



- DIN rail mountable
- 8 Relay outputs (5A, 250VAC contacts)
- 4 Optically Isolated Inputs, with counters
- 3 Analog Inputs (10 bit) jumper-selectable for 0-5V or 0-20mA
- RS485 or USB (virtual serial port)
- 10/100baseTX Ethernet with MAC address
- Modbus TCP/IP with easy configuration via webpage
- 1200-38400 Baud Modbus RTU Slave Device
- Can be used as a USB to RS485 converter
- Watchdog Timer resets the unit when communication from the network master is lost

The KTA-324 is a Modbus Slave IO module for interfacing to any PLC or PC using the Modbus (RTU or TCP/IP) protocol. It behaves as a Modbus Slave and Relays, Inputs and Outputs are controlled by writing to and reading from the Coils and Holding Registers. It can be used for many applications such as controlling lights and sprinkler systems, reading sensors and monitoring switches and other digital signals, or even for industrial control.

The module can connect to a standard RS-485 2-wire half duplex network, to a computer via USB, or over Ethernet. When connected via USB, the module acts as a USB to RS-485 converter and multiple IO units (or other Modbus devices) can be connected to the RS-485 bus. USB drivers are available for Windows, Mac and Linux.

The user can save a set of output statuses to be loaded when the unit is powered up or reset. A watchdog timer can be configured to reset the unit after a user-definable number of seconds since the last communication from a Modbus master.

## Specifications:

### Power Supply V+ and COM:

- 8 to 32V DC
- ~3.1W + External 5V drain

### Analog Inputs:

- 0 to 5 V: ~500 k $\Omega$  effective resistance with no jumper installed
- 0 to 20 mA: 250  $\Omega$  effective resistance with jumper installed

### Opto-Isolated Input:

- 0 to 30 V, ~1 k $\Omega$  effective resistance
- $\leq 2.5$  VDC activation threshold
- 3750V<sub>RMS</sub> Isolation

### Relay Outputs:

- SPST relays rated to 5 A (resistive).
- 250 VAC / 30 VDC

### 5 V Auxiliary Supply:

- 300 mA

**Connections:**

**Table 1 - Connections**

Label	Description	Label	Description
Dx	Opto-Isolated Digital Input x	5VO	5V Output for Sensors
COM	Opto-Isolated Common	V+	Power Supply Positive Input
ANx	Analog Input x	GND	Ground
D+	RS485 Data+	USB	USB B-type connection to PC
D-	RS485 Data-	NO	Relay Normally Open Contact
ETHERNET	10/100baseTx Ethernet	C	Relay Common Contact

**Jumper Settings:**

The analog inputs of the KTA-324 can be set for 0-5V or 0-20mA operation. Opening the case and inserting jumper shunts in the positions J1, J2 or J3 will set the analog input to 0-20mA operation. Removing the shunts will set the analog inputs to 0-5V operation. The KTA-324 is equipped with protection on the analog inputs, but excessive voltage or current could damage the microcontroller and should be avoided.

**Push Buttons:**

Two mechanical push buttons are also provided on the board. The KTA-324 checks on power up if the IP RESET button is being held down. If so it returns the controller to the default serial and IP communications settings.

Pressing the RESET BUTTON puts the unit into bootloader mode, ready for firmware updates.

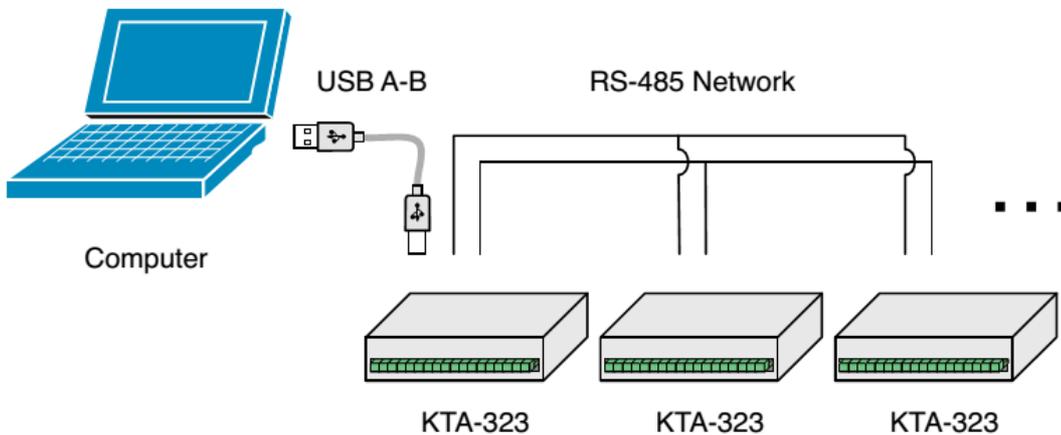
**Communicating with the KTA-324:**

By default, the KTA-324 communicates at 9600 8N1 (8 data bits, no parity, 1 stop bit) with the Modbus slave address of 1. These settings can be changed by altering holding registers in the unit.

A computer can connect to the unit via USB. The USB circuit is based on the FTDI FT232 series of converters and virtual serial port drivers are available from FTDI for Windows, Mac and Linux. Ocean Controls has a range of Windows utilities for communicating to Modbus slave devices, including Modbus View and ISEE Modbus.

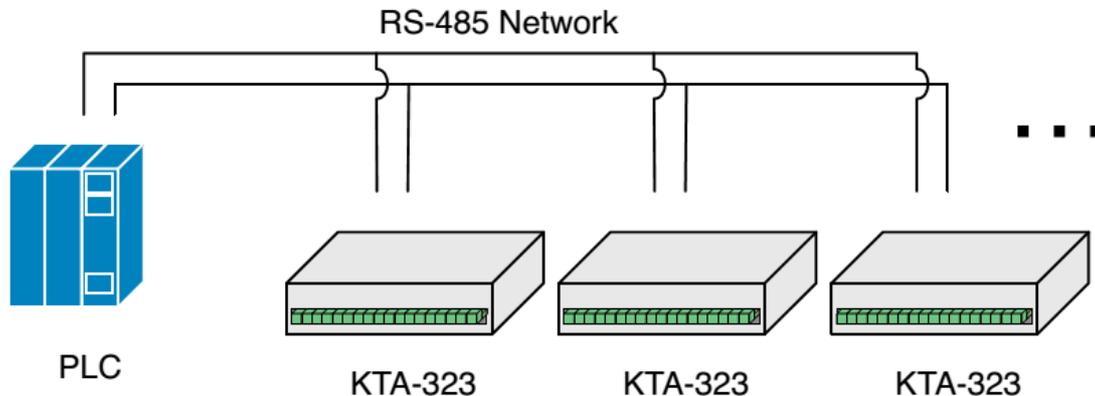
The USB circuitry works as a USB to RS-485 converter. A single KTA-324 can be plugged into a computer via USB, and a chain of up to 32 KTA-324 or other RS-485 devices can be connected to the serial bus.

**Figure 1 - Connecting multiple controllers with a RS485 network**



A PLC (or computer with the appropriate convertor) can connect to the unit via 2-wire RS485 serial at the D+ and D- terminals. In the case of a 3-wire network, the signal ground can be connected to any one of the COM terminals.

**Figure 2 - Connecting multiple controllers with a RS485 network**



The Ethernet ships with the default IP settings:

**IP Address: 192.168.1.100**

**Subnet Mask: 255.255.255.0**

**Default Gateway: 192.168.1.1**

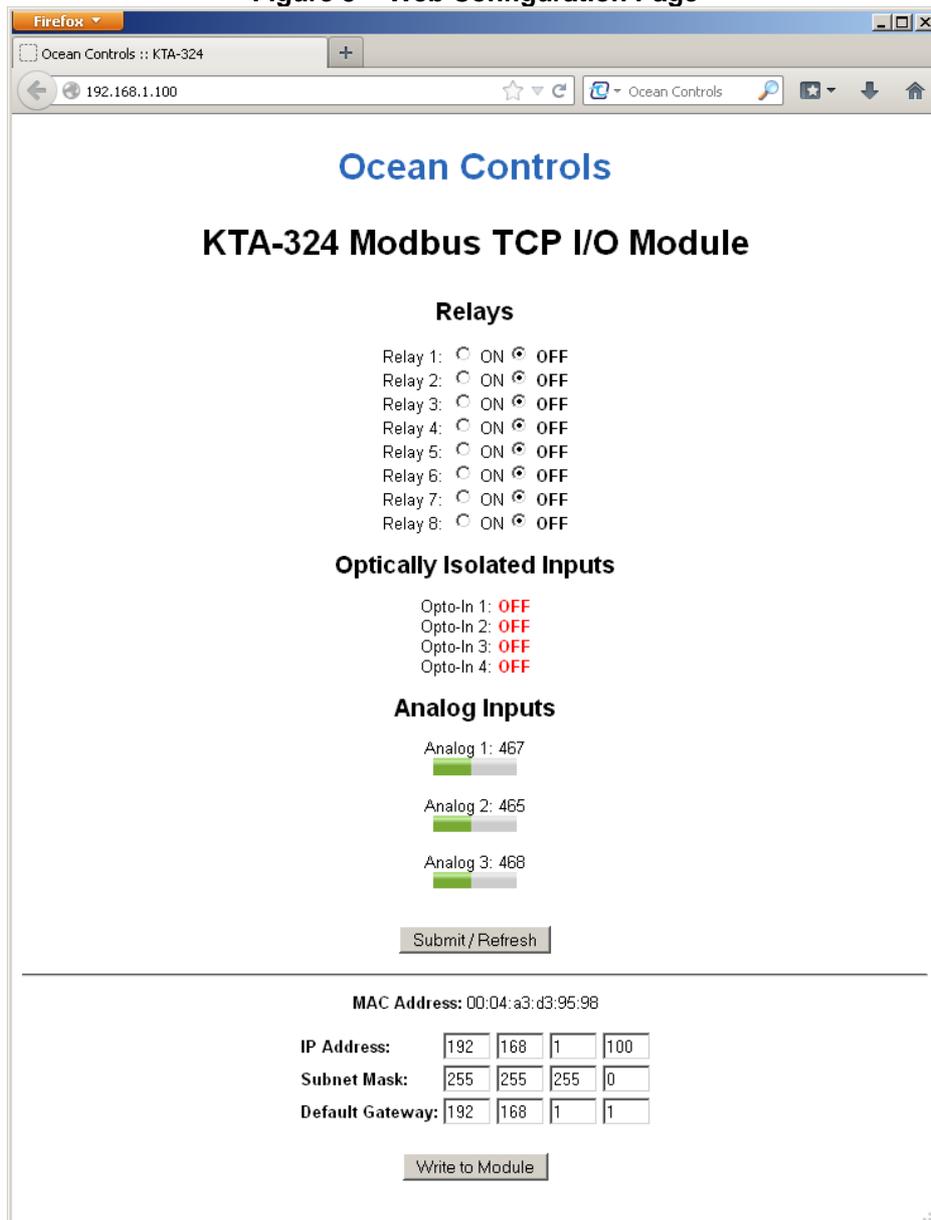
**MAC address: globally unique**

These settings can be changed using the webpage, or by writing to the Modbus Holding Registers. Once these values have been written, they are committed to memory and will be loaded the next time the KTA-324 is reset (or power cycled).

If the unit has unknown communications settings, it can be reset to the default by holding down the IP ADDR RESET button and power cycling the unit (or pressing the RESET BUTTON). This will return the serial to 9600 8N1 (8 data bits, no parity, 1 stop bit), and the Ethernet to the default IP settings.

Configuration Page:

Figure 3 - Web Configuration Page



The KTA-324 also acts as a webserver over Ethernet. Navigating a browser to the IP address of the unit will serve out a configuration page, whereby the IO of the device can be viewed and altered.

Below the IO is a form used to set the IP settings. The IP address, subnet mask, and default gateway can all be changed and written to the unit. The changes will be applied on the next power cycle or reset of the unit. The MAC address is also displayed for convenience.

**Modbus Registers:**

Modbus is an industrial serial control protocol. A Modbus master (usually a PLC or PC) polls slave devices, asking for their status or commanding them to change an internal parameter. The specification defines coils, holding registers, input statuses, and input registers. Coils represent relays. Input statuses are digital inputs, such as the KTA-324's opto-Isolated inputs. Input registers are 16 bit input values, such as the KTA-324's analog inputs. Holding registers are internal registers of the slave.

To simplify communications some Modbus systems only use coils and holding registers. The KTA-324 replicates the opto-isolated inputs onto coils and the analog inputs onto holding registers to make interfacing to the unit simpler.

The table below shows the mapping of inputs and outputs (and special configuration registers) to holding registers, coils, input statuses and input registers.

**Table 2 - Modbus Function Map**

<b>Holding Register</b>	<b>Function</b>
40001	Counter 1
40002	Counter 2
40003	Counter 3
40004	Counter 4
40005	Analog Input 1
40006	Analog Input 2
40007	Analog Input 3
40008	Opto-Isolated Input 1
40009	Opto-Isolated Input 2
40010	Opto-Isolated Input 3
40011	Opto-Isolated Input 4
40012	Watchdog Timer
40013	Modbus RTU Slave Address
40014	Serial Baudrate
40015	Serial Parity
40016	IP Address Octet 1
40017	IP Address Octet 2
40018	IP Address Octet 3
40019	IP Address Octet 4
40020	Subnet Mask Octet 1
40021	Subnet Mask Octet 2
40022	Subnet Mask Octet 3
40023	Subnet Mask Octet 4
40024	Default Gateway Octet 1
40025	Default Gateway Octet 2
40026	Default Gateway Octet 3
40027	Default Gateway Octet 4

<b>Input Register</b>	<b>Function</b>
30001	Analog Input 1
30002	Analog Input 2
30003	Analog Input 3

<b>Coil</b>	<b>Function</b>
1	Relay 1
2	Relay 2
3	Relay 3
4	Relay 4

5	Relay 5
6	Relay 6
7	Relay 7
8	Relay 8
9	Opto-Isolated Input 1
10	Opto-Isolated Input 2
11	Opto-Isolated Input 3
12	Opto-Isolated Input 4

Input Status	Function
10001	Opto-Isolated Input 1
10002	Opto-Isolated Input 2
10003	Opto-Isolated Input 3
10004	Opto-Isolated Input 4

The counter registers increment every time the respective opto-isolated input is activated.

The analog inputs are continuously sampled and presented as input registers and at the holding registers 40005-40007. The analog converter is 10 bit. 5V (or 20mA) is represented by the value 1024.

The Watchdog Timer defines a length of time in seconds to wait after the last communication from a Modbus master before resetting. A value of 0 disables the timer.

Writing to any of the holding registers between 40013 – 40027 saves the current state of the relays and the counter values to non-volatile memory. It is this state that is loaded when the unit powers up or is reset by the watchdog timer.

The Modbus slave address can be any value from 1 to 247, as per the Modbus specification.

The value in register 40014 sets the serial baudrate and must be one of the values shown in Table 3.

**Table 3 -Baudrate**

Register 40014	Baudrate
12	1200 baud
24	2400 baud
48	4800 baud
96	9600 baud
192	19200 baud
384	38400 baud

The value in register 40015 must be one of the values in Table 4.

**Table 4 -Parity**

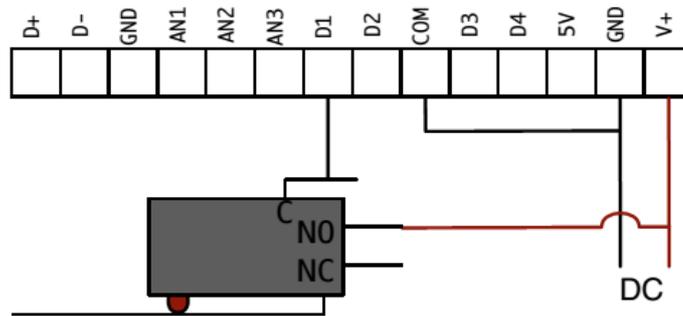
Register 40015	Parity
0	No Parity
1	Odd Parity
2	Even Parity

Modbus TCP/IP communicates over port 502. The webserver listens for requests on port 80.

**Wiring:**

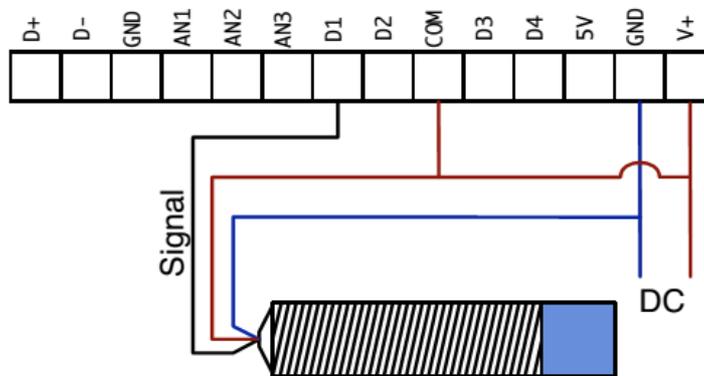
The optically isolated inputs allow for a range of connection possibilities. They are bi-directional, meaning they activate if current is passed in either direction through their inputs. One side of all of the opto-isolated inputs are tied together to the COM terminal. The figures below show how to interface a dry-contact switch, NPN, and PNP-type sensor.

**Figure 4 - Wiring a dry contact switch**



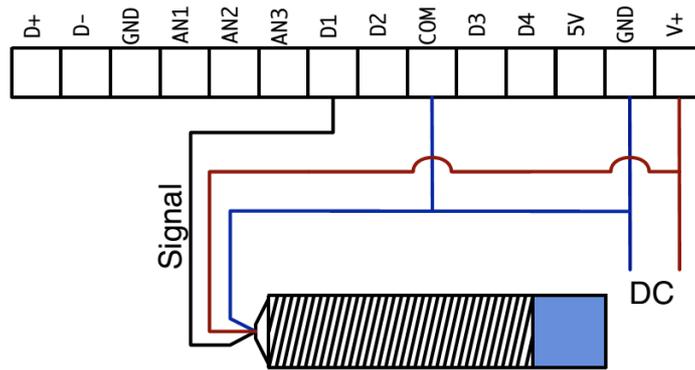
Wiring a Switch

**Figure 5 - Wiring an NPN-type sensor**



Wiring an NPN-type Sensor

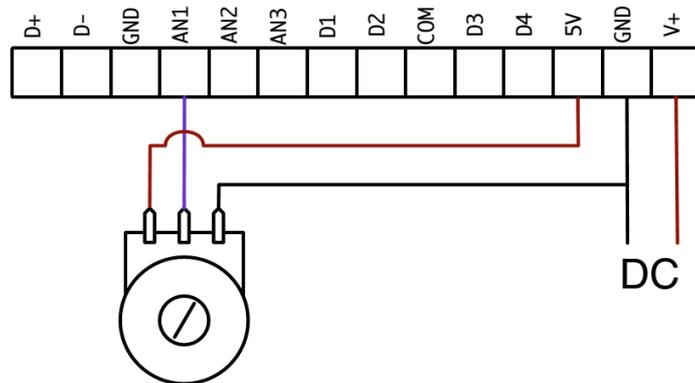
**Figure 6 - Wiring a PNP-type sensor**



### Wiring a PNP-type Sensor

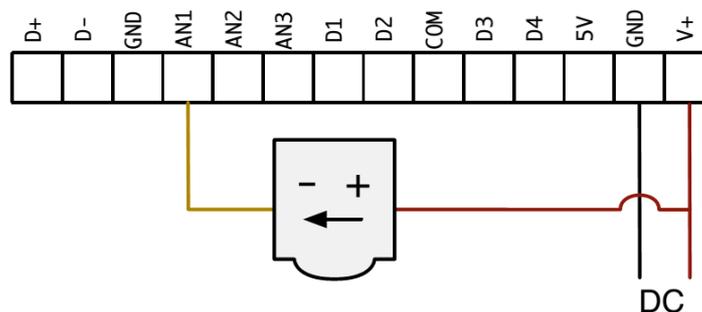
Analog inputs can be wired for 0 to 5 V or 0 to 20 mA signals, depending on the position of the input jumper inside the unit. A regulated 5 VDC output is provided for the convenience of wiring analog sensors like potentiometers.

**Figure 7 - Wiring a potentiometer**



### Wiring a potentiometer

**Figure 8 - Wiring a 4 to 20 mA, loop-powered sensor**

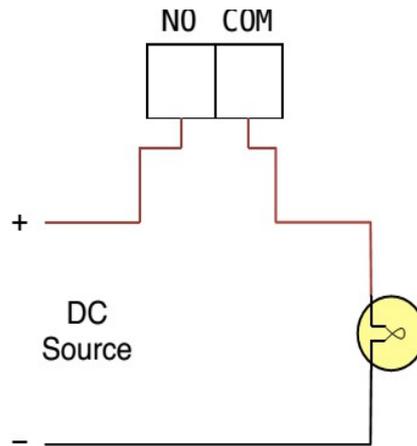


### Wiring a 4-20ma Loop-powered Sensor

#### Wiring Examples: Outputs

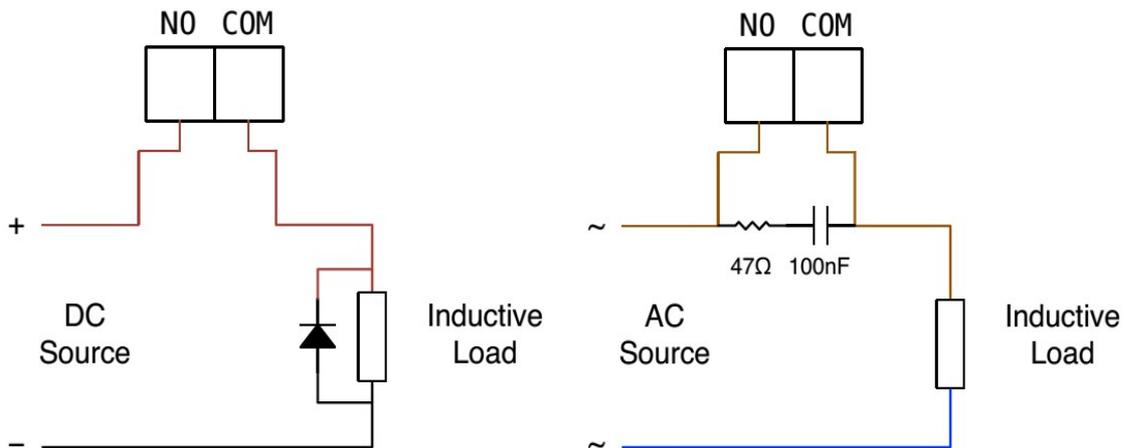
The relay outputs on the KTA-324 can be wired to DC or AC loads.

**Figure 9 - Wiring a basic DC load**



Inductive loads at high currents cause large voltage spikes when turned on or off, and this can disrupt sensitive electronics. For large inductive loads, a snubber is recommended. A DC load can be bypassed with a circulation diode. An AC load requires an RC snubber across the relay contacts or load. Ensure that diodes, resistors and capacitors used for snubbers are correctly rated for the load and voltage being switched.

**Figure 10 - Wiring Snubber Circuits**



**Hardware Revision History:**

KTA-324v1: Prototype

KTA-324v2: Initial Release

**Firmware Revision History:**

Firmware v1: Initial Release.

Firmware v2: Various bug fixes

Firmware v3: Added serial bootloader, Modbus multiple write registers bug fix

# VERIFICATION OF CONFORMITY

## According to FCC Part 15B

Certificate No.: SEM13099591

**Responsible Party's Name :** Ocean Controls  
**Address :** Factory 3 / 24 Wise Ave Seaford Victoria Australia

**Manufacturer :** Ocean Controls  
**Address :** Factory 3 / 24 Wise Ave Seaford Victoria Australia

**Description of Product :** Modbus TCP I/O Module

**Model No. :** KTA-323, v2

**Trade Name :** Ocean Controls

**Report No. :** STR13098329E-3

### Compliance With Part 15B of FCC Rules.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

**Responsible Party:**

**Tested By:**



Shenzhen SEM.Test Technology Co., Ltd.  
1/F, Building A, Hongwei Industrial Park, Liuxian  
2nd Road, Bao'an District, Shenzhen, P.R.C.

Responsible Signature: \_\_\_\_\_

Issued By: \_\_\_\_\_

Name / Title: \_\_\_\_\_

Name / Title: Jandy So / PSQ Manager

Date: \_\_\_\_\_

Date of Issue: Nov 15, 2013



The Certification of Verification shows that the tested sample technically compliances with the FCC Part 15. The certification applies to the tested sample above mentioned only and should not implied an assessment of the whole.

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Bao'an District, Shenzhen, P.R.C. (518101)

## CERTIFICATE OF CONFORMITY

Certificate No.: SEM13096095

The following product has been tested by SEM.Test Compliance Service Co., Ltd. with the listing standards and found in conformity with the **EC Council Directive of 2004/108/EC & 2006/95/EC**. It is possible to use CE marking to demonstrate the conformity with this **EMC Directive**.

**Report No.** : STR13098328E

**Applicant** : Ocean Controls  
**Address** : Factory 3 / 24 Wise Ave Seaford Victoria Australia

**Manufacturer** : Ocean Controls  
**Address** : Factory 3 / 24 Wise Ave Seaford Victoria Australia

**Description of Product** : Modbus TCP I/O Module  
**Model No.** : KTA-323, v2  
**Trade Name** : Ocean Controls  
**Test Standards** : EN 61000-6-1:2007  
EN 61000-6-3:2007+A1:2011

The referred test report(s) show that the product complies with the essential requirements in the above listed standards. The applicant is authorized to use this certificate in connection with the EC declaration of conformity according to Annex 1 of the Directive.



Test Laboratory



This certificate of conformity is based on a single evaluation of the submitted sample(s) of the above mentioned product. It does not imply an assessment of the whole production and other relevant Directives have to be observed.

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