviceUpdateCallback) arrivalCallback
pas   yRegisterDeviceArrivalCallback( arrivalCallback: yDeviceUpdateFunc)
vb    procedure RegisterDeviceArrivalCallback( ByVal arrivalCallback As yDeviceUpdateFunc)
cs    static void RegisterDeviceArrivalCallback( yDeviceUpdateFunc arrivalCallback)
java   void RegisterDeviceArrivalCallback( DeviceArrivalCallback arrivalCallback)
uwp   void RegisterDeviceArrivalCallback( DeviceUpdateHandler arrivalCallback)
py    RegisterDeviceArrivalCallback( arrivalCallback)
php   function RegisterDeviceArrivalCallback( $arrivalCallback)
ts    async RegisterDeviceArrivalCallback( arrivalCallback: YDeviceUpdateCallback| null): Promise<void>
es    async RegisterDeviceArrivalCallback( arrivalCallback)

```

This callback will be invoked while `yUpdateDeviceList` is running. You will have to call this function on a regular basis.

Parameters :

arrivalCallback a procedure taking a `YModule` parameter, or `null`

YAPI.RegisterDeviceRemovalCallback()

YAPI

Register a callback function, to be called each time a device is unplugged.

js	<code>function yRegisterDeviceRemovalCallback(removalCallback)</code>
cpp	<code>void RegisterDeviceRemovalCallback(yDeviceUpdateCallback removalCallback)</code>
m	<code>+(void) RegisterDeviceRemovalCallback :(yDeviceUpdateCallback) removalCallback</code>
pas	<code>yRegisterDeviceRemovalCallback(removalCallback: yDeviceUpdateFunc)</code>
vb	<code>procedure RegisterDeviceRemovalCallback(ByVal removalCallback As yDeviceUpdateFunc)</code>
cs	<code>static void RegisterDeviceRemovalCallback(yDeviceUpdateFunc removalCallback)</code>
java	<code>void RegisterDeviceRemovalCallback(DeviceRemovalCallback removalCallback)</code>
uwp	<code>void RegisterDeviceRemovalCallback(DeviceUpdateHandler removalCallback)</code>
py	<code>RegisterDeviceRemovalCallback(removalCallback)</code>
php	<code>function RegisterDeviceRemovalCallback(\$removalCallback)</code>
ts	<code>async RegisterDeviceRemovalCallback(removalCallback: YDeviceUpdateCallback null): Promise<void></code>
es	<code>async RegisterDeviceRemovalCallback(removalCallback)</code>

This callback will be invoked while `yUpdateDeviceList` is running. You will have to call this function on a regular basis.

Parameters :

`removalCallback` a procedure taking a `YModule` parameter, or null

YAPI.RegisterHub()

YAPI

Setup the Yoctopuce library to use modules connected on a given machine.

```

js   function yRegisterHub( url, errmsg)
cpp  YRETCODE RegisterHub( string url, string errmsg)
m    +(YRETCODE) RegisterHub : (NSString *) url : (NSError**) errmsg
pas   integer yRegisterHub( url: string, var errmsg: string): integer
vb    function RegisterHub( ByVal url As String,
                           ByRef errmsg As String) As Integer
cs   static int RegisterHub( string url, ref string errmsg)
java  int RegisterHub( String url)
uwp   async Task<int> RegisterHub( string url)
py    RegisterHub( url, errmsg=None)
php   function RegisterHub( $url, &$errmsg)
ts    async RegisterHub( url: string, errmsg: YErrorMsg): Promise<number>
es    async RegisterHub( url, errmsg)
dnp   static string RegisterHub( string url)
cp    static string RegisterHub( string url)

```

The parameter will determine how the API will work. Use the following values:

usb: When the **usb** keyword is used, the API will work with devices connected directly to the USB bus. Some programming languages such as JavaScript, PHP, and Java don't provide direct access to USB hardware, so **usb** will not work with these. In this case, use a VirtualHub or a networked YoctoHub (see below).

x.x.x.x or **hostname**: The API will use the devices connected to the host with the given IP address or hostname. That host can be a regular computer running a VirtualHub, or a networked YoctoHub such as YoctoHub-Ethernet or YoctoHub-Wireless. If you want to use the VirtualHub running on your local computer, use the IP address 127.0.0.1.

callback: This keyword makes the API run in "HTTP Callback" mode. This is a special mode allowing to take control of Yoctopuce devices through a NAT filter when using a VirtualHub or a networked YoctoHub. You only need to configure your hub to call your server script on a regular basis. This mode is currently available for PHP and Node.js only.

Be aware that only one application can use direct USB access at a given time on a machine. Multiple access would cause conflicts while trying to access the USB modules. In particular, this means that you must stop the VirtualHub software before starting an application that uses direct USB access. The workaround for this limitation is to setup the library to use the VirtualHub rather than direct USB access.

If access control has been activated on the hub, virtual or not, you want to reach, the URL parameter should look like:

`http://username:password@address:port`

You can call *RegisterHub* several times to connect to several machines.

Parameters :

url a string containing either "**usb**", "**callback**" or the root URL of the hub to monitor

errmsg a string passed by reference to receive any error message.

Returns :

YAPI.SUCCESS when the call succeeds.

On failure, throws an exception or returns a negative error code.

YAPI.RegisterHubDiscoveryCallback()

YAPI

YAPI.RegisterHubDiscoveryCallback()

Register a callback function, to be called each time an Network Hub send an SSDP message.

cpp	<code>void RegisterHubDiscoveryCallback(YHubDiscoveryCallback hubDiscoveryCallback)</code>
m	<code>+ (void) RegisterHubDiscoveryCallback : (YHubDiscoveryCallback) hubDiscoveryCallback</code>
pas	<code>yRegisterHubDiscoveryCallback(hubDiscoveryCallback: YHubDiscoveryCallback)</code>
vb	<code>procedure RegisterHubDiscoveryCallback(ByVal hubDiscoveryCallback As YHubDiscoveryCallback)</code>
cs	<code>static void RegisterHubDiscoveryCallback(YHubDiscoveryCallback hubDiscoveryCallback)</code>
java	<code>void RegisterHubDiscoveryCallback(HubDiscoveryCallback hubDiscoveryCallback)</code>
uwp	<code>async Task RegisterHubDiscoveryCallback(HubDiscoveryHandler hubDiscoveryCallback)</code>
py	<code>RegisterHubDiscoveryCallback(hubDiscoveryCallback)</code>
ts	<code>async RegisterHubDiscoveryCallback(hubDiscoveryCallback: YHubDiscoveryCallback): Promise<number></code>
es	<code>async RegisterHubDiscoveryCallback(hubDiscoveryCallback)</code>

The callback has two string parameter, the first one contain the serial number of the hub and the second contain the URL of the network hub (this URL can be passed to RegisterHub). This callback will be invoked while yUpdateDeviceList is running. You will have to call this function on a regular basis.

Parameters :

hubDiscoveryCallback a procedure taking two string parameter, the serial

YAPI.RegisterHubWebsocketCallback()**YAPI****YAPI.RegisterHubWebsocketCallback()**

Variant to `yRegisterHub()` used to initialize Yoctopuce API on an existing Websocket session, as happens for incoming WebSocket callbacks.

Parameters :

ws node WebSocket object for the incoming WebSocket callback connection

errmsg a string passed by reference to receive any error message.

authpwd the optional authentication password, required only authentication is configured on the calling hub.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

YAPI.RegisterLogFunction()**YAPI****YAPI.RegisterLogFunction()**

Registers a log callback function.

```
cpp void RegisterLogFunction( yLogFunction logfun)
m +(void) RegisterLogFunction :(yLogCallback) logfun
pas yRegisterLogFunction( logfun: yLogFunc)
vb procedure RegisterLogFunction( ByVal logfun As yLogFunc)
cs static void RegisterLogFunction( yLogFunc logfun)
java void RegisterLogFunction( LogCallback logfun)
uwp void RegisterLogFunction( LogHandler logfun)
py RegisterLogFunction( logfun)
ts async RegisterLogFunction( logfun: YLogCallback): Promise<number>
es async RegisterLogFunction( logfun)
```

This callback will be called each time the API have something to say. Quite useful to debug the API.

Parameters :

logfun a procedure taking a string parameter, or null

YAPI.SelectArchitecture()

YAPI

Select the architecture or the library to be loaded to access to USB.

py

SelectArchitecture(arch)

By default, the Python library automatically detects the appropriate library to use. However, for Linux ARM, it is not possible to reliably distinguish between a Hard Float (armhf) and a Soft Float (armel) install. For this case, it is therefore recommended to manually select the proper architecture by calling `SelectArchitecture()` before any other call to the library.

Parameters :

arch A string containing the architecture to use. Possible values are: "armhf", "armel", "aarch64", "i386", "x86_64", "32bit", "64bit"

Returns :

nothing.

On failure, throws an exception.

YAPI.SetCacheValidity()**YAPI****YAPI.SetCacheValidity()**

Change the validity period of the data loaded by the library.

```
cpp static void SetCacheValidity( u64 cacheValidityMs)
m +(void) SetCacheValidity : (u64) cacheValidityMs
pas ySetCacheValidity( cacheValidityMs: u64)
vb procedure SetCacheValidity( ByVal cacheValidityMs As Long)
cs void SetCacheValidity( ulong cacheValidityMs)
java void SetCacheValidity( long cacheValidityMs)
uwp async Task SetCacheValidity( ulong cacheValidityMs)
py SetCacheValidity( cacheValidityMs)
php function SetCacheValidity( $cacheValidityMs)
ts async SetCacheValidity( cacheValidityMs: number): Promise<void>
es async SetCacheValidity( cacheValidityMs)
```

By default, when accessing a module, all the attributes of the module functions are automatically kept in cache for the standard duration (5 ms). This method can be used to change this standard duration, for example in order to reduce network or USB traffic. This parameter does not affect value change callbacks Note: This function must be called after `yInitAPI`.

Parameters :

cacheValidityMs an integer corresponding to the validity attributed to the loaded function parameters, in milliseconds.

YAPI.SetDelegate()**YAPI****YAPI.SetDelegate()**

(Objective-C only) Register an object that must follow the protocol YDeviceHotPlug.

m +(void) SetDelegate :(id) **object**

The methods `yDeviceArrival` and `yDeviceRemoval` will be invoked while `yUpdateDeviceList` is running. You will have to call this function on a regular basis.

Parameters :**object** an object that must follow the protocol YAPIDelegate, or nil

YAPI.SetDeviceListValidity()

YAPI

Modifies the delay between each forced enumeration of the used YoctoHubs.

```
cpp static void SetDeviceListValidity( int deviceListValidity)
m +(void) SetDeviceListValidity : (int) deviceListValidity
pas ySetDeviceListValidity( deviceListValidity: LongInt)
vb procedure SetDeviceListValidity( ByVal deviceListValidity As Integer)
cs void SetDeviceListValidity( int deviceListValidity)
java void SetDeviceListValidity( int deviceListValidity)
uwp async Task SetDeviceListValidity( int deviceListValidity)
py SetDeviceListValidity( deviceListValidity)
php function SetDeviceListValidity( $deviceListValidity)
ts async SetDeviceListValidity( deviceListValidity: number): Promise<void>
es async SetDeviceListValidity( deviceListValidity)
```

By default, the library performs a full enumeration every 10 seconds. To reduce network traffic, you can increase this delay. It's particularly useful when a YoctoHub is connected to the GSM network where traffic is billed. This parameter doesn't impact modules connected by USB, nor the working of module arrival/removal callbacks. Note: you must call this function after `yInitAPI`.

Parameters :

`deviceListValidity` number of seconds between each enumeration.

YAPI.SetHTTPCallbackCacheDir() YAPI.SetHTTPCallbackCacheDir()

YAPI

Enables the HTTP callback cache.

```
php function SetHTTPCallbackCacheDir( $str_directory)
```

When enabled, this cache reduces the quantity of data sent to the PHP script by 50% to 70%. To enable this cache, the method `ySetHTTPCallbackCacheDir()` must be called before any call to `yRegisterHub()`. This method takes in parameter the path of the directory used for saving data between each callback. This folder must exist and the PHP script needs to have write access to it. It is recommended to use a folder that is not published on the Web server since the library will save some data of Yoctopuce devices into this folder.

Note: This feature is supported by YoctoHub and VirtualHub since version 27750.

Parameters :

`str_directory` the path of the folder that will be used as cache.

Returns :

nothing.

On failure, throws an exception.

YAPI.SetNetworkTimeout()**YAPI****YAPI.SetNetworkTimeout()**

Modifies the network connection delay for `yRegisterHub()` and `yUpdateDeviceList()`.

```

cpp static void SetNetworkTimeout( int networkMsTimeout)
m +(void) SetNetworkTimeout : (int) networkMsTimeout
pas ySetNetworkTimeout( networkMsTimeout: LongInt)
vb procedure SetNetworkTimeout( ByVal networkMsTimeout As Integer)
cs void SetNetworkTimeout( int networkMsTimeout)
java void SetNetworkTimeout( int networkMsTimeout)
uwp async Task SetNetworkTimeout( int networkMsTimeout)
py SetNetworkTimeout( networkMsTimeout)
php function SetNetworkTimeout( $networkMsTimeout)
ts async SetNetworkTimeout( networkMsTimeout: number): Promise<void>
es async SetNetworkTimeout( networkMsTimeout)
dnp static void SetNetworkTimeout( int networkMsTimeout)
cp static void SetNetworkTimeout( int networkMsTimeout)

```

This delay impacts only the YoctoHubs and VirtualHub which are accessible through the network. By default, this delay is of 20000 milliseconds, but depending on your network you may want to change this delay, for example if your network infrastructure is based on a GSM connection.

Parameters :

networkMsTimeout the network connection delay in milliseconds.

YAPI.SetTimeout()**YAPI****YAPI.SetTimeout()**

Invoke the specified callback function after a given timeout.

js	ySetTimeout(callback, ms_timeout, args)
ts	SetTimeout(callback: Function, ms_timeout: number): number
es	SetTimeout(callback, ms_timeout, args)

This function behaves more or less like Javascript `setTimeout`, but during the waiting time, it will call `yHandleEvents` and `yUpdateDeviceList` periodically, in order to keep the API up-to-date with current devices.

Parameters :

callback the function to call after the timeout occurs. On Microsoft Internet Explorer, the callback must be provided as a string to be evaluated.
ms_timeout an integer corresponding to the duration of the timeout, in milliseconds.
args additional arguments to be passed to the callback function can be provided, if needed (not supported on Microsoft Internet Explorer).

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

YAPI.SetUSBPacketAckMs() YAPI.SetUSBPacketAckMs()

YAPI

Enables the acknowledge of every USB packet received by the Yoctopuce library.

```
java void SetUSBPacketAckMs( int pktAckDelay)
```

This function allows the library to run on Android phones that tend to loose USB packets. By default, this feature is disabled because it doubles the number of packets sent and slows down the API considerably. Therefore, the acknowledge of incoming USB packets should only be enabled on phones or tablets that loose USB packets. A delay of 50 milliseconds is generally enough. In case of doubt, contact Yoctopuce support. To disable USB packets acknowledge, call this function with the value 0. Note: this feature is only available on Android.

Parameters :

pktAckDelay then number of milliseconds before the module

YAPI.Sleep()**YAPI****YAPI.Sleep()**

Pauses the execution flow for a specified duration.

js	<code>function ySleep(ms_duration, errmsg)</code>
cpp	<code>YRETCODE Sleep(unsigned ms_duration, string errmsg)</code>
m	<code>+ (YRETCODE) Sleep : (unsigned) ms_duration : (NSError **) errmsg</code>
pas	<code>integer ySleep(ms_duration: integer, var errmsg: string): integer</code>
vb	<code>function Sleep(ByVal ms_duration As Integer, ByRef errmsg As String) As Integer</code>
cs	<code>static int Sleep(int ms_duration, ref string errmsg)</code>
java	<code>int Sleep(long ms_duration)</code>
uwp	<code>async Task<int> Sleep(ulong ms_duration)</code>
py	<code>Sleep(ms_duration, errmsg=None)</code>
php	<code>function Sleep(\$ms_duration, &\$errmsg)</code>
ts	<code>async Sleep(ms_duration: number, errmsg: YErrorMsg null): Promise<number></code>
es	<code>async Sleep(ms_duration, errmsg)</code>

This function implements a passive waiting loop, meaning that it does not consume CPU cycles significantly. The processor is left available for other threads and processes. During the pause, the library nevertheless reads from time to time information from the Yoctopuce modules by calling `yHandleEvents()`, in order to stay up-to-date.

This function may signal an error in case there is a communication problem while contacting a module.

Parameters :

ms_duration an integer corresponding to the duration of the pause, in milliseconds.
errmsg a string passed by reference to receive any error message.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

YAPI.TestHub()**YAPI.TestHub()**

Test if the hub is reachable.

```

cpp YRETCODE TestHub( string url, int mstimeout, string errmsg)
m +(YRETCODE) TestHub : (NSString*) url
    : (int) mstimeout
    : (NSError**) errmsg

pas integer yTestHub( url: string,
    mstimeout: integer,
    var errmsg: string): integer

vb function TestHub( ByVal url As String,
    ByVal mstimeout As Integer,
    ByRef errmsg As String) As Integer

cs static int TestHub( string url, int mstimeout, ref string errmsg)
java int TestHub( String url, int mstimeout)
uwp async Task<int> TestHub( string url, uint mstimeout)
py TestHub( url, mstimeout, errmsg=None)
php function TestHub( $url, $mstimeout, &$errmsg)
ts async TestHub( url: string, mstimeout: number, errmsg: YErrorMsg): Promise<number>
es async TestHub( url, mstimeout, errmsg)
dnp static string TestHub( string url, int mstimeout)
cp static string TestHub( string url, int mstimeout)

```

This method do not register the hub, it only test if the hub is usable. The url parameter follow the same convention as the `yRegisterHub` method. This method is useful to verify the authentication parameters for a hub. It is possible to force this method to return after mstimeout milliseconds.

Parameters :

url a string containing either "usb", "callback" or the root URL of the hub to monitor
mstimeout the number of millisecond available to test the connection.
errmsg a string passed by reference to receive any error message.

Returns :

YAPI.SUCCESS when the call succeeds.

On failure returns a negative error code.

YAPI.TriggerHubDiscovery()**YAPI****YAPI.TriggerHubDiscovery()**

Force a hub discovery, if a callback has been registered with `yRegisterHubDiscoveryCallback` it will be called for each network hub that will respond to the discovery.

<code>cpp</code>	<code>YRETCODE TriggerHubDiscovery(string errmsg)</code>
<code>m</code>	<code>+ (YRETCODE) TriggerHubDiscovery : (NSError**) errmsg</code>
<code>pas</code>	<code>integer yTriggerHubDiscovery(var errmsg: string): integer</code>
<code>vb</code>	<code>function TriggerHubDiscovery(ByRef errmsg As String) As Integer</code>
<code>cs</code>	<code>static int TriggerHubDiscovery(ref string errmsg)</code>
<code>java</code>	<code>int TriggerHubDiscovery()</code>
<code>uwp</code>	<code>Task<int> TriggerHubDiscovery()</code>
<code>py</code>	<code>TriggerHubDiscovery(errmsg=None)</code>
<code>ts</code>	<code>async TriggerHubDiscovery(errmsg: YErrorMsg null): Promise<number></code>
<code>es</code>	<code>async TriggerHubDiscovery(errmsg)</code>

Parameters :

`errmsg` a string passed by reference to receive any error message.

Returns :

`YAPI.SUCCESS` when the call succeeds. On failure, throws an exception or returns a negative error code.

YAPI.UnregisterHub()**YAPI****YAPI.UnregisterHub()**

Setup the Yoctopuce library to no more use modules connected on a previously registered machine with RegisterHub.

js	function yUnregisterHub(url)
cpp	void UnregisterHub(string url)
m	+ (void) UnregisterHub : (NSString *) url
pas	yUnregisterHub(url: string)
vb	procedure UnregisterHub(ByVal url As String)
cs	static void UnregisterHub(string url)
java	void UnregisterHub(String url)
uwp	async Task UnregisterHub(string url)
py	UnregisterHub(url)
php	function UnregisterHub(\$url)
ts	async UnregisterHub(url: string): Promise<void>
es	async UnregisterHub(url)

Parameters :

url a string containing either "usb" or the

YAPI.UpdateDeviceList()

YAPI

Triggers a (re)detection of connected Yoctopuce modules.

js	function yUpdateDeviceList(errmsg)
cpp	YRETCODE UpdateDeviceList(string errmsg)
m	+(YRETCODE) UpdateDeviceList :(NSError**) errmsg
pas	integer yUpdateDeviceList(var errmsg: string): integer
vb	function UpdateDeviceList(ByRef errmsg As String) As YRETCODE
cs	static YRETCODE UpdateDeviceList(ref string errmsg)
java	int UpdateDeviceList()
uwp	async Task<int> UpdateDeviceList()
py	UpdateDeviceList(errmsg=None)
php	function UpdateDeviceList(&\$errmsg)
ts	async UpdateDeviceList(errmsg: YErrorMsg null): Promise<number>
es	async UpdateDeviceList(errmsg)

The library searches the machines or USB ports previously registered using `yRegisterHub()`, and invokes any user-defined callback function in case a change in the list of connected devices is detected.

This function can be called as frequently as desired to refresh the device list and to make the application aware of hot-plug events. However, since device detection is quite a heavy process, `UpdateDeviceList` shouldn't be called more than once every two seconds.

Parameters :

`errmsg` a string passed by reference to receive any error message.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

YAPI.UpdateDeviceList_async()**YAPI****YAPI.UpdateDeviceList_async()**

Triggers a (re)detection of connected Yoctopuce modules.

```
js function yUpdateDeviceList_async( callback, context)
```

The library searches the machines or USB ports previously registered using `yRegisterHub()`, and invokes any user-defined callback function in case a change in the list of connected devices is detected.

This function can be called as frequently as desired to refresh the device list and to make the application aware of hot-plug events.

This asynchronous version exists only in JavaScript. It uses a callback instead of a return value in order to avoid blocking Firefox JavaScript VM that does not implement context switching during blocking I/O calls.

Parameters :

callback callback function that is invoked when the result is known. The callback function receives three arguments: the caller-specific context object, the result code (`YAPI.SUCCESS` if the operation completes successfully) and the error message.

context caller-specific object that is passed as-is to the callback function

Returns :

nothing : the result is provided to the callback.

23.2. Class YModule

Global parameters control interface for all Yoctopuce devices

The `YModule` class can be used with all Yoctopuce USB devices. It can be used to control the module global parameters, and to enumerate the functions provided by each module.

In order to use the functions described here, you should include:

js	<script type='text/javascript' src='yocto_api.js'></script>
cpp	#include "yocto_api.h"
m	#import "yocto_api.h"
pas	uses yocto_api;
vb	yocto_api.vb
cs	yocto_api.cs
java	import com.yoctopuce.YoctoAPI.YModule;
uwp	import com.yoctopuce.YoctoAPI.YModule;
py	from yocto_api import *
php	require_once('yocto_api.php');
ts	in HTML: import { YAPI, YErrorMsg, YModule, YSensor } from '../../../../../dist/esm/yocto_api_browser.js'; in Node.js: import { YAPI, YErrorMsg, YModule, YSensor } from 'yoctolib-cjs/yocto_api_nodejs.js';
es	in HTML: <script src="../../lib/yocto_api.js"></script> in node.js: require('yoctolib-es2017/yocto_api.js');
dnp	import YoctoProxyAPI.YModuleProxy
cp	#include "yocto_module_proxy.h"
vi	YModule.vi
ml	import YoctoProxyAPI.YModuleProxy"

Global functions

`YModule.FindModule(func)`

Allows you to find a module from its serial number or from its logical name.

`YModule.FindModuleInContext(yctx, func)`

Retrieves a module for a given identifier in a YAPI context.

`YModule.FirstModule()`

Starts the enumeration of modules currently accessible.

YModule properties

`module→Beacon [writable]`

State of the localization beacon.

`module→FirmwareRelease [read-only]`

Version of the firmware embedded in the module.

`module→FunctionId [read-only]`

Retrieves the hardware identifier of the *n*th function on the module.

`module→HardwareId [read-only]`

Unique hardware identifier of the module.

`module→IsOnline [read-only]`

Checks if the module is currently reachable.

`module→LogicalName [writable]`

Logical name of the module.

`module→Luminosity [writable]`

Luminosity of the module informative LEDs (from 0 to 100).

module→ProductId [read-only]

USB device identifier of the module.

module→ProductName [read-only]

Commercial name of the module, as set by the factory.

module→ProductRelease [read-only]

Release number of the module hardware, preprogrammed at the factory.

module→SerialNumber [read-only]

Serial number of the module, as set by the factory.

YModule methods
module→checkFirmware(path, onlynew)

Tests whether the bin file is valid for this module.

module→clearCache()

Invalidates the cache.

module→describe()

Returns a descriptive text that identifies the module.

module→download(pathname)

Downloads the specified built-in file and returns a binary buffer with its content.

module→functionBaseType(functionIndex)

Retrieves the base type of the *n*th function on the module.

module→functionCount()

Returns the number of functions (beside the "module" interface) available on the module.

module→functionId(functionIndex)

Retrieves the hardware identifier of the *n*th function on the module.

module→functionName(functionIndex)

Retrieves the logical name of the *n*th function on the module.

module→functionType(functionIndex)

Retrieves the type of the *n*th function on the module.

module→functionValue(functionIndex)

Retrieves the advertised value of the *n*th function on the module.

module→get_allSettings()

Returns all the settings and uploaded files of the module.

module→get_beacon()

Returns the state of the localization beacon.

module→get_errorMessage()

Returns the error message of the latest error with this module object.

module→get_errorType()

Returns the numerical error code of the latest error with this module object.

module→get_firmwareRelease()

Returns the version of the firmware embedded in the module.

module→get_functionIds(funType)

Retrieve all hardware identifier that match the type passed in argument.

module→get_hardwareId()

Returns the unique hardware identifier of the module.

module→get_icon2d()

Returns the icon of the module.

module→get_lastLogs()

Returns a string with last logs of the module.

module→get_logicalName()

Returns the logical name of the module.

module→get_luminosity()

Returns the luminosity of the module informative LEDs (from 0 to 100).

module→get_parentHub()

Returns the serial number of the YoctoHub on which this module is connected.

module→get_persistentSettings()

Returns the current state of persistent module settings.

module→get_productId()

Returns the USB device identifier of the module.

module→get_productName()

Returns the commercial name of the module, as set by the factory.

module→get_productRelease()

Returns the release number of the module hardware, preprogrammed at the factory.

module→get_rebootCountdown()

Returns the remaining number of seconds before the module restarts, or zero when no reboot has been scheduled.

module→get_serialNumber()

Returns the serial number of the module, as set by the factory.

module→get_subDevices()

Returns a list of all the modules that are plugged into the current module.

module→get_upTime()

Returns the number of milliseconds spent since the module was powered on.

module→get_url()

Returns the URL used to access the module.

module→get_usbCurrent()

Returns the current consumed by the module on the USB bus, in milli-amps.

module→get_userData()

Returns the value of the userData attribute, as previously stored using method `set(userData)`.

module→get_userVar()

Returns the value previously stored in this attribute.

module→hasFunction(funcId)

Tests if the device includes a specific function.

module→isOnline()

Checks if the module is currently reachable, without raising any error.

module→isOnline_async(callback, context)

Checks if the module is currently reachable, without raising any error.

module→load(msValidity)

Preloads the module cache with a specified validity duration.

module→load_async(msValidity, callback, context)

Preloads the module cache with a specified validity duration (asynchronous version).

module→log(text)

Adds a text message to the device logs.

module→nextModule()	Continues the module enumeration started using <code>yFirstModule()</code> .
module→reboot(secBeforeReboot)	Schedules a simple module reboot after the given number of seconds.
module→registerBeaconCallback(callback)	Register a callback function, to be called when the localization beacon of the module has been changed.
module→registerConfigChangeCallback(callback)	Register a callback function, to be called when a persistent settings in a device configuration has been changed (e.g.
module→registerLogCallback(callback)	Registers a device log callback function.
module→revertFromFlash()	Reloads the settings stored in the nonvolatile memory, as when the module is powered on.
module→saveToFlash()	Saves current settings in the nonvolatile memory of the module.
module→set_allSettings(settings)	Restores all the settings of the device.
module→set_allSettingsAndFiles(settings)	Restores all the settings and uploaded files to the module.
module→set_beacon(newval)	Turns on or off the module localization beacon.
module→set_logicalName(newval)	Changes the logical name of the module.
module→set_luminosity(newval)	Changes the luminosity of the module informative leds.
module→set(userData)	Stores a user context provided as argument in the <code>userData</code> attribute of the function.
module→set_userVar(newval)	Stores a 32 bit value in the device RAM.
module→triggerConfigChangeCallback()	Triggers a configuration change callback, to check if they are supported or not.
module→triggerFirmwareUpdate(secBeforeReboot)	Schedules a module reboot into special firmware update mode.
module→updateFirmware(path)	Prepares a firmware update of the module.
module→updateFirmwareEx(path, force)	Prepares a firmware update of the module.
module→wait_async(callback, context)	Waits for all pending asynchronous commands on the module to complete, and invoke the user-provided callback function.

YModule.FindModule()**YModule****YModule.FindModule()**

Allows you to find a module from its serial number or from its logical name.

<code>js</code>	<code>function yFindModule(func)</code>
<code>cpp</code>	<code>YModule* FindModule(string func)</code>
<code>m</code>	<code>+ (YModule*) FindModule : (NSString*) func</code>
<code>pas</code>	<code>TYModule yFindModule(func: string): TYModule</code>
<code>vb</code>	<code>function FindModule(ByVal func As String) As YModule</code>
<code>cs</code>	<code>static YModule FindModule(string func)</code>
<code>java</code>	<code>static YModule FindModule(String func)</code>
<code>uwp</code>	<code>static YModule FindModule(string func)</code>
<code>py</code>	<code>FindModule(func)</code>
<code>php</code>	<code>function FindModule(\$func)</code>
<code>ts</code>	<code>static FindModule(func: string): YModule</code>
<code>es</code>	<code>static FindModule(func)</code>
<code>dnp</code>	<code>static YModuleProxy FindModule(string func)</code>
<code>cp</code>	<code>static YModuleProxy * FindModule(string func)</code>

This function does not require that the module is online at the time it is invoked. The returned object is nevertheless valid. Use the method `YModule.isOnline()` to test if the module is indeed online at a given time. In case of ambiguity when looking for a module by logical name, no error is notified: the first instance found is returned. The search is performed first by hardware name, then by logical name.

If a call to this object's `is_online()` method returns FALSE although you are certain that the device is plugged, make sure that you did call `registerHub()` at application initialization time.

Parameters :

`func` a string containing either the serial number or the logical name of the desired module

Returns :

a `YModule` object allowing you to drive the module or get additional information on the module.

YModule.FindModuleInContext()**YModule****YModule.FindModuleInContext()**

Retrieves a module for a given identifier in a YAPI context.

`java static YModule FindModuleInContext(YAPIContext yctx, String func)`

`uwp static YModule FindModuleInContext(YAPIContext yctx, string func)`

`ts static FindModuleInContext(yctx: YAPIContext, func: string): YModule`

`es static FindModuleInContext(yctx, func)`

The identifier can be specified using several formats:

- FunctionLogicalName
- ModuleSerialNumber.FunctionIdentifier
- ModuleSerialNumber.FunctionLogicalName
- ModuleLogicalName.FunctionIdentifier
- ModuleLogicalName.FunctionLogicalName

This function does not require that the module is online at the time it is invoked. The returned object is nevertheless valid. Use the method `YModule.isOnline()` to test if the module is indeed online at a given time. In case of ambiguity when looking for a module by logical name, no error is notified: the first instance found is returned. The search is performed first by hardware name, then by logical name.

Parameters :

`yctx` a YAPI context

`func` a string that uniquely characterizes the module, for instance `MyDevice.module`.

Returns :

a `YModule` object allowing you to drive the module.

YModule.FirstModule()**YModule****YModule.FirstModule()**

Starts the enumeration of modules currently accessible.

<code>js</code>	<code>function yFirstModule()</code>
<code>cpp</code>	<code>YModule * FirstModule()</code>
<code>m</code>	<code>+ (YModule*) FirstModule</code>
<code>pas</code>	<code>TYModule yFirstModule(): TYModule</code>
<code>vb</code>	<code>function FirstModule() As YModule</code>
<code>cs</code>	<code>static YModule FirstModule()</code>
<code>java</code>	<code>static YModule FirstModule()</code>
<code>uwp</code>	<code>static YModule FirstModule()</code>
<code>py</code>	<code>FirstModule()</code>
<code>php</code>	<code>function FirstModule()</code>
<code>ts</code>	<code>static FirstModule(): YModule null</code>
<code>es</code>	<code>static FirstModule()</code>

Use the method `YModule.nextModule()` to iterate on the next modules.

Returns :

a pointer to a `YModule` object, corresponding to the first module currently online, or a `null` pointer if there are none.

module→Beacon**YModule**

State of the localization beacon.

dnp int **Beacon**

Writable. Turns on or off the module localization beacon.

module→FirmwareRelease**YModule**

Version of the firmware embedded in the module.

dnp	string FirmwareRelease
-----	-------------------------------

module→FunctionId**YModule**

Retrieves the hardware identifier of the *n*th function on the module.

dnp string **FunctionId**

@param functionIndex : the index of the function for which the information is desired, starting at 0 for the first function.

module→HardwareId**YModule**

Unique hardware identifier of the module.

dnp string **HardwareId**

The unique hardware identifier is made of the device serial number followed by string ".module".

module→IsOnline**YModule**

Checks if the module is currently reachable.

dnp bool **IsOnline**

If there are valid cached values for the module, that have not yet expired, the device is considered reachable. No exception is raised if there is an error while trying to contact the requested module.

module→LogicalName**YModule**

Logical name of the module.

dnp string **LogicalName**

Writable. You can use `yCheckLogicalName()` prior to this call to make sure that your parameter is valid. Remember to call the `saveToFlash()` method of the module if the modification must be kept.

module→Luminosity**YModule**

Luminosity of the module informative LEDs (from 0 to 100).

dnp int **Luminosity**

Writable. Changes the luminosity of the module informative leds. The parameter is a value between 0 and 100. Remember to call the `saveToFlash()` method of the module if the modification must be kept.

module→ProductId**YModule**

USB device identifier of the module.

dnp int **ProductId**

module→ProductName

YModule

Commercial name of the module, as set by the factory.

dnp string **ProductName**

module→ProductRelease**YModule**

Release number of the module hardware, preprogrammed at the factory.

dnp int **ProductRelease**

The original hardware release returns value 1, revision B returns value 2, etc.

module→SerialNumber**YModule**

Serial number of the module, as set by the factory.

dnp string **SerialNumber**

module→checkFirmware()**YModule**

Tests whether the byn file is valid for this module.

js	<code>function checkFirmware(path, onlynew)</code>
cpp	<code>string checkFirmware(string path, bool onlynew)</code>
m	<code>-(NSString*) checkFirmware : (NSString*) path : (bool) onlynew</code>
pas	<code>string checkFirmware(path: string, onlynew: boolean): string</code>
vb	<code>function checkFirmware(ByVal path As String, ByVal onlynew As Boolean) As String</code>
cs	<code>string checkFirmware(string path, bool onlynew)</code>
java	<code>String checkFirmware(String path, boolean onlynew)</code>
uwp	<code>async Task<string> checkFirmware(string path, bool onlynew)</code>
py	<code>checkFirmware(path, onlynew)</code>
php	<code>function checkFirmware(\$path, \$onlynew)</code>
ts	<code>async checkFirmware(path: string, onlynew: boolean): Promise<string></code>
es	<code>async checkFirmware(path, onlynew)</code>
dnp	<code>string checkFirmware(string path, bool onlynew)</code>
cp	<code>string checkFirmware(string path, bool onlynew)</code>
cmd	<code>YModule target checkFirmware path onlynew</code>

This method is useful to test if the module needs to be updated. It is possible to pass a directory as argument instead of a file. In this case, this method returns the path of the most recent appropriate .byn file. If the parameter `onlynew` is true, the function discards firmwares that are older or equal to the installed firmware.

Parameters :

path the path of a byn file or a directory that contains byn files
onlynew returns only files that are strictly newer

Returns :

the path of the byn file to use or a empty string if no byn files matches the requirement

On failure, throws an exception or returns a string that start with "error:".

module→clearCache()**YModule**

Invalidate the cache.

js	function clearCache()
cpp	void clearCache()
m	-(void) clearCache
pas	clearCache()
vb	procedure clearCache()
cs	void clearCache()
java	void clearCache()
py	clearCache()
php	function clearCache()
ts	async clearCache() : Promise<void>
es	async clearCache()

Invalidate the cache of the module attributes. Forces the next call to get_xxx() or loadxxx() to use values that come from the device.

module→describe()**YModule**

Returns a descriptive text that identifies the module.

js	<code>function describe()</code>
cpp	<code>string describe()</code>
m	<code>-(NSString*) describe</code>
pas	<code>string describe(): string</code>
vb	<code>function describe() As String</code>
cs	<code>string describe()</code>
java	<code>String describe()</code>
py	<code>describe()</code>
php	<code>function describe()</code>
ts	<code>async describe(): Promise<string></code>
es	<code>async describe()</code>

The text may include either the logical name or the serial number of the module.

Returns :

a string that describes the module

module→download()**YModule**

Downloads the specified built-in file and returns a binary buffer with its content.

js	<code>function download(pathname)</code>
cpp	<code>string download(string pathname)</code>
m	<code>-(NSMutableData*) download : (NSString*) pathname</code>
pas	<code>TByteArray download(pathname: string): TByteArray</code>
vb	<code>function download(ByVal pathname As String) As Byte</code>
cs	<code>byte[] download(string pathname)</code>
java	<code>byte[] download(String pathname)</code>
uwp	<code>async Task<byte[]> download(string pathname)</code>
py	<code>download(pathname)</code>
php	<code>function download(\$pathname)</code>
ts	<code>async download(pathname: string): Promise<Uint8Array></code>
es	<code>async download(pathname)</code>
dnp	<code>byte[] download(string pathname)</code>
cp	<code>string download(string pathname)</code>
cmd	<code>YModule target download pathname</code>

Parameters :

pathname name of the new file to load

Returns :

a binary buffer with the file content

On failure, throws an exception or returns YAPI_INVALID_STRING.

module→functionBaseType()**YModule**

Retrieves the base type of the *n*th function on the module.

<code>js</code>	<code>function functionBaseType(functionIndex)</code>
<code>cpp</code>	<code>string functionBaseType(int functionIndex)</code>
<code>pas</code>	<code>string functionBaseType(functionIndex: integer): string</code>
<code>vb</code>	<code>function functionBaseType(ByVal functionIndex As Integer) As String</code>
<code>cs</code>	<code>string functionBaseType(int functionIndex)</code>
<code>java</code>	<code>String functionBaseType(int functionIndex)</code>
<code>py</code>	<code>functionBaseType(functionIndex)</code>
<code>php</code>	<code>function functionBaseType(\$functionIndex)</code>
<code>ts</code>	<code>async functionBaseType(functionIndex: number): Promise<string></code>
<code>es</code>	<code>async functionBaseType(functionIndex)</code>

For instance, the base type of all measuring functions is "Sensor".

Parameters :

functionIndex the index of the function for which the information is desired, starting at 0 for the first function.

Returns :

a string corresponding to the base type of the function

On failure, throws an exception or returns an empty string.

module→functionCount()**YModule**

Returns the number of functions (beside the "module" interface) available on the module.

js	function functionCount()
cpp	int functionCount()
m	- (int) functionCount
pas	integer functionCount() : integer
vb	function functionCount() As Integer
cs	int functionCount()
java	int functionCount()
py	functionCount()
php	function functionCount()
ts	async functionCount() : Promise<number>
es	async functionCount()

Returns :

the number of functions on the module

On failure, throws an exception or returns a negative error code.

module→functionId()**YModule**

Retrieves the hardware identifier of the *n*th function on the module.

<code>js</code>	<code>function functionId(functionIndex)</code>
<code>cpp</code>	<code>string functionId(int functionIndex)</code>
<code>m</code>	<code>-(NSString*) functionId : (int) functionIndex</code>
<code>pas</code>	<code>string functionId(functionIndex: integer): string</code>
<code>vb</code>	<code>function functionId(ByVal functionIndex As Integer) As String</code>
<code>cs</code>	<code>string functionId(int functionIndex)</code>
<code>java</code>	<code>String functionId(int functionIndex)</code>
<code>py</code>	<code>functionId(functionIndex)</code>
<code>php</code>	<code>function functionId(\$functionIndex)</code>
<code>ts</code>	<code>async functionId(functionIndex: number): Promise<string></code>
<code>es</code>	<code>async functionId(functionIndex)</code>

Parameters :

functionIndex the index of the function for which the information is desired, starting at 0 for the first function.

Returns :

a string corresponding to the unambiguous hardware identifier of the requested module function

On failure, throws an exception or returns an empty string.

module→functionName()**YModule**

Retrieves the logical name of the *n*th function on the module.

js	function functionName(functionIndex)
cpp	string functionName(int functionIndex)
m	- (NSString*) functionName : (int) functionIndex
pas	string functionName(functionIndex: integer): string
vb	function functionName(ByVal functionIndex As Integer) As String
cs	string functionName(int functionIndex)
java	String functionName(int functionIndex)
py	functionName(functionIndex)
php	functionName(\$functionIndex)
ts	async functionName(functionIndex: number): Promise<string>
es	async functionName(functionIndex)

Parameters :

functionIndex the index of the function for which the information is desired, starting at 0 for the first function.

Returns :

a string corresponding to the logical name of the requested module function

On failure, throws an exception or returns an empty string.

module→functionType()**YModule**

Retrieves the type of the *n*th function on the module.

<code>js</code>	<code>function functionType(functionIndex)</code>
<code>cpp</code>	<code>string functionType(int functionIndex)</code>
<code>pas</code>	<code>string functionType(functionIndex: integer): string</code>
<code>vb</code>	<code>function functionType(ByVal functionIndex As Integer) As String</code>
<code>cs</code>	<code>string functionType(int functionIndex)</code>
<code>java</code>	<code>String functionType(int functionIndex)</code>
<code>py</code>	<code>functionType(functionIndex)</code>
<code>php</code>	<code>function functionType(\$functionIndex)</code>
<code>ts</code>	<code>async functionType(functionIndex: number): Promise<string></code>
<code>es</code>	<code>async functionType(functionIndex)</code>

Parameters :

functionIndex the index of the function for which the information is desired, starting at 0 for the first function.

Returns :

a string corresponding to the type of the function

On failure, throws an exception or returns an empty string.

module→functionValue()**YModule**

Retrieves the advertised value of the *n*th function on the module.

js	function functionValue(functionIndex)
cpp	string functionValue(int functionIndex)
m	-NSString* functionValue : (int) functionIndex
pas	string functionValue(functionIndex: integer): string
vb	function functionValue(ByVal functionIndex As Integer) As String
cs	string functionValue(int functionIndex)
java	String functionValue(int functionIndex)
py	functionValue(functionIndex)
php	function functionValue(\$functionIndex)
ts	async functionValue(functionIndex: number): Promise<string>
es	async functionValue(functionIndex)

Parameters :

functionIndex the index of the function for which the information is desired, starting at 0 for the first function.

Returns :

a short string (up to 6 characters) corresponding to the advertised value of the requested module function

On failure, throws an exception or returns an empty string.

module→get_allSettings()**YModule****module→allSettings()**

Returns all the settings and uploaded files of the module.

js	<code>function get_allSettings()</code>
cpp	<code>string get_allSettings()</code>
m	<code>-(NSMutableData*) allSettings</code>
pas	<code>TByteArray get_allSettings(): TByteArray</code>
vb	<code>function get_allSettings() As Byte</code>
cs	<code>byte[] get_allSettings()</code>
java	<code>byte[] get_allSettings()</code>
uwp	<code>async Task<byte[]> get_allSettings()</code>
py	<code>get_allSettings()</code>
php	<code>function get_allSettings()</code>
ts	<code>async get_allSettings(): Promise<Uint8Array></code>
es	<code>async get_allSettings()</code>
dnp	<code>byte[] get_allSettings()</code>
cp	<code>string get_allSettings()</code>
cmd	YModule target get_allSettings

Useful to backup all the logical names, calibrations parameters, and uploaded files of a device.

Returns :

a binary buffer with all the settings.

On failure, throws an exception or returns an binary object of size 0.

module→get_beacon()**YModule****module→beacon()**

Returns the state of the localization beacon.

js	function get_beacon()
cpp	Y_BEACON_enum get_beacon()
m	-(Y_BEACON_enum) beacon
pas	Integer get_beacon() : Integer
vb	function get_beacon() As Integer
cs	int get_beacon()
java	int get_beacon()
uwp	async Task<int> get_beacon()
py	get_beacon()
php	function get_beacon()
ts	async get_beacon() : Promise<YModule_Beacon>
es	async get_beacon()
dnp	int get_beacon()
cp	int get_beacon()
cmd	YModule target get_beacon

Returns :

either YModule.BEACON_OFF or YModule.BEACON_ON, according to the state of the localization beacon

On failure, throws an exception or returns YModule.BEACON_INVALID.

module→get_errorMessage()**YModule****module→errorMessage()**

Returns the error message of the latest error with this module object.

js	<code>function get_errorMessage()</code>
cpp	<code>string get_errorMessage()</code>
m	<code>-(NSString*) errorMessage</code>
pas	<code>string get_errorMessage(): string</code>
vb	<code>function get_errorMessage() As String</code>
cs	<code>string get_errorMessage()</code>
java	<code>String get_errorMessage()</code>
py	<code>get_errorMessage()</code>
php	<code>function get_errorMessage()</code>
ts	<code>get_errorMessage(): string</code>
es	<code>get_errorMessage()</code>

This method is mostly useful when using the Yoctopuce library with exceptions disabled.

Returns :

a string corresponding to the latest error message that occurred while using this module object

module→get_errorType()**YModule****module→errorType()**

Returns the numerical error code of the latest error with this module object.

js	function get_errorType()
cpp	YRETCODE get_errorType()
m	- (YRETCODE) errorType
pas	YRETCODE get_errorType() : YRETCODE
vb	function get_errorType() As YRETCODE
cs	YRETCODE get_errorType()
java	int get_errorType()
py	get_errorType()
php	function get_errorType()
ts	get_errorType() : number
es	get_errorType()

This method is mostly useful when using the Yoctopuce library with exceptions disabled.

Returns :

a number corresponding to the code of the latest error that occurred while using this module object

module→get_firmwareRelease()**YModule****module→firmwareRelease()**

Returns the version of the firmware embedded in the module.

<code>js</code>	<code>function get_firmwareRelease()</code>
<code>cpp</code>	<code>string get_firmwareRelease()</code>
<code>m</code>	<code>-(NSString*) firmwareRelease</code>
<code>pas</code>	<code>string get_firmwareRelease(): string</code>
<code>vb</code>	<code>function get_firmwareRelease() As String</code>
<code>cs</code>	<code>string get_firmwareRelease()</code>
<code>java</code>	<code>String get_firmwareRelease()</code>
<code>uwp</code>	<code>async Task<string> get_firmwareRelease()</code>
<code>py</code>	<code>get_firmwareRelease()</code>
<code>php</code>	<code>function get_firmwareRelease()</code>
<code>ts</code>	<code>async get_firmwareRelease(): Promise<string></code>
<code>es</code>	<code>async get_firmwareRelease()</code>
<code>dnp</code>	<code>string get_firmwareRelease()</code>
<code>cp</code>	<code>string get_firmwareRelease()</code>
<code>cmd</code>	<code>YModule target get_firmwareRelease</code>

Returns :

a string corresponding to the version of the firmware embedded in the module

On failure, throws an exception or returns `YModule.FIRMWARERELEASE_INVALID`.

module→get_functionIds()**YModule****module→functionIds()**

Retrieve all hardware identifier that match the type passed in argument.

js	<code>function get_functionIds(funType)</code>
cpp	<code>vector<string> get_functionIds(string funType)</code>
m	<code>-(NSMutableArray*) functionIds : (NSString*) funType</code>
pas	<code>TStringArray get_functionIds(funType: string): TStringArray</code>
vb	<code>function get_functionIds(ByVal funType As String) As List</code>
cs	<code>List<string> get_functionIds(string funType)</code>
java	<code>ArrayList<String> get_functionIds(String funType)</code>
uwp	<code>async Task<List<string>> get_functionIds(string funType)</code>
py	<code>get_functionIds(funType)</code>
php	<code>function get_functionIds(\$funType)</code>
ts	<code>async get_functionIds(funType: string): Promise<string[]></code>
es	<code>async get_functionIds(funType)</code>
dnp	<code>string[] get_functionIds(string funType)</code>
cp	<code>vector<string> get_functionIds(string funType)</code>
cmd	<code>YModule target get_functionIds funType</code>

Parameters :

funType The type of function (Relay, LightSensor, Voltage,...)

Returns :

an array of strings.

module→get_hardwareId()**YModule****module→hardwareId()**

Returns the unique hardware identifier of the module.

js	<code>function get_hardwareId()</code>
cpp	<code>string get_hardwareId()</code>
m	<code>-(NSString*) hardwareId</code>
vb	<code>function get_hardwareId() As String</code>
cs	<code>string get_hardwareId()</code>
java	<code>String get_hardwareId()</code>
py	<code>get_hardwareId()</code>
php	<code>function get_hardwareId()</code>
ts	<code>async get_hardwareId(): Promise<string></code>
es	<code>async get_hardwareId()</code>
dnp	<code>string get_hardwareId()</code>
cp	<code>string get_hardwareId()</code>
pas	<code>string get_hardwareId(): string</code>
uwp	<code>async Task<string> get_hardwareId()</code>
cmd	YModule target get_hardwareId

The unique hardware identifier is made of the device serial number followed by string ".module".

Returns :

a string that uniquely identifies the module

module→get_icon2d()**YModule****module→icon2d()**

Returns the icon of the module.

```
js function get_icon2d( )  
cpp string get_icon2d( )  
m -(NSMutableData*) icon2d  
pas TByteArray get_icon2d( ): TByteArray  
vb function get_icon2d( ) As Byte  
cs byte[] get_icon2d( )  
java byte[] get_icon2d()  
uwp async Task<byte[]> get_icon2d( )  
py get_icon2d( )  
php function get_icon2d( )  
ts async get_icon2d( ): Promise<Uint8Array>  
es async get_icon2d( )  
dnp byte[] get_icon2d( )  
cp string get_icon2d( )  
cmd YModule target get_icon2d
```

The icon is a PNG image and does not exceed 1536 bytes.

Returns :

a binary buffer with module icon, in png format. On failure, throws an exception or returns YAPI_INVALID_STRING.

module→get_lastLogs()**YModule****module→lastLogs()**

Returns a string with last logs of the module.

js	<code>function get_lastLogs()</code>
cpp	<code>string get_lastLogs()</code>
m	<code>-(NSString*) lastLogs</code>
pas	<code>string get_lastLogs(): string</code>
vb	<code>function get_lastLogs() As String</code>
cs	<code>string get_lastLogs()</code>
java	<code>String get_lastLogs()</code>
uwp	<code>async Task<string> get_lastLogs()</code>
py	<code>get_lastLogs()</code>
php	<code>function get_lastLogs()</code>
ts	<code>async get_lastLogs(): Promise<string></code>
es	<code>async get_lastLogs()</code>
dnp	<code>string get_lastLogs()</code>
cp	<code>string get_lastLogs()</code>
cmd	<code>YModule target get_lastLogs</code>

This method return only logs that are still in the module.

Returns :

a string with last logs of the module. On failure, throws an exception or returns YAPI_INVALID_STRING.

module→get_logicalName()**YModule****module→logicalName()**

Returns the logical name of the module.

```
js function get_logicalName( )  
cpp string get_logicalName( )  
m -(NSString*) logicalName  
pas string get_logicalName( ): string  
vb function get_logicalName( ) As String  
cs string get_logicalName( )  
java String get_logicalName( )  
uwp async Task<string> get_logicalName( )  
py get_logicalName( )  
php function get_logicalName( )  
ts async get_logicalName( ): Promise<string>  
es async get_logicalName( )  
dnp string get_logicalName( )  
cp string get_logicalName( )  
cmd YModule target get_logicalName
```

Returns :

a string corresponding to the logical name of the module

On failure, throws an exception or returns YModule.LOGICALNAME_INVALID.

module→get_luminosity()**YModule****module→luminosity()**

Returns the luminosity of the module informative LEDs (from 0 to 100).

js	<code>function get_luminosity()</code>
cpp	<code>int get_luminosity()</code>
m	<code>-(int) luminosity</code>
pas	<code>LongInt get_luminosity(): LongInt</code>
vb	<code>function get_luminosity() As Integer</code>
cs	<code>int get_luminosity()</code>
java	<code>int get_luminosity()</code>
uwp	<code>async Task<int> get_luminosity()</code>
py	<code>get_luminosity()</code>
php	<code>function get_luminosity()</code>
ts	<code>async get_luminosity(): Promise<number></code>
es	<code>async get_luminosity()</code>
dnp	<code>int get_luminosity()</code>
cp	<code>int get_luminosity()</code>
cmd	<code>YModule target get_luminosity</code>

Returns :

an integer corresponding to the luminosity of the module informative LEDs (from 0 to 100)

On failure, throws an exception or returns `YModule.LUMINOSITY_INVALID`.

module→get_parentHub()**YModule****module→parentHub()**

Returns the serial number of the YoctoHub on which this module is connected.

js	function get_parentHub()
cpp	string get_parentHub()
m	-(NSString*) parentHub
pas	string get_parentHub() : string
vb	function get_parentHub() As String
cs	string get_parentHub()
java	String get_parentHub()
uwp	async Task<string> get_parentHub()
py	get_parentHub()
php	function get_parentHub()
ts	async get_parentHub() : Promise<string>
es	async get_parentHub()
dnp	string get_parentHub()
cp	string get_parentHub()
cmd	YModule target get_parentHub

If the module is connected by USB, or if the module is the root YoctoHub, an empty string is returned.

Returns :

a string with the serial number of the YoctoHub or an empty string

module→get_persistentSettings()**YModule****module→persistentSettings()**

Returns the current state of persistent module settings.

js	<code>function get_persistentSettings()</code>
cpp	<code>Y_PERSISTENTSETTINGS_enum get_persistentSettings()</code>
m	<code>-(Y_PERSISTENTSETTINGS_enum) persistentSettings</code>
pas	<code>Integer get_persistentSettings(): Integer</code>
vb	<code>function get_persistentSettings() As Integer</code>
cs	<code>int get_persistentSettings()</code>
java	<code>int get_persistentSettings()</code>
uwp	<code>async Task<int> get_persistentSettings()</code>
py	<code>get_persistentSettings()</code>
php	<code>function get_persistentSettings()</code>
ts	<code>async get_persistentSettings(): Promise<YModule_PersistentSettings></code>
es	<code>async get_persistentSettings()</code>
dnp	<code>int get_persistentSettings()</code>
cp	<code>int get_persistentSettings()</code>
cmd	<code>YModule target get_persistentSettings</code>

Returns :

a value among `YModule.PERSISTENTSETTINGS_LOADED`, `YModule.PERSISTENTSETTINGS_SAVED` and `YModule.PERSISTENTSETTINGS_MODIFIED` corresponding to the current state of persistent module settings

On failure, throws an exception or returns `YModule.PERSISTENTSETTINGS_INVALID`.

module→get_productId()**YModule****module→productId()**

Returns the USB device identifier of the module.

js	function get(productId) ()
cpp	int get(productId) ()
m	- (int) productId
pas	LongInt get(productId) (): LongInt
vb	function get(productId) () As Integer
cs	int get(productId) ()
java	int get(productId) ()
uwp	async Task<int> get(productId) ()
py	get(productId) ()
php	function get(productId) ()
ts	async get(productId) (): Promise<number>
es	async get(productId) ()
dnp	int get(productId) ()
cp	int get(productId) ()
cmd	YModule target get(productId)

Returns :

an integer corresponding to the USB device identifier of the module

On failure, throws an exception or returns YModule.PRODUCTID_INVALID.

module→get_productName()**YModule****module→productName()**

Returns the commercial name of the module, as set by the factory.

<code>js</code>	<code>function get_productName()</code>
<code>cpp</code>	<code>string get_productName()</code>
<code>m</code>	<code>-(NSString*) productName</code>
<code>pas</code>	<code>string get_productName(): string</code>
<code>vb</code>	<code>function get_productName() As String</code>
<code>cs</code>	<code>string get_productName()</code>
<code>java</code>	<code>String get_productName()</code>
<code>uwp</code>	<code>async Task<string> get_productName()</code>
<code>py</code>	<code>get_productName()</code>
<code>php</code>	<code>function get_productName()</code>
<code>ts</code>	<code>async get_productName(): Promise<string></code>
<code>es</code>	<code>async get_productName()</code>
<code>dnp</code>	<code>string get_productName()</code>
<code>cp</code>	<code>string get_productName()</code>
<code>cmd</code>	<code>YModule target get_productName</code>

Returns :

a string corresponding to the commercial name of the module, as set by the factory

On failure, throws an exception or returns `YModule.PRODUCTNAME_INVALID`.

module→get_productRelease()**YModule****module→productRelease()**

Returns the release number of the module hardware, preprogrammed at the factory.

js	function get_productRelease()
cpp	int get_productRelease()
m	- (int) productRelease
pas	LongInt get_productRelease() : LongInt
vb	function get_productRelease() As Integer
cs	int get_productRelease()
java	int get_productRelease()
uwp	async Task<int> get_productRelease()
py	get_productRelease()
php	function get_productRelease()
ts	async get_productRelease() : Promise<number>
es	async get_productRelease()
dnp	int get_productRelease()
cp	int get_productRelease()
cmd	YModule target get_productRelease

The original hardware release returns value 1, revision B returns value 2, etc.

Returns :

an integer corresponding to the release number of the module hardware, preprogrammed at the factory

On failure, throws an exception or returns YModule.PRODUCTRELEASE_INVALID.

module→get_rebootCountdown()**YModule****module→rebootCountdown()**

Returns the remaining number of seconds before the module restarts, or zero when no reboot has been scheduled.

js	function get_rebootCountdown()
cpp	int get_rebootCountdown()
m	-(int) rebootCountdown
pas	LongInt get_rebootCountdown() : LongInt
vb	function get_rebootCountdown() As Integer
cs	int get_rebootCountdown()
java	int get_rebootCountdown()
uwp	async Task<int> get_rebootCountdown()
py	get_rebootCountdown()
php	function get_rebootCountdown()
ts	async get_rebootCountdown() : Promise<number>
es	async get_rebootCountdown()
dnp	int get_rebootCountdown()
cp	int get_rebootCountdown()
cmd	YModule target get_rebootCountdown

Returns :

an integer corresponding to the remaining number of seconds before the module restarts, or zero when no reboot has been scheduled

On failure, throws an exception or returns YModule.REBOOTCOUNTDOWN_INVALID.

module→get_serialNumber()**YModule****module→serialNumber()**

Returns the serial number of the module, as set by the factory.

js	function get_serialNumber()
cpp	string get_serialNumber()
m	- (NSString*) serialNumber
pas	string get_serialNumber() : string
vb	function get_serialNumber() As String
cs	string get_serialNumber()
java	String get_serialNumber()
uwp	async Task<string> get_serialNumber()
py	get_serialNumber()
php	function get_serialNumber()
ts	async get_serialNumber() : Promise<string>
es	async get_serialNumber()
dnp	string get_serialNumber()
cp	string get_serialNumber()
cmd	YModule target get_serialNumber

Returns :

a string corresponding to the serial number of the module, as set by the factory

On failure, throws an exception or returns YModule.SERIALNUMBER_INVALID.

module→get_subDevices()**YModule****module→subDevices()**

Returns a list of all the modules that are plugged into the current module.

<code>js</code>	<code>function get_subDevices()</code>
<code>cpp</code>	<code>vector<string> get_subDevices()</code>
<code>m</code>	<code>-(NSMutableArray*) subDevices</code>
<code>pas</code>	<code>TStringArray get_subDevices(): TStringArray</code>
<code>vb</code>	<code>function get_subDevices() As List</code>
<code>cs</code>	<code>List<string> get_subDevices()</code>
<code>java</code>	<code>ArrayList<String> get_subDevices()</code>
<code>uwp</code>	<code>async Task<List<string>> get_subDevices()</code>
<code>py</code>	<code>get_subDevices()</code>
<code>php</code>	<code>function get_subDevices()</code>
<code>ts</code>	<code>async get_subDevices(): Promise<string[]></code>
<code>es</code>	<code>async get_subDevices()</code>
<code>dnp</code>	<code>string[] get_subDevices()</code>
<code>cp</code>	<code>vector<string> get_subDevices()</code>
<code>cmd</code>	<code>YModule target get_subDevices</code>

This method only makes sense when called for a YoctoHub/VirtualHub. Otherwise, an empty array will be returned.

Returns :

an array of strings containing the sub modules.

module→get_upTime()**YModule****module→upTime()**

Returns the number of milliseconds spent since the module was powered on.

js	function get_upTime()
cpp	s64 get_upTime()
m	-(s64) upTime
pas	int64 get_upTime() : int64
vb	function get_upTime() As Long
cs	long get_upTime()
java	long get_upTime()
uwp	async Task<long> get_upTime()
py	get_upTime()
php	function get_upTime()
ts	async get_upTime() : Promise<number>
es	async get_upTime()
dnp	long get_upTime()
cp	s64 get_upTime()
cmd	YModule target get_upTime

Returns :

an integer corresponding to the number of milliseconds spent since the module was powered on

On failure, throws an exception or returns YModule.UPTIME_INVALID.

module→get_url()**YModule****module→url()**

Returns the URL used to access the module.

<code>js</code>	<code>function get_url()</code>
<code>cpp</code>	<code>string get_url()</code>
<code>m</code>	<code>-(NSString*) url</code>
<code>pas</code>	<code>string get_url(): string</code>
<code>vb</code>	<code>function get_url() As String</code>
<code>cs</code>	<code>string get_url()</code>
<code>java</code>	<code>String get_url()</code>
<code>uwp</code>	<code>async Task<string> get_url()</code>
<code>py</code>	<code>get_url()</code>
<code>php</code>	<code>function get_url()</code>
<code>ts</code>	<code>async get_url(): Promise<string></code>
<code>es</code>	<code>async get_url()</code>
<code>dnp</code>	<code>string get_url()</code>
<code>cp</code>	<code>string get_url()</code>
<code>cmd</code>	<code>YModule target get_url</code>

If the module is connected by USB, the string 'usb' is returned.

Returns :

a string with the URL of the module.

module→get_usbCurrent()**YModule****module→usbCurrent()**

Returns the current consumed by the module on the USB bus, in milli-amps.

js	function get_usbCurrent()
cpp	int get_usbCurrent()
m	- (int) usbCurrent
pas	LongInt get_usbCurrent() : LongInt
vb	function get_usbCurrent() As Integer
cs	int get_usbCurrent()
java	int get_usbCurrent()
uwp	async Task<int> get_usbCurrent()
py	get_usbCurrent()
php	function get_usbCurrent()
ts	async get_usbCurrent() : Promise<number>
es	async get_usbCurrent()
dnp	int get_usbCurrent()
cp	int get_usbCurrent()
cmd	YModule target get_usbCurrent

Returns :

an integer corresponding to the current consumed by the module on the USB bus, in milli-amps

On failure, throws an exception or returns YModule.USBCURRENT_INVALID.

module→get(userData)**YModule****module→userData()**

Returns the value of the userData attribute, as previously stored using method `set(userData)`.

js	<code>function get(userData) </code>
cpp	<code>void * get(userData) </code>
m	<code>-(id) userData</code>
pas	<code>Tobject get(userData): Tobject</code>
vb	<code>function get(userData) As Object</code>
cs	<code>object get(userData)</code>
java	<code>Object get(userData)</code>
py	<code>get(userData)</code>
php	<code>function get(userData)</code>
ts	<code>async get(userData): Promise<object null></code>
es	<code>async get(userData)</code>

This attribute is never touched directly by the API, and is at disposal of the caller to store a context.

Returns :

the object stored previously by the caller.

module→get_userVar()**YModule****module→userVar()**

Returns the value previously stored in this attribute.

js	function get_userVar()
cpp	int get_userVar()
m	- (int) userVar
pas	LongInt get_userVar() : LongInt
vb	function get_userVar() As Integer
cs	int get_userVar()
java	int get_userVar()
uwp	async Task<int> get_userVar()
py	get_userVar()
php	function get_userVar()
ts	async get_userVar() : Promise<number>
es	async get_userVar()
dnp	int get_userVar()
cp	int get_userVar()
cmd	YModule target get_userVar

On startup and after a device reboot, the value is always reset to zero.

Returns :

an integer corresponding to the value previously stored in this attribute

On failure, throws an exception or returns YModule.USERVAR_INVALID.

module→hasFunction()**YModule**

Tests if the device includes a specific function.

<code>js</code>	<code>function hasFunction(funcId)</code>
<code>cpp</code>	<code>bool hasFunction(string funcId)</code>
<code>m</code>	<code>-(BOOL) hasFunction : (NSString*) funcId</code>
<code>pas</code>	<code>boolean hasFunction(funcId: string): boolean</code>
<code>vb</code>	<code>function hasFunction(ByVal funcId As String) As Boolean</code>
<code>cs</code>	<code>bool hasFunction(string funcId)</code>
<code>java</code>	<code>boolean hasFunction(String funcId)</code>
<code>uwp</code>	<code>async Task<bool> hasFunction(string funcId)</code>
<code>py</code>	<code>hasFunction(funcId)</code>
<code>php</code>	<code>function hasFunction(\$funcId)</code>
<code>ts</code>	<code>async hasFunction(funcId: string): Promise<boolean></code>
<code>es</code>	<code>async hasFunction(funcId)</code>
<code>dnp</code>	<code>bool hasFunction(string funcId)</code>
<code>cp</code>	<code>bool hasFunction(string funcId)</code>
<code>cmd</code>	<code>YModule target hasFunction funcId</code>

This method takes a function identifier and returns a boolean.

Parameters :

`funcId` the requested function identifier

Returns :

true if the device has the function identifier

module→isOnline()**YModule**

Checks if the module is currently reachable, without raising any error.

js	function isOnline()
cpp	bool isOnline()
m	-(BOOL) isOnline
pas	boolean isOnline() : boolean
vb	function isOnline() As Boolean
cs	bool isOnline()
java	boolean isOnline()
py	isOnline()
php	function isOnline()
ts	async isOnline() : Promise<boolean>
es	async isOnline()
dnp	bool isOnline()
cp	bool isOnline()

If there are valid cached values for the module, that have not yet expired, the device is considered reachable. No exception is raised if there is an error while trying to contact the requested module.

Returns :

true if the module can be reached, and false otherwise

module→isOnline_async()**YModule**

Checks if the module is currently reachable, without raising any error.

js **function isOnline_async(callback, context)**

If there are valid cached values for the module, that have not yet expired, the device is considered reachable. No exception is raised if there is an error while trying to contact the requested module.

This asynchronous version exists only in JavaScript. It uses a callback instead of a return value in order to avoid blocking Firefox JavaScript VM that does not implement context switching during blocking I/O calls.

Parameters :

callback callback function that is invoked when the result is known. The callback function receives three arguments: the caller-specific context object, the receiving module object and the boolean result

context caller-specific object that is passed as-is to the callback function

Returns :

nothing : the result is provided to the callback.

module→load()**YModule**

Preloads the module cache with a specified validity duration.

<code>js</code>	<code>function load(msValidity)</code>
<code>cpp</code>	<code>YRETCODE load(int msValidity)</code>
<code>m</code>	<code>-(YRETCODE) load : (u64) msValidity</code>
<code>pas</code>	<code>YRETCODE load(msValidity: u64): YRETCODE</code>
<code>vb</code>	<code>function load(ByVal msValidity As Long) As YRETCODE</code>
<code>cs</code>	<code>YRETCODE load(ulong msValidity)</code>
<code>java</code>	<code>int load(long msValidity)</code>
<code>py</code>	<code>load(msValidity)</code>
<code>php</code>	<code>function load(\$msValidity)</code>
<code>ts</code>	<code>async load(msValidity: number): Promise<number></code>
<code>es</code>	<code>async load(msValidity)</code>

By default, whenever accessing a device, all module attributes are kept in cache for the standard duration (5 ms). This method can be used to temporarily mark the cache as valid for a longer period, in order to reduce network traffic for instance.

Parameters :

msValidity an integer corresponding to the validity attributed to the loaded module parameters, in milliseconds

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

module→load_async()**YModule**

Preloads the module cache with a specified validity duration (asynchronous version).

```
js   function load_async( msValidity, callback, context)
```

By default, whenever accessing a device, all module attributes are kept in cache for the standard duration (5 ms). This method can be used to temporarily mark the cache as valid for a longer period, in order to reduce network traffic for instance.

This asynchronous version exists only in JavaScript. It uses a callback instead of a return value in order to avoid blocking Firefox JavaScript VM that does not implement context switching during blocking I/O calls. See the documentation section on asynchronous JavaScript calls for more details.

Parameters :

msValidity an integer corresponding to the validity of the loaded module parameters, in milliseconds

callback callback function that is invoked when the result is known. The callback function receives three arguments: the caller-specific context object, the receiving module object and the error code (or YAPI.SUCCESS)

context caller-specific object that is passed as-is to the callback function

Returns :

nothing : the result is provided to the callback.

module→log()**YModule**

Adds a text message to the device logs.

js	<code>function log(text)</code>
cpp	<code>int log(string text)</code>
m	<code>- (int) log : (NSString*) text</code>
pas	<code>LongInt log(text: string): LongInt</code>
vb	<code>function log(ByVal text As String) As Integer</code>
cs	<code>int log(string text)</code>
java	<code>int log(String text)</code>
uwp	<code>async Task<int> log(string text)</code>
py	<code>log(text)</code>
php	<code>function log(\$text)</code>
ts	<code>async log(text: string): Promise<number></code>
es	<code>async log(text)</code>
dnp	<code>int log(string text)</code>
cp	<code>int log(string text)</code>
cmd	<code>YModule target log text</code>

This function is useful in particular to trace the execution of HTTP callbacks. If a newline is desired after the message, it must be included in the string.

Parameters :

`text` the string to append to the logs.

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

module→nextModule()**YModule**

Continues the module enumeration started using `yFirstModule()`.

<code>js</code>	<code>function nextModule()</code>
<code>cpp</code>	<code>YModule * nextModule()</code>
<code>m</code>	<code>-(nullable YModule*) nextModule</code>
<code>pas</code>	<code>TYModule nextModule(): TYModule</code>
<code>vb</code>	<code>function nextModule() As YModule</code>
<code>cs</code>	<code>YModule nextModule()</code>
<code>java</code>	<code>YModule nextModule()</code>
<code>uwp</code>	<code>YModule nextModule()</code>
<code>py</code>	<code>nextModule()</code>
<code>php</code>	<code>function nextModule()</code>
<code>ts</code>	<code>nextModule(): YModule null</code>
<code>es</code>	<code>nextModule()</code>

Caution: You can't make any assumption about the returned modules order. If you want to find a specific module, use `Module.findModule()` and a hardwareID or a logical name.

Returns :

a pointer to a `YModule` object, corresponding to the next module found, or a `null` pointer if there are no more modules to enumerate.

module→reboot()**YModule**

Schedules a simple module reboot after the given number of seconds.

js	<code>function reboot(secBeforeReboot)</code>
cpp	<code>int reboot(int secBeforeReboot)</code>
m	<code>- (int) reboot : (int) secBeforeReboot</code>
pas	<code>LongInt reboot(secBeforeReboot: LongInt): LongInt</code>
vb	<code>function reboot(ByVal secBeforeReboot As Integer) As Integer</code>
cs	<code>int reboot(int secBeforeReboot)</code>
java	<code>int reboot(int secBeforeReboot)</code>
uwp	<code>async Task<int> reboot(int secBeforeReboot)</code>
py	<code>reboot(secBeforeReboot)</code>
php	<code>function reboot(\$secBeforeReboot)</code>
ts	<code>async reboot(secBeforeReboot: number): Promise<number></code>
es	<code>async reboot(secBeforeReboot)</code>
dnp	<code>int reboot(int secBeforeReboot)</code>
cp	<code>int reboot(int secBeforeReboot)</code>
cmd	<code>YModule target reboot secBeforeReboot</code>

Parameters :

secBeforeReboot number of seconds before rebooting

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

module→registerBeaconCallback()**YModule**

Register a callback function, to be called when the localization beacon of the module has been changed.

js	<code>function registerBeaconCallback(callback)</code>
cpp	<code>int registerBeaconCallback(YModuleBeaconCallback callback)</code>
m	<code>-(int) registerBeaconCallback : (YModuleBeaconCallback _Nullable) callback</code>
pas	<code>LongInt registerBeaconCallback(callback: TYModuleBeaconCallback): LongInt</code>
vb	<code>function registerBeaconCallback(ByVal callback As YModuleBeaconCallback) As Integer</code>
cs	<code>int registerBeaconCallback(BeaconCallback callback)</code>
java	<code>int registerBeaconCallback(BeaconCallback callback)</code>
uwp	<code>async Task<int> registerBeaconCallback(BeaconCallback callback)</code>
py	<code>registerBeaconCallback(callback)</code>
php	<code>function registerBeaconCallback(\$callback)</code>
ts	<code>async registerBeaconCallback(callback: YModuleBeaconCallback null): Promise<number></code>
es	<code>async registerBeaconCallback(callback)</code>

The callback function should take two arguments: the YModule object of which the beacon has changed, and an integer describing the new beacon state.

Parameters :

callback The callback function to call, or `null` to unregister a

module→registerConfigChangeCallback()**YModule**

Register a callback function, to be called when a persistent settings in a device configuration has been changed (e.g.

```

js   function registerConfigChangeCallback( callback)
cpp  int registerConfigChangeCallback( YModuleConfigChangeCallback callback)
m    -(int) registerConfigChangeCallback : (YModuleConfigChangeCallback _Nullable) callback
pas   LongInt registerConfigChangeCallback( callback: TYModuleConfigChangeCallback): LongInt
vb    function registerConfigChangeCallback( ByVal callback As YModuleConfigChangeCallback) As Integer
cs    int registerConfigChangeCallback( ConfigChangeCallback callback)
java   int registerConfigChangeCallback( ConfigChangeCallback callback)
uwp   async Task<int> registerConfigChangeCallback( ConfigChangeCallback callback)
py    registerConfigChangeCallback( callback)
php   function registerConfigChangeCallback( $callback)
ts    async registerConfigChangeCallback( callback: YModuleConfigChangeCallback | null):
                  Promise<number>
es    async registerConfigChangeCallback( callback)

```

change of unit, etc).

Parameters :

callback a procedure taking a YModule parameter, or null

module→registerLogCallback()**YModule**

Registers a device log callback function.

js	<code>function registerLogCallback(callback)</code>
cpp	<code>int registerLogCallback(YModuleLogCallback callback)</code>
m	<code>-(int) registerLogCallback : (YModuleLogCallback _Nullable) callback</code>
pas	<code>LongInt registerLogCallback(callback: TYModuleLogCallback): LongInt</code>
vb	<code>function registerLogCallback(ByVal callback As YModuleLogCallback) As Integer</code>
cs	<code>int registerLogCallback(LogCallback callback)</code>
java	<code>int registerLogCallback(LogCallback callback)</code>
uwp	<code>async Task<int> registerLogCallback(LogCallback callback)</code>
py	<code>registerLogCallback(callback)</code>
php	<code>function registerLogCallback(\$callback)</code>
ts	<code>async registerLogCallback(callback: YModuleLogCallback null): Promise<number></code>
es	<code>async registerLogCallback(callback)</code>

This callback will be called each time that a module sends a new log message. Mostly useful to debug a Yoctopuce module.

Parameters :

callback the callback function to call, or a null pointer. The callback function should take two arguments: the module object that emitted the log message, and the character string containing the log.

module→revertFromFlash()**YModule**

Reloads the settings stored in the nonvolatile memory, as when the module is powered on.

js	function revertFromFlash()
cpp	int revertFromFlash()
m	- (int) revertFromFlash
pas	LongInt revertFromFlash(): LongInt
vb	function revertFromFlash() As Integer
cs	int revertFromFlash()
java	int revertFromFlash()
uwp	async Task<int> revertFromFlash()
py	revertFromFlash()
php	function revertFromFlash()
ts	async revertFromFlash(): Promise<number>
es	async revertFromFlash()
dnp	int revertFromFlash()
cp	int revertFromFlash()
cmd	YModule target revertFromFlash

Returns :

YAPI.SUCCESS when the call succeeds.

On failure, throws an exception or returns a negative error code.

module→saveToFlash()**YModule**

Saves current settings in the nonvolatile memory of the module.

<code>js</code>	<code>function saveToFlash()</code>
<code>cpp</code>	<code>int saveToFlash()</code>
<code>m</code>	<code>- (int) saveToFlash</code>
<code>pas</code>	<code>LongInt saveToFlash(): LongInt</code>
<code>vb</code>	<code>function saveToFlash() As Integer</code>
<code>cs</code>	<code>int saveToFlash()</code>
<code>java</code>	<code>int saveToFlash()</code>
<code>uwp</code>	<code>async Task<int> saveToFlash()</code>
<code>py</code>	<code>saveToFlash()</code>
<code>php</code>	<code>function saveToFlash()</code>
<code>ts</code>	<code>async saveToFlash(): Promise<number></code>
<code>es</code>	<code>async saveToFlash()</code>
<code>dnp</code>	<code>int saveToFlash()</code>
<code>cp</code>	<code>int saveToFlash()</code>
<code>cmd</code>	<code>YModule target saveToFlash</code>

Warning: the number of allowed save operations during a module life is limited (about 100000 cycles). Do not call this function within a loop.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

module→set_allSettings()**YModule****module→setAllSettings()**

Restores all the settings of the device.

js	<code>function set_allSettings(settings)</code>
cpp	<code>int set_allSettings(string settings)</code>
m	<code>-(int) setAllSettings : (NSData*) settings</code>
pas	<code>LongInt set_allSettings(settings: TByteArray): LongInt</code>
vb	<code>procedure set_allSettings(ByVal settings As Byte())</code>
cs	<code>int set_allSettings(byte[] settings)</code>
java	<code>int set_allSettings(byte[] settings)</code>
uwp	<code>async Task<int> set_allSettings(byte[] settings)</code>
py	<code>set_allSettings(settings)</code>
php	<code>function set_allSettings(\$settings)</code>
ts	<code>async set_allSettings(settings: Uint8Array): Promise<number></code>
es	<code>async set_allSettings(settings)</code>
dnp	<code>int set_allSettings(byte[] settings)</code>
cp	<code>int set_allSettings(string settings)</code>
cmd	<code>YModule target set_allSettings settings</code>

Useful to restore all the logical names and calibrations parameters of a module from a backup. Remember to call the `saveToFlash()` method of the module if the modifications must be kept.

Parameters :

settings a binary buffer with all the settings.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

module→set_allSettingsAndFiles()**YModule****module→setAllSettingsAndFiles()**

Restores all the settings and uploaded files to the module.

js	<code>function set_allSettingsAndFiles(settings)</code>
cpp	<code>int set_allSettingsAndFiles(string settings)</code>
m	<code>-(int) setAllSettingsAndFiles : (NSData*) settings</code>
pas	<code>LongInt set_allSettingsAndFiles(settings: TByteArray): LongInt</code>
vb	<code>procedure set_allSettingsAndFiles(ByVal settings As Byte())</code>
cs	<code>int set_allSettingsAndFiles(byte[] settings)</code>
java	<code>int set_allSettingsAndFiles(byte[] settings)</code>
uwp	<code>async Task<int> set_allSettingsAndFiles(byte[] settings)</code>
py	<code>set_allSettingsAndFiles(settings)</code>
php	<code>function set_allSettingsAndFiles(\$settings)</code>
ts	<code>async set_allSettingsAndFiles(settings: Uint8Array): Promise<number></code>
es	<code>async set_allSettingsAndFiles(settings)</code>
dnp	<code>int set_allSettingsAndFiles(byte[] settings)</code>
cp	<code>int set_allSettingsAndFiles(string settings)</code>
cmd	<code>YModule target set_allSettingsAndFiles settings</code>

This method is useful to restore all the logical names and calibrations parameters, uploaded files etc. of a device from a backup. Remember to call the `saveToFlash()` method of the module if the modifications must be kept.

Parameters :

settings a binary buffer with all the settings.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

module→set_beacon()**YModule****module→setBeacon()**

Turns on or off the module localization beacon.

<code>js</code>	<code>function set_beacon(newval)</code>
<code>cpp</code>	<code>int set_beacon(Y_BEACON_enum newval)</code>
<code>m</code>	<code>-(int) setBeacon : (Y_BEACON_enum) newval</code>
<code>pas</code>	<code>integer set_beacon(newval: Integer): integer</code>
<code>vb</code>	<code>function set_beacon(ByVal newval As Integer) As Integer</code>
<code>cs</code>	<code>int set_beacon(int newval)</code>
<code>java</code>	<code>int set_beacon(int newval)</code>
<code>uwp</code>	<code>async Task<int> set_beacon(int newval)</code>
<code>py</code>	<code>set_beacon(newval)</code>
<code>php</code>	<code>function set_beacon(\$newval)</code>
<code>ts</code>	<code>async set_beacon(newval: YModule_Beacon): Promise<number></code>
<code>es</code>	<code>async set_beacon(newval)</code>
<code>dnp</code>	<code>int set_beacon(int newval)</code>
<code>cp</code>	<code>int set_beacon(int newval)</code>
<code>cmd</code>	<code>YModule target set_beacon newval</code>

Parameters :

`newval` either `YModule.BEACON_OFF` or `YModule.BEACON_ON`

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

module→set_logicalName()**YModule****module→setLogicalName()**

Changes the logical name of the module.

js	<code>function set_logicalName(newval)</code>
cpp	<code>int set_logicalName(string newval)</code>
m	<code>-(int) setLogicalName : (NSString*) newval</code>
pas	<code>integer set_logicalName(newval: string): integer</code>
vb	<code>function set_logicalName(ByVal newval As String) As Integer</code>
cs	<code>int set_logicalName(string newval)</code>
java	<code>int set_logicalName(String newval)</code>
uwp	<code>async Task<int> set_logicalName(string newval)</code>
py	<code>set_logicalName(newval)</code>
php	<code>function set_logicalName(\$newval)</code>
ts	<code>async set_logicalName(newval: string): Promise<number></code>
es	<code>async set_logicalName(newval)</code>
dnp	<code>int set_logicalName(string newval)</code>
cp	<code>int set_logicalName(string newval)</code>
cmd	<code>YModule target set_logicalName newval</code>

You can use `yCheckLogicalName()` prior to this call to make sure that your parameter is valid. Remember to call the `saveToFlash()` method of the module if the modification must be kept.

Parameters :

newval a string corresponding to the logical name of the module

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

module→set_luminosity()**YModule****module→setLuminosity()**

Changes the luminosity of the module informative leds.

js	function set_luminosity(newval)
cpp	int set_luminosity(int newval)
m	- (int) setLuminosity : (int) newval
pas	integer set_luminosity(newval: LongInt): integer
vb	function set_luminosity(ByVal newval As Integer) As Integer
cs	int set_luminosity(int newval)
java	int set_luminosity(int newval)
uwp	async Task<int> set_luminosity(int newval)
py	set_luminosity(newval)
php	function set_luminosity(\$newval)
ts	async set_luminosity(newval: number): Promise<number>
es	async set_luminosity(newval)
dnp	int set_luminosity(int newval)
cp	int set_luminosity(int newval)
cmd	YModule target set_luminosity newval

The parameter is a value between 0 and 100. Remember to call the `saveToFlash()` method of the module if the modification must be kept.

Parameters :

newval an integer corresponding to the luminosity of the module informative leds

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

module→set(userData)**YModule****module→setUserData()**

Stores a user context provided as argument in the userData attribute of the function.

js	<code>function set(userData(data)</code>
cpp	<code>void set(userData(void * data)</code>
m	<code>-(void) setUserData : (id) data</code>
pas	<code>set(userData(data: TObject)</code>
vb	<code>procedure set(userData(ByVal data As Object)</code>
cs	<code>void set(userData(object data)</code>
java	<code>void set(userData(Object data)</code>
py	<code>set(userData(data)</code>
php	<code>function set(userData(\$data)</code>
ts	<code>async set(userData(data: object null): Promise<void></code>
es	<code>async set(userData(data)</code>

This attribute is never touched by the API, and is at disposal of the caller to store a context.

Parameters :

data any kind of object to be stored

module→set_userVar()**YModule****module→setUserVar()**

Stores a 32 bit value in the device RAM.

<code>js</code>	<code>function set_userVar(newval)</code>
<code>cpp</code>	<code>int set_userVar(int newval)</code>
<code>m</code>	<code>-(int) setUserVar : (int) newval</code>
<code>pas</code>	<code>integer set_userVar(newval: LongInt): integer</code>
<code>vb</code>	<code>function set_userVar(ByVal newval As Integer) As Integer</code>
<code>cs</code>	<code>int set_userVar(int newval)</code>
<code>java</code>	<code>int set_userVar(int newval)</code>
<code>uwp</code>	<code>async Task<int> set_userVar(int newval)</code>
<code>py</code>	<code>set_userVar(newval)</code>
<code>php</code>	<code>function set_userVar(\$newval)</code>
<code>ts</code>	<code>async set_userVar(newval: number): Promise<number></code>
<code>es</code>	<code>async set_userVar(newval)</code>
<code>dnp</code>	<code>int set_userVar(int newval)</code>
<code>cp</code>	<code>int set_userVar(int newval)</code>
<code>cmd</code>	<code>YModule target set_userVar newval</code>

This attribute is at programmer disposal, should he need to store a state variable. On startup and after a device reboot, the value is always reset to zero.

Parameters :

`newval` an integer

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

module→triggerConfigChangeCallback()**YModule**

Triggers a configuration change callback, to check if they are supported or not.

js	function triggerConfigChangeCallback()
cpp	int triggerConfigChangeCallback()
m	- (int) triggerConfigChangeCallback
pas	LongInt triggerConfigChangeCallback(): LongInt
vb	function triggerConfigChangeCallback() As Integer
cs	int triggerConfigChangeCallback()
java	int triggerConfigChangeCallback()
uwp	async Task<int> triggerConfigChangeCallback()
py	triggerConfigChangeCallback()
php	function triggerConfigChangeCallback()
ts	async triggerConfigChangeCallback(): Promise<number>
es	async triggerConfigChangeCallback()
dnp	int triggerConfigChangeCallback()
cp	int triggerConfigChangeCallback()
cmd	YModule target triggerConfigChangeCallback

module→triggerFirmwareUpdate()**YModule**

Schedules a module reboot into special firmware update mode.

js	function triggerFirmwareUpdate(secBeforeReboot)
cpp	int triggerFirmwareUpdate(int secBeforeReboot)
m	- (int) triggerFirmwareUpdate : (int) secBeforeReboot
pas	LongInt triggerFirmwareUpdate(secBeforeReboot: LongInt): LongInt
vb	function triggerFirmwareUpdate(ByVal secBeforeReboot As Integer) As Integer
cs	int triggerFirmwareUpdate(int secBeforeReboot)
java	int triggerFirmwareUpdate(int secBeforeReboot)
uwp	async Task<int> triggerFirmwareUpdate(int secBeforeReboot)
py	triggerFirmwareUpdate(secBeforeReboot)
php	function triggerFirmwareUpdate(\$secBeforeReboot)
ts	async triggerFirmwareUpdate(secBeforeReboot: number): Promise<number>
es	async triggerFirmwareUpdate(secBeforeReboot)
dnp	int triggerFirmwareUpdate(int secBeforeReboot)
cp	int triggerFirmwareUpdate(int secBeforeReboot)
cmd	YModule target triggerFirmwareUpdate secBeforeReboot

Parameters :

secBeforeReboot number of seconds before rebooting

Returns :

YAPI.SUCCESS when the call succeeds.

On failure, throws an exception or returns a negative error code.

module→updateFirmware()**YModule**

Prepares a firmware update of the module.

js	<code>function updateFirmware(path)</code>
cpp	<code>YFirmwareUpdate updateFirmware(string path)</code>
m	<code>-(YFirmwareUpdate*) updateFirmware : (NSString*) path</code>
pas	<code>TYFirmwareUpdate updateFirmware(path: string): TYFirmwareUpdate</code>
vb	<code>function updateFirmware(ByVal path As String) As YFirmwareUpdate</code>
cs	<code>YFirmwareUpdate updateFirmware(string path)</code>
java	<code>YFirmwareUpdate updateFirmware(String path)</code>
uwp	<code>async Task<YFirmwareUpdate> updateFirmware(string path)</code>
py	<code>updateFirmware(path)</code>
php	<code>function updateFirmware(\$path)</code>
ts	<code>async updateFirmware(path: string): Promise<YFirmwareUpdate></code>
es	<code>async updateFirmware(path)</code>
dnp	<code>YFirmwareUpdateProxy updateFirmware(string path)</code>
cp	<code>YFirmwareUpdateProxy* updateFirmware(string path)</code>
cmd	<code>YModule target updateFirmware path</code>

This method returns a `YFirmwareUpdate` object which handles the firmware update process.

Parameters :

path the path of the .byn file to use.

Returns :

a `YFirmwareUpdate` object or NULL on error.

module→updateFirmwareEx()**YModule**

Prepares a firmware update of the module.

```

js   function updateFirmwareEx( path, force)
cpp  YFirmwareUpdate updateFirmwareEx( string path, bool force)
m    -(YFirmwareUpdate*) updateFirmwareEx : (NSString*) path
      : (bool) force
pas  TYFirmwareUpdate updateFirmwareEx( path: string, force: boolean): TYFirmwareUpdate
vb   function updateFirmwareEx( ByVal path As String,
                               ByVal force As Boolean) As YFirmwareUpdate
cs   YFirmwareUpdate updateFirmwareEx( string path, bool force)
java  YFirmwareUpdate updateFirmwareEx( String path, boolean force)
uwp   async Task<YFirmwareUpdate> updateFirmwareEx( string path, bool force)
py    updateFirmwareEx( path, force)
php   function updateFirmwareEx( $path, $force)
ts    async updateFirmwareEx( path: string, force: boolean): Promise<YFirmwareUpdate>
es    async updateFirmwareEx( path, force)
dnp   YFirmwareUpdateProxy updateFirmwareEx( string path, bool force)
cp    YFirmwareUpdateProxy* updateFirmwareEx( string path,
                                              bool force)
cmd  YModule target updateFirmwareEx path force

```

This method returns a `YFirmwareUpdate` object which handles the firmware update process.

Parameters :

path the path of the `.byn` file to use.

force true to force the firmware update even if some prerequisites appear not to be met

Returns :

a `YFirmwareUpdate` object or NULL on error.

module→wait_async()**YModule**

Waits for all pending asynchronous commands on the module to complete, and invoke the user-provided callback function.

```
js  function wait_async( callback, context)
ts  wait_async( callback: Function, context: object)
es  wait_async( callback, context)
```

The callback function can therefore freely issue synchronous or asynchronous commands, without risking to block the JavaScript VM.

Parameters :

callback callback function that is invoked when all pending commands on the module are completed. The callback function receives two arguments: the caller-specific context object and the receiving function object.

context caller-specific object that is passed as-is to the callback function

Returns :

nothing.

23.3. Class YDigitalIO

Digital IO port control interface, available for instance in the Yocto-IO or the Yocto-Maxi-IO-V2

The YDigitalIO class allows you to drive a Yoctopuce digital input/output port. It can be used to setup the direction of each channel, to read the state of each channel and to switch the state of each channel configures as an output. You can work on all channels at once, or one by one. Most functions use a binary representation for channels where bit 0 matches channel #0 , bit 1 matches channel #1 and so on. If you are not familiar with numbers binary representation, you will find more information here: https://en.wikipedia.org/wiki/Binary_number#Representation. It is also possible to automatically generate short pulses of a determined duration. Electrical behavior of each I/O can be modified (open drain and reverse polarity).

In order to use the functions described here, you should include:

es	in HTML: <script src="../../lib/yocto_digitalio.js"></script>
js	in node.js: require('yoctolib-es2017/yocto_digitalio.js');
cpp	<script type='text/javascript' src='yocto_digitalio.js'></script>
m	#include "yocto_digitalio.h"
pas	#import "yocto_digitalio.h"
vb	uses yocto_digitalio;
cs	yocto_digitalio.vb
java	import com.yoctopuce.YoctoAPI.YDigitalIO;
uwp	import com.yoctopuce.YoctoAPI.YDigitalIO;
py	from yocto_digitalio import *
php	require_once('yocto_digitalio.php');
ts	in HTML: import { YDigitalIO } from '../../dist/esm/yocto_digitalio.js'; in Node.js: import { YDigitalIO } from 'yoctolib-cjs/yocto_digitalio.js';
dnp	import YoctoProxyAPI.YDigitalIOProxy
cp	#include "yocto_digitalio_proxy.h"
vi	YDigitalIO.vi
ml	import YoctoProxyAPI.YDigitalIOProxy

Global functions

YDigitalIO.FindDigitalIO(func)

Retrieves a digital IO port for a given identifier.

YDigitalIO.FindDigitalIOInContext(yctx, func)

Retrieves a digital IO port for a given identifier in a YAPI context.

YDigitalIO.FirstDigitalIO()

Starts the enumeration of digital IO ports currently accessible.

YDigitalIO.FirstDigitalIOInContext(yctx)

Starts the enumeration of digital IO ports currently accessible.

YDigitalIO.GetSimilarFunctions()

Enumerates all functions of type DigitalIO available on the devices currently reachable by the library, and returns their unique hardware ID.

YDigitalIO properties

digitalio→AdvertisedValue [read-only]

Short string representing the current state of the function.

digitalio→FriendlyName [read-only]

Global identifier of the function in the format MODULE_NAME . FUNCTION_NAME.

digitalio→FunctionId [read-only]

Hardware identifier of the digital IO port, without reference to the module.

digitalio→HardwareId [read-only]

Unique hardware identifier of the function in the form SERIAL . FUNCTIONID.

digitalio→IsOnline [read-only]

Checks if the function is currently reachable.

digitalio→LogicalName [writable]

Logical name of the function.

digitalio→OutputVoltage [writable]

Voltage source used to drive output bits.

digitalio→PortDirection [writable]

I/O direction of all channels of the port (bitmap): 0 makes a bit an input, 1 makes it an output.

digitalio→PortOpenDrain [writable]

Electrical interface for each bit of the port.

digitalio→PortPolarity [writable]

Polarity of all the bits of the port.

digitalio→PortSize [read-only]

Number of bits (i.e.

digitalio→PortState [writable]

Digital IO port state as an integer with each bit representing a channel.

digitalio→SerialNumber [read-only]

Serial number of the module, as set by the factory.

YDigitalIO methods

digitalio→clearCache()

Invalidates the cache.

digitalio→delayedPulse(bitno, ms_delay, ms_duration)

Schedules a pulse on a single bit for a specified duration.

digitalio→describe()

Returns a short text that describes unambiguously the instance of the digital IO port in the form TYPE (NAME) = SERIAL . FUNCTIONID.

digitalio→get_advertisedValue()

Returns the current value of the digital IO port (no more than 6 characters).

digitalio→get_bitDirection(bitno)

Returns the direction of a single bit (i.e.

digitalio→get_bitOpenDrain(bitno)

Returns the type of electrical interface of a single bit from the I/O port.

digitalio→get_bitPolarity(bitno)

Returns the polarity of a single bit from the I/O port (0 means the I/O works in regular mode, 1 means the I/O works in reverse mode).

digitalio→get_bitState(bitno)

Returns the state of a single bit (i.e.

digitalio→get_errorMessage()

Returns the error message of the latest error with the digital IO port.

digitalio→get_errorType()

Returns the numerical error code of the latest error with the digital IO port.

digitalio→get_friendlyName()

Returns a global identifier of the digital IO port in the format MODULE_NAME . FUNCTION_NAME.

digitalio→get_functionDescriptor()

Returns a unique identifier of type YFUN_DESCR corresponding to the function.

digitalio→get_functionId()

Returns the hardware identifier of the digital IO port, without reference to the module.

digitalio→get_hardwareId()

Returns the unique hardware identifier of the digital IO port in the form SERIAL . FUNCTIONID.

digitalio→get_logicalName()

Returns the logical name of the digital IO port.

digitalio→get_module()

Gets the YModule object for the device on which the function is located.

digitalio→get_module_async(callback, context)

Gets the YModule object for the device on which the function is located (asynchronous version).

digitalio→get_outputVoltage()

Returns the voltage source used to drive output bits.

digitalio→get_portDiags()

Returns the port state diagnostics (Yocto-IO and Yocto-MaxiO-V2 only).

digitalio→get_portDirection()

Returns the I/O direction of all channels of the port (bitmap): 0 makes a bit an input, 1 makes it an output.

digitalio→get_portOpenDrain()

Returns the electrical interface for each bit of the port.

digitalio→get_portPolarity()

Returns the polarity of all the bits of the port.

digitalio→get_portSize()

Returns the number of bits (i.e.

digitalio→get_portState()

Returns the digital IO port state as an integer with each bit representing a channel.

digitalio→get_serialNumber()

Returns the serial number of the module, as set by the factory.

digitalio→get(userData)

Returns the value of the userData attribute, as previously stored using method `set(userData)`.

digitalio→isOnline()

Checks if the digital IO port is currently reachable, without raising any error.

digitalio→isOnline_async(callback, context)

Checks if the digital IO port is currently reachable, without raising any error (asynchronous version).

digitalio→isReadOnly()

Test if the function is readOnly.

digitalio→load(msValidity)

Preloads the digital IO port cache with a specified validity duration.

digitalio→loadAttribute(attrName)

Returns the current value of a single function attribute, as a text string, as quickly as possible but without using the cached value.

digitalio→load_async(msValidity, callback, context)

Preloads the digital IO port cache with a specified validity duration (asynchronous version).

`digitalio→muteValueCallbacks()`

Disables the propagation of every new advertised value to the parent hub.

`digitalio→nextDigitalIO()`

Continues the enumeration of digital IO ports started using `yFirstDigitalIO()`.

`digitalio→pulse(bitno, ms_duration)`

Triggers a pulse on a single bit for a specified duration.

`digitalio→registerValueCallback(callback)`

Registers the callback function that is invoked on every change of advertised value.

`digitalio→set_bitDirection(bitno, bitdirection)`

Changes the direction of a single bit (i.e.

`digitalio→set_bitOpenDrain(bitno, opendrain)`

Changes the electrical interface of a single bit from the I/O port.

`digitalio→set_bitPolarity(bitno, bitpolarity)`

Changes the polarity of a single bit from the I/O port.

`digitalio→set_bitState(bitno, bitstate)`

Sets a single bit (i.e.

`digitalio→set_logicalName(newval)`

Changes the logical name of the digital IO port.

`digitalio→set_outputVoltage(newval)`

Changes the voltage source used to drive output bits.

`digitalio→set_portDirection(newval)`

Changes the I/O direction of all channels of the port (bitmap): 0 makes a bit an input, 1 makes it an output.

`digitalio→set_portOpenDrain(newval)`

Changes the electrical interface for each bit of the port.

`digitalio→set_portPolarity(newval)`

Changes the polarity of all the bits of the port: For each bit set to 0, the matching I/O works the regular, intuitive way; for each bit set to 1, the I/O works in reverse mode.

`digitalio→set_portState(newval)`

Changes the state of all digital IO port's channels at once: the parameter is an integer where each bit represents a channel, with bit 0 matching channel #0.

`digitalio→set(userData)`

Stores a user context provided as argument in the `userData` attribute of the function.

`digitalio→toggle_bitState(bitno)`

Reverts a single bit (i.e.

`digitalio→unmuteValueCallbacks()`

Re-enables the propagation of every new advertised value to the parent hub.

`digitalio→wait_async(callback, context)`

Waits for all pending asynchronous commands on the module to complete, and invoke the user-provided callback function.

YDigitalIO.FindDigitalIO()**YDigitalIO****YDigitalIO.FindDigitalIO()**

Retrieves a digital IO port for a given identifier.

<code>js</code>	<code>function yFindDigitalIO(func)</code>
<code>cpp</code>	<code>YDigitalIO* FindDigitalIO(string func)</code>
<code>m</code>	<code>+ (YDigitalIO*) FindDigitalIO : (NSString*) func</code>
<code>pas</code>	<code>TYDigitalIO yFindDigitalIO(func: string): TYDigitalIO</code>
<code>vb</code>	<code>function FindDigitalIO(ByVal func As String) As YDigitalIO</code>
<code>cs</code>	<code>static YDigitalIO FindDigitalIO(string func)</code>
<code>java</code>	<code>static YDigitalIO FindDigitalIO(String func)</code>
<code>uwp</code>	<code>static YDigitalIO FindDigitalIO(string func)</code>
<code>py</code>	<code>FindDigitalIO(func)</code>
<code>php</code>	<code>function FindDigitalIO(\$func)</code>
<code>ts</code>	<code>static FindDigitalIO(func: string): YDigitalIO</code>
<code>es</code>	<code>static FindDigitalIO(func)</code>
<code>dnp</code>	<code>static YDigitalIOPrinter FindDigitalIO(string func)</code>
<code>cp</code>	<code>static YDigitalIOPrinter * FindDigitalIO(string func)</code>

The identifier can be specified using several formats:

- FunctionLogicalName
- ModuleSerialNumber.FunctionIdentifier
- ModuleSerialNumber.FunctionLogicalName
- ModuleLogicalName.FunctionIdentifier
- ModuleLogicalName.FunctionLogicalName

This function does not require that the digital IO port is online at the time it is invoked. The returned object is nevertheless valid. Use the method `YDigitalIO.isOnline()` to test if the digital IO port is indeed online at a given time. In case of ambiguity when looking for a digital IO port by logical name, no error is notified: the first instance found is returned. The search is performed first by hardware name, then by logical name.

If a call to this object's `is_online()` method returns FALSE although you are certain that the matching device is plugged, make sure that you did call `registerHub()` at application initialization time.

Parameters :

`func` a string that uniquely characterizes the digital IO port, for instance `YMINIIO0.digitalIO`.

Returns :

a `YDigitalIO` object allowing you to drive the digital IO port.

YDigitalIO.FindDigitalIOInContext()

YDigitalIO

Retrieves a digital IO port for a given identifier in a YAPI context.

<code>java</code>	<code>static YDigitalIO FindDigitalIOInContext(YAPIContext yctx, String func)</code>
<code>uwp</code>	<code>static YDigitalIO FindDigitalIOInContext(YAPIContext yctx, string func)</code>
<code>ts</code>	<code>static FindDigitalIOInContext(yctx: YAPIContext, func: string): YDigitalIO</code>
<code>es</code>	<code>static FindDigitalIOInContext(yctx, func)</code>

The identifier can be specified using several formats:

- FunctionLogicalName
- ModuleSerialNumber.FunctionIdentifier
- ModuleSerialNumber.FunctionLogicalName
- ModuleLogicalName.FunctionIdentifier
- ModuleLogicalName.FunctionLogicalName

This function does not require that the digital IO port is online at the time it is invoked. The returned object is nevertheless valid. Use the method `YDigitalIO.isOnline()` to test if the digital IO port is indeed online at a given time. In case of ambiguity when looking for a digital IO port by logical name, no error is notified: the first instance found is returned. The search is performed first by hardware name, then by logical name.

Parameters :

yctx a YAPI context

func a string that uniquely characterizes the digital IO port, for instance `YMINIIO0.digitalIO`.

Returns :

a `YDigitalIO` object allowing you to drive the digital IO port.

YDigitalIO.FirstDigitalIO()**YDigitalIO****YDigitalIO.FirstDigitalIO()**

Starts the enumeration of digital IO ports currently accessible.

js	function yFirstDigitalIO()
cpp	YDigitalIO * FirstDigitalIO()
m	+(YDigitalIO*) FirstDigitalIO
pas	TYDigitalIO yFirstDigitalIO() : TYDigitalIO
vb	function FirstDigitalIO() As YDigitalIO
cs	static YDigitalIO FirstDigitalIO()
java	static YDigitalIO FirstDigitalIO()
uwp	static YDigitalIO FirstDigitalIO()
py	FirstDigitalIO()
php	function FirstDigitalIO()
ts	static FirstDigitalIO() : YDigitalIO null
es	static FirstDigitalIO()

Use the method `YDigitalIO.nextDigitalIO()` to iterate on next digital IO ports.

Returns :

a pointer to a `YDigitalIO` object, corresponding to the first digital IO port currently online, or a null pointer if there are none.

YDigitalIO.FirstDigitalIOInContext() YDigitalIO.FirstDigitalIOInContext()

YDigitalIO

Starts the enumeration of digital IO ports currently accessible.

```
java static YDigitalIO FirstDigitalIOInContext( YAPIContext yctx)
uwp static YDigitalIO FirstDigitalIOInContext( YAPIContext yctx)
ts static FirstDigitalIOInContext( yctx: YAPIContext): YDigitalIO | null
es static FirstDigitalIOInContext( yctx)
```

Use the method `YDigitalIO.nextDigitalIO()` to iterate on next digital IO ports.

Parameters :

`yctx` a YAPI context.

Returns :

a pointer to a `YDigitalIO` object, corresponding to the first digital IO port currently online, or a `null` pointer if there are none.

YDigitalIO.GetSimilarFunctions()**YDigitalIO****YDigitalIO.GetSimilarFunctions()**

Enumerates all functions of type DigitalIO available on the devices currently reachable by the library, and returns their unique hardware ID.

dnp static new string[] **GetSimilarFunctions()**

cp static vector<string> **GetSimilarFunctions()**

Each of these IDs can be provided as argument to the method `YDigitalIO.FindDigitalIO` to obtain an object that can control the corresponding device.

Returns :

an array of strings, each string containing the unique hardwareId of a device function currently connected.

digitalio→AdvertisedValue**YDigitalIO**

Short string representing the current state of the function.

dnp | **string AdvertisedValue**

digitalio→FriendlyName**YDigitalIO**

Global identifier of the function in the format MODULE_NAME.FUNCTION_NAME.

dnp string **FriendlyName**

The returned string uses the logical names of the module and of the function if they are defined, otherwise the serial number of the module and the hardware identifier of the function (for example: MyCustomName.relay1)

digitalio→FunctionId**YDigitalIO**

Hardware identifier of the digital IO port, without reference to the module.

dnp string **FunctionId**

For example `relay1`

digitalio→HardwareId**YDigitalIO**

Unique hardware identifier of the function in the form SERIAL.FUNCTIONID.

dnp string **HardwareId**

The unique hardware identifier is composed of the device serial number and of the hardware identifier of the function (for example RELAY01-123456.relay1).

digitalio→IsOnline**YDigitalIO**

Checks if the function is currently reachable.

dnp **bool IsOnline**

If there is a cached value for the function in cache, that has not yet expired, the device is considered reachable. No exception is raised if there is an error while trying to contact the device hosting the function.

digitalio→LogicalName**YDigitalIO**

Logical name of the function.

dnp string **LogicalName**

Writable. You can use `yCheckLogicalName()` prior to this call to make sure that your parameter is valid. Remember to call the `saveToFlash()` method of the module if the modification must be kept.

digitalio→OutputVoltage**YDigitalIO**

Voltage source used to drive output bits.

dnp int **OutputVoltage**

Writable. Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

digitalio→PortDirection**YDigitalIO**

I/O direction of all channels of the port (bitmap): 0 makes a bit an input, 1 makes it an output.

dnp int **PortDirection**

Writable. Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

digitalio→PortOpenDrain

YDigitalIO

Electrical interface for each bit of the port.

dnp int PortOpenDrain

For each bit set to 0 the matching I/O works in the regular, intuitive way, for each bit set to 1, the I/O works in reverse mode.

Writable. 0 makes a bit a regular input/output, 1 makes it an open-drain (open-collector) input/output. Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

digitalio→PortPolarity

YDigitalIO

Polarity of all the bits of the port.

dnp int PortPolarity

For each bit set to 0, the matching I/O works the regular, intuitive way; for each bit set to 1, the I/O works in reverse mode.

Writable. For each bit set to 0, the matching I/O works the regular, intuitive way; for each bit set to 1, the I/O works in reverse mode. Remember to call the `saveToFlash()` method to make sure the setting will be kept after a reboot.

digitalio→PortSize**YDigitalIO**

Number of bits (i.e.

dnp int **PortSize**

channels)implemented in the I/O port.

digitalio→PortState**YDigitalIO**

Digital IO port state as an integer with each bit representing a channel.

dnp int **PortState**

value 0 = 0b00000000 -> all channels are OFF value 1 = 0b00000001 -> channel #0 is ON value 2 = 0b00000010 -> channel #1 is ON value 3 = 0b00000011 -> channels #0 and #1 are ON value 4 = 0b00000100 -> channel #2 is ON and so on...

Writable. Changes the state of all digital IO port's channels at once: the parameter is an integer where each bit represents a channel, with bit 0 matching channel #0. To set all channels to 0 -> 0b00000000 -> parameter = 0 To set channel #0 to 1 -> 0b00000001 -> parameter = 1 To set channel #1 to 1 -> 0b00000010 -> parameter = 2 To set channel #0 and #1 -> 0b00000011 -> parameter = 3 To set channel #2 to 1 -> 0b00000100 -> parameter = 4 and so on.... Only channels configured as outputs will be affected, according to the value configured using `set_portDirection`.

digitalio→SerialNumber**YDigitalIO**

Serial number of the module, as set by the factory.

dnp string **SerialNumber**

digitalio→clearCache()**YDigitalIO**

Invalidates the cache.

js	function clearCache()
cpp	void clearCache()
m	-(void) clearCache
pas	clearCache()
vb	procedure clearCache()
cs	void clearCache()
java	void clearCache()
py	clearCache()
php	function clearCache()
ts	async clearCache() : Promise<void>
es	async clearCache()

Invalidates the cache of the digital IO port attributes. Forces the next call to get_xxx() or loadxxx() to use values that come from the device.

digitalio→delayedPulse()

YDigitalIO

Schedules a pulse on a single bit for a specified duration.

```

js   function delayedPulse( bitno, ms_delay, ms_duration)
cpp  int delayedPulse( int bitno, int ms_delay, int ms_duration)
m    -(int) delayedPulse : (int) bitno
           : (int) ms_delay
           : (int) ms_duration
pas  LongInt delayedPulse( bitno: LongInt,
                           ms_delay: LongInt,
                           ms_duration: LongInt): LongInt
vb   function delayedPulse( ByVal bitno As Integer,
                           ByVal ms_delay As Integer,
                           ByVal ms_duration As Integer) As Integer
cs   int delayedPulse( int bitno, int ms_delay, int ms_duration)
java int delayedPulse( int bitno, int ms_delay, int ms_duration)
uwp  async Task<int> delayedPulse( int bitno, int ms_delay, int ms_duration)
py   delayedPulse( bitno, ms_delay, ms_duration)
php  function delayedPulse( $bitno, $ms_delay, $ms_duration)
ts   async delayedPulse( bitno: number, ms_delay: number, ms_duration: number): Promise<number>
es   async delayedPulse( bitno, ms_delay, ms_duration)
dnp  int delayedPulse( int bitno, int ms_delay, int ms_duration)
cp   int delayedPulse( int bitno, int ms_delay, int ms_duration)
cmd  YDigitalIO target delayedPulse bitno ms_delay ms_duration

```

The specified bit will be turned to 1, and then back to 0 after the given duration.

Parameters :

bitno the bit number; lowest bit has index 0
ms_delay waiting time before the pulse, in milliseconds
ms_duration desired pulse duration in milliseconds. Be aware that the device time resolution is not guaranteed up to the millisecond.

Returns :

YAPI.SUCCESS if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→describe()**YDigitalIO**

Returns a short text that describes unambiguously the instance of the digital IO port in the form
 TYPE (NAME)=SERIAL.FUNCTIONID.

js	function describe()
cpp	string describe()
m	- (NSString*) describe
pas	string describe() : string
vb	function describe() As String
cs	string describe()
java	String describe()
py	describe()
php	function describe()
ts	async describe() : Promise<string>
es	async describe()

More precisely, TYPE is the type of the function, NAME is the name used for the first access to the function, SERIAL is the serial number of the module if the module is connected or "unresolved", and FUNCTIONID is the hardware identifier of the function if the module is connected. For example, this method returns Relay(MyCustomName.relay1)=RELAYL01-123456.relay1 if the module is already connected or Relay(BadCustomName.relay1)=unresolved if the module has not yet been connected. This method does not trigger any USB or TCP transaction and can therefore be used in a debugger.

Returns :

a string that describes the digital IO port (ex:
 Relay(MyCustomName.relay1)=RELAYL01-123456.relay1)

digitalio→get_advertisedValue()**YDigitalIO****digitalio→advertisedValue()**

Returns the current value of the digital IO port (no more than 6 characters).

<code>js</code>	<code>function get_advertisedValue()</code>
<code>cpp</code>	<code>string get_advertisedValue()</code>
<code>m</code>	<code>-(NSString*) advertisedValue</code>
<code>pas</code>	<code>string get_advertisedValue(): string</code>
<code>vb</code>	<code>function get_advertisedValue() As String</code>
<code>cs</code>	<code>string get_advertisedValue()</code>
<code>java</code>	<code>String get_advertisedValue()</code>
<code>uwp</code>	<code>async Task<string> get_advertisedValue()</code>
<code>py</code>	<code>get_advertisedValue()</code>
<code>php</code>	<code>function get_advertisedValue()</code>
<code>ts</code>	<code>async get_advertisedValue(): Promise<string></code>
<code>es</code>	<code>async get_advertisedValue()</code>
<code>dnp</code>	<code>string get_advertisedValue()</code>
<code>cp</code>	<code>string get_advertisedValue()</code>
<code>cmd</code>	<code>YDigitalIO target get_advertisedValue</code>

Returns :

a string corresponding to the current value of the digital IO port (no more than 6 characters).

On failure, throws an exception or returns `YDigitalIO.ADVERTISEDVALUE_INVALID`.

digitalio→get_bitDirection()**YDigitalIO****digitalio→bitDirection()**

Returns the direction of a single bit (i.e.

js	<code>function get_bitDirection(bitno)</code>
cpp	<code>int get_bitDirection(int bitno)</code>
m	<code>-(int) bitDirection : (int) bitno</code>
pas	<code>LongInt get_bitDirection(bitno: LongInt): LongInt</code>
vb	<code>function get_bitDirection(ByVal bitno As Integer) As Integer</code>
cs	<code>int get_bitDirection(int bitno)</code>
java	<code>int get_bitDirection(int bitno)</code>
uwp	<code>async Task<int> get_bitDirection(int bitno)</code>
py	<code>get_bitDirection(bitno)</code>
php	<code>function get_bitDirection(\$bitno)</code>
ts	<code>async get_bitDirection(bitno: number): Promise<number></code>
es	<code>async get_bitDirection(bitno)</code>
dnp	<code>int get_bitDirection(int bitno)</code>
cp	<code>int get_bitDirection(int bitno)</code>
cmd	<code>YDigitalIO target get_bitDirection bitno</code>

channel) from the I/O port (0 means the bit is an input, 1 an output).

Parameters :

bitno the bit number; lowest bit has index 0

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→get_bitOpenDrain()**YDigitalIO****digitalio→bitOpenDrain()**

Returns the type of electrical interface of a single bit from the I/O port.

js	<code>function get_bitOpenDrain(bitno)</code>
cpp	<code>int get_bitOpenDrain(int bitno)</code>
m	<code>-(int) bitOpenDrain : (int) bitno</code>
pas	<code>LongInt get_bitOpenDrain(bitno: LongInt): LongInt</code>
vb	<code>function get_bitOpenDrain(ByVal bitno As Integer) As Integer</code>
cs	<code>int get_bitOpenDrain(int bitno)</code>
java	<code>int get_bitOpenDrain(int bitno)</code>
uwp	<code>async Task<int> get_bitOpenDrain(int bitno)</code>
py	<code>get_bitOpenDrain(bitno)</code>
php	<code>function get_bitOpenDrain(\$bitno)</code>
ts	<code>async get_bitOpenDrain(bitno: number): Promise<number></code>
es	<code>async get_bitOpenDrain(bitno)</code>
dnp	<code>int get_bitOpenDrain(int bitno)</code>
cp	<code>int get_bitOpenDrain(int bitno)</code>
cmd	<code>YDigitalIO target get_bitOpenDrain bitno</code>

(0 means the bit is an input, 1 an output).

Parameters :

bitno the bit number; lowest bit has index 0

Returns :

0 means the a bit is a regular input/output, 1 means the bit is an open-drain (open-collector) input/output.

On failure, throws an exception or returns a negative error code.

digitalio→get_bitPolarity() digitalio→bitPolarity()

YDigitalIO

Returns the polarity of a single bit from the I/O port (0 means the I/O works in regular mode, 1 means the I/O works in reverse mode).

js	<code>function get_bitPolarity(bitno)</code>
cpp	<code>int get_bitPolarity(int bitno)</code>
m	<code>-(int) bitPolarity : (int) bitno</code>
pas	<code>LongInt get_bitPolarity(bitno: LongInt): LongInt</code>
vb	<code>function get_bitPolarity(ByVal bitno As Integer) As Integer</code>
cs	<code>int get_bitPolarity(int bitno)</code>
java	<code>int get_bitPolarity(int bitno)</code>
uwp	<code>async Task<int> get_bitPolarity(int bitno)</code>
py	<code>get_bitPolarity(bitno)</code>
php	<code>function get_bitPolarity(\$bitno)</code>
ts	<code>async get_bitPolarity(bitno: number): Promise<number></code>
es	<code>async get_bitPolarity(bitno)</code>
dnp	<code>int get_bitPolarity(int bitno)</code>
cp	<code>int get_bitPolarity(int bitno)</code>
cmd	<code>YDigitalIO target get_bitPolarity bitno</code>

Parameters :

bitno the bit number; lowest bit has index 0

Returns :

YAPI.SUCCESS if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→get_bitState()**YDigitalIO****digitalio→bitState()**

Returns the state of a single bit (i.e.

js	<code>function get_bitState(bitno)</code>
cpp	<code>int get_bitState(int bitno)</code>
m	<code>-(int) bitState : (int) bitno</code>
pas	<code>LongInt get_bitState(bitno: LongInt): LongInt</code>
vb	<code>function get_bitState(ByVal bitno As Integer) As Integer</code>
cs	<code>int get_bitState(int bitno)</code>
java	<code>int get_bitState(int bitno)</code>
uwp	<code>async Task<int> get_bitState(int bitno)</code>
py	<code>get_bitState(bitno)</code>
php	<code>function get_bitState(\$bitno)</code>
ts	<code>async get_bitState(bitno: number): Promise<number></code>
es	<code>async get_bitState(bitno)</code>
dnp	<code>int get_bitState(int bitno)</code>
cp	<code>int get_bitState(int bitno)</code>
cmd	<code>YDigitalIO target get_bitState bitno</code>

channel) of the I/O port.

Parameters :

bitno the bit number; lowest bit has index 0

Returns :

the bit state (0 or 1)

On failure, throws an exception or returns a negative error code.

digitalio→get_errorMessage()**YDigitalIO****digitalio→errorMessage()**

Returns the error message of the latest error with the digital IO port.

js	function get_errorMessage()
cpp	string get_errorMessage()
m	- (NSString*) errorMessage
pas	string get_errorMessage() : string
vb	function get_errorMessage() As String
cs	string get_errorMessage()
java	String get_errorMessage()
py	get_errorMessage()
php	function get_errorMessage()
ts	get_errorMessage() : string
es	get_errorMessage()

This method is mostly useful when using the Yoctopuce library with exceptions disabled.

Returns :

a string corresponding to the latest error message that occurred while using the digital IO port object

digitalio→get_errorType()**YDigitalIO****digitalio→errorType()**

Returns the numerical error code of the latest error with the digital IO port.

<code>js</code>	<code>function get_errorType()</code>
<code>cpp</code>	<code>YRETCODE get_errorType()</code>
<code>m</code>	<code>-(YRETCODE) errorType</code>
<code>pas</code>	<code>YRETCODE get_errorType(): YRETCODE</code>
<code>vb</code>	<code>function get_errorType() As YRETCODE</code>
<code>cs</code>	<code>YRETCODE get_errorType()</code>
<code>java</code>	<code>int get_errorType()</code>
<code>py</code>	<code>get_errorType()</code>
<code>php</code>	<code>function get_errorType()</code>
<code>ts</code>	<code>get_errorType(): number</code>
<code>es</code>	<code>get_errorType()</code>

This method is mostly useful when using the Yoctopuce library with exceptions disabled.

Returns :

a number corresponding to the code of the latest error that occurred while using the digital IO port object

digitalio→get_friendlyName() digitalio→friendlyName()

YDigitalIO

Returns a global identifier of the digital IO port in the format MODULE_NAME . FUNCTION_NAME.

js	function get_friendlyName()
cpp	string get_friendlyName()
m	- (NSString*) friendlyName
cs	string get_friendlyName()
java	String get_friendlyName()
py	get_friendlyName()
php	function get_friendlyName()
ts	async get_friendlyName(): Promise<string>
es	async get_friendlyName()
dnp	string get_friendlyName()
cp	string get_friendlyName()

The returned string uses the logical names of the module and of the digital IO port if they are defined, otherwise the serial number of the module and the hardware identifier of the digital IO port (for example: MyCustomName.relay1)

Returns :

a string that uniquely identifies the digital IO port using logical names (ex: MyCustomName.relay1)

On failure, throws an exception or returns YDigitalIO.FRIENDLYNAME_INVALID.

digitalio→get_functionDescriptor()**YDigitalIO****digitalio→functionDescriptor()**

Returns a unique identifier of type YFUN_DESCR corresponding to the function.

<code>js</code>	<code>function get_functionDescriptor()</code>
<code>cpp</code>	<code>YFUN_DESCR get_functionDescriptor()</code>
<code>m</code>	<code>-(YFUN_DESCR) functionDescriptor</code>
<code>pas</code>	<code>YFUN_DESCR get_functionDescriptor(): YFUN_DESCR</code>
<code>vb</code>	<code>function get_functionDescriptor() As YFUN_DESCR</code>
<code>cs</code>	<code>YFUN_DESCR get_functionDescriptor()</code>
<code>java</code>	<code>String get_functionDescriptor()</code>
<code>py</code>	<code>get_functionDescriptor()</code>
<code>php</code>	<code>function get_functionDescriptor()</code>
<code>ts</code>	<code>async get_functionDescriptor(): Promise<string></code>
<code>es</code>	<code>async get_functionDescriptor()</code>

This identifier can be used to test if two instances of YFunction reference the same physical function on the same physical device.

Returns :

an identifier of type YFUN_DESCR.

If the function has never been contacted, the returned value is `Y$CLASSNAME$.FUNCTIONDESCRIPTOR_INVALID`.

digitalio→get_functionId()**YDigitalIO****digitalio→functionId()**

Returns the hardware identifier of the digital IO port, without reference to the module.

js	<code>function get_functionId()</code>
cpp	<code>string get_functionId()</code>
m	<code>-(NSString*) functionId</code>
vb	<code>function get_functionId() As String</code>
cs	<code>string get_functionId()</code>
java	<code>String get_functionId()</code>
py	<code>get_functionId()</code>
php	<code>function get_functionId()</code>
ts	<code>async get_functionId(): Promise<string></code>
es	<code>async get_functionId()</code>
dnp	<code>string get_functionId()</code>
cp	<code>string get_functionId()</code>

For example `relay1`

Returns :

a string that identifies the digital IO port (ex: `relay1`)

On failure, throws an exception or returns `YDigitalIO.FUNCTIONID_INVALID`.

digitalio→get_hardwareId()**YDigitalIO****digitalio→hardwareId()**

Returns the unique hardware identifier of the digital IO port in the form SERIAL.FUNCTIONID.

js	<code>function get_hardwareId()</code>
cpp	<code>string get_hardwareId()</code>
m	<code>-(NSString*) hardwareId</code>
vb	<code>function get_hardwareId() As String</code>
cs	<code>string get_hardwareId()</code>
java	<code>String get_hardwareId()</code>
py	<code>get_hardwareId()</code>
php	<code>function get_hardwareId()</code>
ts	<code>async get_hardwareId(): Promise<string></code>
es	<code>async get_hardwareId()</code>
dnp	<code>string get_hardwareId()</code>
cp	<code>string get_hardwareId()</code>

The unique hardware identifier is composed of the device serial number and of the hardware identifier of the digital IO port (for example RELAYL01-123456.relay1).

Returns :

a string that uniquely identifies the digital IO port (ex: RELAYL01-123456.relay1)

On failure, throws an exception or returns YDigitalIO.HARDWAREID_INVALID.

digitalio→get_logicalName() digitalio→logicalName()

YDigitalIO

Returns the logical name of the digital IO port.

```
js function get_logicalName( )  
cpp string get_logicalName( )  
m -(NSString*) logicalName  
pas string get_logicalName( ): string  
vb function get_logicalName( ) As String  
cs string get_logicalName( )  
java String get_logicalName( )  
uwp async Task<string> get_logicalName( )  
py get_logicalName( )  
php function get_logicalName( )  
ts async get_logicalName( ): Promise<string>  
es async get_logicalName( )  
dnp string get_logicalName( )  
cp string get_logicalName( )  
cmd YDigitalIO target get_logicalName
```

Returns :

a string corresponding to the logical name of the digital IO port.

On failure, throws an exception or returns YDigitalIO.LOGICALNAME_INVALID.

digitalio→get_module()**YDigitalIO****digitalio→module()**

Gets the `YModule` object for the device on which the function is located.

<code>js</code>	<code>function get_module()</code>
<code>cpp</code>	<code>YModule * get_module()</code>
<code>m</code>	<code>-(YModule*) module</code>
<code>pas</code>	<code>TYModule get_module(): TYModule</code>
<code>vb</code>	<code>function get_module() As YModule</code>
<code>cs</code>	<code>YModule get_module()</code>
<code>java</code>	<code>YModule get_module()</code>
<code>py</code>	<code>get_module()</code>
<code>php</code>	<code>function get_module()</code>
<code>ts</code>	<code>async get_module(): Promise<YModule></code>
<code>es</code>	<code>async get_module()</code>
<code>dnp</code>	<code>YModuleProxy get_module()</code>
<code>cp</code>	<code>YModuleProxy * get_module()</code>

If the function cannot be located on any module, the returned instance of `YModule` is not shown as online.

Returns :

an instance of `YModule`

digitalio→get_module_async()**YDigitalIO****digitalio→module_async()**

Gets the `YModule` object for the device on which the function is located (asynchronous version).

```
js function get_module_async( callback, context)
```

If the function cannot be located on any module, the returned `YModule` object does not show as online.

This asynchronous version exists only in JavaScript. It uses a callback instead of a return value in order to avoid blocking Firefox JavaScript VM that does not implement context switching during blocking I/O calls. See the documentation section on asynchronous JavaScript calls for more details.

Parameters :

callback callback function that is invoked when the result is known. The callback function receives three arguments: the caller-specific context object, the receiving function object and the requested `YModule` object

context caller-specific object that is passed as-is to the callback function

Returns :

nothing : the result is provided to the callback.

digitalio→get_outputVoltage()**YDigitalIO****digitalio→outputVoltage()**

Returns the voltage source used to drive output bits.

js	<code>function get_outputVoltage()</code>
cpp	<code>Y_OUTPUTVOLTAGE_enum get_outputVoltage()</code>
m	<code>-(Y_OUTPUTVOLTAGE_enum) outputVoltage</code>
pas	<code>Integer get_outputVoltage(): Integer</code>
vb	<code>function get_outputVoltage() As Integer</code>
cs	<code>int get_outputVoltage()</code>
java	<code>int get_outputVoltage()</code>
uwp	<code>async Task<int> get_outputVoltage()</code>
py	<code>get_outputVoltage()</code>
php	<code>function get_outputVoltage()</code>
ts	<code>async get_outputVoltage(): Promise<YDigitalIO_OutputVoltage></code>
es	<code>async get_outputVoltage()</code>
dnp	<code>int get_outputVoltage()</code>
cp	<code>int get_outputVoltage()</code>
cmd	<code>YDigitalIO target get_outputVoltage</code>

Returns :

a value among YDigitalIO.OUTPUTVOLTAGE_USB_5V, YDigitalIO.OUTPUTVOLTAGE_USB_3V and YDigitalIO.OUTPUTVOLTAGE_EXT_V corresponding to the voltage source used to drive output bits

On failure, throws an exception or returns YDigitalIO.OUTPUTVOLTAGE_INVALID.

digitalio→get_portDiags()**YDigitalIO****digitalio→portDiags()**

Returns the port state diagnostics (Yocto-IO and Yocto-MaxI/O-V2 only).

js	<code>function get_portDiags()</code>
cpp	<code>int get_portDiags()</code>
m	<code>-(int) portDiags</code>
pas	<code>LongInt get_portDiags(): LongInt</code>
vb	<code>function get_portDiags() As Integer</code>
cs	<code>int get_portDiags()</code>
java	<code>int get_portDiags()</code>
uwp	<code>async Task<int> get_portDiags()</code>
py	<code>get_portDiags()</code>
php	<code>function get_portDiags()</code>
ts	<code>async get_portDiags(): Promise<number></code>
es	<code>async get_portDiags()</code>
dnp	<code>int get_portDiags()</code>
cp	<code>int get_portDiags()</code>
cmd	<code>YDigitalIO target get_portDiags</code>

Bit 0 indicates a shortcut on output 0, etc. Bit 8 indicates a power failure, and bit 9 signals overheating (overcurrent). During normal use, all diagnostic bits should stay clear.

Returns :

an integer corresponding to the port state diagnostics (Yocto-IO and Yocto-MaxI/O-V2 only)

On failure, throws an exception or returns `YDigitalIO.PORTDIAGS_INVALID`.

digitalio→get_portDirection()**YDigitalIO****digitalio→portDirection()**

Returns the I/O direction of all channels of the port (bitmap): 0 makes a bit an input, 1 makes it an output.

js	function get_portDirection()
cpp	int get_portDirection()
m	- (int) portDirection
pas	LongInt get_portDirection() : LongInt
vb	function get_portDirection() As Integer
cs	int get_portDirection()
java	int get_portDirection()
uwp	async Task<int> get_portDirection()
py	get_portDirection()
php	function get_portDirection()
ts	async get_portDirection() : Promise<number>
es	async get_portDirection()
dnp	int get_portDirection()
cp	int get_portDirection()
cmd	YDigitalIO target get_portDirection

Returns :

an integer corresponding to the I/O direction of all channels of the port (bitmap): 0 makes a bit an input, 1 makes it an output

On failure, throws an exception or returns `YDigitalIO.PORTDIRECTION_INVALID`.

digitalio→get_portOpenDrain()**YDigitalIO****digitalio→portOpenDrain()**

Returns the electrical interface for each bit of the port.

js	<code>function get_portOpenDrain()</code>
cpp	<code>int get_portOpenDrain()</code>
m	<code>- (int) portOpenDrain</code>
pas	<code>LongInt get_portOpenDrain(): LongInt</code>
vb	<code>function get_portOpenDrain() As Integer</code>
cs	<code>int get_portOpenDrain()</code>
java	<code>int get_portOpenDrain()</code>
uwp	<code>async Task<int> get_portOpenDrain()</code>
py	<code>get_portOpenDrain()</code>
php	<code>function get_portOpenDrain()</code>
ts	<code>async get_portOpenDrain(): Promise<number></code>
es	<code>async get_portOpenDrain()</code>
dnp	<code>int get_portOpenDrain()</code>
cp	<code>int get_portOpenDrain()</code>
cmd	<code>YDigitalIO target get_portOpenDrain</code>

For each bit set to 0 the matching I/O works in the regular, intuitive way, for each bit set to 1, the I/O works in reverse mode.

Returns :

an integer corresponding to the electrical interface for each bit of the port

On failure, throws an exception or returns `YDigitalIO.PORTOPENDRAIN_INVALID`.

digitalio→get_portPolarity()**YDigitalIO****digitalio→portPolarity()**

Returns the polarity of all the bits of the port.

<code>js</code>	<code>function get_portPolarity()</code>
<code>cpp</code>	<code>int get_portPolarity()</code>
<code>m</code>	<code>-(int) portPolarity</code>
<code>pas</code>	<code>LongInt get_portPolarity(): LongInt</code>
<code>vb</code>	<code>function get_portPolarity() As Integer</code>
<code>cs</code>	<code>int get_portPolarity()</code>
<code>java</code>	<code>int get_portPolarity()</code>
<code>uwp</code>	<code>async Task<int> get_portPolarity()</code>
<code>py</code>	<code>get_portPolarity()</code>
<code>php</code>	<code>function get_portPolarity()</code>
<code>ts</code>	<code>async get_portPolarity(): Promise<number></code>
<code>es</code>	<code>async get_portPolarity()</code>
<code>dnp</code>	<code>int get_portPolarity()</code>
<code>cp</code>	<code>int get_portPolarity()</code>
<code>cmd</code>	<code>YDigitalIO target get_portPolarity</code>

For each bit set to 0, the matching I/O works the regular, intuitive way; for each bit set to 1, the I/O works in reverse mode.

Returns :

an integer corresponding to the polarity of all the bits of the port

On failure, throws an exception or returns `YDigitalIO.PORTPOLARITY_INVALID`.

digitalio→get_portSize()**YDigitalIO****digitalio→portSize()**

Returns the number of bits (i.e.

js	function get_portSize()
cpp	int get_portSize()
m	- (int) portSize
pas	LongInt get_portSize() : LongInt
vb	function get_portSize() As Integer
cs	int get_portSize()
java	int get_portSize()
uwp	async Task<int> get_portSize()
py	get_portSize()
php	function get_portSize()
ts	async get_portSize() : Promise<number>
es	async get_portSize()
dnp	int get_portSize()
cp	int get_portSize()
cmd	YDigitalIO target get_portSize

channels) implemented in the I/O port.

Returns :

an integer corresponding to the number of bits (i.e

On failure, throws an exception or returns YDigitalIO.PORTSIZE_INVALID.

digitalio→get_portState()**YDigitalIO****digitalio→portState()**

Returns the digital IO port state as an integer with each bit representing a channel.

<code>js</code>	<code>function get_portState()</code>
<code>cpp</code>	<code>int get_portState()</code>
<code>m</code>	<code>-(int) portState</code>
<code>pas</code>	<code>LongInt get_portState(); LongInt</code>
<code>vb</code>	<code>function get_portState() As Integer</code>
<code>cs</code>	<code>int get_portState()</code>
<code>java</code>	<code>int get_portState()</code>
<code>uwp</code>	<code>async Task<int> get_portState()</code>
<code>py</code>	<code>get_portState()</code>
<code>php</code>	<code>function get_portState()</code>
<code>ts</code>	<code>async get_portState(): Promise<number></code>
<code>es</code>	<code>async get_portState()</code>
<code>dnp</code>	<code>int get_portState()</code>
<code>cp</code>	<code>int get_portState()</code>
<code>cmd</code>	<code>YDigitalIO target get_portState</code>

value 0 = 0b00000000 -> all channels are OFF value 1 = 0b00000001 -> channel #0 is ON value 2 = 0b00000010 -> channel #1 is ON value 3 = 0b00000011 -> channels #0 and #1 are ON value 4 = 0b00000100 -> channel #2 is ON and so on...

Returns :

an integer corresponding to the digital IO port state as an integer with each bit representing a channel

On failure, throws an exception or returns `YDigitalIO.PORTSTATE_INVALID`.

digitalio→get_serialNumber()
digitalio→serialNumber()**YDigitalIO**

Returns the serial number of the module, as set by the factory.

js	function get_serialNumber()
cpp	string get_serialNumber()
m	- (NSString*) serialNumber
pas	string get_serialNumber() : string
vb	function get_serialNumber() As String
cs	string get_serialNumber()
java	String get_serialNumber()
uwp	async Task<string> get_serialNumber()
py	get_serialNumber()
php	function get_serialNumber()
ts	async get_serialNumber() : Promise<string>
es	async get_serialNumber()
dnp	string get_serialNumber()
cp	string get_serialNumber()
cmd	YDigitalIO target get_serialNumber

Returns :

a string corresponding to the serial number of the module, as set by the factory.

On failure, throws an exception or returns YFunction.SERIALNUMBER_INVALID.

digitalio→get(userData)**YDigitalIO****digitalio→userData()**

Returns the value of the userData attribute, as previously stored using method `set(userData)`.

<code>js</code>	<code>function get(userData) </code>
<code>cpp</code>	<code>void * get(userData) </code>
<code>m</code>	<code>-(id) userData</code>
<code>pas</code>	<code>Tobject get(userData): Tobject</code>
<code>vb</code>	<code>function get(userData) As Object</code>
<code>cs</code>	<code>object get(userData) </code>
<code>java</code>	<code>Object get(userData) </code>
<code>py</code>	<code>get(userData) </code>
<code>php</code>	<code>function get(userData) </code>
<code>ts</code>	<code>async get(userData): Promise<object null></code>
<code>es</code>	<code>async get(userData) </code>

This attribute is never touched directly by the API, and is at disposal of the caller to store a context.

Returns :

the object stored previously by the caller.

digitalio→isOnline()**YDigitalIO**

Checks if the digital IO port is currently reachable, without raising any error.

js	function isOnline()
cpp	bool isOnline()
m	-(BOOL) isOnline
pas	boolean isOnline() : boolean
vb	function isOnline() As Boolean
cs	bool isOnline()
java	boolean isOnline()
py	isOnline()
php	function isOnline()
ts	async isOnline() : Promise<boolean>
es	async isOnline()
dnp	bool isOnline()
cp	bool isOnline()

If there is a cached value for the digital IO port in cache, that has not yet expired, the device is considered reachable. No exception is raised if there is an error while trying to contact the device hosting the digital IO port.

Returns :

true if the digital IO port can be reached, and false otherwise

digitalio→isOnline_async()

YDigitalIO

Checks if the digital IO port is currently reachable, without raising any error (asynchronous version).

```
js   function isOnline_async( callback, context)
```

If there is a cached value for the digital IO port in cache, that has not yet expired, the device is considered reachable. No exception is raised if there is an error while trying to contact the device hosting the requested function.

This asynchronous version exists only in Javascript. It uses a callback instead of a return value in order to avoid blocking the Javascript virtual machine.

Parameters :

callback callback function that is invoked when the result is known. The callback function receives three arguments: the caller-specific context object, the receiving function object and the boolean result

context caller-specific object that is passed as-is to the callback function

Returns :

nothing : the result is provided to the callback.

digitalio→isReadOnly()

YDigitalIO

Test if the function is readOnly.

cpp	bool isReadOnly()
m	- (bool) isReadOnly
pas	boolean isReadOnly(): boolean
vb	function isReadOnly() As Boolean
cs	bool isReadOnly()
java	boolean isReadOnly()
uwp	async Task<bool> isReadOnly()
py	isReadOnly()
php	function isReadOnly()
ts	async isReadOnly(): Promise<boolean>
es	async isReadOnly()
dnp	bool isReadOnly()
cp	bool isReadOnly()
cmd	YDigitalIO target isReadOnly

Return true if the function is write protected or that the function is not available.

Returns :

true if the function is readOnly or not online.

digitalio→load()**YDigitalIO**

Preloads the digital IO port cache with a specified validity duration.

js	<code>function load(msValidity)</code>
cpp	<code>YRETCODE load(int msValidity)</code>
m	<code>-(YRETCODE) load : (u64) msValidity</code>
pas	<code>YRETCODE load(msValidity: u64): YRETCODE</code>
vb	<code>function load(ByVal msValidity As Long) As YRETCODE</code>
cs	<code>YRETCODE load(ulong msValidity)</code>
java	<code>int load(long msValidity)</code>
py	<code>load(msValidity)</code>
php	<code>function load(\$msValidity)</code>
ts	<code>async load(msValidity: number): Promise<number></code>
es	<code>async load(msValidity)</code>

By default, whenever accessing a device, all function attributes are kept in cache for the standard duration (5 ms). This method can be used to temporarily mark the cache as valid for a longer period, in order to reduce network traffic for instance.

Parameters :

msValidity an integer corresponding to the validity attributed to the loaded function parameters, in milliseconds

Returns :

YAPI.SUCCESS when the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→loadAttribute()**YDigitalIO**

Returns the current value of a single function attribute, as a text string, as quickly as possible but without using the cached value.

js	function loadAttribute(attrName)
cpp	string loadAttribute(string attrName)
m	- (NSString*) loadAttribute : (NSString*) attrName
pas	string loadAttribute(attrName: string): string
vb	function loadAttribute(ByVal attrName As String) As String
cs	string loadAttribute(string attrName)
java	String loadAttribute(String attrName)
uwp	async Task<string> loadAttribute(string attrName)
py	loadAttribute(attrName)
php	function loadAttribute(\$attrName)
ts	async loadAttribute(attrName: string): Promise<string>
es	async loadAttribute(attrName)
dnp	string loadAttribute(string attrName)
cp	string loadAttribute(string attrName)

Parameters :

attrName the name of the requested attribute

Returns :

a string with the value of the the attribute

On failure, throws an exception or returns an empty string.

digitalio→load_async()**YDigitalIO**

Preloads the digital IO port cache with a specified validity duration (asynchronous version).

```
js   function load_async( msValidity, callback, context)
```

By default, whenever accessing a device, all function attributes are kept in cache for the standard duration (5 ms). This method can be used to temporarily mark the cache as valid for a longer period, in order to reduce network traffic for instance.

This asynchronous version exists only in JavaScript. It uses a callback instead of a return value in order to avoid blocking the JavaScript virtual machine.

Parameters :

msValidity an integer corresponding to the validity of the loaded function parameters, in milliseconds

callback callback function that is invoked when the result is known. The callback function receives three arguments: the caller-specific context object, the receiving function object and the error code (or YAPI.SUCCESS)

context caller-specific object that is passed as-is to the callback function

Returns :

nothing : the result is provided to the callback.

digitalio→muteValueCallbacks()

YDigitalIO

Disables the propagation of every new advertised value to the parent hub.

js	function muteValueCallbacks()
cpp	int muteValueCallbacks()
m	- (int) muteValueCallbacks
pas	LongInt muteValueCallbacks(): LongInt
vb	function muteValueCallbacks() As Integer
cs	int muteValueCallbacks()
java	int muteValueCallbacks()
uwp	async Task<int> muteValueCallbacks()
py	muteValueCallbacks()
php	function muteValueCallbacks()
ts	async muteValueCallbacks(): Promise<number>
es	async muteValueCallbacks()
dnp	int muteValueCallbacks()
cp	int muteValueCallbacks()
cmd	YDigitalIO target muteValueCallbacks

You can use this function to save bandwidth and CPU on computers with limited resources, or to prevent unwanted invocations of the HTTP callback. Remember to call the `saveToFlash()` method of the module if the modification must be kept.

Returns :

YAPI.SUCCESS when the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→nextDigitalIO()**YDigitalIO**

Continues the enumeration of digital IO ports started using `yFirstDigitalIO()`.

<code>js</code>	<code>function nextDigitalIO()</code>
<code>cpp</code>	<code>YDigitalIO * nextDigitalIO()</code>
<code>m</code>	<code>-(nullable YDigitalIO*) nextDigitalIO</code>
<code>pas</code>	<code>TYDigitalIO nextDigitalIO(): TYDigitalIO</code>
<code>vb</code>	<code>function nextDigitalIO() As YDigitalIO</code>
<code>cs</code>	<code>YDigitalIO nextDigitalIO()</code>
<code>java</code>	<code>YDigitalIO nextDigitalIO()</code>
<code>uwp</code>	<code>YDigitalIO nextDigitalIO()</code>
<code>py</code>	<code>nextDigitalIO()</code>
<code>php</code>	<code>function nextDigitalIO()</code>
<code>ts</code>	<code>nextDigitalIO(): YDigitalIO null</code>
<code>es</code>	<code>nextDigitalIO()</code>

Caution: You can't make any assumption about the returned digital IO ports order. If you want to find a specific a digital IO port, use `DigitalIO.findDigitalIO()` and a hardwareID or a logical name.

Returns :

a pointer to a `YDigitalIO` object, corresponding to a digital IO port currently online, or a `null` pointer if there are no more digital IO ports to enumerate.

digitalio→pulse()

YDigitalIO

Triggers a pulse on a single bit for a specified duration.

js	<code>function pulse(bitno, ms_duration)</code>
cpp	<code>int pulse(int bitno, int ms_duration)</code>
m	<code>- (int) pulse : (int) bitno : (int) ms_duration</code>
pas	<code>LongInt pulse(bitno: LongInt, ms_duration: LongInt): LongInt</code>
vb	<code>function pulse(ByVal bitno As Integer, ByVal ms_duration As Integer) As Integer</code>
cs	<code>int pulse(int bitno, int ms_duration)</code>
java	<code>int pulse(int bitno, int ms_duration)</code>
uwp	<code>async Task<int> pulse(int bitno, int ms_duration)</code>
py	<code>pulse(bitno, ms_duration)</code>
php	<code>function pulse(\$bitno, \$ms_duration)</code>
ts	<code>async pulse(bitno: number, ms_duration: number): Promise<number></code>
es	<code>async pulse(bitno, ms_duration)</code>
dnp	<code>int pulse(int bitno, int ms_duration)</code>
cp	<code>int pulse(int bitno, int ms_duration)</code>
cmd	<code>YDigitalIO target pulse bitno ms_duration</code>

The specified bit will be turned to 1, and then back to 0 after the given duration.

Parameters :

bitno the bit number; lowest bit has index 0

ms_duration desired pulse duration in milliseconds. Be aware that the device time resolution is not guaranteed up to the millisecond.

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→registerValueCallback()**YDigitalIO**

Registers the callback function that is invoked on every change of advertised value.

js	<code>function registerValueCallback(callback)</code>
cpp	<code>int registerValueCallback(YDigitalIOValueCallback callback)</code>
m	<code>-(int) registerValueCallback : (YDigitalIOValueCallback _Nullable) callback</code>
pas	<code>LongInt registerValueCallback(callback: TYDigitalIOValueCallback): LongInt</code>
vb	<code>function registerValueCallback(ByVal callback As YDigitalIOValueCallback) As Integer</code>
cs	<code>int registerValueCallback(ValueCallback callback)</code>
java	<code>int registerValueCallback(UpdateCallback callback)</code>
uwp	<code>async Task<int> registerValueCallback(ValueCallback callback)</code>
py	<code>registerValueCallback(callback)</code>
php	<code>function registerValueCallback(\$callback)</code>
ts	<code>async registerValueCallback(callback: YDigitalIOValueCallback null): Promise<number></code>
es	<code>async registerValueCallback(callback)</code>

The callback is invoked only during the execution of `ySleep` or `yHandleEvents`. This provides control over the time when the callback is triggered. For good responsiveness, remember to call one of these two functions periodically. To unregister a callback, pass a null pointer as argument.

Parameters :

callback the callback function to call, or a null pointer. The callback function should take two arguments: the function object of which the value has changed, and the character string describing the new advertised value.

digitalio→set_bitDirection() digitalio→setBitDirection()

YDigitalIO

Changes the direction of a single bit (i.e.

```

js function set_bitDirection( bitno, bitdirection)
cpp int set_bitDirection( int bitno, int bitdirection)
m -(int) setBitDirection : (int) bitno
: (int) bitdirection
pas LongInt set_bitDirection( bitno: LongInt, bitdirection: LongInt): LongInt
vb function set_bitDirection( ByVal bitno As Integer,
                             ByVal bitdirection As Integer) As Integer
cs int set_bitDirection( int bitno, int bitdirection)
java int set_bitDirection( int bitno, int bitdirection)
uwp async Task<int> set_bitDirection( int bitno, int bitdirection)
py set_bitDirection( bitno, bitdirection)
php function set_bitDirection( $bitno, $bitdirection)
ts async set_bitDirection( bitno: number, bitdirection: number): Promise<number>
es async set_bitDirection( bitno, bitdirection)
dnp int set_bitDirection( int bitno, int bitdirection)
cp int set_bitDirection( int bitno, int bitdirection)
cmd YDigitalIO target set_bitDirection bitno bitdirection

```

channel) from the I/O port.

Parameters :

bitno the bit number; lowest bit has index 0

bitdirection direction to set, 0 makes the bit an input, 1 makes it an output. Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_bitOpenDrain()

YDigitalIO

digitalio→setBitOpenDrain()

Changes the electrical interface of a single bit from the I/O port.

js	<code>function set_bitOpenDrain(bitno, opendrain)</code>
cpp	<code>int set_bitOpenDrain(int bitno, int opendrain)</code>
m	<code>-(int) setBitOpenDrain : (int) bitno : (int) opendrain</code>
pas	<code>LongInt set_bitOpenDrain(bitno: LongInt, opendrain: LongInt): LongInt</code>
vb	<code>function set_bitOpenDrain(ByVal bitno As Integer, ByVal opendrain As Integer) As Integer</code>
cs	<code>int set_bitOpenDrain(int bitno, int opendrain)</code>
java	<code>int set_bitOpenDrain(int bitno, int opendrain)</code>
uwp	<code>async Task<int> set_bitOpenDrain(int bitno, int opendrain)</code>
py	<code>set_bitOpenDrain(bitno, opendrain)</code>
php	<code>function set_bitOpenDrain(\$bitno, \$opendrain)</code>
ts	<code>async set_bitOpenDrain(bitno: number, opendrain: number): Promise<number></code>
es	<code>async set_bitOpenDrain(bitno, opendrain)</code>
dnp	<code>int set_bitOpenDrain(int bitno, int opendrain)</code>
cp	<code>int set_bitOpenDrain(int bitno, int opendrain)</code>
cmd	<code>YDigitalIO target set_bitOpenDrain bitno opendrain</code>

Parameters :

bitno the bit number; lowest bit has index 0

opendrain 0 makes a bit a regular input/output, 1 makes it an open-drain (open-collector) input/output. Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_bitPolarity() digitalio→setBitPolarity()

YDigitalIO

Changes the polarity of a single bit from the I/O port.

js	<code>function set_bitPolarity(bitno, bitpolarity)</code>
cpp	<code>int set_bitPolarity(int bitno, int bitpolarity)</code>
m	<code>- (int) setBitPolarity : (int) bitno : (int) bitpolarity</code>
pas	<code>LongInt set_bitPolarity(bitno: LongInt, bitpolarity: LongInt): LongInt</code>
vb	<code>function set_bitPolarity(ByVal bitno As Integer, ByVal bitpolarity As Integer) As Integer</code>
cs	<code>int set_bitPolarity(int bitno, int bitpolarity)</code>
java	<code>int set_bitPolarity(int bitno, int bitpolarity)</code>
uwp	<code>async Task<int> set_bitPolarity(int bitno, int bitpolarity)</code>
py	<code>set_bitPolarity(bitno, bitpolarity)</code>
php	<code>function set_bitPolarity(\$bitno, \$bitpolarity)</code>
ts	<code>async set_bitPolarity(bitno: number, bitpolarity: number): Promise<number></code>
es	<code>async set_bitPolarity(bitno, bitpolarity)</code>
dnp	<code>int set_bitPolarity(int bitno, int bitpolarity)</code>
cp	<code>int set_bitPolarity(int bitno, int bitpolarity)</code>
cmd	<code>YDigitalIO target set_bitPolarity bitno bitpolarity</code>

Parameters :

bitno the bit number; lowest bit has index 0.

bitpolarity polarity to set, 0 makes the I/O work in regular mode, 1 makes the I/O works in reverse mode.
Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_bitState() digitalio→setBitState()

YDigitalIO

Sets a single bit (i.e.

<code>js</code>	<code>function set_bitState(bitno, bitstate)</code>
<code>cpp</code>	<code>int set_bitState(int bitno, int bitstate)</code>
<code>m</code>	<code>-(int) setBitState : (int) bitno : (int) bitstate</code>
<code>pas</code>	<code>LongInt set_bitState(bitno: LongInt, bitstate: LongInt): LongInt</code>
<code>vb</code>	<code>function set_bitState(ByVal bitno As Integer, ByVal bitstate As Integer) As Integer</code>
<code>cs</code>	<code>int set_bitState(int bitno, int bitstate)</code>
<code>java</code>	<code>int set_bitState(int bitno, int bitstate)</code>
<code>uwp</code>	<code>async Task<int> set_bitState(int bitno, int bitstate)</code>
<code>py</code>	<code>set_bitState(bitno, bitstate)</code>
<code>php</code>	<code>function set_bitState(\$bitno, \$bitstate)</code>
<code>ts</code>	<code>async set_bitState(bitno: number, bitstate: number): Promise<number></code>
<code>es</code>	<code>async set_bitState(bitno, bitstate)</code>
<code>dnp</code>	<code>int set_bitState(int bitno, int bitstate)</code>
<code>cp</code>	<code>int set_bitState(int bitno, int bitstate)</code>
<code>cmd</code>	<code>YDigitalIO target set_bitState bitno bitstate</code>

channel) of the I/O port.

Parameters :

bitno the bit number; lowest bit has index 0
bitstate the state of the bit (1 or 0)

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_logicalName()**YDigitalIO****digitalio→setLogicalName()**

Changes the logical name of the digital IO port.

js	<code>function set_logicalName(newval)</code>
cpp	<code>int set_logicalName(string newval)</code>
m	<code>-(int) setLogicalName : (NSString*) newval</code>
pas	<code>integer set_logicalName(newval: string): integer</code>
vb	<code>function set_logicalName(ByVal newval As String) As Integer</code>
cs	<code>int set_logicalName(string newval)</code>
java	<code>int set_logicalName(String newval)</code>
uwp	<code>async Task<int> set_logicalName(string newval)</code>
py	<code>set_logicalName(newval)</code>
php	<code>function set_logicalName(\$newval)</code>
ts	<code>async set_logicalName(newval: string): Promise<number></code>
es	<code>async set_logicalName(newval)</code>
dnp	<code>int set_logicalName(string newval)</code>
cp	<code>int set_logicalName(string newval)</code>
cmd	<code>YDigitalIO target set_logicalName newval</code>

You can use `yCheckLogicalName()` prior to this call to make sure that your parameter is valid. Remember to call the `saveToFlash()` method of the module if the modification must be kept.

Parameters :

newval a string corresponding to the logical name of the digital IO port.

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_outputVoltage()**YDigitalIO****digitalio→setOutputVoltage()**

Changes the voltage source used to drive output bits.

js	<code>function set_outputVoltage(newval)</code>
cpp	<code>int set_outputVoltage(Y_OUTPUTVOLTAGE_enum newval)</code>
m	<code>-(int) setOutputVoltage : (Y_OUTPUTVOLTAGE_enum) newval</code>
pas	<code>integer set_outputVoltage(newval: Integer): integer</code>
vb	<code>function set_outputVoltage(ByVal newval As Integer) As Integer</code>
cs	<code>int set_outputVoltage(int newval)</code>
java	<code>int set_outputVoltage(int newval)</code>
uwp	<code>async Task<int> set_outputVoltage(int newval)</code>
py	<code>set_outputVoltage(newval)</code>
php	<code>function set_outputVoltage(\$newval)</code>
ts	<code>async set_outputVoltage(newval: YDigitalIO_OutputVoltage): Promise<number></code>
es	<code>async set_outputVoltage(newval)</code>
dnp	<code>int set_outputVoltage(int newval)</code>
cp	<code>int set_outputVoltage(int newval)</code>
cmd	<code>YDigitalIO target set_outputVoltage newval</code>

Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

Parameters :

newval a value among `YDigitalIO.OUTPUTVOLTAGE_USB_5V`,
`YDigitalIO.OUTPUTVOLTAGE_USB_3V` and
`YDigitalIO.OUTPUTVOLTAGE_EXT_V` corresponding to the voltage source used to drive
output bits

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_portDirection()**YDigitalIO****digitalio→setPortDirection()**

Changes the I/O direction of all channels of the port (bitmap): 0 makes a bit an input, 1 makes it an output.

js	<code>function set_portDirection(newval)</code>
cpp	<code>int set_portDirection(int newval)</code>
m	<code>-(int) setPortDirection : (int) newval</code>
pas	<code>integer set_portDirection(newval: LongInt): integer</code>
vb	<code>function set_portDirection(ByVal newval As Integer) As Integer</code>
cs	<code>int set_portDirection(int newval)</code>
java	<code>int set_portDirection(int newval)</code>
uwp	<code>async Task<int> set_portDirection(int newval)</code>
py	<code>set_portDirection(newval)</code>
php	<code>function set_portDirection(\$newval)</code>
ts	<code>async set_portDirection(newval: number): Promise<number></code>
es	<code>async set_portDirection(newval)</code>
dnp	<code>int set_portDirection(int newval)</code>
cp	<code>int set_portDirection(int newval)</code>
cmd	<code>YDigitalIO target set_portDirection newval</code>

Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

Parameters :

newval an integer corresponding to the I/O direction of all channels of the port (bitmap): 0 makes a bit an input, 1 makes it an output

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_portOpenDrain()**YDigitalIO****digitalio→setPortOpenDrain()**

Changes the electrical interface for each bit of the port.

js	<code>function set_portOpenDrain(newval)</code>
cpp	<code>int set_portOpenDrain(int newval)</code>
m	<code>-(int) setPortOpenDrain : (int) newval</code>
pas	<code>integer set_portOpenDrain(newval: LongInt): integer</code>
vb	<code>function set_portOpenDrain(ByVal newval As Integer) As Integer</code>
cs	<code>int set_portOpenDrain(int newval)</code>
java	<code>int set_portOpenDrain(int newval)</code>
uwp	<code>async Task<int> set_portOpenDrain(int newval)</code>
py	<code>set_portOpenDrain(newval)</code>
php	<code>function set_portOpenDrain(\$newval)</code>
ts	<code>async set_portOpenDrain(newval: number): Promise<number></code>
es	<code>async set_portOpenDrain(newval)</code>
dnp	<code>int set_portOpenDrain(int newval)</code>
cp	<code>int set_portOpenDrain(int newval)</code>
cmd	<code>YDigitalIO target set_portOpenDrain newval</code>

0 makes a bit a regular input/output, 1 makes it an open-drain (open-collector) input/output. Remember to call the `saveToFlash()` method to make sure the setting is kept after a reboot.

Parameters :

newval an integer corresponding to the electrical interface for each bit of the port

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_portPolarity() digitalio→setPortPolarity()

YDigitalIO

Changes the polarity of all the bits of the port: For each bit set to 0, the matching I/O works the regular, intuitive way; for each bit set to 1, the I/O works in reverse mode.

js	function set_portPolarity(newval)
cpp	int set_portPolarity(int newval)
m	-(int) setPortPolarity : (int) newval
pas	integer set_portPolarity(newval: LongInt): integer
vb	function set_portPolarity(ByVal newval As Integer) As Integer
cs	int set_portPolarity(int newval)
java	int set_portPolarity(int newval)
uwp	async Task<int> set_portPolarity(int newval)
py	set_portPolarity(newval)
php	function set_portPolarity(\$newval)
ts	async set_portPolarity(newval: number): Promise<number>
es	async set_portPolarity(newval)
dnp	int set_portPolarity(int newval)
cp	int set_portPolarity(int newval)
cmd	YDigitalIO target set_portPolarity newval

Remember to call the `saveToFlash()` method to make sure the setting will be kept after a reboot.

Parameters :

newval an integer corresponding to the polarity of all the bits of the port: For each bit set to 0, the matching I/O works the regular, intuitive way; for each bit set to 1, the I/O works in reverse mode

Returns :

`YAPI.SUCCESS` if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set_portState()

YDigitalIO

digitalio→setPortState()

Changes the state of all digital IO port's channels at once: the parameter is an integer where each bit represents a channel, with bit 0 matching channel #0.

js	<code>function set_portState(newval)</code>
cpp	<code>int set_portState(int newval)</code>
m	<code>-(int) setPortState : (int) newval</code>
pas	<code>integer set_portState(newval: LongInt): integer</code>
vb	<code>function set_portState(ByVal newval As Integer) As Integer</code>
cs	<code>int set_portState(int newval)</code>
java	<code>int set_portState(int newval)</code>
uwp	<code>async Task<int> set_portState(int newval)</code>
py	<code>set_portState(newval)</code>
php	<code>function set_portState(\$newval)</code>
ts	<code>async set_portState(newval: number): Promise<number></code>
es	<code>async set_portState(newval)</code>
dnp	<code>int set_portState(int newval)</code>
cp	<code>int set_portState(int newval)</code>
cmd	<code>YDigitalIO target set_portState newval</code>

To set all channels to 0 -> 0b00000000 -> parameter = 0 To set channel #0 to 1 -> 0b00000001 -> parameter = 1 To set channel #1 to 1 -> 0b00000010 -> parameter = 2 To set channel #0 and #1 -> 0b00000011 -> parameter = 3 To set channel #2 to 1 -> 0b00000100 -> parameter = 4 an so on.... Only channels configured as outputs will be affecter, according to the value configured using set_portDirection.

Parameters :

newval an integer corresponding to the state of all digital IO port's channels at once: the parameter is an integer where each bit represents a channel, with bit 0 matching channel #0

Returns :

YAPI.SUCCESS if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→set(userData)**YDigitalIO****digitalio→setUserData()**

Stores a user context provided as argument in the userData attribute of the function.

js	function set(userData)
cpp	void set(userData) (void * data)
m	- (void) setUserData : (id) data
pas	set(userData) (data : Tobject)
vb	procedure set(userData) (ByVal data As Object)
cs	void set(userData) (object data)
java	void set(userData) (Object data)
py	set(userData) (data)
php	function set(userData) (\$ data)
ts	async set(userData) (data : object null): Promise<void>
es	async set(userData) (data)

This attribute is never touched by the API, and is at disposal of the caller to store a context.

Parameters :

data any kind of object to be stored

digitalio→toggle_bitState()

YDigitalIO

Reverts a single bit (i.e.

js	function toggle_bitState(bitno)
cpp	int toggle_bitState(int bitno)
m	- (int) toggle_bitState : (int) bitno
pas	LongInt toggle_bitState(bitno: LongInt): LongInt
vb	function toggle_bitState(ByVal bitno As Integer) As Integer
cs	int toggle_bitState(int bitno)
java	int toggle_bitState(int bitno)
uwp	async Task<int> toggle_bitState(int bitno)
py	toggle_bitState(bitno)
php	function toggle_bitState(\$bitno)
ts	async toggle_bitState(bitno: number): Promise<number>
es	async toggle_bitState(bitno)
dnp	int toggle_bitState(int bitno)
cp	int toggle_bitState(int bitno)
cmd	YDigitalIO target toggle_bitState bitno

channel) of the I/O port.

Parameters :

bitno the bit number; lowest bit has index 0

Returns :

YAPI.SUCCESS if the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→unmuteValueCallbacks()

YDigitalIO

Re-enables the propagation of every new advertised value to the parent hub.

js	function unmuteValueCallbacks()
cpp	int unmuteValueCallbacks()
m	- (int) unmuteValueCallbacks
pas	LongInt unmuteValueCallbacks(): LongInt
vb	function unmuteValueCallbacks() As Integer
cs	int unmuteValueCallbacks()
java	int unmuteValueCallbacks()
uwp	async Task<int> unmuteValueCallbacks()
py	unmuteValueCallbacks()
php	function unmuteValueCallbacks()
ts	async unmuteValueCallbacks(): Promise<number>
es	async unmuteValueCallbacks()
dnp	int unmuteValueCallbacks()
cp	int unmuteValueCallbacks()
cmd	YDigitalIO target unmuteValueCallbacks

This function reverts the effect of a previous call to `muteValueCallbacks()`. Remember to call the `saveToFlash()` method of the module if the modification must be kept.

Returns :

`YAPI.SUCCESS` when the call succeeds.

On failure, throws an exception or returns a negative error code.

digitalio→wait_async()

YDigitalIO

Waits for all pending asynchronous commands on the module to complete, and invoke the user-provided callback function.

```
js  function wait_async( callback, context)
ts  wait_async( callback: Function, context: object)
es  wait_async( callback, context)
```

The callback function can therefore freely issue synchronous or asynchronous commands, without risking to block the JavaScript VM.

Parameters :

callback callback function that is invoked when all pending commands on the module are completed. The callback function receives two arguments: the caller-specific context object and the receiving function object.

context caller-specific object that is passed as-is to the callback function

Returns :

nothing.

24. Troubleshooting

24.1. Where to start?

If it is the first time that you use a Yoctopuce module and you do not really know where to start, have a look at the Yoctopuce blog. There is a section dedicated to beginners¹.

24.2. Programming examples don't seem to work

Most of Yoctopuce API programming examples are command line programs and require some parameters to work properly. You have to start them from your operating system command prompt, or configure your IDE to run them with the proper parameters.²

24.3. Linux and USB

To work correctly under Linux, the library needs to have write access to all the Yoctopuce USB peripherals. However, by default under Linux, USB privileges of the non-root users are limited to read access. To avoid having to run the *VirtualHub* as root, you need to create a new *udev* rule to authorize one or several users to have write access to the Yoctopuce peripherals.

To add a new *udev* rule to your installation, you must add a file with a name following the "##-arbitraryName.rules" format, in the "/etc/udev/rules.d" directory. When the system is starting, *udev* reads all the files with a ".rules" extension in this directory, respecting the alphabetical order (for example, the "51-custom.rules" file is interpreted AFTER the "50-udev-default.rules" file).

The "50-udev-default" file contains the system default *udev* rules. To modify the default behavior, you therefore need to create a file with a name that starts with a number larger than 50, that will override the system default rules. Note that to add a rule, you need a root access on the system.

In the *udev_conf* directory of the *VirtualHub* for Linux³ archive, there are two rule examples which you can use as a basis.

¹ see: http://www.yoctopuce.com/EN/blog_by_categories/for-the-beginners

² see: <http://www.yoctopuce.com/EN/article/about-programming-examples>

³ <http://www.yoctopuce.com/FR/virtualhub.php>

Example 1: 51-yoctopuce.rules

This rule provides all the users with read and write access to the Yoctopuce USB peripherals. Access rights for all other peripherals are not modified. If this scenario suits you, you only need to copy the "51-yoctopuce_all.rules" file into the "/etc/udev/rules.d" directory and to restart your system.

```
# udev rules to allow write access to all users
# for Yoctopuce USB devices
SUBSYSTEM=="usb", ATTR{idVendor}=="24e0", MODE=="0666"
```

Example 2: 51-yoctopuce_group.rules

This rule authorizes the "yoctogroup" group to have read and write access to Yoctopuce USB peripherals. Access rights for all other peripherals are not modified. If this scenario suits you, you only need to copy the "51-yoctopuce_group.rules" file into the "/etc/udev/rules.d" directory and restart your system.

```
# udev rules to allow write access to all users of "yoctogroup"
# for Yoctopuce USB devices
SUBSYSTEM=="usb", ATTR{idVendor}=="24e0", MODE=="0664", GROUP="yoctogroup"
```

24.4. ARM Platforms: HF and EL

There are two main flavors of executable on ARM: HF (Hard Float) binaries, and EL (EABI Little Endian) binaries. These two families are not compatible at all. The compatibility of a given ARM platform with one of these two families depends on the hardware and on the OS build. ArmHF and ArmEL compatibility problems are quite difficult to detect. Most of the time, the OS itself is unable to make a difference between an HF and an EL executable and will return meaningless messages when you try to use the wrong type of binary.

All pre-compiled Yoctopuce binaries are provided in both formats, as two separate ArmHF et ArmEL executables. If you do not know what family your ARM platform belongs to, just try one executable from each family.

24.5. Powered module but invisible for the OS

If your Yocto-Maxi-IO-V2 is connected by USB, if its blue led is on, but if the operating system cannot see the module, check that you are using a true USB cable with data wires, and not a charging cable. Charging cables have only power wires.

24.6. Another process named xxx is already using yAPI

If when initializing the Yoctopuce API, you obtain the "*Another process named xxx is already using yAPI*" error message, it means that another application is already using Yoctopuce USB modules. On a single machine only one process can access Yoctopuce modules by USB at a time. You can easily work around this limitation by using a VirtualHub and the network mode⁴.

24.7. Disconnections, erratic behavior

If you Yocto-Maxi-IO-V2 behaves erratically and/or disconnects itself from the USB bus without apparent reason, check that it is correctly powered. Avoid cables with a length above 2 meters. If needed, insert a powered USB hub⁵⁶.

⁴ see: <http://www.yoctopuce.com/EN/article/error-message-another-process-is-already-using-yapi>

⁵ see: <http://www.yoctopuce.com/EN/article/usb-cables-size-matters>

⁶ see: <http://www.yoctopuce.com/EN/article/how-many-usb-devices-can-you-connect>

24.8. Registering a VirtualHub disconnect an other one

If, when performing a call to RegisterHub() with an VirtualHub address, an other previously registered VirtualHub disconnects, make sure the machine running theses VirtualHubs don't have the same *Hostname*. Same *Hostname* can happen very easily when the operating system is installed from a monolithic image, Raspberry-PI are the best example. The Yoctopuce API uses serial numbers to communicate with devices and VirtualHub serial number are created on the fly based the *hostname* of the machine running the VirtualHub.

24.9. Dropped commands

If, after sending a bunch of commands to a Yoctopuce device, you are under the impression that the last ones have been ignored, typical example is a quick and dirty program meant to configure a device, make sure you used a YAPI.FreeAPI() at the end of the program. Commands are sent to Yoctopuce modules asynchronously thanks to a background thread. When the main program terminates, that thread is killed no matter if some command are left to be sent. However API.FreeAPI() will wait until there is no more commands to send before freeing the API resources and returning.

24.10. Damaged device

Yoctopuce strives to reduce the production of electronic waste. If you believe that your Yocto-Maxi-IO-V2 is not working anymore, start by contacting Yoctopuce support by e-mail to diagnose the failure. Even if you know that the device was damaged by mistake, Yoctopuce engineers might be able to repair it, and thus avoid creating electronic waste.



Waste Electrical and Electronic Equipment (WEEE) If you really want to get rid of your Yocto-Maxi-IO-V2, do not throw it away in a trash bin but bring it to your local WEEE recycling point. In this way, it will be disposed properly by a specialized WEEE recycling center.

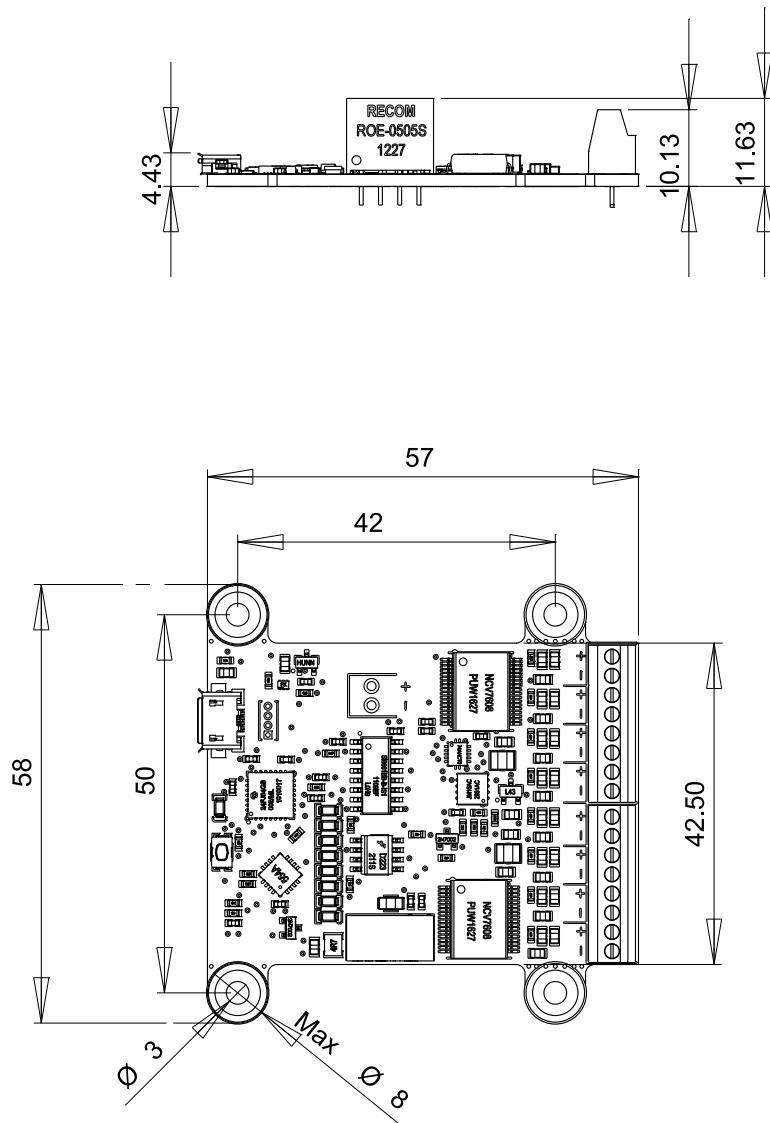
25. Characteristics

You can find below a summary of the main technical characteristics of your Yocto-Maxi-IO-V2 module.

Product ID	MAXIO02
Hardware release [†]	
USB connector	micro-B
Width	58 mm
Length	57 mm
Weight	18 g
Channels	8
Chipset	NCV7608
Refresh rate	250 Hz
Output impedance	<>10 Ω
Max working voltage	28 V
Protection class, according to IEC 61140	class III
USB isolation, dielectric strength (1 min.)	1 kV
Normal operating temperature	5...40 °C
Extended operating temperature [‡]	-30...85 °C
RoHS compliance	RoHS III (2011/65/UE+2015/863)
USB Vendor ID	0x24E0
USB Device ID	0x0079
Suggested enclosure	YoctoBox-MaxiIO-Transp
Harmonized tariff code	9032.9000
Made in	Switzerland

[†] These specifications are for the current hardware revision. Specifications for earlier revisions may differ.

[‡] The extended temperature range is defined based on components specifications and has been tested during a limited duration (1h). When using the device in harsh environments for a long period of time, we strongly advise to run extensive tests before going to production.



All dimensions are in mm
Toutes les dimensions sont en mm

Yocto-Maxi-IO-V2