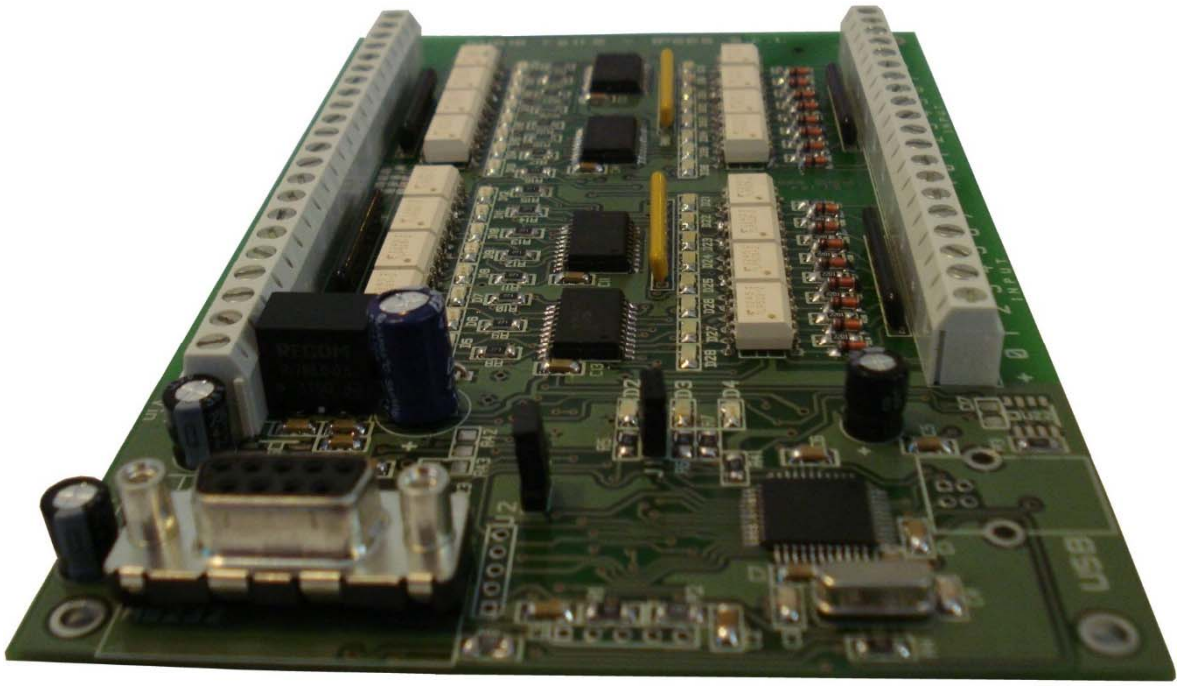
IO1616-S Control Unit
USER MANUAL

Rel.01.00.0002
(Product Code: IO1616-S)



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This manual in English is the original version.

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[1]With the exclusion of shipping costs for and from IPSES's development office.

WARNING!

ELECTRICAL DEVICES COULD DAMAGE EQUIPMENT OR PROPERTY OR CAUSE PERSONAL INJURY

This guide contains instructions and technical features of the IO1616-S Control Unit.
Read with attention before attempting to install.
It is the responsibility of the technician to undertake all the safety rules provided by the law during the installation and the use of this device.
For any information which is not contained in this guide, please contact:

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REVISION HISTORY

Manual revision history

Revision/ Date	Change description	Author
01.00.0000 July, 2013	First version released	Rivolta A.
01.00.0001 February 2016	Changed document layout	Bottaccioli M.
01.00.0002 August, 2016	Added ISO 9001:20015 logo	Bottaccioli M.

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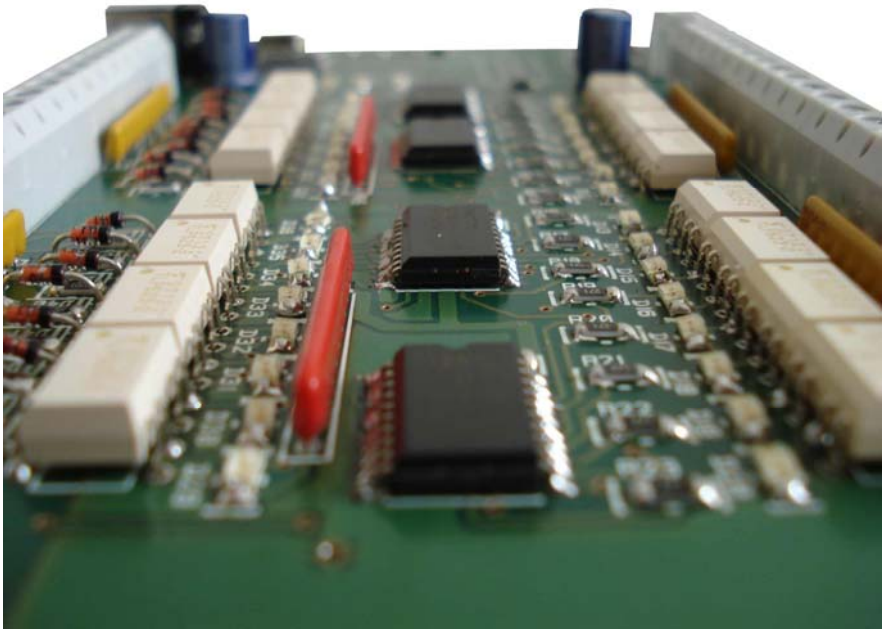
GENERAL FEATURES

IO1616-S is a control unit integrated on *European Card Format* (160 x 100 mm – 6,30 x 3,94 inches) equipped with RS232 interface. IO1616-S can check sixteen optocoupled inputs and driving sixteen optocoupled outputs. Both are reciprocally isolated in two groups of eight.
The control and the configuration of the device are achieved through RS232 serial interface, easy to use thanks to *hyperterminal* program, or using the simple demo software.
The board is equipped with a non-volatile memory where it is possible to store the power-on status of every output.



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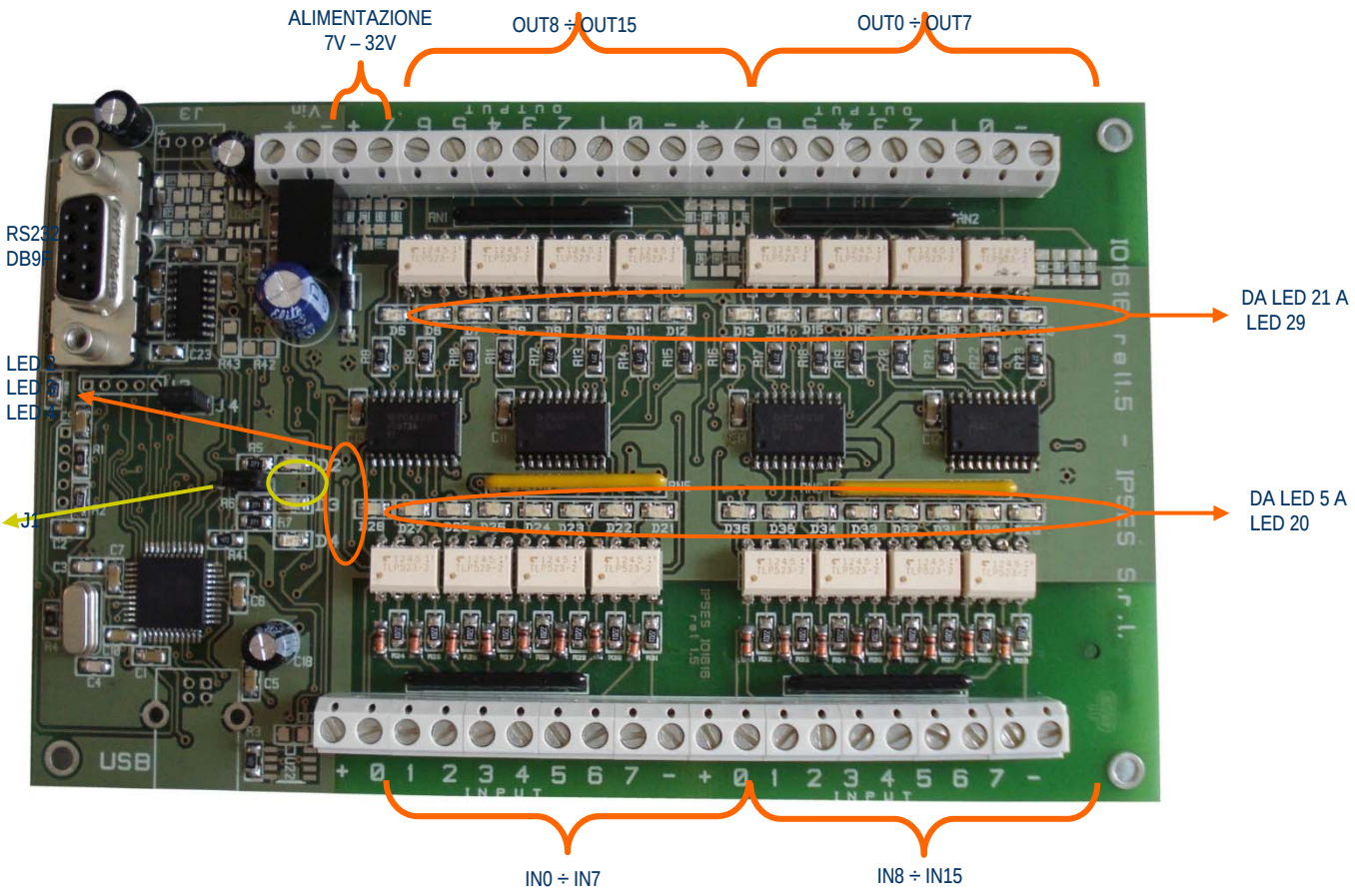
CARD DESCRIPTION

IO1616-S card is shown in the picture below: in the lower part of the card the sixteen inputs are divided in two groups of eight (numbered from 0 to 7 on the card serigraphy), and, similarly, in the upper part of the card there are the sixteen outputs (numbered and divided in the same way).



Picture 1: IO1616-S card

The LEDs are:

D2	Green LED: hardware initialized correctly
D3	Green LED: applicative modules loaded
D4	Red LED: Status LED (see relating paragraph)
D5	Red LED: OUT 15 activated
D6	Red LED: OUT 14 activated
D7	Red LED: OUT 13 activated
D8	Red LED: OUT 12 activated
D9	Red LED: OUT 11 activated
D10	Red LED: OUT 10 activated
D11	Red LED: OUT 9 activated
D12	Red LED: OUT 8 activated
D13	Red LED: OUT 7 activated

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D14	Red LED: OUT 6 activated
D15	Red LED: OUT 5 activated
D16	Red LED: OUT 4 activated
D17	Red LED: OUT 3 activated
D18	Red LED: OUT 2 activated
D19	Red LED: OUT 1 activated
D20	Red LED: OUT 0 activated
D21	Green LED: V_{high} applied at IN 7
D22	Green LED: V_{high} applied at IN 6
D23	Green LED: V_{high} applied at IN 5
D24	Green LED: V_{high} applied at IN 4
D25	Green LED: V_{high} applied at IN 3
D26	Green LED: V_{high} applied at IN 2
D27	Green LED: V_{high} applied at IN 1
D28	Green LED: V_{high} applied at IN 0
D29	Green LED: V_{high} applied at IN 15
D30	Green LED: V_{high} applied at IN 14
D31	Green LED: V_{high} applied at IN 13
D32	Green LED: V_{high} applied at IN 12
D33	Green LED: V_{high} applied at IN 11
D34	Green LED: V_{high} applied at IN 10
D35	Green LED: V_{high} applied at IN 9
D36	Green LED: V_{high} applied at IN 8

Jumper description:

J1	Restoring factory default
J4	*Reserved*

LED STATUS

The LED D4 indicate the status of the system:

LED D4	Status Description
Blinking	System up and running
Fixes	System error

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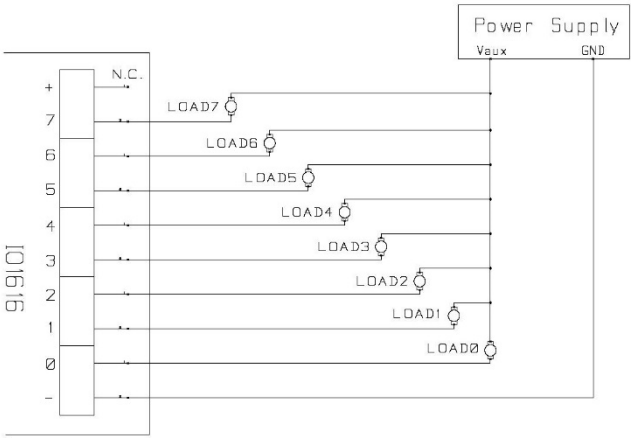
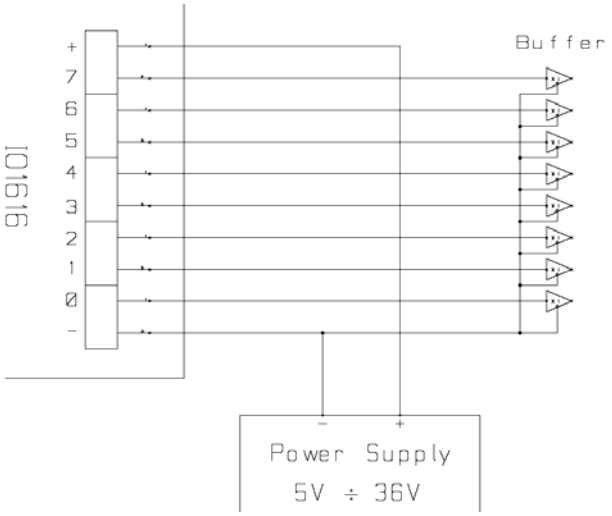
OUTPUT

The sixteen outputs are completely isolated, both between them in two groups of eight and with other signals on the device.
Here below there are the diagrams of two typical connections of external device to IO1616-S card: in the first case (Picture 2a), the card will manage directly some loads (with maximal current of 150mA). In the second case (Picture 2b), the card is connected to a high impedance device (i. e. the inputs of a PLC).



Picture 2a: diagram of the output connections.



Picture 2b: diagram of the output connections.

Output status is displayed by LED placed near every connector (LED from D5 to D20, showed in Picture 1).

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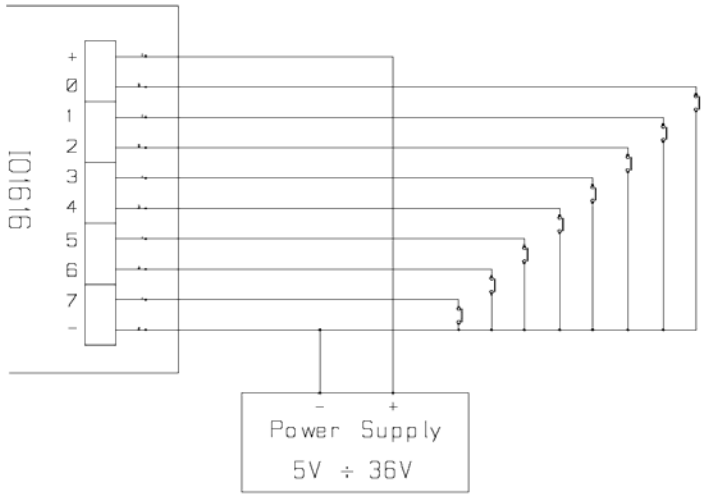
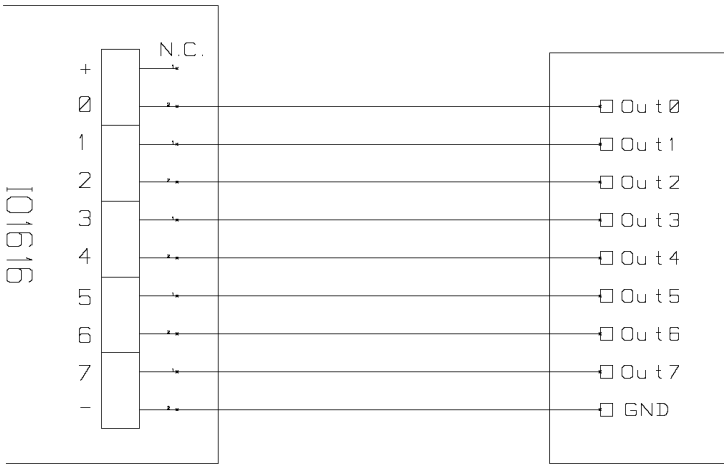
INPUT

The sixteen inputs are completely isolated, both between them in two groups of eight and with other signals on the device.

We suggest to connect inputs following one of the diagrams displayed below:
-Picture 3a: use this way in case inputs have to detect the pression of a switch or an open collector output.
-Picture 3b: use this way in case inputs are directly controlled by a voltage.



Picture 3a: diagram of input implementation.



Picture 3b: diagram of input implementation.

Input status is displayed by LED placed near every connector (LED form D21 to D36, showed in Picture 1).

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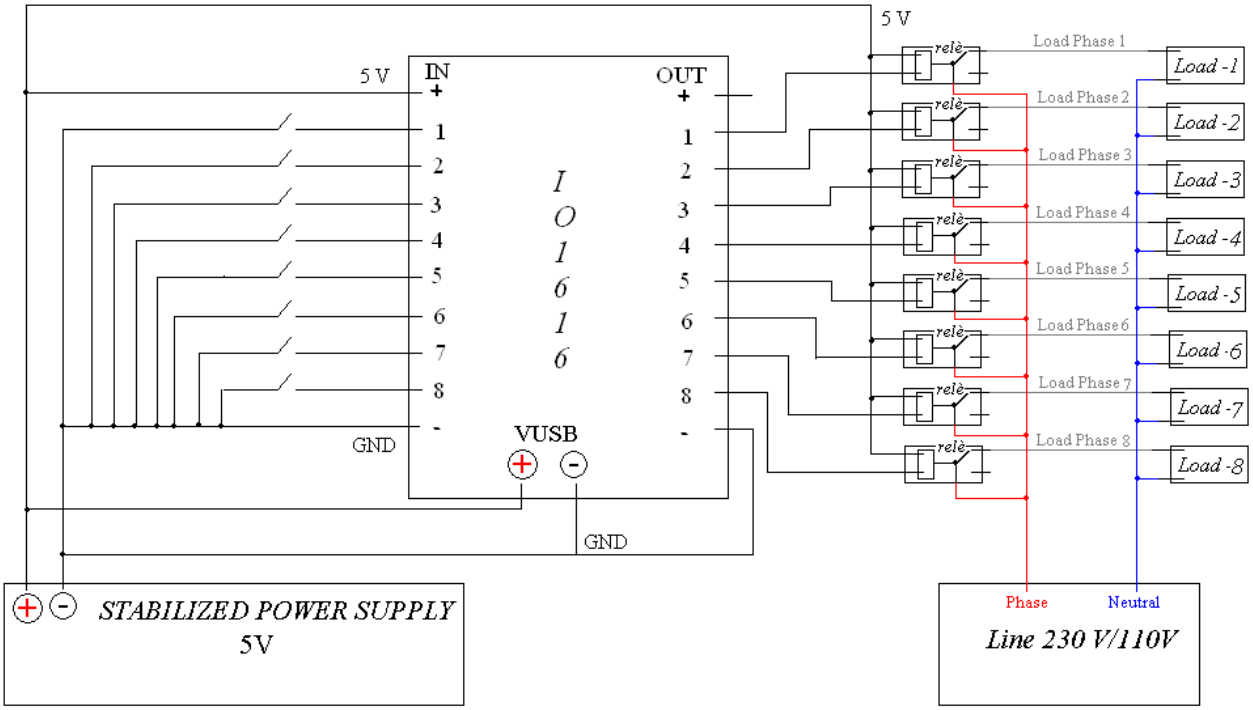
EXAMPLE OF USAGE

The follow examples show how you can connect IO1616-S for manage external load with line supply.

Picture 4 show how connect IO1616-S in *stand-alone* mode (without PC connections). Before using the device in this mode you have to configure IO1616-S using *demo software.*



Picture 4: Stand alone mode connections (without PC).

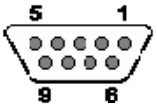
POWER SUPPLY

The board is equipped with a connector (see Picture 1: the connector labeled as "VIN") which allows to connect an external voltage supply to power the board: its value must be included from +7V up to +32V.
The voltage supply can be used also as "*Power Supply*", as indicated in Picture 2b and 3a: by these way, the galvanic isolation of the board between I/O and control logic will be lost, so the GNDs must be connected together to avoid irreversible damage of the card.

WARNING!
The maximum supply voltage must not exceed +32Vdc: in case of use of higher voltage the components of the board may damage irremediably.

RS232 SERIAL INTERFACE

The IO1616-S card is equipped with a serial interface, based on RS232 protocol: the physical connector is a DB9F, as shown in Picture 1.
The connector pinout is the following:



Conn. DB9F

Pin	Signal
1	-
2	TX – RS232
3	RX – RS232
4	-
5	GND
6	-
7	-
8	-
9	-

COMMUNICATION PROTOCOL

To communicate with IO1616-S card the RS232 interface must be configured with the following parameters:

communication speed:	9600 baud
data bits:	8
parity bits:	none
stop bits:	1
flux control:	none

The communications data are based on ASCII strings, terminated with <CR>+<LF> (\r\n) chars.
The commands are case sensitive and must be write in capitol letter, as reported in the following list.

Command list:

Command	Description	Answer type
SN	Requests board serial number	1
FV	Requests firmware version	1
BD	Requests firmware build date	1
DIx	Requests input status (x = 0-15 / A → all)	2
DOx	Requests output status (x = 0-15 / A → all)	2
ADx	Actives related output (x = 0-15 / A → all)	3
SDx	Disables related output (x = 0-15 / A → all)	3
ADA –S[xxxxxxxxxxxxxxxx]	Sets the status of each output, from Out0 to Out15	3
T	Requests measured temperature	1
SP	Requests all startup outputs status	2
SPD –S[xxxxxxxxxxxxxxxx]	Sets startup status (x = 0/1 – Off/On) of each output, from Out0 to Out15	3
TM	Requests timeout settings (outputs status Out0..Out15 – timeout time [0-8])	1
TM –T[x]	Sets timeout time (x = 0-8)	3
TM –S[xxxxxxxxxxxxxxxx]	Sets timeout status (x = 0/1 – Off/On) of each output, from Out0 to Out15	3
PLCy	Requests mask and filter settings (M0..M15 – F0..F15 related to In0..In15 inputs) for the y output (y = 0-15)	1
PLCy –M[xxxxxxxxxxxxxxxx]	Sets the mask status (x = 0/1 – Off/On) of each input, from In0 to In15, for the y output (y = 0-15)	3
PLCy –F[xxxxxxxxxxxxxxxx]	Sets the filter status (x = 0/1 – Off/On) of each input, from In0 to In15, for the y output (y = 0-15)	3
?	Command help	

All commands are answered with a response terminated by the <CR>+<LF> (\r\n) chars.
The following table lists the kind of answer related to the edited command:

Answer type	Description
1	The answer is preceded by a 18 chars length descriptive string, followed by request info or status. For example the SN command generates the following answer: "Serial number: 2013000".
2	The data answer is preceded by a descriptive string with variable length, related to the typed command.
3	The answer to these I/O setting commands is: "done ".
4	The answer is made by a single char: 0 = Off, 1 = On.

If the command syntax is not valid the answer is: "error".

The next table encode the timeout time parameter used in TM and TM –T[x] commands:

Parameter	Value

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0	No timeout
1	5 seconds
2	10 seconds
3	30 seconds
4	1 minute
5	5 minutes
6	10 minutes
7	30 minutes
8	1 hour

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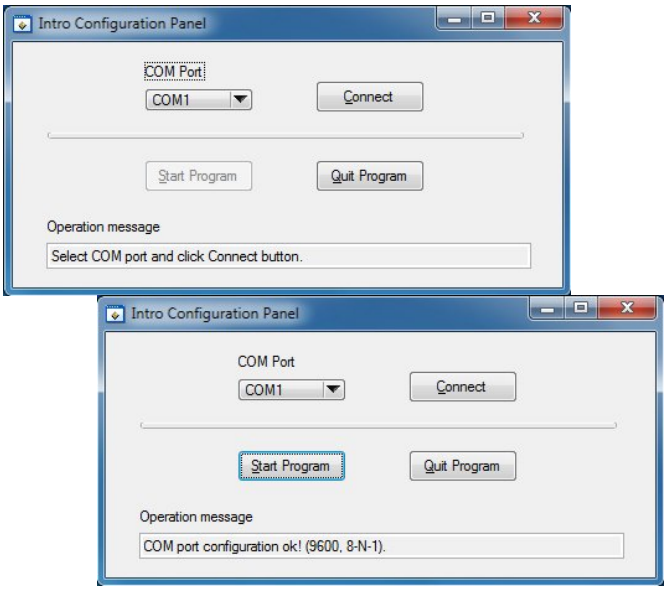
DEMO SOFTWARE

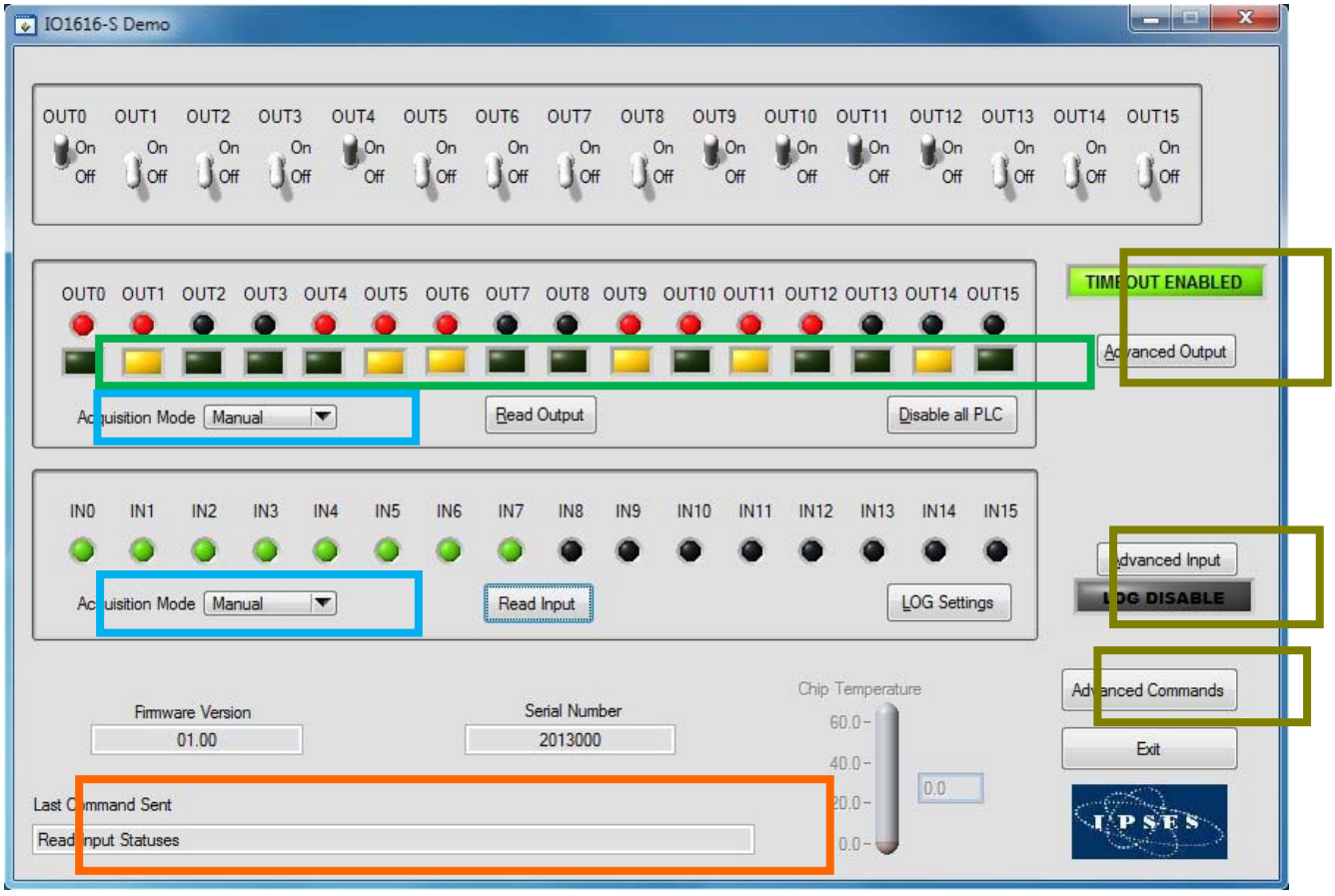
A CD with a demo software is provided with the card. This demo software allows to manage the main functions of IO1616-S.

The program starts with a connection window, as in Picture 5a. To proceed you should select a COM port from the ring menu and click the *Connect* button: if the COM port is available, the *Start Program* button will be enabled.
With this demo software it is possible to control only one card per time.



Picture 5: a) start connection window; b) COM port correctly configured.

Click the *Start Program* button to open the main window of the software, as shown in Picture 6.
The *Firmware Version* and *Serial Number* fields are updated according to the value read from the device. If a temperature sensor is mounted on the card, its value is periodically updated during the use of the device.



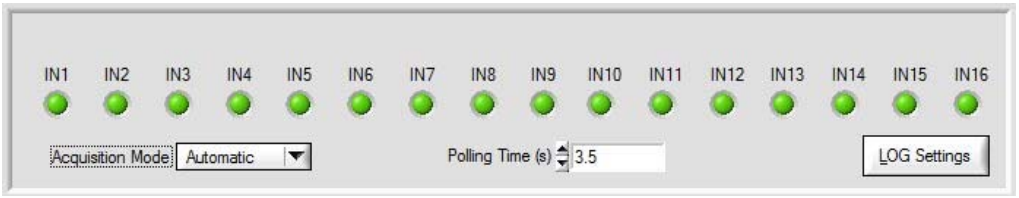
Picture 6a: Main windows of the demo software.

The field *Last Command Sent* (surrounded in orange in Picture 6a) shows the last operation executed. The selectors in the upper part directly manage the sixteen outputs in real time, while the *Read Output* button update the software output LEDs exactly as in the card (the software colour, red, is the same of the card).
The square LED, place under every output indicator (surrounded in green in Picture 6a), show if are define masks and filters for an output.
To disable all filters and masks for every output push *Disable All PLC* button.
To enable/disable masks and filters for a particular output push the corresponding square LED and configure the *PLC panel* (Picture 6b).

Picture 6b: PLC panel.

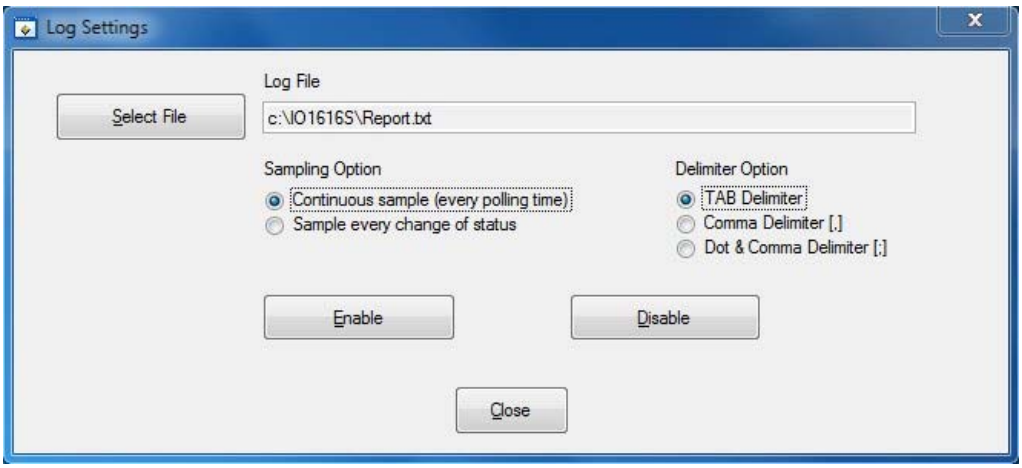
The *checkboxes* allow to create a mask on the inputs useful to the function, while the square LEDs allow to select the desired on/off status on each corresponding masked input.

In main window you can read the logic inputs/outputs status in two ways, thanks to the selector ring menu (surrounded in blue in Picture 6a). The manual mode performs an asynchronous sampling when you push the *Read Input/Read Output* button, while the automatic mode performs a continuous polling of the input/output status. The polling rate is customable by the *Polling Time* control (showed in Picture 6c): this field accepts values between 0.5s and 10s. In both cases, at every sample, the software green/red LEDs referred to the inputs/outputs status are updated.



Picture 6c: Automatic acquisition mode of the inputs.

During the automatic acquisition mode of the inputs, it is possible to generate a log file: the *LOG Settings* button allows to open the configuration window of the *log'* parameters (showed in Picture 6d).

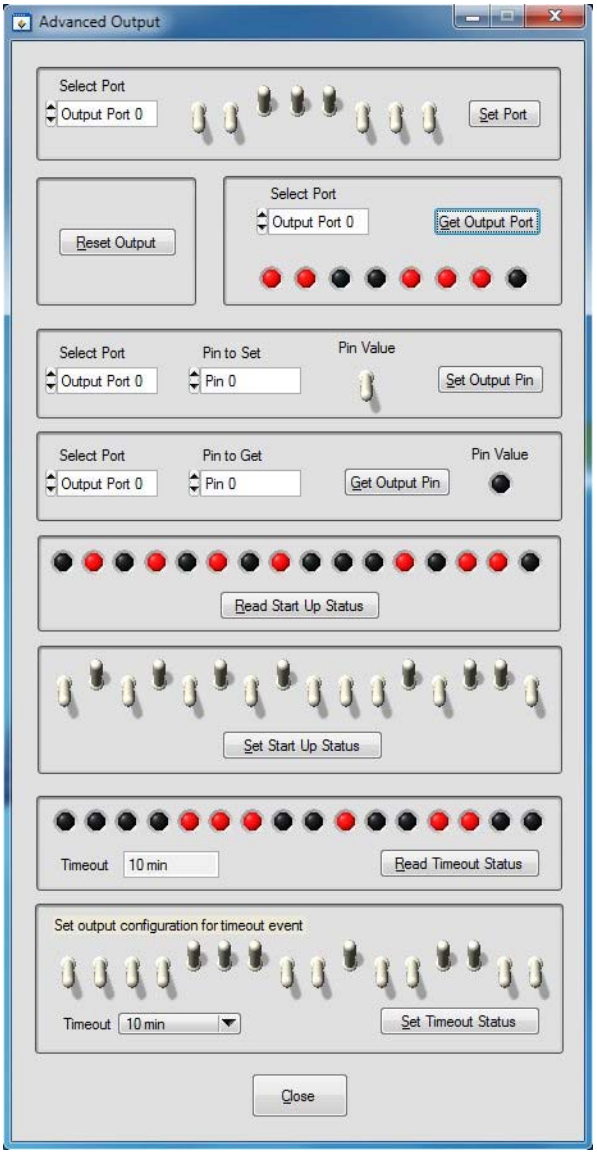


Picture 6d: Log settings window.

The Select File button allows to browse the path and the file name of the log file (.txt). If the file does not exist, it will be created at the first writing.
The Sampling Option selector allows to choose the data logging mode: every polling time, or every polling time when the actual status is different from the previous one. The default is the *Continuous sample* mode.
The *Delimiter Option* selector allows to select the delimiter of the fields in the log file: the default is the TAB.
If the input acquisition mode is set to *Manual* while the logging is enable, this will be automatically suspended until the acquisition mode will not set to *Automatic*.
The structure of the generated log file is:
S/N Date(dd/mm/yyyy) Time(hh:mm:ss) Inputs value(hex) Inputs value(bin)
The value of the inputs, both in hexadecimal and binary format, are coded as Big Endian bitwise, where the less significant bit (LSB) is referred to input 0 and the most significant bit (MSB) is referred to input 15.

Three buttons on the right (surrounded in green in Picture 6a) allow to open three windows: one for the outputs (*Advanced Output)*, one for the inputs (*Advanced Input)* and the last one for the read and write commands in the non volatile memory (*Advanced Commands*).

The *Advanced Output* window (see Picture 6e) allows the typical operations you can performed on the outputs of the device.



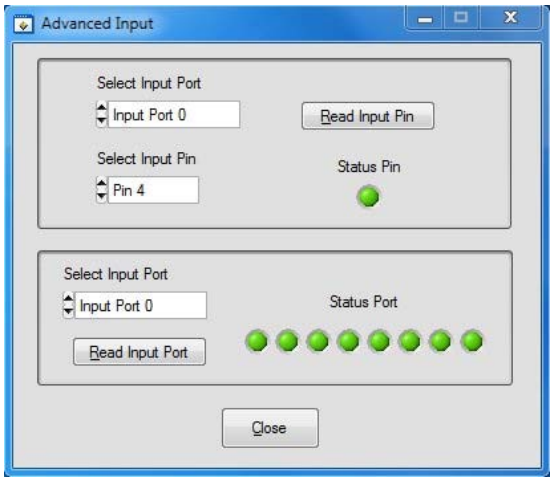
Picture 6e: Advanced Output window.

The output commands are listed below:

- Activation of each output for both ports
- Reset of the outputs (all outputs are switched off)
- Reading of the status of each output for each port
- Command and reading of a single output
- Reading of the output status at the power on
- Setting the output status at the power on
- Reading of the timeout status
- Manage the customizable serial *timeout* with associate outputs configuration

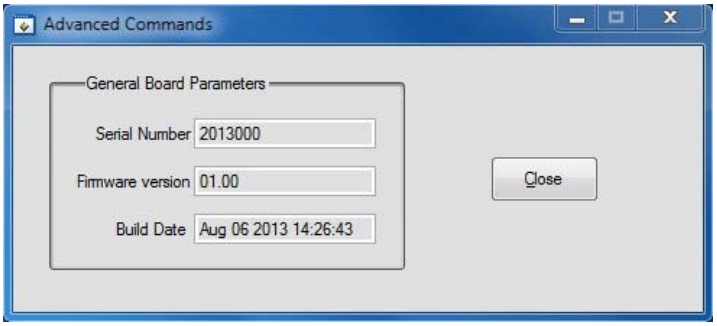
Advanced Input window (see Picture 6f) allows the typical operations you can performed on the inputs of the device.
The input commands are listed below:

- Reading of the status of each input for each port
- Reading of the status of a single input



Picture 6f: Advanced Input window.

The *Advanced Commands* window (see Picture 6g) shows the card information, as serial number, firmware version and firmware build date.



Picture 6g: Advanced Command window.

PRODUCT CODE

Code	Description
IO1616-S	IO1616 serial control card (without temperature sensor)
IO1616T-S	IO1616 serial control card with temperature sensor
IO1616-S-DIN	IO1616 serial control card mounted on a universal support for DIN rail (without temperature sensor)
IO1616T-S-DIN	IO1616 serial control card mounted on a universal support for DIN rail (wit temperature sensor)
IO1616-S Library	LabVIEW 2010 (and following versions) Library for IO1616-S cards
RS232-DB9	RS232 cable with DB9 female connector

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TECHNICAL FEATURES

Power supply:	External, from 7V up to 30V (continuous current)
Working temperature:	From 0°C up to +60°C
Storage temperature:	From -40°C up to +85°C
Interface toward:	RS232 serial connector, DB9F
Card dimensions:	160 x 100 mm (6.30 x 3.94 inches) Thickness (with components): 15 mm (0.59 inches)
Inputs:	Sixteen optocoupled inputs, reciprocally isolated in two groups of eight Maximum applicable voltage: 36V Input Impedance: ≈ 2.5Kohm Logical LOW level:< 1V Logical HIGH level:> 2.5V
Outputs:	Sixteen optocoupled outputs, reciprocally isolated in two groups of eight, in an open-collector configuration Maximum output voltage:36V Maximum output current:150mA
Protection:	Optocouplers with 2.500V_{RMS} maximum operative isolation voltage
Temperature sensor:	Resolution: 0.0625°C Accuracy: ±1°C (max.) from +25°C to +65°C ±2°C (max.) from -40°C to +25°C and from +65°C to +85°C ±3°C (max.) from -55°C to -40°C and from +85°C to +125°C

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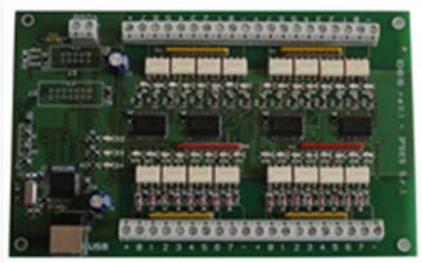
IPSES I/O CARD AVAILABLE MODELS

IO-69: Input/output Card with 6 inputs and 9 relay outputs and USB interface

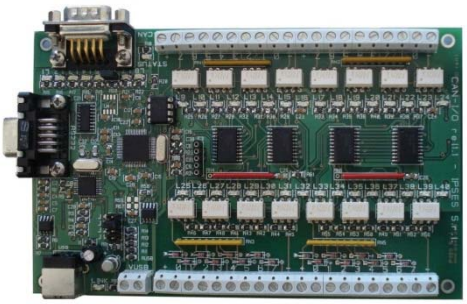
IO-69-USB is a self-powered card to manage six optocoupled inputs and nine relay outputs with USB interface.
A timeout control allows to protect the connecting devices, turning off all the outputs if it does not receive commands from the host within a time configurable through software.
Furthermore, there is the possibility to program all the outputs so that each one will activate only when inputs reach assigned conditions: in this case, IO- 69 acts like a programmable logic controller (PLC).
The card is produced in two versions: with single pole double throw relay (SPDT) and with single pole single throw relay (SPST).

IO-1616: Input/output Card with 16 inputs and 16 outputs and USB or RS232 interface



IO1616 is a self-powered card to manage sixteen optoisolated inputs and sixteen optoisolated outputs with USB interface. The model is available also with RS232 interface, in this case the card needs external power supply.
IO1616 can be directly connected to PLC, to input devices from operator and to other I/O systems. the status of each input
On request, an integrated temperature sensor allows to know in real time the temperature of the system IO1616 is placed in.

CAN-I/O: Input/output Card with 16 inputs and 16 outputs with CAN, USB and RS232 interface



CAN-IO is a control unit equipped with CAN, USB and RS232 interfaces to manage sixteen optocoupled inputs and outputs. The card can work as standalone device on CAN BUS. Its configuration is achieved either through USB (in this case the board is self-powered) or through RS232 interface. Easy to use and to configure, thanks to the provided software, CAN-IO is the right answer to the need to acquire and to drive digital signals through already existing CAN bus.
CAN-IO can be directly connected to PLC, to input devices by operator and to other I/O systems.
Each input and output status can be read by a field bus at any moment. Besides, thanks to LEDs fixed on, the status is shown directly on the board. An integrated temperature sensor allows to know in real time the temperature of the system CAN-IO is placed in.

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WEB-IO: Input/output Card with 16 inputs and 16 outputs, Ethernet interface, integrated web, telnet and SNMP servers and SMTP client.

WEB-IO is a card to manage sixteen optocoupled inputs and sixteen optocoupled outputs with Ethernet interface, equipped with a web, a telnet and an SNMP servers, and an SMTP client. The web server allows to connect and to manage the card using any web browser (i. e. Internet Explorer or Firefox), with no needs to install a software on your PC. Besides, the card can be connected directly to a switch or to a router with no need to use a PC. It is also possible to develop a customized software managed by telnet service or SNMP client. The SMTP client allows to send alert email based on inputs status change events.
WEB-IO can be directly connected to PLC, to input devices from operator and to other I/O systems. Each input and output status can be read by a web browser or a telnet client at any moment, besides it is shown directly on the board thanks to LEDs fixed on. On request, the card can be equipped with an integrated temperature sensor which allows to monitor in real time the temperature around the regulator voltage module. Through expansion connectors the card can be interfaced to a RTCLOG (Real Time Clock and Logger) optional module: by this way, it can perform a log of the I/O states on a dedicated memory.
WEB-IO is available also in box version, it is provided with a demo software for Windows environment, based on telnet service.

WEB-IO-WiFi: Input/output Card with 16 inputs and 16 outputs, Ethernet and WiFi interfaces, integrated web, telnet and SNMP servers

WEB-IO-WiFi is a card to manage sixteen optocoupled inputs and sixteen optocoupled outputs with Ethernet and WiFi interfaces, equipped with a web, a telnet and an SNMP servers. The web server allows to connect and to manage the card using any web browser (i. e. Internet Explorer or Firefox), with no needs to install a software on your PC. Besides, the card can be connected directly to a switch or to a router, by this way it can be accessed by any PC connected to Internet. It is also possible to develop a customized software managed by telnet service or SNMP protocol. The board is available with built-in antenna or with ultra-miniature coaxial (U.FL) connector for external antenna connection.
WEB-IO-WiFi can be directly connected to PLC, to input devices from operator and to other I/O systems. Each input and output status can be read by a web browser or a telnet client at any moment, besides it is shown directly on the board thanks to LEDs fixed on. On request, the card can be equipped with an integrated temperature sensor which allows to monitor in real time the temperature around the regulator voltage module.

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WEB-ADIO: Input/output Card with 8 analogical inputs, 8 digital inputs, 8 analogical outputs and 8 digital outputs, Ethernet interface, integrated web, telnet and SNMP servers

WEB-ADIO is a card to manage 8 optocoupled digital inputs, 8 analogical inputs, 8 optocoupled digital outputs and 8 analogical outputs with Ethernet interface, equipped with a web, a telnet and an SNMP servers. The WEB server allows to connect and to manage the card using any web browser (i. e. Internet Explorer and Firefox), with no needs to install a software on your PC Beside, the card can be connected directly to a switch or to a router with no need to use a PC.

It is also possible to develop a customized software managed by telnet service.

WEB-ADIO can be directly connected to PLC or to analogical transducer, to input devices from operator and to other I/O systems.

The analogical inputs and outputs have an operative voltage from 0V to 10V, with a resolution of 10mV and are calibrated one by one. Each input and output status can be read by a web browser or a telnet client at any moment, besides, the status of digital inputs and outputs it is shown directly on the board thanks to LEDs fixed on.

WEB-ADIO-WiFi: Input/output Card with 8 analogical inputs, 8 digital inputs, 8 analogical outputs and 8 digital outputs, Ethernet and WiFi interfaces, integrated web, telnet and SNMP servers

WEB-ADIO-WiFi is a card to manage 8 optocoupled digital inputs, 8 analogical inputs, 8 optocoupled digital outputs and 8 analogical outputs with Ethernet and WiFi interfaces, equipped with a web, a telnet and an SNMP servers. The web server allows to connect and to manage the card using any web browser (i. e. Internet Explorer and Firefox), with no needs to install a software on your PC Beside, the card can be connected directly to a switch or to a router with no need to use a PC. The board is available with built-in antenna or with ultra-miniature coaxial (U.FL) connector for external antenna connection.

It is also possible to develop a customized software managed by telnet service.

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WEB-ADIO-WiFi can be directly connected to PLC or to analogical transducer, to input devices from operator and to other I/O systems.

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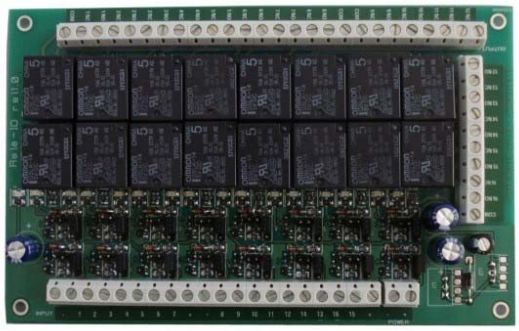
RELE' I/O: Interface module with16 digital inputs that can control 16 SPDT relay outputs 5A



RELAY I/O(-SEL) is an expansion module with16 digital inputs that can control 16 SPDT relay outputs 5A @ 250VAC or 5A @ 24VDC each

These modules can be used as an expansion for ant I/O card, transforming the TTL or contact freedmen open-collector type outputs (up to a maximum of 16 ones) in 16 relay outputs with NO and/or NC contact.

IPSES provides two board models, based on different relay output tipology:

- RELÈ-IO board: the sixteen outputs are divided in two groups of eight with common COM contact and both NC and NO contacts available on output connectors.
- RELÈ-IO-SEL board: each output is independent and each relay provides COM contact and one contact selectable between NC and NO according dedicated selector configuration.

To operate the cards require an external power supply. Two version are available: RELE'-IO(-SEL)-5 which requires an external power supply of $5V_{dc}$ or RELE'-IO(-SEL)-24 which requires an external power supply from $7V_{DC}$ up to $24V_{DC}$.

The card is in standard Eurocad format (100 x 160 mm - 3,94 x6,30 inches) and can be supplied mounted on opened DIN rail.

N8-USB: *Input Card with 8 inputs and USB interface*

IN8 is a low size auto powered control unit equipped with USB interface. IN8 can check eight galvanic isolated inputs: on each input it is possible to apply voltages regardless form the USB ground, with a maximum voltage of 30V.

Easy to use, thanks to the driver provided with and to the LabVIEW library available on demand, IN8 also reduce installation costs.

The board low size to be easily integrated in several systems. Besides, IN8 has its inputs galvanically isolated to protect from electromagnetic disturbances and ground loops, improving its reliability and quality.

IN8 is the right answer to the need to acquire digital signals from a PC in an industrial environment.

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LabVIEW Library for I/O cards:

A complete library for LabVIEW, giving the feasibility of I/O devices remote control, is available on request. The Library allows to implement a LabVIEW application without knowing the details of the communication protocol, making the development quick and easy. Each library is provided with a help file which explains deeper each function included with.

CONTACTS

IPSES S.r.l. conceives, projects and markets electronic and scientific instruments. The customized planning of our devices allows us to answer specific necessities for customers asking for embedded systems. IPSES clients enjoy access to a dedicated project engineering team, available as needed.
Our pool consists of highly competent professionals whose experience in this field is extremely strong. Thanks to constant updating and technical development, IPSES is a leading company, combining the dynamism of a young group into the competence and reliability of a qualified staff.

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PROBLEM REPORT

The next page is a standard template used for reporting system problems. It can be copied and send as a fax. Alternative bugs may be reported by emails, in this case please insure that the mail contains similar information as the *Engineering Problem Report* form.

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ENGINEERING PROBLEM REPORT

Problem describer

Name			**IPSES S.r.l.** **Via Lazzarotto, 10** **Cesate (MI)** **Italy** **Fax ++39 02/700403170** **e-mail*support@ipses.com***
Company			
Date	Tel.	Fax	

Product

Name	Version	Serial No.

Report Type (bug, change request or technical problem)

Major bug	☐	Urgency:	
Minor bug	☐	High	☐
Change request	☐	Medium	☐
Technical problem	☐	Low	☐

Problem Description

Reproduction of Problem

IPSES s.r.l. Action notes

Received by	Date	Report No.	Action

(Code IO1616-S Control Unit Rel.01.00.0002)

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