Ace PLC

Velocio's Ace PLC

The Ace PLC is a member of the Velocio's groundbreaking series of programmable logic controllers. These PLCs introduce revolutionary new concepts, capabilities, performance and ease of use features to the automation market. They constitute a generational leap over the staid products that have comprised the PLC world for years.

The Ace is the small, stand alone member of the Velocio family. It brings incredible power, in a very small package and at a very low price. Many control system applications require 36 points of IO or less, all located very close to the PLC. For those applications, the Ace is the Velocio PLC that fits the requirements.

Ace PLCs are programmable, using Velocio's vBuilder software. The Ace connects to a PC using a standard USB communications cable. Through this USB cable, the Ace PLC can be programmed, debugged and deployed.
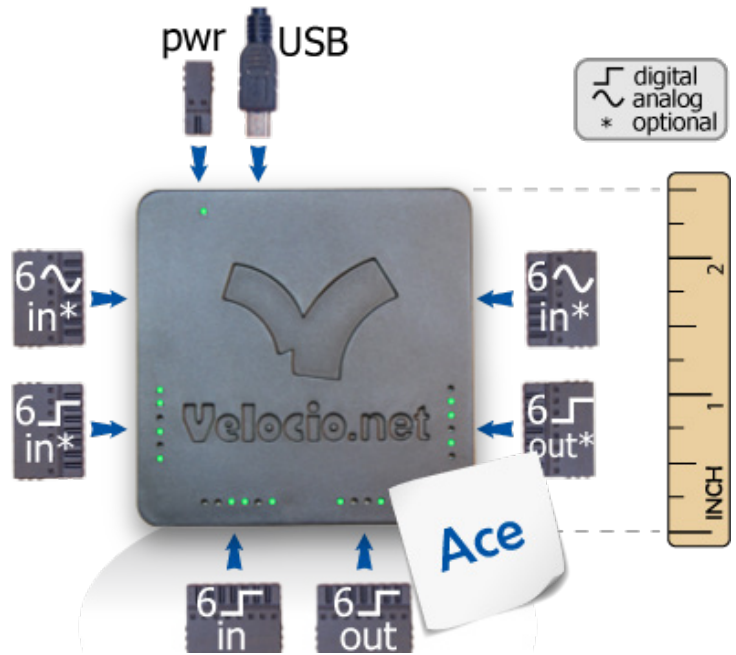
Direct digital inputs to the Ace are any DC voltage signal between 3 and 30 volts. If an AC signal is to be sensed, a standard optocoupled input module can be plugged into an Ace digital input port, via a standard cable. This module then provides screw terminal connections for AC signal inputs.

Direct digital outputs from the Ace are sinking transistor outputs. They can be used do sink to ground (turn on) any DC output up to 30V and 200mA. If AC or high current or voltage DC outputs must be switched, Velocio Relay terminal blocks can be connected.

Ace PLCs can be configured for high speed input counting and stepper motion control. Using vBuilder, you can configure selected digital inputs for either simple high speed pulse counting or for quadrature input pulse counting. Likewise, through vBuilder, you can select digital outputs for pulse and direction stepping motor motion control.

The analog inputs are available in three ranges : 0-5VDC, 0-10VDC and 0-20mA. These three ranges cover the vast majority of analog signal requirements. Resolution is 12 bit (conversion values between 0 and 4095), providing very precise measurement of most common analog signals.

The Ace's small size is another key feature. High end automation capabilites are packed into a PLC that fits in a shirt pocket. For those systems with limited availabilty of space, the Ace can provide a solution.

Applications
- Machine control
- Process control
- Small machine control
- Home automation
- Automated Test
- Motion system control

Features
- Up to 36 Inputs and Outputs
  - 12 Digital Inputs
  - 12 Digital Outputs
  - 12 Analog Inputs
- USB connection to PC and other Host devices
- Smallest physical footprint of any PLC
- Software features at or beyond those of the most advanced PLCs and Programmable Automation Controllers (PACs)
- Program development via vBuilder
  - Graphical program development
  - Flow Chart Programming
  - Ladder Logic Programming
  - Interactive, graphical debug functionality
  - Software reusablity
  - Advanced functionality
  - • Subroutines, Object orientation, PID, motion, statistics & many more

Available Versions of the Ace PLC

Ace 11 :   6 digital inputs, 6 digital outputs
Ace 22 :   12 digital inputs, 12 digital outputs
Ace 222v5 :   12 dig. ins, 12 dig. outs, 12 analog ins (0-5V)
Ace 222v10 : 12 dig. ins, 12 dig. outs, 12 analog ins (0-10V)
Ace 222c :   12 dig. ins, 12 dig. outs, 12 analog ins (0-20mA)

Benefits
- Greatly enhanced and efficient development process
- Reduced system cost
- Reduced development time
- Improved reliability

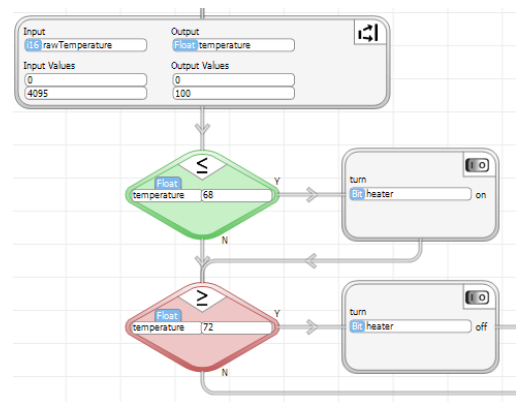Velocio Networks, Inc.   Velocio.net   March 2014

vBuilder Software

Like all Velocio PLCs, Ace can be custom programmed for your application's requirements, using Velocio Builder (vBuilder). vBuilder is an application that is distributed free of charge, for use in developing programs for Velocio PLCs.
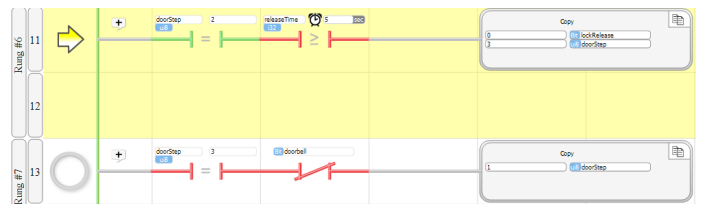
vBuilder is the most powerful, flexible and easy to use graphical program development software available in the industry. That includes the packages from the industry titans, that will cost you hundreds to thousands of dollars. We're sure that you'll love it.

In vBuilder, you can develop applications using either Flow Chart, or traditional Ladder Logic programming.

Some vBuilder features include :
- Flow Chart programming
- Ladder Logic programming
- True subroutines
- Object oriented graphical programming
- Distributed program operation
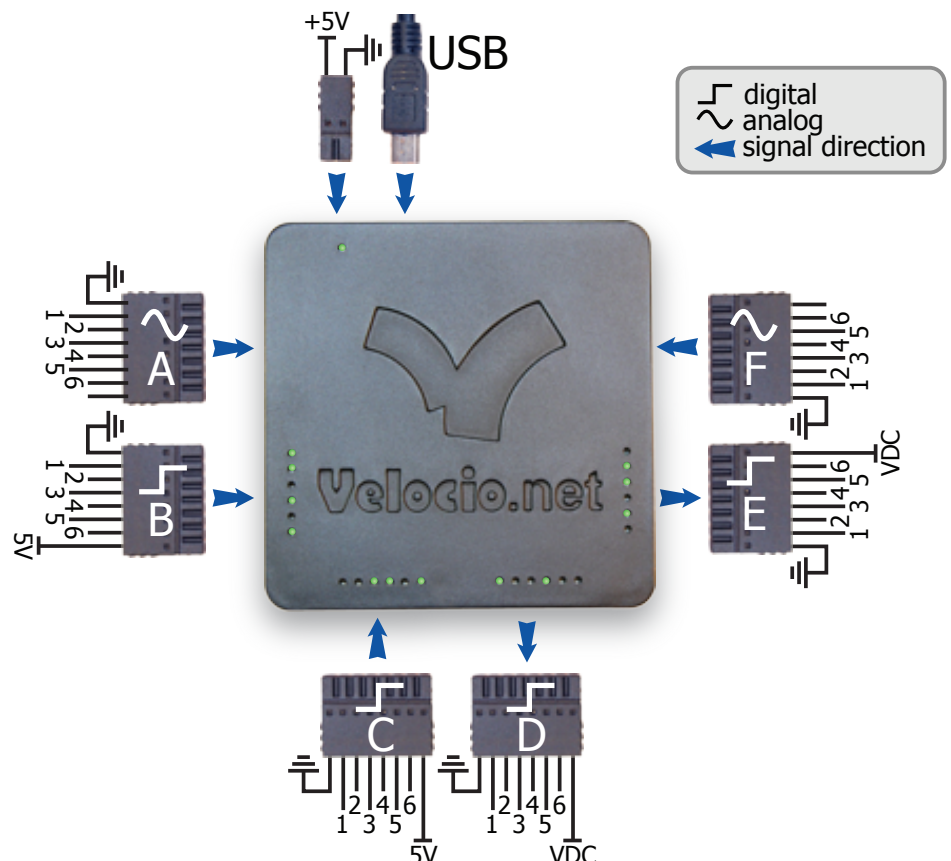- Single point debug of local or distributed systems

There's so much more. Download vBuilder at Velocio.net to see for yourself. You'll notice very quickly that you can develop any program that you can logically define, in a fraction of the time required using other approaches, with easy to use graphical tools - and its fun!

Ace Inputs and Outputs

Each Ace PLC can connect to 6 or 12 digital inputs, 6 or 12 digital outputs and 0 or 12 analog inputs. There are up to 6 IO ports total. Each IO port has an 8 pin pluggable terminal block connector. Each of these port connectors connect to 6 points of IO.

The layout of Ace IO ports (looking from the top of the Ace), is shown here.
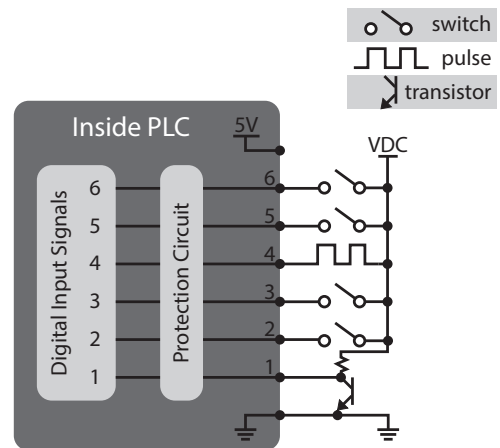
Ace IO

◊ **Digital Inputs :**

Ace PLCs have either 6 (1 port) or 12 (2 ports) digital inputs. Digital inputs sense binary status, such as on/off, switch open/closed, etc. The Ace PLC can interface any DC voltage signal between 3 and 30VDC. Typical system designs utilize 5V, 12V or 24VDC power supplies, which are all within the Ace's signal range.

Any connection to DC voltage between 3 and 30VDC is sensed as a '1'. Any connection to ground (or voltage below 0.8VDC) or an open connection is sensed as '0'. The ground reference of the signal must be connected to the ground terminal pin next to signal 1.

Using vBuilder, one high speed pulse counter can be configured for basic high speed pulse counting (one digital input), or quadrature pulse counting (two digital inputs). The same signal level requirements apply, as listed above.

For digital inputs that are AC signals, the Ace's digital input ports can be connected to Velocio Optocoupled Input Terminal Block modules. These modules interface 24VAC or 120VAC signals. A cable, supplied with each terminal block module is then connected to the Ace digital input port. The Optocoupler Input Terminal Block modules convert the AC signals to the proper DC levels to the PLC.
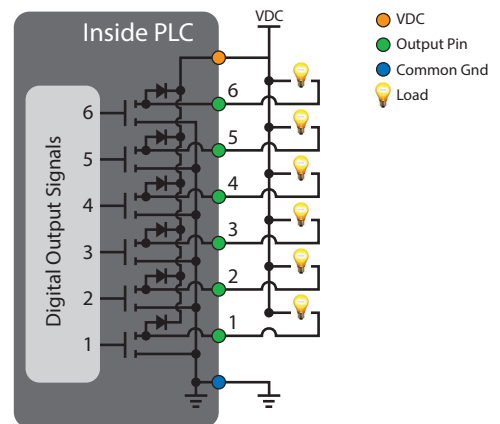

◊ **Digital Outputs :**

Ace PLCs have either 6 (1 port) or 12 (2 ports) digital outputs. Ace digital outputs are sinking transistor outputs. When switched on under program control, they complete the circuit to turn on any connected DC device up to 30VDC and 200mA.

Each ouput includes diode snubber protection, for inductive load (solenoids, relays, etc.) protection. The supply voltage, up to 30VDC, which is connected to the load devices, must be connected to the VDC terminal pin, next to output 6 of the output port, to enable this protection. All loads connected to a digital output port should be connected to the same DC supply. The load power supply ground must be connected to the ground (next to signal 1) of the output port.

If AC power, or higher power DC needs to be switched, the Ace's digital output ports can be connected to a Velocio Relay Terminal Block module, through a short standard cable, supplied with the module. With a Relay module, up to 250VAC and 5 Amps can be switched under program control. The cable diagram connection to the PLC digital output port pluggable connector is illustrated in the Relay Terminal Block module documentation.
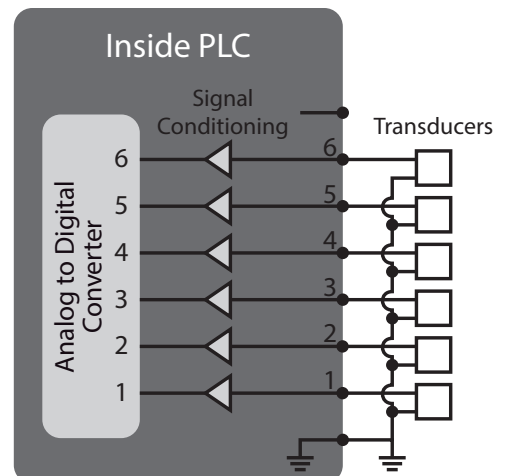

◊ **Analog Inputs :**

Ace PLCs are available with 12 analog inputs (2 ports). Ace PLC analog input interfaces are available for either 0-5VDC, 0-10VDC or 0-20mA.

Analog inputs are normally used to connect to transducer outputs. Such transducers measure some physical parameter, such as pressure, temperature, liquid level, position, pH level, or other such continuously variable measurement. The signal output should be connected to a signal input on the Ace analog port and the transducer return or ground reference line must be connected to the PLC ground, next to signal 1.

Ace PLCs with current input analog input ports (Ace 222c) should be used for analog current signals between 0 and 20 mA. The two most common type of current signals are 4-20 mA and 0-20 mA.

Full range analog signals will convert to a value between 0 and 4095 (12 bits). For 4-20mA inputs, the converted value will be between 820 and 4095. The Scale function in vBuilder can be used to automatically convert the signal value to meaningful data.

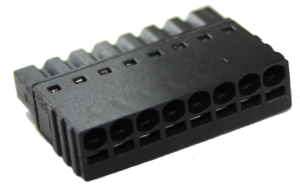# Wire Connections to the Ace Pluggable Terminal Blocks

Ace units come with pluggable terminal blocks, like the one shown on the on the right. Connect your wires using the larger circular holes on the top row of the orientation shown.

Looking at the connector, in the orientation shown from left to right, the eight wire positions are ground, six signal positions 1 through 6, and either a no connect (analog), VDC (output) or 5VDC from the 5V power input to the PLC (input).

If you have solid wire, you simply need to strip the insulation back about 1/8 inch, insert each wire into the proper round connector hole and push the wire in. It should push in very easily and lock in place. You should not be able to pull the wire back out.

To insert stranded wire, insert the blade of a Velocio connector tool (screwdriver) in the rectangular hole directly below the connection hole which you wish to insert your wire. The screwdriver blade should be horizontal (in line with the long dimension of the rectangular hole). This will open the spring capture connection. Simply push your wire in, then remove the blade. If you pull the wire, it should be captured in place and will not come out.

To remove any wire from the connector, use the Velocio screwdriver connector tool. Push the blade into the rectangular slot below the wire to open the spring clamp and release the wire. Gently pull the wire out, then remove to blade.
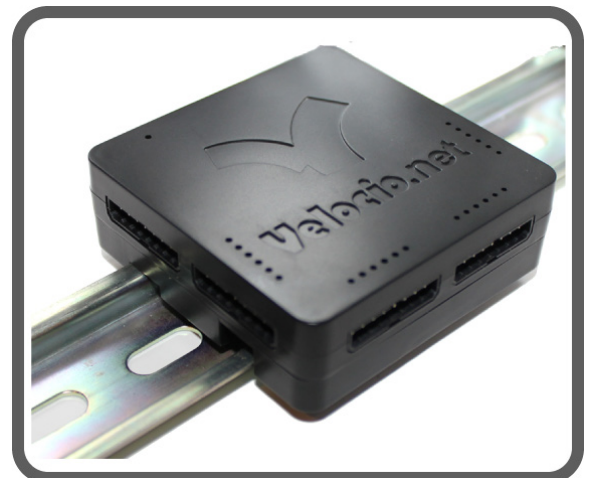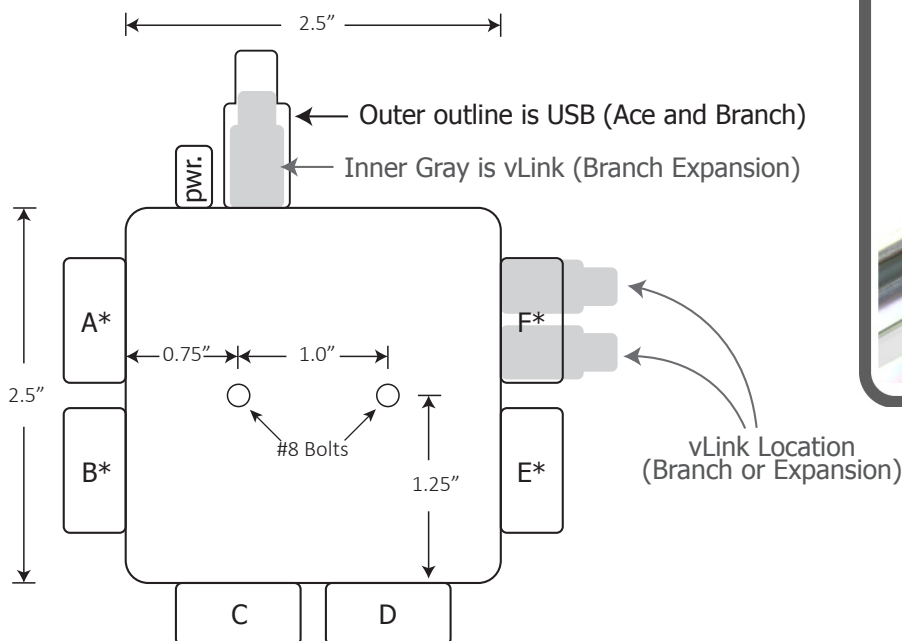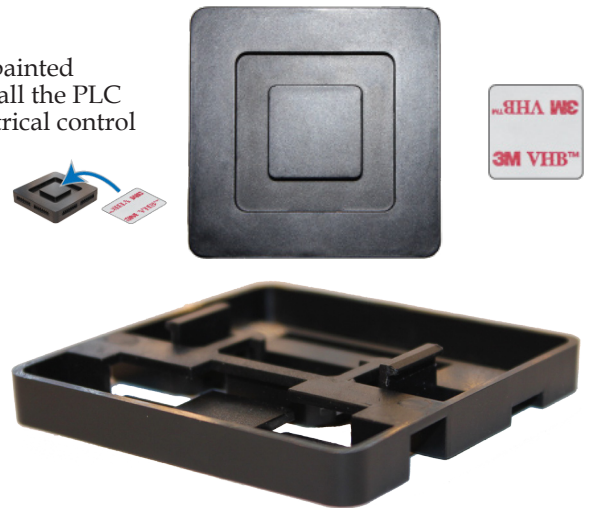
Mounting Options

Each Velocio PLC comes with a double sided adhesive pad for attaching to painted metals, plastics or glass. Using this method of attachment allows you to install the PLC in very tight and unusual environments as well as place them in typical electrical control panels. The adhesive is very strong and will provide a solid permanant attachment, unless extreme pressure is applied to break the seal.

Alternatively, Velocio PLCs are designed to add an optional vMount DIN rail mounting adapter. The vMount adapter snaps onto the bottom side of the PLC. It can then be snapped onto a standard 35mm DIN rail, or can slide onto a pair of properly spaced screws.

DIN rail mounting is illustrated on the right. The necessary hole pattern for screw mounting is shown below.

Outer outline is USB (Ace and Branch)

Inner Gray is vLink (Branch Expansion)

#8 Bolts

vLink Location
(Branch or Expansion)

Connecting Power

Power to the Ace PLC must be provided via a two position pluggable connector, included with the Ace unit. To connect power, insert the 5VDC and ground connections from a power supply into the plug, as shown in the figure below. When plugged into the PLC's power connector socket, the +5VDC connection is to the right, closest to the corner..

GND   +5V

Specifications :

Hardware Specifications

Power :

Voltage	4.75 - 5.5VDC	
current	300mA maximum	
	< 100mA typical	

Digital Inputs :
- Type :   DC voltage input
- Input range : 3 to 30 VDC
- Input low (or 0) signal : 0 to 0.8V, or open connection
- Input high (or 1) siganl : 3 to 30VDC
- Pulse counter input frequency :
  - up to 100 KHz (typical)
  - up to 250 KHz (maximum)

Digital Outputs :
- Type : Sinking transistor
- Voltage range :   3 to 30VDC
- On resistance :   5 ohms
- Current :   200 mA maximum

Do not connect digital outputs to loads drawing excessive current. A load drawing over 350mA may cause the output transitor to 'latch up' in the on condition. Clearing a 'latch up' requires a power down.

Motion output pulse frequency
- 0 to 100 KHz (typical)
- 0 to 250 KHz (maximum)

Analog Inputs :
- Type :
  - v5   = 0 to 5VDC:
  - v10 = 0 to 10VDC
  - c   = 0 to 20 mA
- resolution :   12 bit

Communications :

Upstream :	USB Device
	mini USB connector

Physical Dimensions :

2.5"H x 2.5"W x 0.5" deep

Software Specifications

Application Program Limits (in Ace PLC)

Program Memory :		34K Words
Maximum rungs or function blocks		4K
Maximum # Subroutines		68
Maximum Tagnames		950
Main Program data memory		
Bits		2,048
unsigned 8 bit integers		512
unsigned 16 bit integers		512
signed 16 bit integers		512
signed 32 bit integers		256
floating point numbers		256
Object Memory (used for subroutine data)		
object words		4,096
object bits	up to	65,536
object 8 bit integers	up to	8,192
object signed 16 bit	up to	4,096
object unsigned 16 bit	up to	4,096
object signed 32 bit	up to	2,048
object floating point	up to	2,048
Maximum # objects		292

Terminal Block Connections

Terminal type	Socket connectors and Spring cage capture plug
Terminal spacing :	2.50 mm
Wire AWG	20 to 26 AWG*

* best wire fit is with 22 or 24 AWG

Ports included :

Ace 11 : Ports C, D and power
Ace 22 : Ports B, C, D, E and power
Ace222 : Ports A, B, C, D, E, F and power