# DATA ACQUISITION SYSTEMS

## MODBUS® Serial Interface Modules

### D6000 Series

**1 YEAR WARRANTY** **CE**

- Complete Data Acquisition Systems
- Analog and Digital I/O Models Available
- RS485 Serial Communications 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 10V to 30 Vdc Unregulated Supply
- Transient Suppression on Serial RS485 Data Lines
- Removable Screw Terminal Plug Connectors Supplied

### Applications

- Process Monitoring and Control
- Remote Data Logging to any Host Computer
- Product Testing
- Direct Connection to PLC

D6200, shown smaller then actual size

The D6000 Series 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 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 D6000 modules and a host supervisory computer or programmable logic controller.

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

The D6000 series modules communicate with a host computer using the MODBUS RTU protocol. The MODBUS RTU protocol is widely recognized throughout the data acquisition industry by and supported by almost all commercially available process control programs and supervisory host PLC's.

This binary protocol communicates via a two-wire RS485 serial interface. The key to the product concept is that the modules are easy to connect and use. You do not need engineering experience in complicated data acquisition hardware. With the modules, anyone familiar with a personal computer can construct a data acquisition system.

This modular approach to data acquisition is very flexible, easy to use and cost effective. The modules can be mixed and matched to fit your application. They can be placed remote from the host and from each other.

The D6000 series is completely hardware compatible with the D1000M, D1700M, D3000M and D5000M series modules. Meaning, they can all be mixed and matched on one RS485 serial communications line. Each module is identified by a unique user-programmable address. This addressing technique allows modules to be interrogated in any order.

### ANALOG INPUT MODULES

The D6100 through D6400 Series analog input modules contain seven input channels and make up a complete data acquisition system. Each unit contains analog signal conditioning circuits optimized for a specific input type. The amplified 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 output the resultant digital data as unsigned integer percentage of full-scale values that are compatible with the MODBUS RTU protocol. The modules continuously convert data at the rate of up to 25 conversions per second and store the latest result in a buffer. Host processors may request data by sending a MODBUS query to the module. The D6000 series modules will instantly respond by communicating the memory buffer data back to the host processor. Up to 247 modules may be linked to a single RS485 port.

**D6500 shown smaller than actual size.**



**D6720 shown smaller than actual size**

## ANALOG OUTPUT MODULES

The D6500 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. Two voltage and two current ranges are available.

The D6500 analog output modules also contain programmable features such as output slew rate, a communications watchdog timer, programmable startup signal value, and 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 OUTPUT MODULES

The D6720 digital output modules contain 15 individual open-collector transistor outputs for controlling annunciators, lamps, or other devices that require an ON/OFF signal.

The D6720 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.



**D6710 shown smaller than actual size.**



**D6400 shown smaller than actual size.**

## DIGITAL INPUT MODULES

The D6710 digital input modules contain 15 individual signal inputs for monitoring logic levels, contact closures, or other ON/OFF signals in a data acquisition system. Each discrete input terminal contains a pull-up biasing resistor allowing for direct connection to a set of contacts. The input terminals can accept signals between ±30 Vdc without damage.

## COMMUNICATIONS

The D6000 series modules are designed to easily interface with computers and PLC's. All communications to and from the module are performed using the MODBUS RTU protocol via an RS485 interface.

The two-wire RS485 system is a half duplex system, developed for multi-dropped systems that can communicate at high data rates over long distances. RS485 receivers can handle common mode voltages from -7 to 12V without loss of data, making them ideal for transmission over great distances.

## MODBUS® COMMAND SET

The D6000 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 D6000 modules and most data acquisition software programs.

## SETUP

The D6000 series are initialized at the factory using the MODBUS RTU protocol. Features such as the MODBUS device address, baud rate, and analog signal ranges can be easily configured using the setup software. Each D6000 module must be properly configured before installation into a MODBUS system.

## UTILITY SOFTWARE

Complimentary Utility Software is included with each purchase order. The software is compatible with Windows® operating systems and distributed on CD-ROM. 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 at omega.com.

## SPECIFICATIONS

**D6000 (Typical @ 25°C and nominal power supply unless otherwise noted)**
**GENERAL**
**Programmable Digital Filters:**
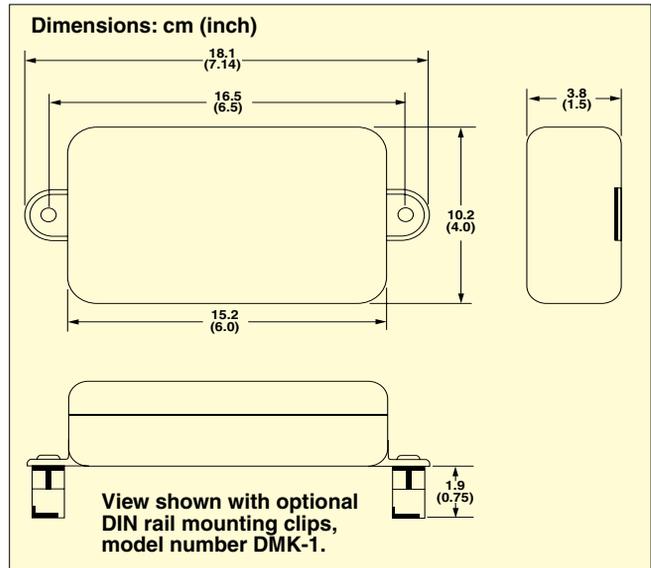In analog input modules
**Maximum CMV (Input to Output at 115Vrms, 60Hz):**
500V rms
**Setups:** Stored in EEPROM
**Unused Analog Input Channels:** Software disable
**INTERFACE**
**Communications:** MODBUS RTU protocol/RS485
Serial port



Dimensions: cm (inch)

View shown with optional DIN rail mounting clips, model number DMK-1.

**SERIAL COMMUNICATIONS**
**Baud Rates:** 9600, 19.2K, 38.4K, 57.6K, 115.2K
**Data Format:** 8 data bits, and 1 or 2 stop bits
**Parity:** Odd, even, none
**Device Address:** User selectable
**Number of Modules:** Up to 247 multi-drop modules per host serial port
**Communications Distance:** Up to 1219 m (4000') (RS485)
**Transient Suppression:** On RS485 data lines
**POWER REQUIREMENTS**
Unregulated 10V to 30 Vdc, protected against power supply reversals
**ENVIRONMENTAL**
**Operating Temperature Range:**
-25 to 70°C (-13 to 158°F)
**Storage:** -25 to 85°C (-13 to 185°F)
**Relative Humidity:** 0 to 95% non-condensing
**PACKAGE, DIMENSIONS AND CONNECTORS**
**Case:** ABS thermoplastic, UL-94-5VA rated
**Dimensions:**
102 H x 152 W x 38 mm D (4 x 6 x 1.5"); mounting holes 165 mm (6.6") on center
**Connectors:** Screw terminal barrier plug (supplied)
**MODULE SPECIFICATIONS**
**D6100 VOLTAGE INPUTS**
**Number of Channels:** 7 differential voltage inputs
**Ranges:** ±0.025V, ±0.05V, ±0.1V, ±1V, ±5V, ±10V
**Resolution ADC:** 16-bit ADC, 25/20 conversions per second
**Accuracy:** ±0.05% of FS maximum
**Span Tempco:** ±50ppm/°C maximum
**Input Burnout Protection:** To 250 Vac
**Input impedance:** 20 MΩ min
**Power Requirements:** Serial = 1.4W
**D6200 CURRENT INPUTS**
**Number of Channels:** 7 differential current inputs
**Range:** ±20 mA
**Resolution ADC:** 16-bit ADC, 25/20 conversions per second
**Accuracy:** ±0.05% of FS maximum

**Span Tempco:** ±50ppm/°C maximum
**Voltage Drop:** 2.0V maximum
**Input impedance:** <100 Ω (70 typical)
**Power Requirements:** Serial = 1.4W

## D6300 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 1400°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 (32 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 = ±1.5°C maximum; R, S, B, C = ±3.5°C maximum; (300°C to +F.S.)
**Resolution ADC:** 16-bit ADC, 25/20 conversions per second
**Input Impedance:** 20 MΩ min
**Cold Junction Compensation:** Automatic
**Lead Resistance Effect:** <40 µV per 350 Ω
**Indication:** Open thermocouple and over range indication
**Input Burnout Protection:** To 250 Vac
**Power Requirements:** Serial = 1.4W

## D6400 VOLTAGE, THERMOCOUPLE, CURRENT INPUTS
**Number of Channels:** 7 differential voltage, thermocouple, current inputs
**Specifications:** Equal to D6100, D6200 and D6300 series

## D6500 ANALOG OUTPUTS
**Number of Channels:** Two analog outputs (programmable for voltage or currrent output)
**Voltage Range:** 0 to 10 Vdc, ±10 Vdc

**Current Ranges:** 0 to 20 mA, 4 to 20 mA
**Update Rate:** 250 conversions per second
**Accuracy:** ±0.1%
**DAC Resolution:** 12-bit
**Span Tempco:** ±25ppm/°C maximum
**Settling Time to 0.1% FS**: 1 mS
**Communications:** Watchdog timer
**Current Output Compliance:** ±12 Vdc
**Voltage Output Drive:** 5 mA maximum
**ADC Analog Output Signal Readback:** 8-bit
**Isolation:** 500 Vac, output common to system ground
**Current Output Burnout:** Protected to 250 Vac
**Power Requirements:** Serial = 2.1W

## D6710 DIGITAL INPUTS
**Number of Channels:** 15 digital inputs
**Internal:** 10K pull-up resistors on each bit accept direct switch closure
**Logic "0":** <1Vdc, Logic "1": = >3.5Vdc
**Input Burnout:** To ±30 Vdc without damage
**Isolation:** 500 Vac, input common to system ground
**Power Requirements:** Serial = 0.75W

## D6720 DIGITAL OUTPUTS
**Number of Channels:** 15 Open-collector outputs to 30 Vdc, 100 mA maximum
**Vsat:** +0.3 Vdc maximum 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

**OMEGA CARE**
**Extended Warranty Program**[SM]

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

## To Order *Visit omega.com/d6000_series for Pricing and Details*

| Model No. | Description |
|---|---|
| D6100 | 7-channel differential voltage input module |
| D6200 | 7-channel differential current input module, ±20 mA |
| D6300 | 7-channel differential thermocouple input module |
| D6400 | 7-channel differential voltage/thermocouple/current input module |
| D6500 | 2-channel voltage, current analog output module |
| D6710 | 15-bit digital input module |
| D6720 | 15-bit digital output module |
| DMK-1 | DIN rail mounting kit for D6000 Series modules |

*Comes complete with operator's manual and utility software on CD.*
***Ordering Example: D6100,** 7-channel differential voltage input module and **OCW-1** OMEGACARE[SM] 1 year extended warranty (adds 1 year to standard 1 year warranty).*