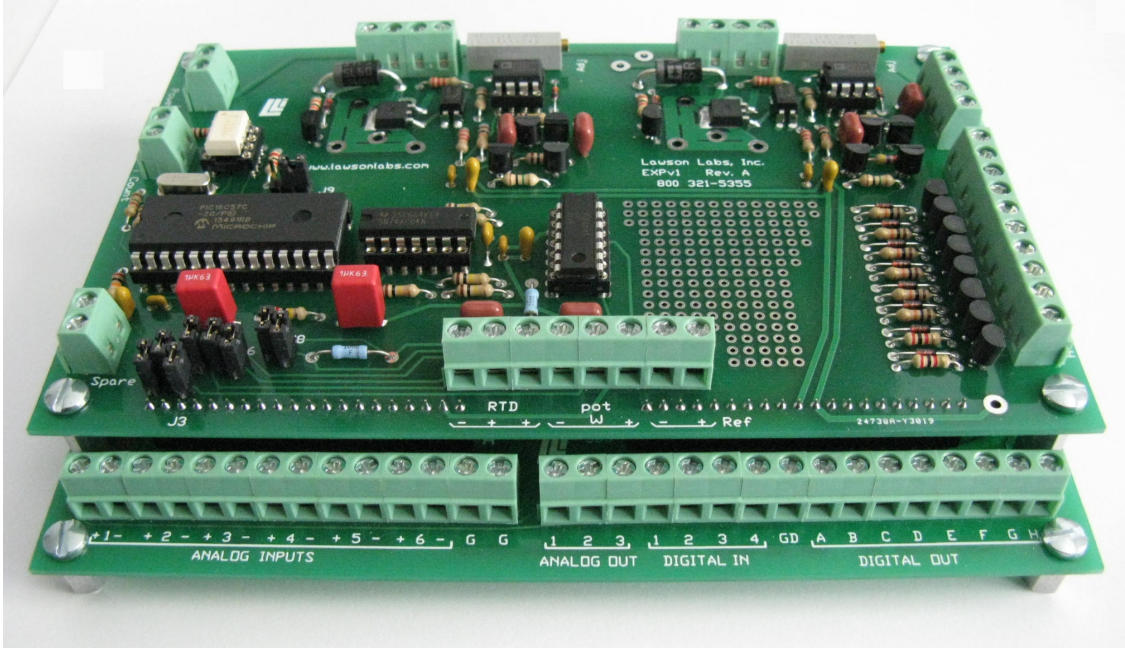
Model 302 EXPv1
Stacking Process Control Expansion Board for expandable Model 302

Instruction Manual

12/15/2022



1) Features Overview

The EXPv1 expansion board stacks on the expandable version of the Model 302 Data Acquisition System. The Expansion board contains a mixture of interfacing circuitry suitable for a wide variety of acquisition and control applications. Inputs can be voltage, current, frequency, or resistance, with accommodation for RTD or thermistor temperature sensors. Analog Outputs can be voltage, current, or PWM. The optically isolated current outputs can sink 2 amps or more. Digital outputs can sink up to 250 ma.

The individual interfacing blocks are based on proven, high performance products and are designed for use with our 24-bit data acquisition systems. High impedance

analog inputs interface directly to ion selective and pH electrodes. High resolution allows direct interfacing to bridge sensors or even thermocouples.

Features:

2 2 Amp Proportional Valve Drivers, both normally OFF (DAC channels 1 & 2)
1 isolated input precision F-to-V converter (A/D channel 1)
1 unassigned buffered 5V reference output
1 set of three terminals for string pot connection (A/D channel 2)
1 set of three terminals for RTD or thermistor connection (A/D channels 3 & 4)
8 250 ma current sink digital outputs for driving solid state relays, etc.
1 PWM output from DAC 3
4 Digital Inputs are available directly on the Model 302 board
2 additional Analog Inputs are available directly on the Model 302 board
Connector for jumpers to send power to the M302 board
4 tie point terminals for V+ connection for poppet valves, relays, etc.
Analog input features can be bypassed
2 spare terminals, plus a prototyping area

A) Proportional Valve Drivers, 2 available

Two proportional drive circuits are provided. They are optically isolated power drivers for solenoids, valves, DC heaters, DC motors, and other DC loads. They output a proportional current from 0 to 2.5 amps, or more. The current output follows an analog voltage from analog outputs 1 and 2 on the Model 302 data system.

A proportional valve, a fan motor, and a heating element are examples of loads that can be controlled with resolution matching the analog control voltage. Expensive loop controllers can be replaced with improved performance and much lower cost in many applications.

Output up to 2 amps, or more, at 10 to 24 volts, optically isolated
Input power supply, 10 to 20 volts, reverse-protected
Input control voltage 0-5 volts
Efficient, so that no active cooling is needed.
Typical modulation frequency 1500 Hz or 4000 Hz factory option
Modulation frequency is preset, but can be set over a wide range
Load can be inductive or resistive
Built-in 5 amp freewheeling diode for inductive loads
Gain is adjustable via on-board trim potentiometer, 0 - 100% range
Output is monotonic
Linearity is excellent over the middle 90% of the range

B) Counts-to-Volts Input, one available

A frequency or pulse stream can be converted to a precise analog voltage. Resolution is good enough to see a single edge while still being able to handle 100s of kHz. The input can be from any sort of pulse or frequency generator, including position sensors and radiation detectors.

A proprietary Sigma-Delta demodulation approach is used for superior accuracy and stability.

18 bit linearity, high stability counts-to-volts converter
Optical isolation on input
Dual sensitivity ranges
Edge triggered, duty-cycle independent
0.25 second time constant
See the Model 106 for more details

C) Digital Outputs

Eight current sink outputs are provided. These accommodate up to 30 volts at 250 ma continuous current. 100% overcurrent can be sustained for a fraction of a second. Contact the factory for higher current options.

D) Digital Inputs

4 digital inputs feed directly to the Model 302 digital input terminals.

E) PWM Output

Analog output number 3 is available as a duty cycle on a screw terminal on the the expansion card.

F) Other Input

Circuitry and connection points are provided for RTD or thermistor inputs. Connections provided for string potentiometer or other ratiometric inputs. Power connections are provided for powering a bridge circuit or other powered sensor.

G) Power Requirement

The expansion card is powered from the Model 302's power supply. It requires less than 30 ma, so the smallest supplies are adequate. Loads can be be powered by the same supply, if sufficient, or by external isolated or unisolated power sources.

H) Customization

The system is designed to be easy to customize. Contact the factory for a different mix of features, or entirely new capabilities.

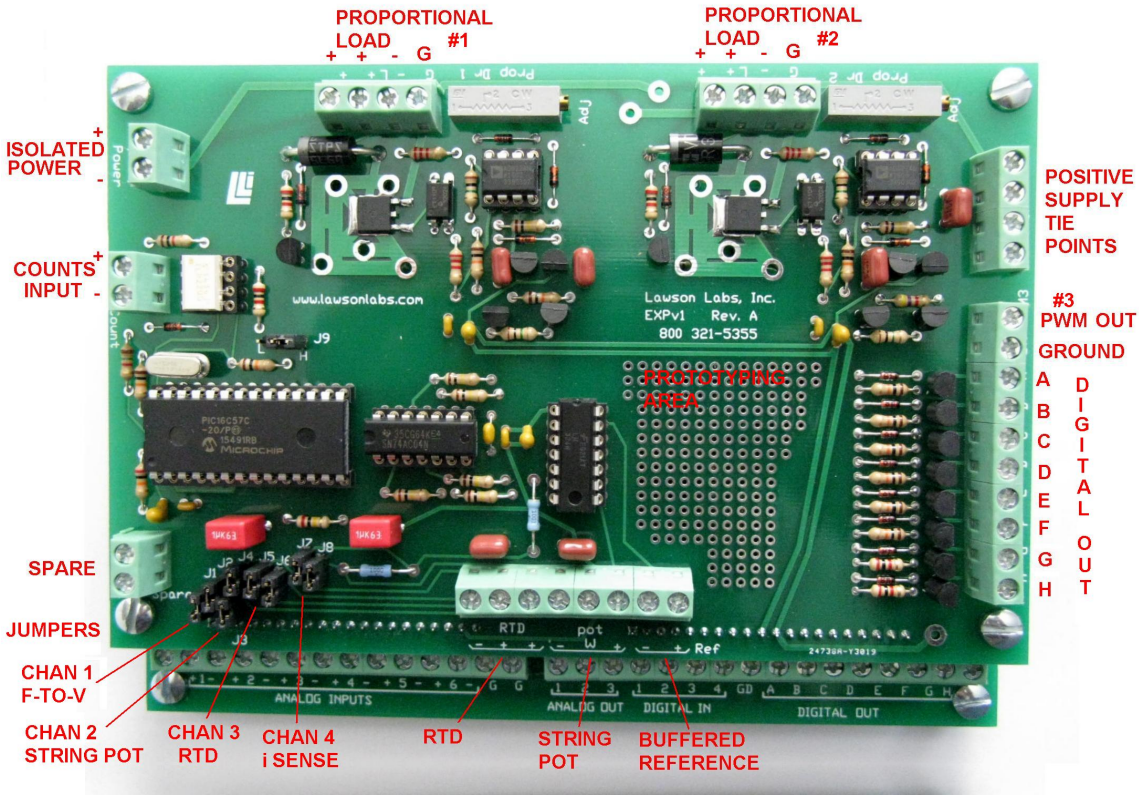
2) OPERATION

The M302EXPv1 is designed for flexibility. It can be tailored to your particular application. In general, the Proportional Current outputs are copies of the PDr1 drive circuit, and the counts-to-volts input is a version of the Model 106.

A) Current outputs

The current outputs are ideal for use inside a control loop. The temperature, pressure, position, etc. that is being controlled is sensed and read by the analog data system. Then, the analog output can be adjusted according to a programmed set of rules.

The trimpots, labeled adj, can be adjusted for the desired maximum current output



with the maximum voltage input. If maximum current is not a limitation, the factory settings should be adequate. That setting provides approximately 50% duty cycle at 2.5 volts in.

The current output will be zero with 0 volts in, or without power to the Model 302. At around 400 mv control input voltage, output current begins to flow. Typically, above about 500 mv control input (0 -5 volt range), the output is fully linear. There may be a non-linear band as the maximum power is approached, depending on the setting of the

adj adjustment.

PDr #1 is wired to he first analog output channel. PDr #2 is wired to the second channel. PDr #1 runs at 1400 Hz modulation frequency and #2 runs at 4000 Hz. Faster or slower frequencies are available as a factory option. Some motors can produce audible noise at one or the other frequency. In general, frequencies much over 5000 Hz will begin to reduce efficiency, causing a temperature rise. Frequencies below 500 Hz may cause dithering of the load. Consult the factory for advice on custom settings.

Because the control is modulated, dithering should not be necessary.

Connections

The Output is optically isolated. Connect the output power power supply between the + and - terminals. The load connects to the + and - LOAD terminals. If isolation is not required, the + and - power terminals can be jumpered down to the + and - power terminals on the Model 302.

Power for both PDr output circuits is wired in parallel. If you want separately isolated power for each PDr output, there are drillouts on the expansion board to allow separate power to be connected to each. The #2 ouput power is also available at the 4 extra power + terminals. These are provided for powering relays or valves connected to the digital outputs for situations where the ground of the #2 PDr power is shared with the ground of the Model 302 power supply. Use optically coupled digital output modules for full isolation.

B) Counts-to-Volts

The counts-to-volts section is a positive edge triggered with high and low ranges for maximum flexibility. It is suited for interfacing to position sensors, radiation detectors, or other frequency-to-voltage uses. The counter input is optically isolated.

With jumpers JP1 and JP2 in place, the output will appear at the first analog input channel.

Note: With JP1 and JP2 open, the first analog input channel can be connected for other use on the Model 302 board terminals.

RANGE
The standard ranges are 1 volt out equals 100,000 counts per minute in, and 1 volt out equals 12,000,000 counts per minute in. Both ranges include zero. These ranges correspond to 0 to 1666 Hz and 0 to 200 KHz for a one volt output range. The standard high range extends to 380 KHz at 1.9 volts out. The low range stays linear to over 4.5 volts, or 7.5 KHz (450,000 cpm).

Expect to see an offset at zero counts in of less than 1 mv. Subtract this offset from the channel 1 input voltage readings for best linearity.

Set the jumper to the H position for the high range and the L position for the low range. Power must be cycled to the system for the range change to take effect.

Use 5 volt signals at the counter input. Other voltages can be accommodated. The input signal should be able to source 5 ma in order to properly drive the optical isolation.

FILTRATION
The filtration time constant is set for 0.25 seconds. The output settles to 16 bits in 2.5 seconds after an instantaneous full-scale step.

C) Digital Outputs

The 8 outputs are open collector current sinks capable of 250ma continuous current. Clamp diodes are provided for inductive loads such as mechanical relays or valves. If multiple high current loads are to be used at once, connect a heavy wire directly from the Digital Output GND terminal to the ground at your power supply. If that connection causes a ground loop issue, there is a drill-out on the EXPv1 board to break that ground connection.

Digital outputs will accept loads connected to up to 24 volts. Higher voltage can be handled as an option.

For higher current outputs, use the digital outputs to activate relay modules. The relay modules can be optically isolated for freedom in grounding and powering the controlled devices.

Contact the factory for customization to achieve higher current sinking capability.

D) PWM Output

Analog output # 3 is available as a PWM signal at the PWM screw terminal. The same signal is available as a voltage at the usual place on the Model 302 board. The base frequency of the PWM signal is fixed at 200Hz.

E) Stringpot Input

A potentiometer, or other ratiometric sensor, can be connected at the " -", "W", and "+" potentiometer terminals. The W voltage will appear at analog input channel 2 when jumpers J3 and J4 are in place. Without the jumpers, the analog input channel is available for use at the Model 302 input terminals.

The "+" terminal is an individually buffered version of the 5 volt A/D reference voltage. The recommended minimum potentiometer impedance is 400 ohms.

F) RTD Input

An RTD or thermistor can be connected at the terminals labeled "-", "+" and "+". For two-wire sensors, jumper the two + terminals together. Three-wire sensors connect to the three terminals. For four-wire sensors, connect the second minus connection to the pot "-" terminal. The RTD or thermistor itself should be electrically isolated.

A factory-set resistor determines the RTD current. Analog input channel 3 reads the

RTD voltage when jumpers JP5 and 6 are in place. Analog input channel 4 reads the voltage across a 100 ohm sense resistor when jumpers
JP7 and 8 are in place. Without the jumpers, the analog input channels are available for use at the Model 302 input terminals.

The values for the current setting resistor and the current sense resistor can be chosen at the factory to optimize for any particular resistive sensor.

Note: These connections can also be used with a resistance cell.

G) BUF OUT

The "+" and "-" BUF terminals provide an individually buffered 5 volt reference. This output can handle loads of up to 12 ma.

H) SPARE

Two spare screw terminals and an unassigned prototyping area are available for custom features.