

MODBUS® Serial Interface Modules

D6000 Series



- ✓ 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

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.



D6200, shown smaller than actual size

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.

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.

D6710 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.

D6720 shown smaller than actual size

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.

D6400 shown smaller than actual size.

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

SPECIFICATIONS

D6000 (Typical @ 25°C and nominal power supply unless otherwise noted)

GENERAL

Programmable Digital Filters:

In analog input modules

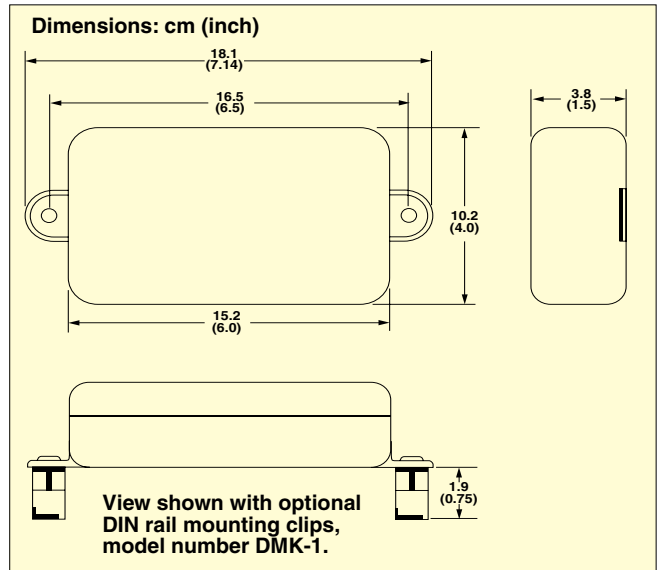
Maximum CMV (Input to Output at 115Vrms, 60Hz): 500V rms

Setups: Stored in EEPROM

Unused Analog Input Channels: Software disable

INTERFACE

Communications: MODBUS RTU protocol/RS485 Serial port



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: ± 50 ppm/ $^{\circ}$ C maximum

Voltage Drop: 2.0V maximum

Input impedance: $< 100 \Omega$ (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 $^{\circ}$ C (-328 to 1400 $^{\circ}$ F)

K = -150 to 1250 $^{\circ}$ C (-238 to 2282 $^{\circ}$ F)

T = -200 to 400 $^{\circ}$ C (-328 to 752 $^{\circ}$ F)

E = -100 to 1000 $^{\circ}$ C (-148 to 1832 $^{\circ}$ F)

R = 0 to 1750 $^{\circ}$ C (32 to 3182 $^{\circ}$ F)

S = 0 to 1750 $^{\circ}$ C (32 to 3182 $^{\circ}$ F)

B = 0 to 1820 $^{\circ}$ C (32 to 3308 $^{\circ}$ F)

C = 0 to 2315 $^{\circ}$ C (32 to 4199 $^{\circ}$ F)

Thermocouple Accuracy (Error From all Sources)

from 0 to 40 $^{\circ}$ C Ambient: J, K, T, E = $\pm 1.5^{\circ}$ C maximum; R, S, B, C = $\pm 3.5^{\circ}$ C maximum; (300 $^{\circ}$ C to +F.S.)

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

Input Impedance: 20 M Ω min

Cold Junction Compensation: Automatic

Lead Resistance Effect: $< 40 \mu$ V 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 current 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: $\pm 0.1\%$

DAC Resolution: 12-bit

Span Tempco: ± 25 ppm/ $^{\circ}$ 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": < 1 Vdc, Logic "1": > 3.5 Vdc

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

To Order	
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