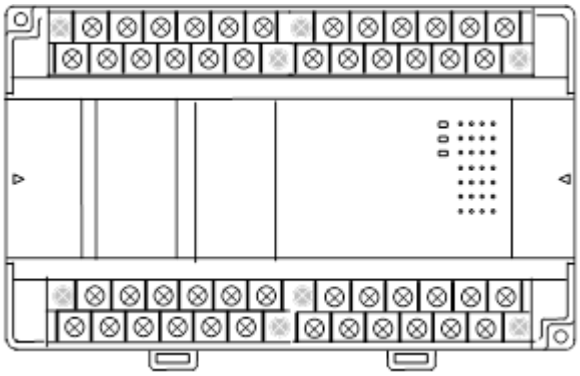
Chapter 5: Micro PLCs with 23 Discrete Points and 3 Analog Channels

This chapter describes the features and specifications of the VersaMax Micro PLCs with 23 Discrete Points and 3 Analog Channels. It also provides additional information about analog operation and calibration.

IC200UAL004	Micro PLC with 23 Discrete Points and 3 Analog Channels: (13) 12Vdc In, (10) Relay Out, (2) Analog In and (1) Analog Out, 12Vdc Power Supply
IC200UAL005	Micro PLC with 23 Discrete Points and 3 Analog Channels: (13) 24Vdc In, (1) 24Vdc Out, (9) Relay Out, (2) Analog In and (1) Analog Out, 24Vdc Power Supply
IC200UAL006	Micro PLC with 23 Discrete Points and 3 Analog Channels: (13) 24Vdc In, (1) 24Vdc Out, (9) Relay Out, (2) Analog In and (1) Analog Out, 120/240Vac Power Supply

5.1 VersaMax 23 Discrete / 3 Analog Micro PLC Features

Figure 28



- Supports up to four Expansion Units in any combination.
- Four removable screw-down “barrier-style” terminal strips with protective covers.
- Two Serial communications ports. Port 1 (RS-232) supports SNP/SNPX slave protocols. Port 2 (RS-485) supports SNP/ SNPX master and slave, RTU master and slave, and Serial I/O.
- Run/Stop mode switch that can be configured as a run/stop switch, a memory protect switch, and also used for clearing faults when a fatal fault exists.
- Time-of-Day Clock.

- Two analog potentiometers.
- Full-featured programming Instruction Set with floating point math. The application program can be either Ladder Diagram (LD) or Instruction List (IL) format.
- 9K words of program memory, 2048 words of registers.
- Flash memory (ROM) for non-volatile program storage and for system firmware.
- Configurable to read configuration at power-up from either RAM or flash memory (ROM). Can also be configured to read application program from flash at power-up.
- Capacitor backs up RAM and the Time-of-Day clock for at least 30 minutes.
- Optional lithium battery backup for RAM and real-time clock.

5.2 General Specifications for 23-Point VersaMax Micro PLCs

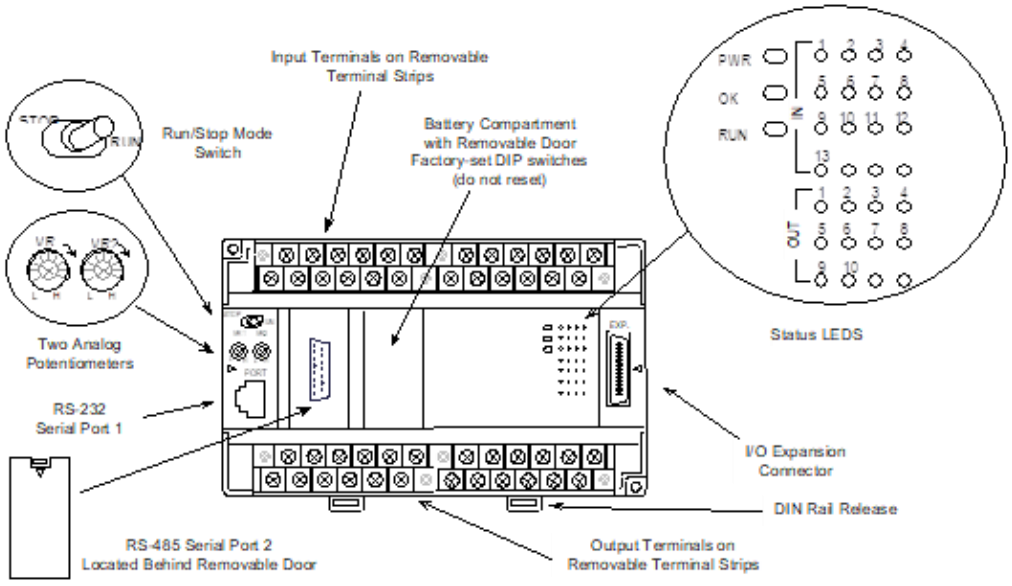
Item	Description
Weight	600 grams (1.32lbs)
Module Dimensions	Height: 90mm (3.6 inches) Depth: 76mm (3.0 inches) Width: 150mm (6.0 inches)
Typical Scan Rate	1.1 ms/K for Boolean logic (see Appendix A:)
Real Time Clock accuracy (for Timer contacts and Timer function blocks)	±0.5%
Time-of-Day Clock accuracy	±5 sec/day @10°C, ±5 sec/day @25°C, and ±11 sec/day @55°C or across full temperature range
High-Speed Counters	Up to four Type A or one Type A and one Type B
Maximum number of slave devices per RS-485 network	8 (can be increased with a repeater)
+5Vdc Output of Serial Ports	Port 1, pin 7: 100mA maximum[3] Port 2, pin 5: 100mA maximum[3]
Lithium battery (IC200ACC403)	Storage: Up to 5 years typical at 30°C Installed: Up to 3 years typical at 55°C 4 months battery backup time (powered down) minimum at 55°C

[3] Combined port 1 and port 2 total not to exceed 100mA max.

5.2.1 Run/Stop Switch

The Run/Stop switch can be configured as a run/stop switch, a memory protect switch, and used for clearing faults when a fatal fault exists.

Figure 29



5.2.2 Serial Ports

Port 1 is an RS-232 serial port with an RJ-45 connector.

Port 2, located behind a removable door on the front of the Micro PLC, is an RS-485 serial port with a DB-15 connector.

Both ports can be used for programming. Only one port can be used at a time for programming, but both ports can be used for monitoring at the same time. Port 1 uses SNP slave protocol. Port 2 is software-configurable for SNP master/slave RTU slave or Serial I/O operation. CPUs with firmware version 2.02 or later support Modbus RTU Master on port 2. 4-wire and 2-wire RTU are supported. If Port 2 is being used for RTU, it automatically switches to SNP slave mode if necessary. Port 2 defaults to SNP slave and automatically reverts to SNP slave when the CPU is in Stop mode, if configured for Serial I/O.

Either port can be software-configured to set up communications between the CPU and various serial devices. An external device can obtain power from both ports if it requires 100mA or less at 5Vdc.

5.2.3 Analog Potentiometers

The two potentiometers can be used to adjust the values in analog registers %AI016 and %AI017. An example use would be to set thresholds for use in logical relationships with other inputs/outputs.

5.2.4 Removable Terminal Strips

The removable terminal assemblies are protected by hinged covers. After turning off power to the Micro PLC, a terminal assembly and attached field wiring can be separated from the Micro PLC by removing two screws.

5.2.5 Status LEDs

LEDs for Power, OK, and Run mode, plus individual LEDs for each I/O point.

5.2.6 Backup Battery

The Micro PLC uses a large value capacitor to provide memory retention current to the System/User RAM and the Time-of-Day clock when the power supply is either not present or not powered up. The capacitor retains memory contents for at least 30 minutes.

To maintain memory for longer than this, a lithium coin cell assembly (IC200ACC403) can be installed in the battery holder. The Micro PLC reports the battery state to the PLC Fault Table and also uses Status Bits %SA011 and %S0014 to indicate the battery state.

5.3 High-Speed Counters

These VersaMax Micro PLCs can be configured to provide built-in high-speed counter operation.

When configured for High-Speed Counter operation, inputs can be set up as:

- Up to four High-Speed Counters or
- One Type A and one Type B Counter.

Each counter provides direct processing of rapid pulse signals up to 10kHz for industrial control applications such as meter proving, turbine flowmeter, velocity measurement, material handling, motion control, and process control.

Each counter can be enabled independently. Type A counters can be configured for up or down counting (default is up) and for positive or negative edge detection (default is positive). The type B counter provides an A Quad B counting function.

The relay outputs of IC200UAL004 and IC200UAL005 can be configured as up to four counter outputs. They cannot be used as Pulse Train or PWM outputs.

5.3.1 Analog I/O

All VersaMax 23-Point Micro PLCs provide two analog input channels that can be configured to accept inputs from 0 to +10V or from 0 to 20mA or 4 to 20mA input signals. They also have one analog output configurable for the same voltage or current ranges. See Chapter 15 for information about configuring voltage/current operation and range. See Chapter 16 for details of analog operation, automatic gain and offset adjustment, automatic program reference configuration, and calibration procedures.

Analog I/O Specifications	
Input and output ranges	0 to 10V (10.24V maximum) 0 to 20mA (20.5mA maximum) 4 to 20mA (20.5mA maximum)
Resolution	12 bits over 0 to 10V range (1 LSB=2.5mV) 12 bits over 0 to 20mA range (1 LSB=5µA) 11+ bits over 4 to 20mA range (1 LSB=5µA)
Accuracy	±1% of full scale over full operating temperature range
Analog Inputs	**2, differential**
Factory calibrated to:	2.50mV per count on 0 to 10V range 5.00µA per count on 0 to 20mA and 4 to 20mA ranges
Linearity	±3 LSB maximum
Isolation	non-isolated
Common mode voltage	±200 V maximum
Current input impedance	249 Ω
Voltage input impedance	100 kΩ
Input filter time	20ms to reach 1% error for step input
Analog Output	**1, single-ended, non-isolated**
Current: maximum terminal voltage user load range output load capacitance output load inductance	10V (at 20mA output) 0 to 500 Ω 2000 pF maximum 1 Henry maximum
Voltage: output loading output load capacitance	2 kΩ minimum at 10 volts 1 µF maximum

5.4 IC200UAL004 Micro PLC, 23 Discrete Points and 3 Analog Channels: (13) 12Vdc In, (10) Relay Out, (2) Analog In, (1) Analog Out, 12Vdc Power Supply

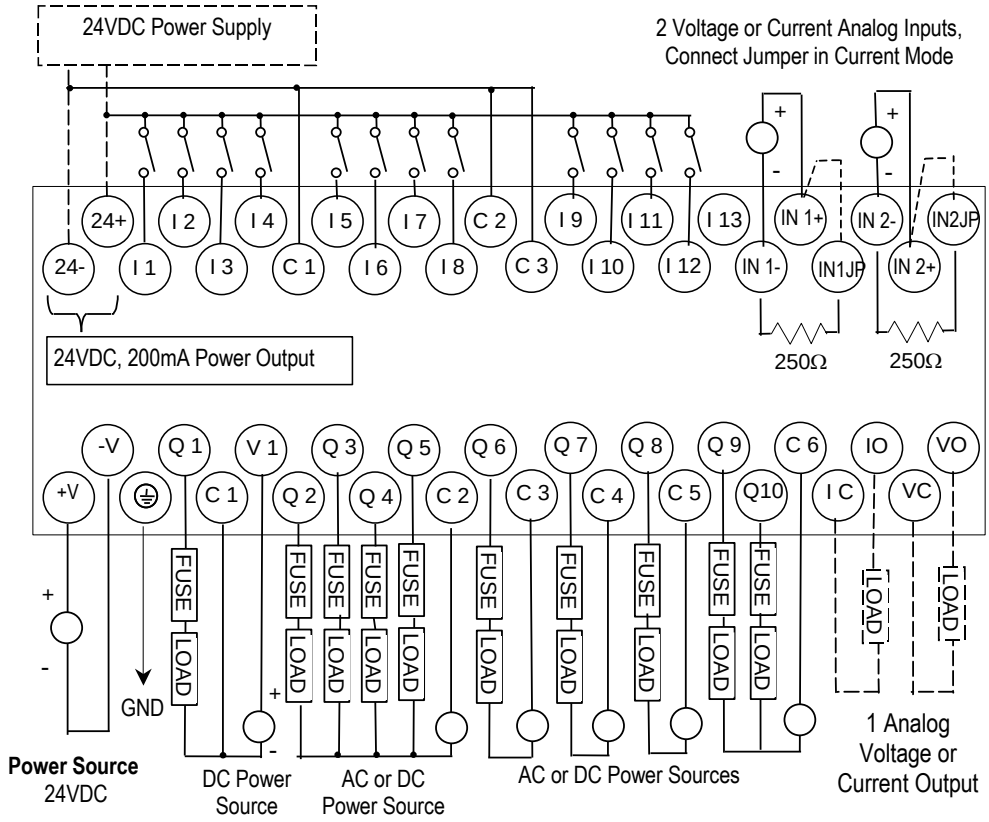
VersaMax Micro PLC IC200UAL004 accepts thirteen 12Vdc inputs and two analog inputs. It provides ten normally open 2 Amp relay outputs and one analog output. It uses +12Vdc nominal input power.

5.4.1 DC Inputs

Thirteen configurable 12Vdc inputs can be used as positive or negative logic standard or High-Speed Counter inputs. Inputs are compatible with a wide range of devices, such as pushbuttons, limit switches, and electronic proximity switches.

5.5.6 Wiring Diagram, IC200UAL005

Figure 31



The resistors illustrated are internal.

5.6 IC200UAL006
Micro PLC, 23 Discrete Points and 3 Analog Channels:
(13) 24Vdc In, (1) 24Vdc Out, (9) Relay Out, (2) Analog In, (1) Analog Out, 120/240Vac Power Supply

VersaMax Micro PLC IC200UAL006 accepts thirteen DC inputs and two analog inputs. It provides one DC output, nine normally open 2 Amp relay outputs, and one analog output. It uses 100Vac to 240Vac nominal input power.

5.6.1 DC Inputs

Thirteen configurable 24Vdc inputs can be used as positive or negative logic standard or High-Speed Counter inputs. Inputs are compatible with a wide range of input devices, such as pushbuttons, limit switches, and electronic proximity switches. Power to operate field devices and the input circuits is supplied by an isolated +24Vdc supply.

5.6.2 DC Output (Q1)

Output circuit Q1 is a 24Vdc transistor output. It can be used as a normal DC output or as a High-Speed Counter-controlled output, Pulse Train output, or Pulse Width Modulation (PWM) output.

5.6.3 Normally Open Relay Outputs

Nine isolated 2-amp, normally open Form A relay outputs (SPST-single pole single throw can control many types of user-supplied load devices such as motor starters, solenoids, and indicators. The switching capacity of each of these circuits is 2 amps. AC or DC power to operate field devices must be supplied from an external source. External fusing is recommended to protect the relay contacts. Relay outputs can be configured as regular outputs or as outputs controlled by High-Speed Counters. They cannot be used as Pulse Train or PWM outputs.

5.6.4 Micro PLC IC200UAL006 Specifications

Item	Description
Inputs	13 DC inputs and 2 Analog inputs
Outputs	1 DC output, 9 relay outputs, 1 analog output
High-Speed Counters	Up to four Type A or one Type A and one Type B
+24Vdc Output Power Supply (for input circuits and user devices)	200 mA maximum
AC Power Specifications	
Range	100 -15% to 240 +10%Vac
Frequency	50 -5% to 60 +5% Hz
Hold-up	10 ms at 85 to 100Vac, 20mS at 100 to 265Vac
Inrush Time	2mS for 40A
Inrush Current	35 Amp maximum at 200Vac 46 Amp maximum at 265Vac
Input Current	0.13 Amp typical at 200Vac 0.20 Amp typical at 100Vac
Input Power Supply Rating	34 VA
Isolation	1500Vac rms field-side to logic (power supply input).
Input Specifications	
Number of Inputs	13
Rated Input Voltage	24 volts DC

Item	Description		
Input Voltage Range	0 to 30 volts DC		
Input Current	7.5mA typical		
Input Resistance	2.8 kΩ		
Input Threshold Voltage	ON: 15Vdc minimum, OFF: 5Vdc maximum		
Input Threshold Current	ON: 4.5mA maximum, OFF: 1.5mA minimum		
Response Time	0.5 to 20ms (user configurable) as regular input; 100µs as HSC input		
Isolation Voltage	1500V RMS field side to logic side, 500V RMS between groups		
DC Output Specifications			
Output logic	Positive Logic		
Operating Voltage	24Vdc / 12Vdc / 5Vdc		
Voltage Range	24Vdc, +20%, -80%		
Maximum UL Pilot Duty Rating	0.75A at 24Vdc		
Maximum Resistive Load Rating	0.75A at 24Vdc 0.5A at 12Vdc 0.25A at 5Vdc		
Output Voltage Drop	0.3Vdc maximum		
Response Time	ON: 0.1ms maximum (24Vdc, 0.2A), OFF: 0.1ms maximum (24Vdc, 0.2A)		
OFF state leakage	0.1mA maximum		
Isolation	1500Vac between field side and logic side, 500Vac between groups		
Fuse	Output should be fused externally. Otherwise, a load short can damage the module output transistor, which is not user replaceable.		
Relay Output Specifications			
Operating Voltage	5 to 30Vdc or 5 to 250Vac		
Isolation	1500 V RMS between field side and logic side, 500 V RMS between groups		
Leakage Current	15 mA at 240Vac maximum		
Maximum UL Pilot Duty Rating	2 amps at 24Vdc and 240Vac		
Maximum Resistive Load Rating	2 amps at 24Vdc and 240Vac		
Minimum Load	10 mA		
Maximum Inrush	5 amps per half cycle		
Response Time	ON: 15 ms maximum, OFF: 15 ms maximum		
Contact Life: Mechanical	20 x 106 mechanical operations		
Contact Life: Electrical Voltage 240Vac, 120Vac, 24Vdc	Current: Resistive 2A	Current: Lamp and Solenoid 0.6A	Typical Operations 200,000

Item	Description
High-Speed Counter Specifications	
Maximum Counter Frequency	10kHz
Input Voltage	ON: 15V, OFF: Off: 5V
Count Pulse Width	20% to 80% duty cycle at 10kHz
Count Registers	16 bits
Available Pulse Outputs	None
Outputs	
Load Voltage	Q1: 5/12/24V
Maximum Pulse/PWM Frequency	(Q1 only) 5kHz
Types available	Up to four HSC outputs or one Pulse/PWM output plus three HSC outputs.

5.6.5 Wiring Diagram, IC200UAL006

Figure 32