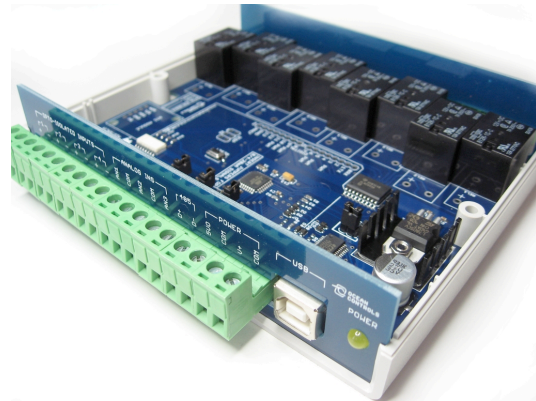


## Ocean Controls KTA-224 Modbus IO Module

- 8 Relay outputs (5A, 250VAC contacts)
- 4 Opto-Isolated Inputs with counters
- 3 Analog Inputs (10 bit) jumper-selectable for 0-5V or 0-20mA
- 4 Input Counters
- RS485 or USB (virtual serial port)
- Can be used as a USB to RS485 converter
- Watchdog Timer resets the unit when communication from the network master is lost
- Connections via Pluggable Screw Terminals
- 1200-38400 Baud Modbus Slave Device



The KTA-224 is a Modbus Slave IO module for interfacing to any PLC or PC using the Modbus 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 RS485 2-wire half duplex network or to a computer via USB. When connected via USB, the module acts as a USB to RS485 converter and multiple IO units (or other Modbus devices) can be connected to the RS485 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.

12V (KTA-224) and 24V (KTB-224) versions are available.

### Specifications:

Power Supply Vs and COM:

KTA-224: 9-16V DC (12V Nominal) ~200mA + External 5V drain

KTB-224: 18-32V DC (24V Nominal) ~200mA + External 5V drain

Analog Input ANx:

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

0-20mA: ~250 $\Omega$  effective resistance with jumper installed

Opto-Isolated Input: 0-30V, ~1k $\Omega$  effective resistance

Relay Outputs: SPDT relays rated to 5A (resistive). 2450VAC / 30VDC

5V Auxiliary Supply 5V: 200mA

**Connections:**

Label	Description
+	Opto-Isolated Input Positive
-	Opto-Isolated Input Negative
AN1	Analog Input 1
COM	Common Connection (Ground)
AN2	Analog Input 2
COM	Common Connection (Ground)
AN3	Analog Input 3
D+	RS-485 Data+ Connection
D-	RS-485 Data- Connection
5VO	Auxiliary 5V output
COM	Common Connection (Ground)
V+	12V / 24V Power Supply Positive Input
COM	Common Connection (Ground)
USB	USB connection to computer
NO	Relay Normally Open Contact
C	Relay Common Contact
NC	Relay Normally Closed Contact

**Table 1 - Connections****Jumper Settings:**

The analog inputs of the KTA-224 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-224 is equipped with protection on the analog inputs, but excessive voltage or current could damage the microcontroller and should be avoided.

**Communicating with the KTA-224:**

By default, the KTA-224 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. If the unit has unknown serial settings, it can be temporarily reset to the default by connecting SCL and SDA (or Digital 12 and 13) internally and powering up the device.

A computer can connect to the unit via USB. The USB circuit is based on the FTDI FT232 series of convertors 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 RS485 converter. A single KTA-224 can be plugged into a computer via USB, and a chain of up to 32 KTA-224 or other RS485 devices can be connected to the serial bus.

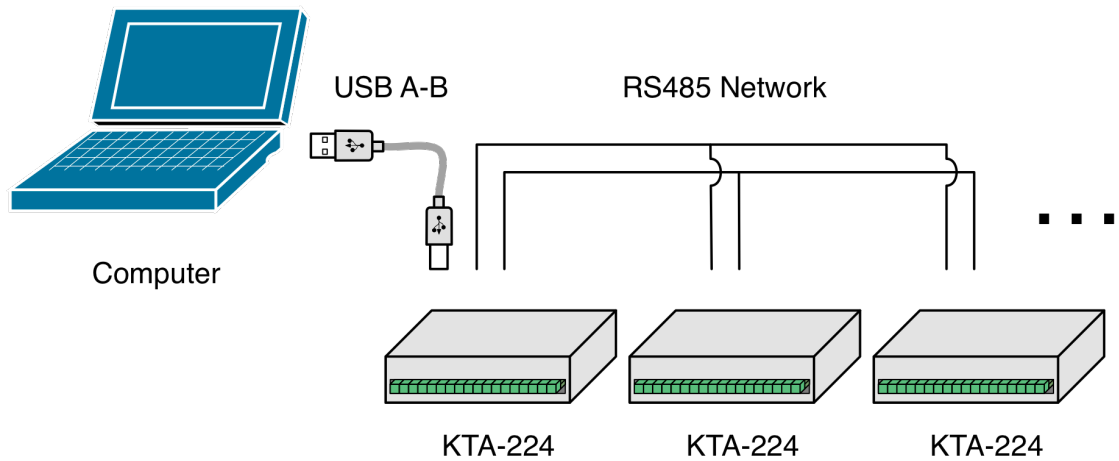


Figure 1

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.

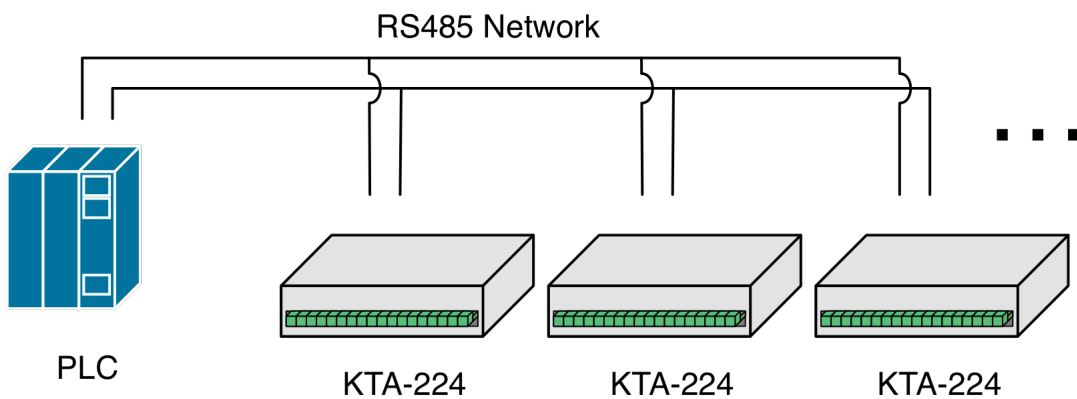


Figure 2

**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-224’s opto-isolated inputs. Input registers are 16 bit input values, such as the KTA-224’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-224 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.

Holding Register	Function
40001	Counter 1
40002	Counter 2
40003	Counter 3
40004	Counter 4
40005	AN1
40006	AN2
40007	AN3
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 Slave Address
40014	Serial Baudrate
40015	Serial Parity

Coil	Function
00001	Relay 1
00002	Relay 2
00003	Relay 3
00004	Relay 4
00005	Relay 5
00006	Relay 6
00007	Relay 7
00008	Relay 8
00009	Opto-Isolated Input 1
00010	Opto-Isolated Input 2
00011	Opto-Isolated Input 3
00012	Opto-Isolated Input 4

Input Register	Function
30001	AN1
30002	AN2
30003	AN2

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

**Table 2 - Modbus Function Map**

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 holding registers 40013 – 40015 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

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

Table 3 - Baudrate

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

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

Table 4 - Parity

**Test Utility**

A test utility is available at <http://www.oceancontrols.com.au>

The test utility speaks to the controller at the default baud and parity. It allows quick testing of the relays and inputs. When Poll is ticked, the utility will constantly query the KTA-223 for the status of its coils and inputs.

When not connected to a sensor, it is normal for the analog inputs to show random readings. This is due to the highly-sensitive inputs picking up charge from the environment.

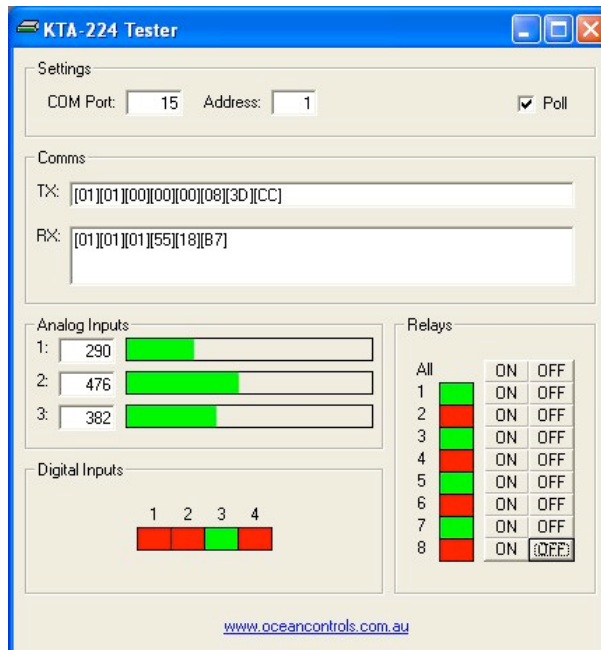
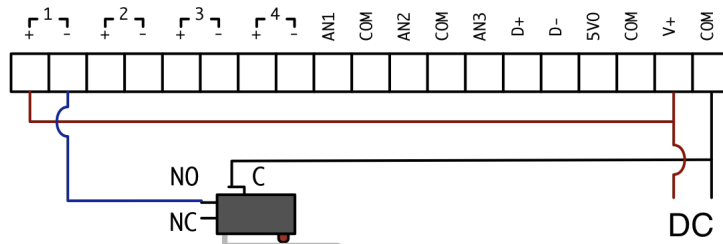


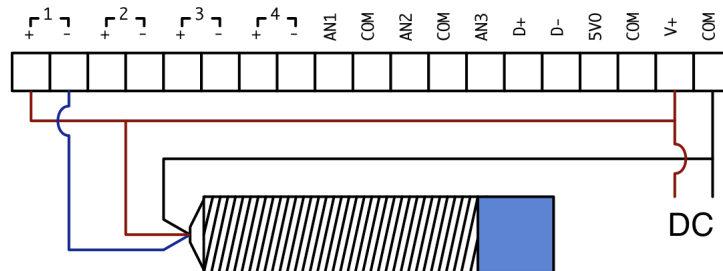
Figure 3 - KTA-223 Tester

**Wiring:**

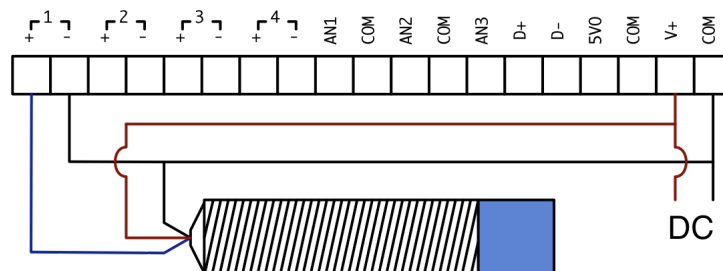
The opto-isolated inputs allow for a range of connection possibilities. The figures below show the wiring for a dry-contact switch, NPN and PNP-type sensor.



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

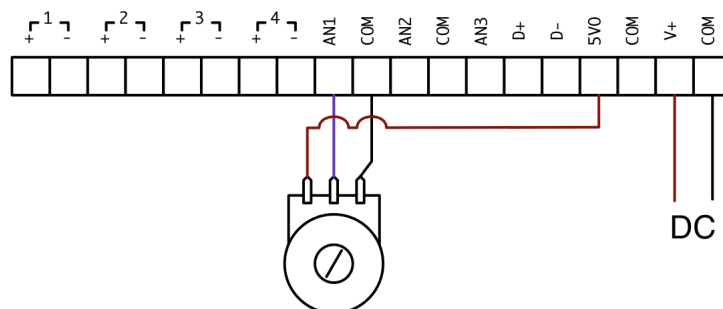


**Figure 5 – Wiring an NPN type sensor**

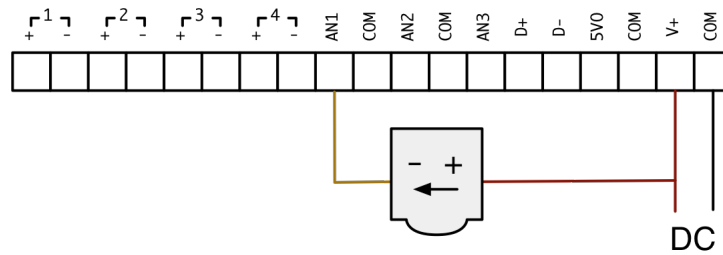


**Figure 6 – Wiring a PNP type sensor**

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

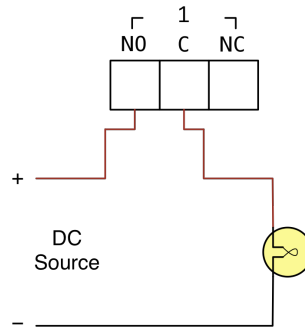


**Figure 7 – Wiring a potentiometer**



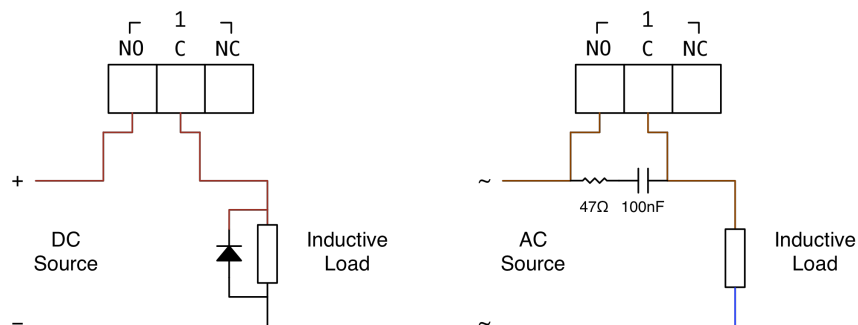
**Figure 8 – Wiring a 4-20mA loop-powered sensor**

The relay outputs on the KTA-224 can be wired to DC or AC loads.

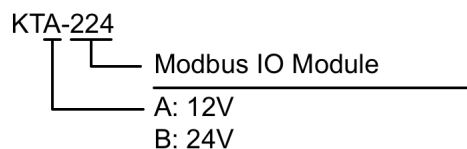


**Figure 9 - Wiring a simple DC load**

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. Ensure that diodes, resistors and capacitors used for snubbers are correctly rated for the load and voltage being switched.



**Selection Guide:**



**Licensing:**

The KTA-224 hardware is derived from the KTA-223 and the schematics and CAD files are available under Creative Commons Attribution Share-Alike licenses. All rights to the firmware are retained by Ocean Controls and will not be released. Contact [info@oceancontrols.com.au](mailto:info@oceancontrols.com.au) for more information.