

## USB Interface Modules

### D8000 Series



- ✓ Complete Data Acquisition Systems
- ✓ Analog and Digital I/O Models Available
- ✓ USB Interface
- ✓ Modbus® RTU Protocol
- ✓ Up to 25 Conversions per Second
- ✓ 500 Vrms Analog Input or Analog Output Isolation
- ✓ 16-Bit Analog Input Measurement Resolution
- ✓ Continuous Self-Calibration; No Adjustments Required
- ✓ Programmable Analog Input Digital Filters
- ✓ Requires 10 to 30 Vdc Unregulated Supply
- ✓ Removable Screw Terminal Plug Connectors Supplied

### APPLICATIONS

- ✓ Process Monitoring and Control
- ✓ Data Logging to any Host Computer
- ✓ Product Testing

The D8000 series USB interface modules are a family of complete data acquisition modules for use in process control systems. The analog input models can measure process signals such as thermocouples, 4 to 20 mA current loops, and discrete contact closures. The analog output models can generate voltage or current signals for controlling annunciators or valves. The digital input and output models can sense the state of remote digital signals or control solid state relays. Complete data acquisition systems can be created with ease with the D8000 modules and a host computer.

The modules provide direct connection to a wide variety of sensors and annunciators such as thermocouple probes, 4 to 20 mA loops, and DC voltage. They perform all signal conditioning, linearization and contain no internal pots or DIP switches. All user-selectable features such as ranges, communications settings are stored in nonvolatile EEPROM, which maintains these values even after power is removed.

The D8000 series USB interface modules connect to a host computer using a USB interface cable and they communicate using a virtual serial communications port using the Modbus RTU protocol.

Use a USB cable to connect the D8000 to a host computer. Plugging the cable into the computer will create a virtual serial port in the computer. The virtual serial port will be used by the host to communicate with the module. Serial communication ports are supported by almost all data acquisition and process control programs in the marketplace.



D8400 USB interface module shown smaller than actual size.

The Modbus RTU protocol is used to read and write data values to the D8000 series modules. The Modbus RTU protocol is a serial protocol and communicates with external devices through serial ports. The Modbus RTU protocol is widely recognized throughout the data acquisition industry and is supported by almost all commercial process control programs.

Multiple D8000 series modules can be connected to one host computer. A unique and separate serial port is created for each module that is connected. The serial port approach provides instant compatibility with almost all industry standard data acquisition programs that support the Modbus RTU protocol.

With the D8000 series modules, anyone familiar with a personal computer can construct a data acquisition system. This approach to data acquisition is very flexible, easy to use and cost effective. The modules can be mixed and matched to fit your application. You do not need engineering experience in complicated data acquisition hardware to build a system.

### ANALOG INPUT MODULES

The D8100 through D8400 series analog input modules contain seven differential analog input channels. Each module contains analog signal conditioning circuits that are optimized for a specific signal input type. Signal types include DC voltage, 4 to 20 mA current loops, and eight thermocouple types. Each input channel can be programmed to accept a different signal input range.

The sensor signals are converted to digital data with a microprocessor-controlled integrating A/D converter. Offset and gain errors in the analog circuitry are continuously monitored and corrected using microprocessor techniques.

The analog input modules communicate the resultant data values as 16-bit unsigned integer numbers that represent a percentage of the full. The modules continuously convert data values at the rate of up to 25 conversions per second and store the latest result in a buffer. The data values are requested by sending a Modbus query to the module. The D8000 series modules will instantly respond by communicating the data values back to the host processor.

### ANALOG OUTPUT MODULES

The D8500 analog output modules contain two 12-bit digital to analog converters (DAC) for generating either voltage or current output signals. The output signal type for each DAC is user-selectable and each DAC is independently controlled via a host computer using the Modbus RTU protocol. Four different analog output ranges are available, two voltage ranges and two current ranges.

The D8500 analog output modules contain user-selectable features such as programmable output slew rate, a communications watchdog timer and programmable startup signal value. They also include an 8-bit analog to digital converter for analog readback the output signal.

The communications watchdog timer can be used to move the analog output signal to a known "safe" condition in the event of a communications failure.

### DIGITAL INPUT MODULES

The D8710 digital input modules contain 15 individual inputs for monitoring logic levels, contact closures, or other ON/OFF signals in a data acquisition system. Each digital input terminal contains a pull-up biasing resistor allowing for direct connection to a set of contacts. The input terminals can accept signals between  $\pm 30$  Vdc without damage.

### DIGITAL OUTPUT MODULES

The D8720 digital output modules contain 15 individual open-collector transistor outputs for controlling annunciators, lamps, or other devices that require an ON/OFF signal.

The D8720 digital output modules also contain programmable features such as a communications watchdog timer and programmable startup signal values for each bit.

The communications watchdog timer can be used to move the digital output signals to a known "safe" condition in the event of a communications failure.

### COMMUNICATIONS

The D8000 series modules are designed to easily interface with computers using a USB interface. The USB interface creates a virtual serial communications port on the host computer. All communications to and from the module, through the virtual serial port are performed using the Modbus RTU protocol. A new serial port is added for each D8000 series module.

### MODBUS COMMAND SET

The D8000 series modules use the Modbus RTU protocol for communications. The Modbus RTU binary protocol uses a master-slave technique, in which only the master device can initiate transactions. The slave devices respond by supplying the requested data to

the master or by performing the requested action in the query. The master can address any slave device. The returned messages are considered response messages. The supported master function codes are:

### Modbus RTU Functions and Descriptions

- 01 – Read Coil Status
- 02 – Read Register Status
- 03 – Read Holding Registers
- 04 – Read Input Register (Analog Inputs)
- 05 – Force Single Coil
- 06 – Preset Single Register
- 0F – Force Multiple Coils
- 10 – Preset Multiple Registers

### PROCESS CONTROL SOFTWARE

Modbus RTU protocol is one of the most widely supported serial protocols in the data acquisition market. Modbus RTU software drivers are available for almost every data acquisition software program available today. Thus providing instant connectivity between the D8000 modules and most data acquisition software programs.

### SETUP

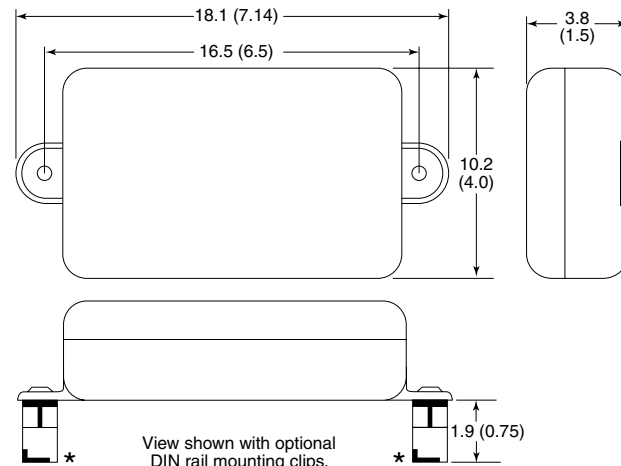
The D8000 series modules are initialized at the factory using the Modbus RTU protocol. User selectable features such as individual channel range selection and digital filters are easily configured using the D6000/D8000 series utility software. Each D8000 module must be properly configured before installation into a Modbus system.

### UTILITY SOFTWARE

Complimentary Utility Software is included with each module. The software is compatible with Windows operating systems and distributed on CDROM.

The Utility Software simplifies configuration of all user selectable options such as device address, baud rate and filtering constants. The latest version of our software is always available on our web site.

Dimensions: cm (inches)



The D8000 Series modules can be easily adapted to a DIN rail using the DMK-1 mounting kit shown in view above.



D8400 USB interface module shown smaller than actual size.

## SPECIFICATIONS

(Typical at +25°C and nominal power supply unless otherwise noted)

### GENERAL

**Programmable Digital Filters:** In analog input modules

**Max CMV (Input to Output at 115 Vrms, 60 Hz):**

500 Vrms

**Setups:** Stored in EEPROM

**Unused Analog Input Channels:** Software disable

### INTERFACE

**Communications:** Modbus RTU protocol

**Interface:** USB port

### POWER REQUIREMENTS

**Supply Voltage:** Unregulated 10 to 30 Vdc; protected against power supply reversals

### ENVIRONMENTAL

**Operating Temperature Range:** -25 to 70°C

(-13 to 158°F)

**Storage Temperature Range:** -25 to 85°C

(-13 to 185°F)

**Relative Humidity:** 0 to 95% RH non-condensing

### PACKAGE, DIMENSIONS AND CONNECTORS

**Case:** ABS thermoplastic, UL-94-5VA rated

**Dimensions:** 102 H x 152 W x 36 mm D (4 x 6 x 1.5")

**Mounting Holes:** 165 mm (6.5") on center

**Connectors:** Screw terminal barrier plug (supplied)

### MODULE SPECIFICATIONS

#### D8100 VOLTAGE INPUTS

**Number of Channels:** 7 differential voltage inputs

**Ranges:**  $\pm 0.025V$ ,  $\pm 0.05V$ ,  $\pm 0.1V$ ,  $\pm 1V$ ,  $\pm 5V$ ,  $\pm 10V$

**Resolution:** 16-bit ADC, 25/20 conversions per second

**Accuracy:**  $\pm 0.05\%$  of FS max

**Span Tempco:**  $\pm 50$  ppm/°C max

**Input Burnout Protection:** To 250 Vac

**Input Impedance:** 20 M $\Omega$  min

**Power Requirements:** Serial = 1.4 W

#### D8200 CURRENT INPUTS

**Number of Channels:** 7 differential current inputs

**Range:**  $\pm 20$  mA

**Resolution:** 16-bit ADC, 25/20 conversions per second

**Accuracy:**  $\pm 0.05\%$  of FS max

**Span Tempco:**  $\pm 50$  ppm/°C max

**Voltage Drop:** 2.0V max

**Input Impedance:** <100  $\Omega$  (70 typical)

**Power Requirements:** Serial = 1.4 W

#### D8300 THERMOCOUPLE INPUTS

**Number of Channels:** 7 differential thermocouple inputs

**Thermocouple Types:** J, K, T, E, R, S, B, and C

**Ranges:**

**J:** -200 to 760°C (-328 to 400°F)

**K:** -150 to 1250°C (-238 to 2282°F)

**T:** -200 to 400°C (-328 to 752°F)

**E:** -100 to 1000°C (-148 to 1832°F)

**R:** 0 to 1750°C (32 to 3182°F)

**S:** 0 to 1750°C (32 to 3182°F)

**B:** 0 to 1820°C (33 to 3308°F)

**C:** 0 to 2315°C (32 to 4199°F)

#### Thermocouple Accuracy

**(Error From all Sources) from 0 to 40°C Ambient:**

**J, K, T, E:**  $\pm 1.5^\circ C$  max

**R, S, B, C:**  $\pm 3.5^\circ C$  max (300°C to +F.S.)

**Resolution:** 16-bit ADC, 25/20 conversions per second

**Input Impedance:** 20 M $\Omega$  min

**Cold Junction Compensation:** Automatic

**Lead Resistance Effect:** <40  $\mu V$  per 350  $\Omega$

**Indication:** Open thermocouple and over range indication

**Input Burnout Protection:** To 250 Vac

**Power Requirements:** Serial = 1.4W



D8400 USB interface module shown smaller than actual size.

### D8400 VOLTAGE, THERMOCOUPLE, CURRENT INPUTS

**Number of Channels:** 7 differential voltage, thermocouple, current inputs

**Specifications:** Equal to D8100, D8200 and D8300 series

### D8500 ANALOG OUTPUTS

**Number of Channels:** Two analog outputs (programmable for voltage or current output)

**Voltage Ranges:** 0 to 10 Vdc,  $\pm 10$  Vdc

**Current Ranges:** 0 to 20 mA, 4 to 20 mA

**Update Rate:** 250 conversions per second

**Accuracy:**  $\pm 0.1\%$

**Resolution:** 12-bit DAC resolution

**Span Tempco:**  $\pm 25$  ppm/ $^{\circ}$ C max

**Settling Time to 0.1% FS:** 1 mS

**Communications:** Watchdog timer

**Current Output Compliance:**  $\pm 12$  Vdc

**Voltage Output Drive:** 5 mA max

**Analog Output Signal Readback:** 8-bit ADC

**Isolation:** 500 Vac, output common to system ground

**Current Output Burnout:** Protected to 250 Vac

**Power Requirements:** Serial = 2.1 W

### D8710 DIGITAL INPUTS

**Number of Channels:** 15 digital Inputs

**Internal:** 10K pull-up resistors on each bit; accept direct switch closure

**Logic "0":**  $< 1$  Vdc

**Logic "1":**  $> 3.5$  Vdc

**Input Burnout:** To  $\pm 30$  Vdc without damage

**Isolation:** 500 Vac, input common to system ground

**Power Requirements:** Serial = 0.75 W

### D8720 DIGITAL OUTPUTS

**Number of Channels:** 15 open-collector outputs to 30 Vdc, 100 mA max

**Vsat:**  $+0.3$  Vdc max at 100 mA

**Short Circuit Protection:** To 500 mA

**Communications:** Watchdog timer

**Digital Output Update Rate:** 4.5 Hz

**Isolation:** 500 Vac, output common to system ground

**Power Requirements:** Serial = 1.0W



OMEGACARE<sup>SM</sup> extended warranty program is available for models shown on this page. Ask your sales representative for full details when placing an order. OMEGACARE<sup>SM</sup> covers parts, labor and equivalent loaners.

## To Order

Model No.	Description
D8100	7-channel differential voltage input module
D8200	7-channel differential current input module, $\pm 20$ mA
D8300	7-channel differential thermocouple input module
D8400	7-channel differential voltage/thermocouple/current input module
D8500	2-channel voltage, current analog output module
D8710	15-bit digital input module
D8720	15-bit digital output module
DMK-1	DIN rail mounting kit for D8000 Series modules

Comes complete with operator's manual and utility software on CD and 0.9 m (3') USB interface cable.

**Ordering Example:** D8100, 7-channel differential voltage input module and OCW-1, OMEGACARE<sup>SM</sup> extends standard 1-year warranty to a total of 2 years.