KTA-215 GIOC MODBUS SERIAL I/O CARD
And Frequency to Analog Converter

The Modbus Serial I/O card operates as a Modbus RTU slave device. It is a general purpose data acquisition or DAQ card that can be multi dropped onto a serial link (RS232 or RS485) to a Modbus Master.

The card features

2 – 10 bit Analog Inputs 4-20mA or 0-20mA or 0-5V
1 – 12 bit Analog Output 4-20mA or 0-20mA or 0-5V option
6 – Digital Inputs (can accept TTL or NPN or Relay contact outputs)
2 – Relay outputs (3A at 240VAC)
- Frequency Input of 5-10kHz or 5-65000 RPM
- Frequency or RPM can be retransmit on analog output.
- Relays can be triggered at set frequency or RPM
- RS232 or RS485 Selectable by jumpers

Connections

The terminals on the card are marked as following

Terminal	Desciption	Terminal	Description
Vs	Supply Voltage 12 to 15VDC	NO1	Relay 1 Normally Open
COM	Common Supply Voltage	C1	Relay 1 Common
+5V	+5V Out	NC1	Relay 1 Normally Closed
D+	D+ RS485 Communications	NO2	Relay 2 Normally Open
D-	D- RS485 Communication	C2	Relay 2 Common
S1	Digital Input 1 or Frequency Signal Input	NC2	Relay 2 Normally Closed
T1	Digital Input 2	A1	Analog Input 1
E1	Digital Input 3	A2	Analog Input 2
COM	Common	COM	Common
S2	Digital Input 4	VO	Analog Output Voltage
T2	Digital Input 5	IO	Analog Output Current
E2	Digital Input 6	COM	Common
COM	Common		

Jumpers

The board has several jumpers

J1 closed, J2 open – RS485 communications
J1 open, J2 closed – RS232 communications
J3 closed – RS485 line termination
J4 closed – Analog Input 1 Current (0-20mA or 4-20mA input)
J4 open – Analog Input 1 Voltage input (0-5V)
J5 closed – Analog Input 1 Current (0-20mA or 4-20mA input)
J5 open – Analog Input 1 Voltage input (0-5V)

Serial Communications
First set jumpers J1 and J2 to RS232 or RS485 communications (see section Jumpers)
The default communications baud rate is 9600, No Parity, 1 Stop bit. For serial communications to a PC use a straight through D9 male to female cable between the D9 connector on the board and the PC's serial port.
For RS485 communications connect to D+ and D- terminals

Modbus Interface
Modbus is a serial Master Slave protocol. The PC is usually the master with a number of slaves (in this case Serial I/O cards). Each slave is given a unique address from 1 to 243. The master outputs a command to the slave and the slave processes the command and then transmits a response back to the master. In the slave there are 4 types of data the master can access. These are:

Data Type	**Description**
Input Registers	16 bit read only registers
Holding Registers	16 bit Read/Write registers
Coils	read/write bit
Input Statuses	read only bit.

The Modbus serial I/O card only has two data types Coils and Holding Registers.
The Modbus Serial I/O card only recognises the following Modbus functions:

Function	**Purpose**
1	Read multiple coils
3	Read multiple Holding registers
5	Write to a single coil
6	Write to a single holding register
15	Write to multiple coils
16	Write to multiple holding registers

Modbus Registers:

Holding Reg. No.	Description	Coil No.	Description
1	Analog Input 1 – 0 to 1023	1	Digital Inputs T1 (0=digital input closed to common, 1=open)
2	Analog Input 2 – 0 to 1023	2	Digital Inputs E1
3	Analog Output - 0 to 4095	3	Digital Inputs S1
4	RPM or Frequency Reading	4	Digital Inputs T2
5	Transmit Low Value	5	Digital Inputs E2
6	Transmit High Value	6	Digital Inputs S2
7	Transmit Enable 0=Off 1=0-20mA or 0-5V 2=4-20mA or 1-5V	7	Relay Output 1 (1=ON)
8	0=RPM 1=Frequency	8	Relay Output 2 (1=ON)
9	Input Divisions		
10	Alarm 1 Set Point		
11	Alarm 1 Hysteresis		
12	Alarm 1 Above/Below 0=Above 1=Below		
13	Alarm 2 Set Point		
14	Alarm 2 Hysteresis		
15	Alarm 2 Above/Below 0=Above 1=Below		

Digital Inputs
The digital inputs can sense NPN, relay contacts or 0-5V TTL outputs.
For a relay contact place the contact across the Digital input and common terminals
For a NPN signal place the signal across the Digital input and common terminals
For a TTL or 0 to5V signal place the signal across the Digital input and common terminals

Analog Inputs
The GIOC card has two analog inputs. The terminals are marked A1 and A2.
A 4.7K resistor is in series to each analog input to protect it against damage if a high voltage is inadvertently connected to it. This will protect the input against voltages up to +/-30VDC. However it should be noted that a voltage higher than 5V on any one input will affect the readings on the other inputs. The 2 analog inputs have provision for a 240 ohm resistor to be placed between the terminal input and ground. Setting Jumpers J4 and J5 select current (4-20mA) or voltage (0-5V) input.
The Holding Registers 1 and 2 will show a reading of 0 to 1023 for analog inputs 1 and 2

Analog Output
The GIOC card has one analog output. The terminal is marked VO (voltage output) or AO (current output)
The Holding Register 3 will accept a value of 0 to 4095 to produce a 0 to 5volt or 4-20mA signal.

Frequency to Analog
To make the controller output an analog signal proportional to the frequency input the controller must first be set up. Writing a 1 or 2 to Holding Register 7 will enable either 0-20mA (or 0-5V) or 4-20mA (or 1-5V) retransmission of the frequency.
The low value for transmission is set in Holding Register 5 and the high value for transmission is set in Holding Register 6 between these values the output will be linear.
Holding Register 8 determines whether Holding Register 4 is displaying an RPM speed or a Frequency in Hertz.
Holding Register 9 determines the number of pulses per revolution for the input. For example, if you are monitoring the speed of a shaft and the shaft being monitored gives 8 pulses per revolution enter the value 8 into Register 9.
Registers 10 to 12 and 13 to 15 determine the frequency at which the relays will turn on and off.
Registers 10 and 13 are the set point for relays 1 and 2, Registers 11 and 14 are the hysteresis values and Registers 12 and 15 determine whether the relay is on or off above that point.
Eg. If you are monitoring the speed of a shaft and wish to trigger an alarm if the speed goes below 2,000 RPM or above 10,000 RPM set register 10 to 2,100, register 11 to 100 and register 12 to 1. This will make the first relay turn on when the speed drops below 2,000 RPM and it will turn off again if it goes above 2,200 RPM. Next Set Register 13 to 9,900 register 14 to 100 and register 15 to 0. When the speed goes above 10,000 RPM Relay 2 will turn on and when it drops below 9,800 the relay will turn off again.

Testing
On our website www.oceancontrols.com.au/modview.htm you will find the ModbusView program. This program allows the PC to simulate a Modbus master and a slave device. From the main menu select Configure. Set Port Active, 9600 baud, 8 data bits, no parity, Address 1 and click on Master. On the main page set the data type to holding registers and the length to 10. The software should start trying to poll the Modbus DAQ for data. If you connect a voltage between 0 to 5V on analog input 1 then holding register 1 should show the value. If this is correct try the analog input 2. (Note unused analog inputs should be grounded)
Now switch to coils and test the digital inputs. You can write to the digital outputs by toggling Coils 7 and 8 in ModbusView.