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PZ 94E User Manual

E-661.CP

NanoAutomation® Controller with Parallel Interface

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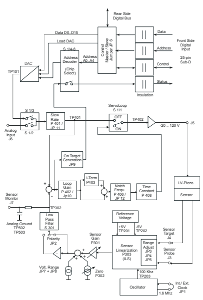
This document describes the following product(s):

- E-661.CP
  LVPZT Servo-Controller with Parallel Interface,



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About this Document

Users of this Manual

This manual is designed to help the reader to install and operate the E-661.CP NanoAutomation® Controller with Parallel Interface. It assumes that the reader has a fundamental understanding of basic servo systems, as well as motion control concepts and applicable safety procedures.
The manual describes the physical specifications and dimensions of the E-661.CP NanoAutomation® Controller with Parallel Interface as well as the installation procedures which are required to put the associated motion system into operation.
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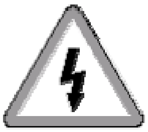
Conventions

The notes and symbols used in this manual have the following meanings:



DANGER

Indicates the presence of high voltage (> 50 V). Calls attention to a procedure, practice or condition which, if not correctly performed or adhered to, could result in injury or death.

!

CAUTION

Calls attention to a procedure, practice, or condition which, if not correctly performed or adhered to, could result in damage to equipment.

NOTE

Provides additional information or application hints.

Related Documents

The stages which might be delivered with the E-661.CP NanoAutomation® Controller with Parallel Interface are described in their own manuals. All documents are available as PDF files.
Updated releases are available from www.pi.ws or email: contact your Physik Instrumente sales engineer or write info@pi.ws.

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1 Introduction

This manual describes the function and use of the

E-661.CP PZT Servo-Controller with parallel interface

The E-661.CP is a single-channel servo-controller for piezoelectric translators (PZTs). It has both an analog and a 16-bit parallel digital input for commanded target values, as well as on-target and near-overflow signal outputs; it includes circuitry for excitation and readout of capacitive position sensors, motion control and power amplification for PZT loads.

All low-voltage actuators with 2-plate capacitive sensors can be operated with the E-661.CP controller. They have PI-standard cable connectors (LEMO-type) with separate lines for sensor signals (target and probe) and operating voltage.

1.1 Features

- Controls low-voltage nanopositioners and actuators with capacitive displacement sensors.
- On-board LVPZT amplifier supplying up to 8 W average power
- Position servo-control circuit
- Opto-isolated, 30 µs, parallel, digital target input
- 16-bit DAC for digital target control
- Indication of near-overflow conditions
- On-target indicator with selectable position window size

The device is built in a compact, bench-top chassis. For special automation purposes, the internal controller board can be used in various configurations, with or without the front panel. The board and front panel without the housing is available as a plug-in module for OEM applications from PI as E-612.C0. PI also offers a compatible chassis capable of holding a number of such modules. See the E-612 User Manual for details.

In the standard configuration, connectors for interface and signal lines are located on both front and back panels.

1.2 Safety Precautions

DANGER

High Voltage Can Cause Injury

E-661s are amplifiers generating voltages up to 120 V for driving LVPZTs. The output power may cause serious injury.

When working with these devices or using PZT products from other manufacturers we strongly advise you to follow general accident prevention regulations.

All work done with and on the devices described here requires adequate knowledge and training in handling High Voltages. Any cabling or connectors used with the system must meet the local safety requirements for the voltages and currents carried. Procedures involving working on the device with the voltages of up to 120 V on the board exposed, should be carried out by qualified, authorized personnel only.

!

CAUTION

PZT Actuator Damage

Most PZT actuator types used with this controller can be permanently damaged by even short-duration operation at or near their resonant frequencies. If you observe resonant behavior, shut down the system immediately

1.3 Product and Accessory Part Numbers

E-661.CP	High Speed NanoMotion Controller
E-661.PS	Power Supply, 100-240 VAC/15 VDC /30VA
E-692.SMB	Adapter Cable SMB-BNC

Contact PI for information on the following options:

- PZT extension cable
- Digital interface cable kit

2 Quick Start

DANGER

High Voltage Can Cause Injury

E-661s are amplifiers generating voltages up to 120 V for driving LVPZTs. The output power may cause serious injury.

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All work done with and on the devices described here requires adequate knowledge and training in handling High Voltages. Any cabling or connectors used with the system must meet the local safety requirements for the voltages and currents carried. Procedures involving opening the case should be carried out by qualified, authorized personnel only.

This quick start assumes your E-661 were factory calibrated with the PZT actuators to be used in your application. If you have more than one E-661, make sure you always connect the same actuator axis with the same E-661 (see label on back with PZT serial number).

1. Make sure the jumpers (p. 26) and DIP switches (p. 12) are set for the desired operating mode and unit address.

2. Connect the sensor target (T) and probe (P) lines to the corresponding sockets. Do not mix up the T and P lines.

3. Connect your control electronics (digital or analog) to the corresponding connectors.

CAUTION

PZT Actuator Damage

Most PZT actuator types used with this controller can be permanently damaged by even short-duration operation at or near their resonant frequencies. If you observe resonant behavior, shut down the system immediately.

4 Set servo-control to OFF.

5 Connect the power supply and switch the unit ON.

6 Command a safe position with the control electronics (e.g. analog input enabled and 0 V on control input).

7 Connect the PZT stage to the controller. Make sure that the controller is connected to the actuator with which it was calibrated.

8 Set servo-control to ON and command the PZT axis over its full travel range (e.g. with analog input enabled, let control in run from 0 to 10 V). If overflow occurs, then try to correct the situation by adjusting the zero-point through the front panel (typical adjustment might have -5 V PZT output voltage at 0 position)

3 Front and Rear Panel Layout

3.1 Front Panel Elements

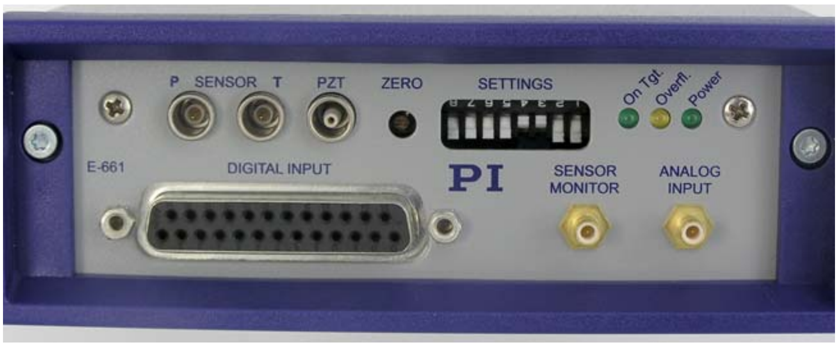

Fig. 1: Front panel

- PZT and sensor (target and probe) connectors.
- Analog input.
- Sensor monitor.
- Connector for digital interface.
- Controller settings (input type, servo mode, address)
- Zero adjustment potentiometer.
- LEDs for Power, Overflow and On Target

3.2 Rear Panel Elements

Fig. 2: Rear panel

- Connectors for power supply and synchronization.
- External synchronization input/output
- Switch for internal/external synchronization

4 Operating Notes

If a power supply other than the original PI P/S order # E-661.PS is used, it must supply 2 A @ 15 VDC.

Upon power-up, the digital-to-analog converter (DAC) may have an unpredictable output value. Before operating the system, a safe target value should be sent.

4.1 Synchronization and Networking

To avoid interference between sensors in a multi-axis system, the sensor excitation signals should be synchronized. This requires that one controller in the system act as master and the rest as slaves. With E-661.CP and E-612.CO controllers, the following settings must be made:

- All units must have the “Single/Multiple” jumper set to “Multiple” (default on E-661s)
- One unit must be set to Master, the others to Slave (rear-panel switch on E-661, “internal” for master)
- The Sync. lines of all units must be connected in parallel (rear-panel connector on E-661s).

Be sure that only one unit is set to master to avoid improper operation.

If multiple E-661 and/or E-612s are also connected to the same digital input lines (and all in digital mode), they can all be controlled from a single digital input source. This is accomplished with the use of address lines in the digital input cable. Each device recognizes the digital input only if the signals on the address lines match the address set in the device’s DIP switches.

4.2 Operating Modes

4.2.1 Analog Operation

For analog operation, an analog voltage can be applied to the "Analog Input" input socket (SMB connector). Front-panel DIP switch 2 must be set accordingly (see p. 12).

Input range:	0 to +10 V (closed-loop) -2 to + 12 V (open-loop)

Closed-Loop Mode

In closed-loop mode, the minimum input corresponds with zero position (no displacement) and the maximum input corresponds with nominal displacement.

Open-Loop Mode

In open-loop mode, the minimum input corresponds with the most negative output voltage (-20 V) and the maximum input signal corresponds with the most positive output voltage (+120 V).

Sensor Monitor Output

The sensor monitor output signal ranges from -2 to +12 .

0 V	= no displacement
+10 V	= nominal displacement

4.2.2 Digital Operation

For digital operation a parallel digital output device like a PC with DIO-board is required. Front-panel DIP switch 3 has to be activated (see p. 12).

Digital TTL signals required to control the E-661.CP:

Signals read by E-661.CP:
- 16 active-low data lines
- 1 strobe line
- 5 active-low address lines (optional)

Signals provided by controller (need not be connected; power from user side):
- 1 on-target line
- 1 near-overflow line

4.3 Indicators and Signals

Power LED: indicates proper input supply voltage.

Error LED: position error signal (also on digital interface pin 13) indicates when the axis is within the jumper-set on-target window centered on the target. In closed-loop operation the on-target LED should be lighted. If the LED is dark, the position error is larger. During open-loop operation—and dynamic operation in closed-loop—the LED may be off. In applications where mechanical forces can disturb the actuator the on-target indicator may also be instable. In such cases, the on-target window can be enlarged with jumper JP9 (see p. 26).

The near-overflow LED indicates a piezo drive voltage that exceeds the nominal range. In the E-661.CP, this occurs when the voltage is below –15 V and higher than +100 V. For a long piezo lifetime, PI recommends operating the piezo inside the nominal range. Because the usable voltage output is from –20 to +120 V, it is possible that the overflow-LED is on at the same time as the on-target LED. This behavior is not an error, but shows a non-optimal operation point.

4.4 Zero Adjust

The PZT drive voltage can be adjusted for various different operating points. For standard operation, PI recommends that a piezo voltage of -5 to 0 V correspond to the 0 position value (closed-loop mode). With this setting, the nominal displacement should be reached at a PZT voltage of 70 to 100 V. This value is highly dependent on the mechanical design of the attached application.

If the PZT voltage is not in this range, the operation point can be readjusted with the ZERO potentiometer on the front panel, as follows:

Procedure:

1. With the unit in open-loop mode, exercise the PZT over its nominal travel range to wring out any hysteresis,
2. Apply a control input of 0 (0 V or digital 0).
3. With a voltmeter on the sensor monitor output, adjust the ZERO potentiometer until you obtain a value from 0 V to +0.5 V.
4. If possible, check the PZT voltage in closed-loop mode for inputs of 0 V and 10 V (or digital 0 and 65535).

4.5 DIP-Switch Settings

Many controller settings can be made by an 8-bit switch labeled "SETTINGS" accessible through the front panel. Default settings are shown in **bold.**

SW8 to SW1

Fig. 3: DIP-Switch Settings (switch slider shown in black)

SW 1: Open-loop mode	ON: open-loop (no servo-control)	**OFF: closed-loop**
SW 2: Analog IN	**ON: enable**	OFF: disable
SW 3: Digital input	ON: enable	**OFF: disable**
SW 4-7:	Address setting=sum of ON's: **SW4-ON=1** (to match line A0) SW5-ON=2 (to match line A1) SW6-ON=4 (to match line A2) SW7-ON=8 (to match line A3)	
SW 8	Must be OFF (internal use)	

5 Digital Interface

The digital interface contains lines for parallel input of 16-bit target and 4-bit address specifications as well as a strobe load-digital-to-analog-converter line (LDAC). It also provides on-target and PZT-out-of-nominal-range output signals.

The digital input and output lines on the sub-D connector, including the signal ground there, are isolated from the other analog and digital circuitry. (The outputs draw power from the user side). This design avoids interference from analog, digital or ground lines with the ultra-precise analog signals used elsewhere.

This electrical isolation is maintained only if *none* of the digital interface lines is connected with the chassis, cable shield, connector shell, or otherwise grounded.

NOTE

Data and address lines are active low.

5.1 Application Examples for Digital Signal I/O

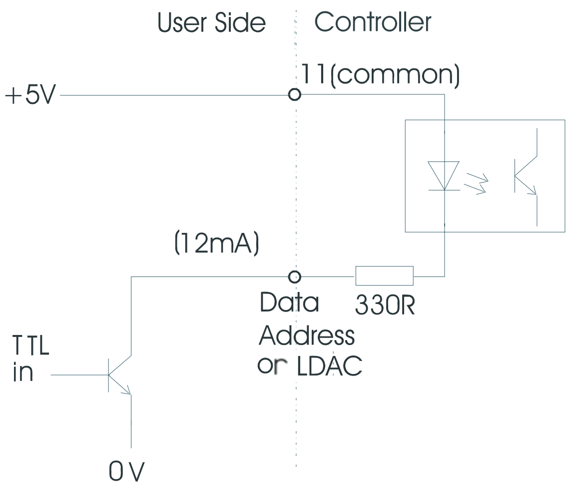

Fig. 4: Digital input optical isolation

Notes:

Data and Address Lines (active low and pulled up):

Logical 0 is generated with an electrical 5V-level, input current is 0 mA
Logical 1 is generated with an electrical 0V-level, input current is 12 mA
User interface must provide a +5 V level with a capability of 250 mA

LDAC Signal (active high and pulled up):

Logical 0 is generated with an electrical 0 V level, input current 12 mA
Logical 1 is generated with an electrical 5 V-level, input current is 0 mA

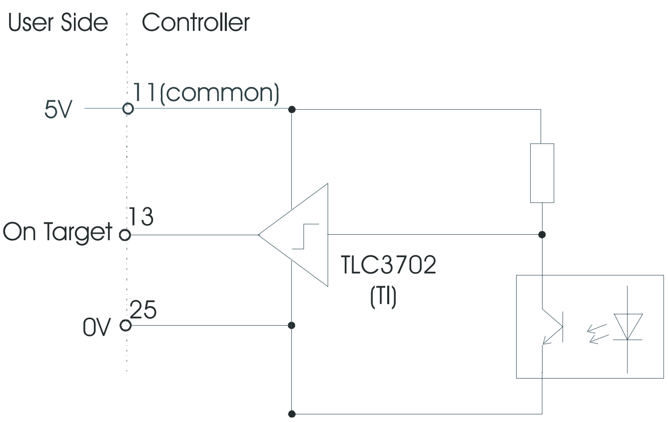

Fig. 5: Example of digital output optical isolation: note that power for the output signal comes from the user side.

5.2 Data Code

Table 1 shows the data code as bit pattern for a 15 µm actuator using the full 16-bit resolution. In this example, the full 15 µm stroke is resolved in 2^{16} steps corresponding with a step resolution of 0.23 nm.

A digital 0 is physically equal to a 5 V level. A digital 1 therefore is equal to a 0 V level.

Example (15 µm travel range):

Data	Position µm	D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15
0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0.00023	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0.00046	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0.00068	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4369	1.0000	1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	0
32767	7.49989	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
32768	7.50011	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
65535	15.0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

All 16 data lines must be connected with a defined TTL level. Open data lines represent digital 0 and produce discontinuities in the data code.

If less then 16-bit resolution is to be used, see next section.

5.3 Digital Interface Timing

The digital interface timing is slower than that of the DAC, due to the opto-isolation feature. The average access time for the DACs is about 30 µs.

This access rate is much faster than the average response time of 10 ms of the analog system. The average delay time of the optocouplers is about 3 µs for a 0-1 (low-high) transition and about 50 µs for a 1-0 (high-low) transition. The resulting minimum signal times of 10 µs are shown in the diagram:

Data is loaded into the transition register at the edge of the valid address signal. The LDAC signal transfers the previously written data from the transition register into the DAC. The analog output is changed about 10 µs after the 0-1 edge of the LDAC signal.

5.3.1 Single, Directly Connected Units

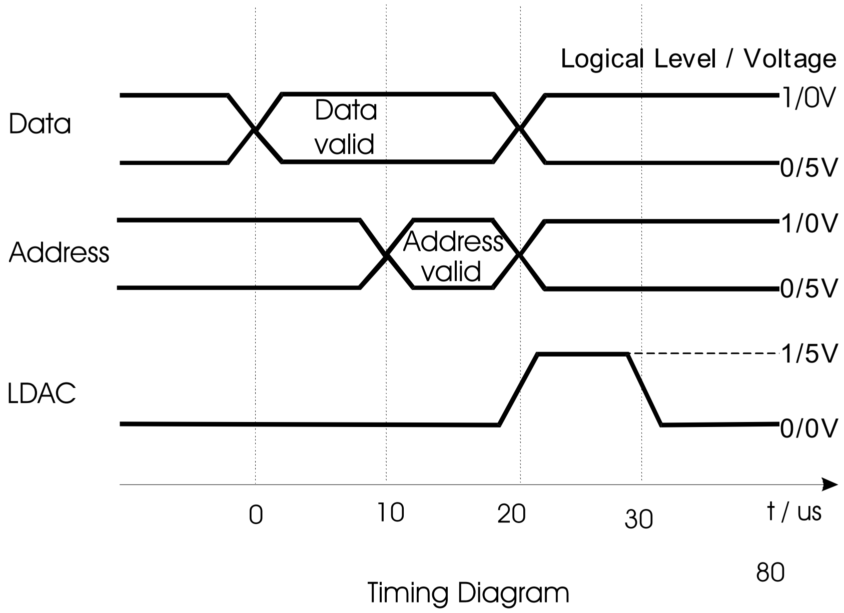

Fig. 6: Single-unit timing

5.3.2 Multiple Units with Synchronized Update

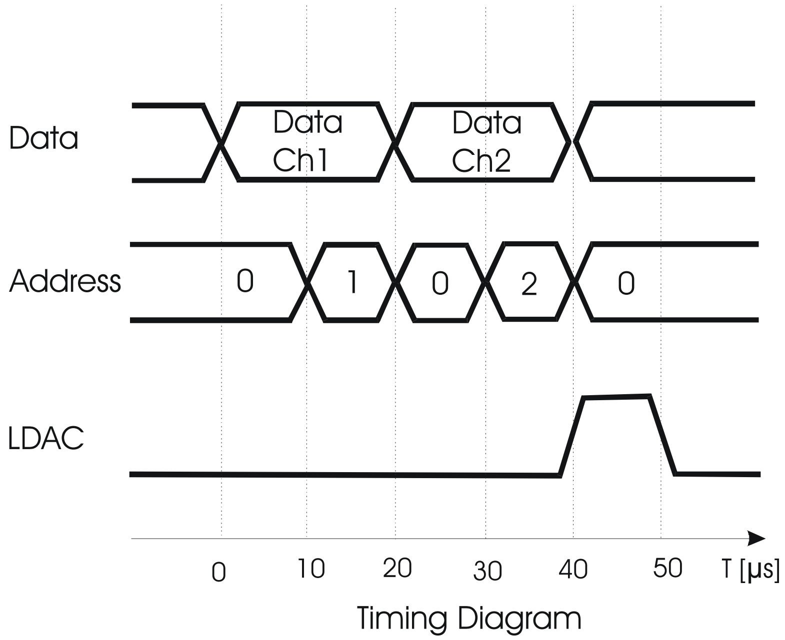

Fig. 7: Synchronized multi-unit timing

5.3.3 Interface Timing with Wait for On-Target Signal

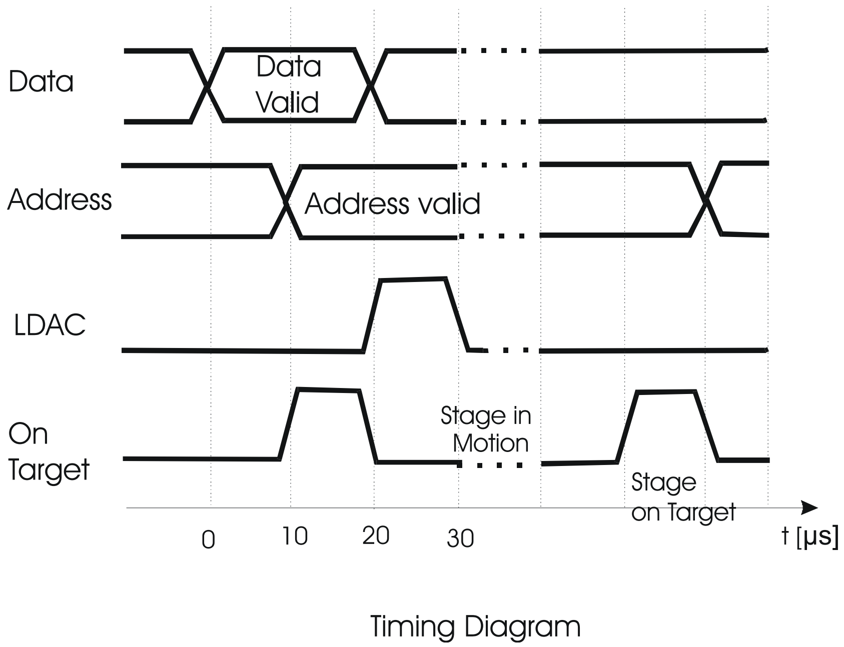

Fig. 8: Timing with wait

6 Servo-Loop Calibration

Static servo-loop calibration makes it possible to accurately drive the PZT system to absolute positions in closed-loop mode with an external analog control signal ranging from 0 to +10 volts. This signal can either be input directly, or it can be generated by computer-control electronics in the system

Static servo calibration establishes the relationship between a sensor input of 10 V and the voltage necessary to drive the PZT to its nominal expansion.

Dynamic servo-loop calibration optimizes step response and suppresses resonance, overshoot, and oscillation (see section Dynamic Calibration beginning on p. 21).

Dynamic performance of the PZT system is determined by the maximum output current of the amplifier and by the mechanical properties of the PZT mechanics, like moving mass, damping and resonant frequencies.

In order to match the circuitry and the mechanical characteristics to achieve the desired performance, the system has to be adjusted for both static and dynamic operations.

The full calibration and adjustment procedure includes adjustment of the zero point, sensor gain, slew rate and step response. All these basic adjustments are done in our lab before shipment.

NOTE

If PI has sufficient information about your application, your PZT system will be shipped ready for operation. Only the zero point will have to be realigned from time to time to compensate for temperature changes. Further adjustments are not required as long as system components are not replaced or modified.

6.1 Equipment Needed for Calibration

For adjustment of the zero-point, only voltmeter is needed and no access to internal elements is required.

For additional calibration procedures it will be necessary to open the case.

DANGER

High Voltage Can Cause Injury

Procedures involving working on the device with the voltages of up to 120 V on the board exposed, should be carried out by qualified, authorized personnel only.

Static displacement calibration requires an external expansion gauge with 0.01 µm resolution (or an interferometer) and a precision voltmeter.

Dynamic calibration procedures require an oscilloscope (a digital storage oscilloscope is recommended), frequency generator to output square and sine functions from 1 Hz to 1 kHz, an ohmmeter with a range from 0.1 to 100 k-ohm.

6.2 Preparations

Mount the PZT actuator in exactly the same way and with the same load as during normal operations in the application.

6.3 Zero-Point Adjustment

Correct zero-point adjustment allows the PZT to be used within the full displacement range without reaching the output voltage limits of the amplifier.

A proper zero-point calibration ensures that in closed-loop operation the full output voltage swing of the amplifier can be used and prevents overflow conditions.

Procedure:

1. Adjust the sensor zero point with servo mode OFF and a commanded position of 0.
2. Set servo mode to SERVO ON.
3. Connect a voltmeter to the PZT operating voltage in parallel with the PZT.
4. Readjust the PZT operating voltage to 0 V using the ZERO potentiometer.

6.4 Static Gain Adjustment

The objective of the static servo-loop adjustment procedure is to ensure that the PZT actuator expands to its nominal expansion when the control signal input is at its nominal maximum (10 V analog or 65,535 digital).

Preparations:

An adjustable voltage source from 0 to +10.0000 V and a displacement gauge with 0.01 µm resolution or an interferometer is needed.

Procedure

1. Make sure that any DC-offset is set to zero or disabled (see main board manual).
2. Set SERVO ON mode.
3. Check whether the PZT oscillates. If it does, you cannot miss hearing it, and dynamic gain adjustments have to be done prior to continuing with static gain adjustment.
4. Apply 0 V to the CONTROL INPUT.
5. Adjust the external position probe and set the expansion reading to zero.
6. Command a position equal to the nominal expansion (i.e. apply the nominal maximum to the control input). The external gauge should show the PZT at nominal expansion and the sensor monitor output should be 10 V.
7. To adjust the expansion without changing the sensor monitor output (servo-control is on!) use the gain adjustment potentiometer, P301.

Repeat the last steps several times until stable results are achieved.

6.5 Dynamic Calibration

A summary of the equipment needed for calibration can be found in section 6.1 on p. 19.

6.5.1 Finding Resonant Frequency and Setting Notch Filter

Evaluate the resonant frequency of the actuator while installed at the operation site. For this purpose a square wave is applied to the input with servo-control set to OFF.

Connect the sensor monitor output with one channel of the oscilloscope and watch the step response. The resonant frequency of the system can be estimated by the induced oscillations. If, for example, the period of the oscillation is 3 ms, then the resonant frequency is 1/period length or
1/3 ms = 0.33 kHz or 330 Hz.

6.5.2 Step Response Optimization (empirical method)

Either this method or the calculation method (described in Section 6.5.3) can be used.

Standard Tuning

For dynamic operation, the step response of the mechanical system is important. The amount of damping and overshoot can be optimized by tuning the differential and integral term of the amplifier. Either the empirical or the calculating method can be used.

Procedure

1. Mount the PZT exactly as it will be operated.
2. Set Servo ON.
3. Use a square wave function generator and supply the input with a square wave of 5 Vpp and a frequency of 5 to 10 Hz.
4. Connect an oscilloscope to the monitor output.
5. Adjust P402 (loop gain) until resonant frequency becomes apparent.
6. Adjust the notch filter frequency using DIP switches S401 and potentiometer P401 (see p. 26 *ff.*) until the oscillation amplitude becomes a minimum.

7 Adjust P402 (loop gain) and P403 (I-term), alternating to optimize step response.

The settling curve seen on the scope could look like one of the following:

Case 1: Large overshoot, unstable
Case 2: Optimal
Case 3: Settling time too long

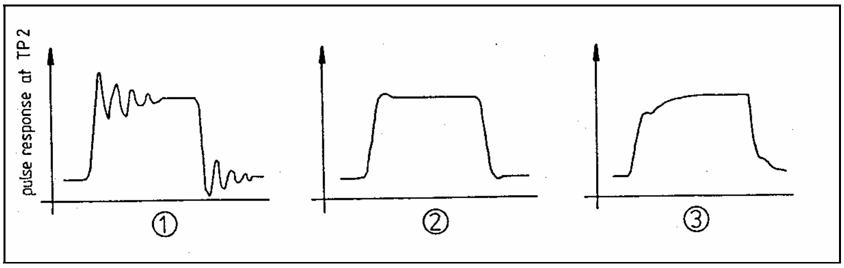

Fig. 9: Settling curve

Fine Tuning

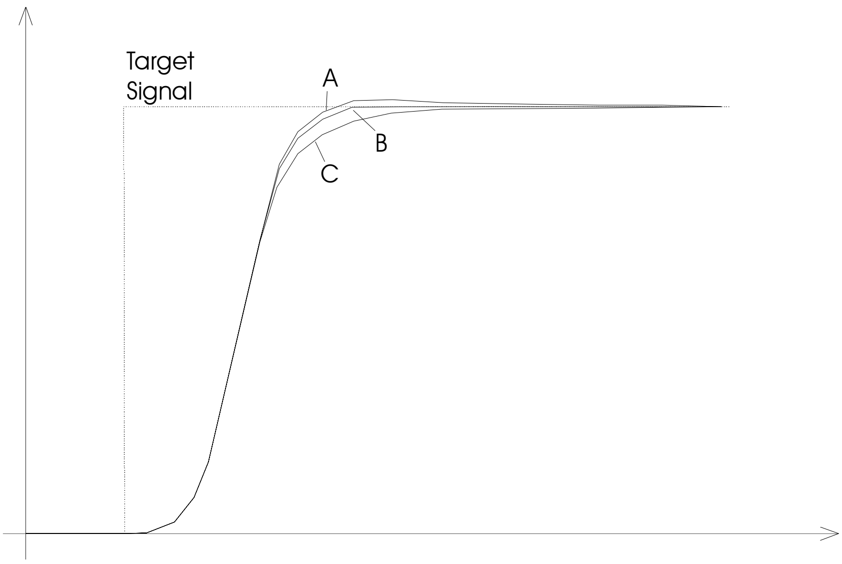

Fig. 10: Fine Tuning

The objective of the drift fine tuning is curve B of the diagram. Because the curve is exaggerated, a high-resolution oscilloscope (12-14 bits) is required as well as a precise voltage generator.

First, adjust the step response without overshoot. Using P408 curve shapes A, B and C can be attained. If the overshoot can not be eliminated by using P408, the loop gain has to be reduced.

The result may be different at rising and falling edges, so a compromise has to be found.

6.5.3 Step-Response Optimization (Calculation Method)

Either this method or the empirical method (described in Section 6.5.2) can be used.

Characterizing Servo Parameters

Servo-loop parameters depend on each and every component used in the system. Amplifier, PZT actuator and sensor have to be treated as a complete system, and the best way to calculate the system servo parameters is the use of a simulation program.

If no simulation program is available, typical assumptions can be made in order to get stable servo parameters—not optimized, but good enough to work with.

Proportional term: $K_P = 0.3$
Integration time: $T_I = (2\pi f_{res})^{-1}$

Example: $f_{res} = 330$ Hz -> $T_I = 0.48$ ms

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CAUTION

If the PZT resonant frequency is above 1 kHz, the system bandwidth is limited by the amplifier and the sensor. In no case should a higher frequency be used.

7 Block Diagram

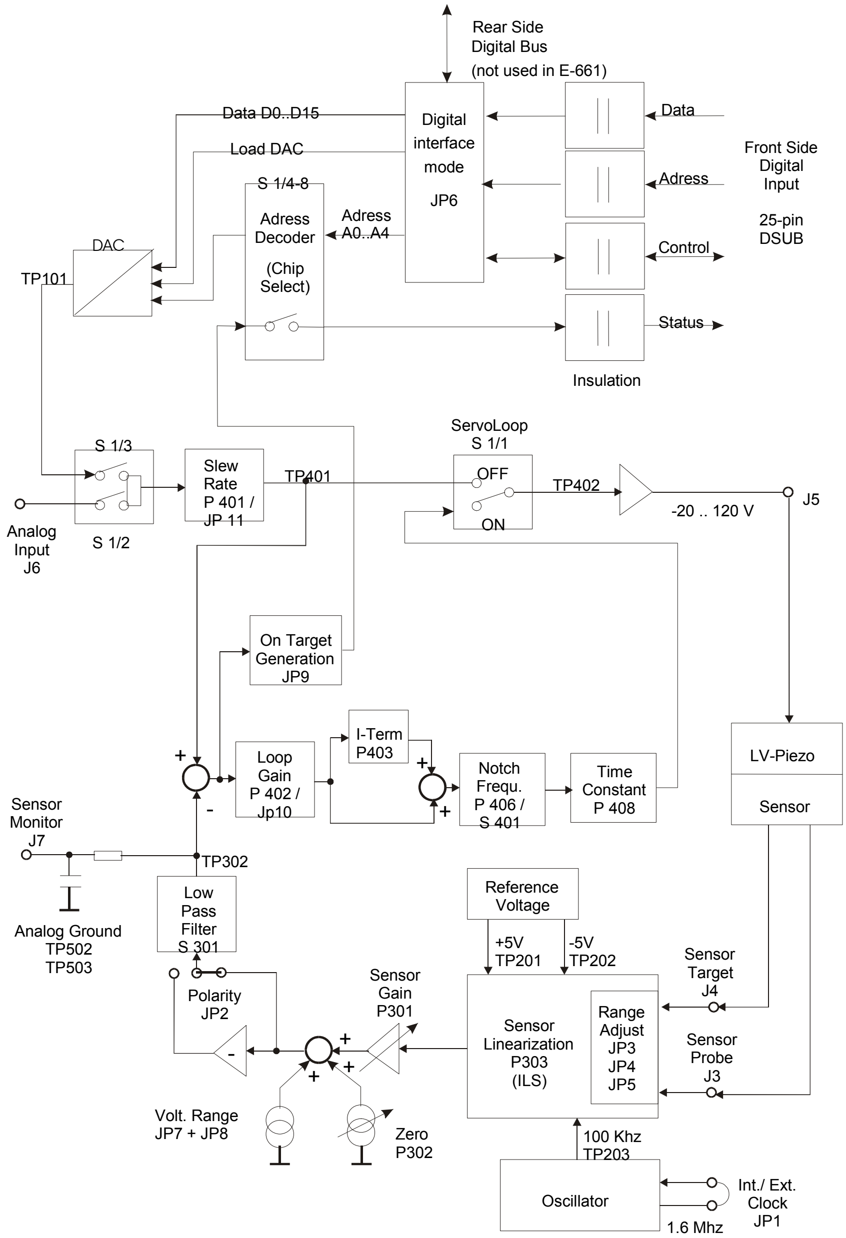
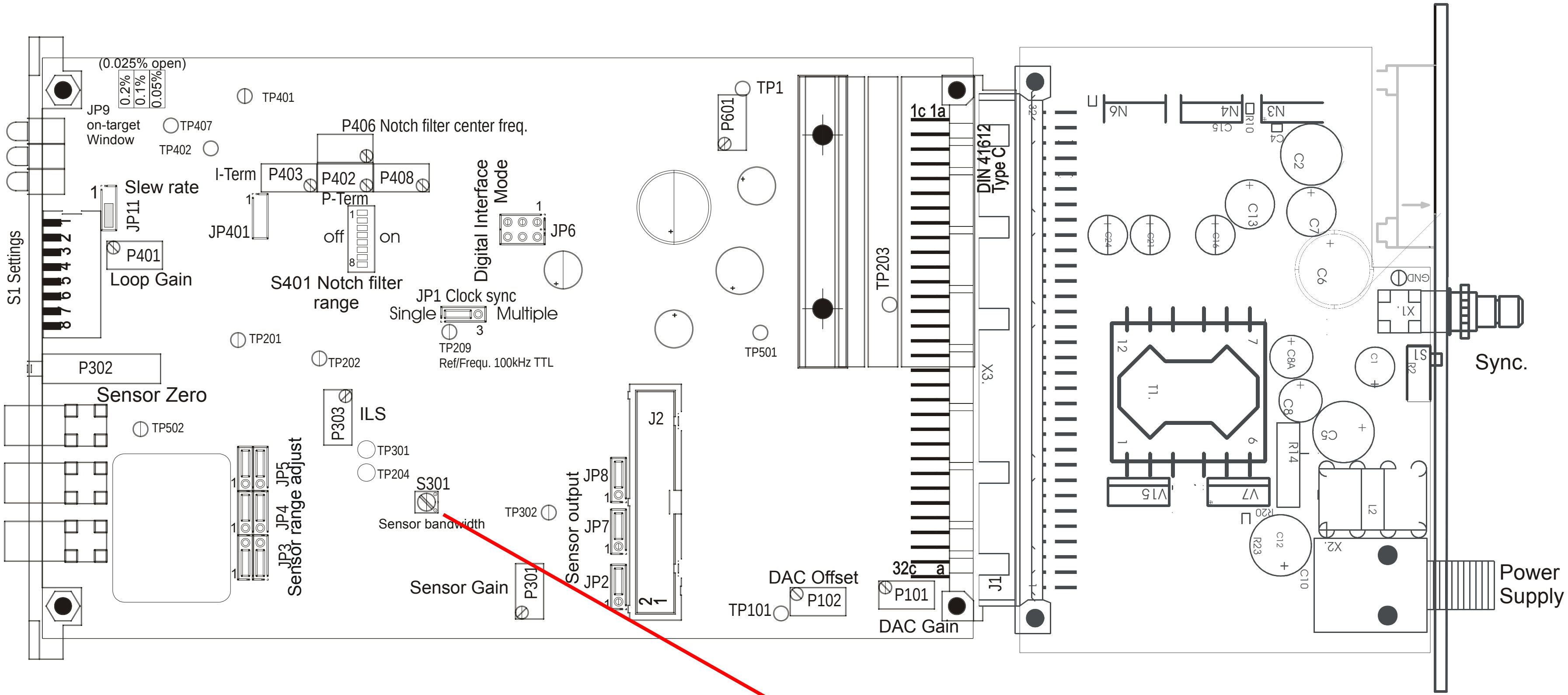


Fig. 11: E-661.CP Block Diagram

8 Adjustment Elements and Test Points



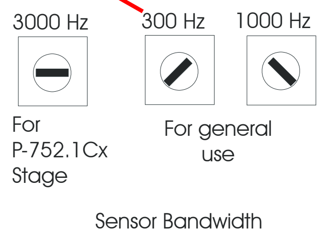


Fig. 12: Adjustment elements and test points

DANGER

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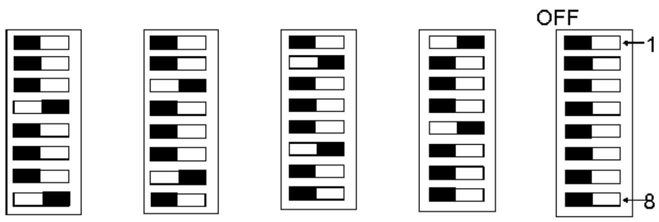
8.1 Adjustment Potentiometers

P101	DAC Gain
P102	DAC Offset
P301	Sensor Gain
P302	Sensor Zero (front panel)
P303	Sensor Linearization (ILS)
P401	Slew Rate
P402	Loop Gain
P403	Integral Term
P406	Notch filter center frequency fine adjust
P408	Drift compensation

8.2 Switches & Jumpers

S1	DIP block with 8 switches (operating mode); accessible from front panel: see p. 12 for settings
S301	Sensor bandwidth; see inset in Fig. 12 above for settings
S401	Notch filter range DIP block (slider in black):

range:	1	2	3	4	5



min.	70	140	340	950	2900
max.	210	450	1100	3100	9300

Notch filter center frequency in Hz, adjustable between min. and max. with potentiometer P406

	JP1		
Clock		single: slave mode not possible	multiple: master/slave mode set elsewhere

	JP2		
Sensor slope polarity		Positive (min. separation gives smallest voltage)	Negative (for use with PI stage P-751K001)

See JP7-JP8 for sensor output range

Sensor range exten-sion	JP5 JP4 JP3								
Factor		OFF	0.56	0.68	0.75	1.0	1.25	2.13	3.0

Digital Interface Mode	JP6	Local*	Auto*	Bus** Master*	Bus** Slave*

*Modes explained:
Local: Digital I/O from D25 socket
Auto: Bus** Master if in slot 1, else Bus** Slave
Bus Master: Digital input from D25 socket, output to rear bus**
Bus Slave: Digital I/O from rear bus**

**Rear bus not accessible in E-661

Sensor output voltage range	JP8 JP7			
		volts -10 to +10	0 to 10	-5 to +5

(See JP2 for sensor slope polarity)

On-target window	JP9				
	% of full range	0.025% Standard	0.05%	0.1%	0.2%

Max. slew rate (can be reduced with P401)	JP11		
		max. 15 ms / 100 V	5 ms / 100 V

8.3 Test points

TP101	DAC output (analog value)
TP201	Reference voltage +5 V
TP202	Reference voltage -5 V
TP203	100 kHz square wave signal, 5 V
TP204	AC-Reference, 100 kHz sine
TP209	100 kHz TTL reference frequency
TP301	Sensor AC-signal
TP302	Sensor output
TP401	Target signal after slew rate limitation
TP402	Control output
TP407	On target signal (internal)
TP501	Digital GND
TP502	Analog GND

9 Technical Data

9.1 Specifications

General

Models	E-612.CO
Function	Bench-top high-speed NanoAutomation® controller with parallel interface
Channels	1
Power-on-current:	2 A max
Master Clock:	1.6 MHz
Switched power supply:	100 kHz

Capacitive Sensor Circuit

Clock Frequency:	1.6 MHz
Bandwidth (fixed)	1.5 kHz

Amplifier

Output Voltage Range:	-20 to +120 V
Output Current, peak:	140 mA (5 ms)
Output current, continuous:	70 mA
Bandwidth (no load).	500 Hz or better

Analog Input

Voltage range:	0 to +10 V
Input Impedance:	50 k-ohm parallel 1 nF
Linearity (closed-loop):	within 0.05%

Sensor Monitor Output

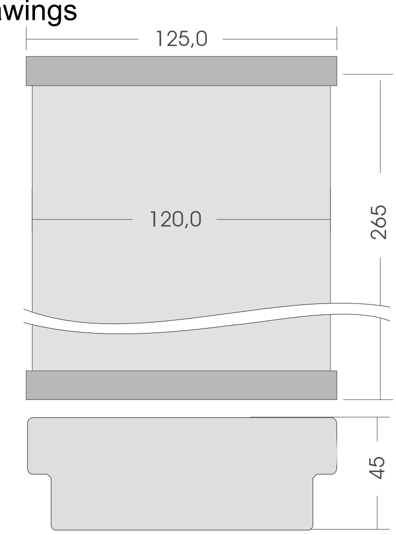
Voltage Range:	10 V active range, jumper settable to 0 to 10, -5 to +5 or -10 to 0; 20% reserve
Output resistance:	10 k-ohm
Bandwidth:	1.5 kHz

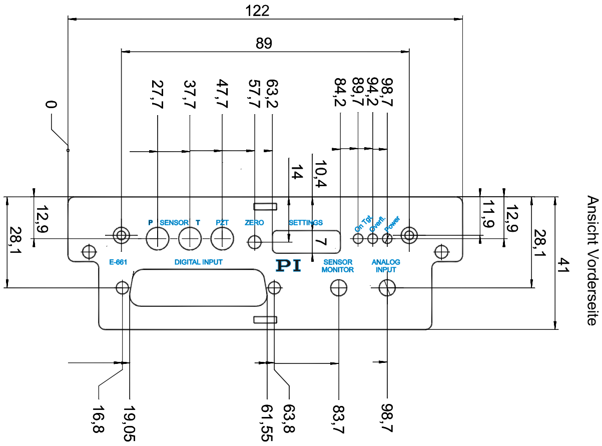
Digital Circuit

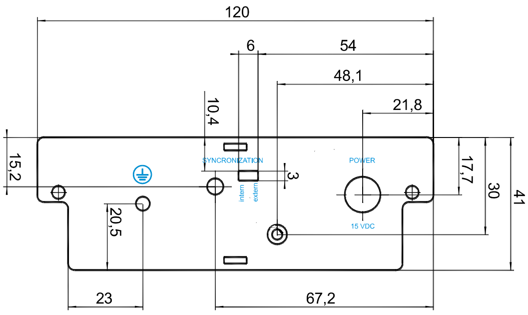
Data.	16 bits
Input level:	5 V
Input Current:	12 mA
Timing.	THmin 10 µs, TLmin 10 µs
Over Voltage Indication:	-14 to +100 V (OK), -20 to -14 V (overflow), +100 to +120 V (overflow)
On Target indication:	True position within jumper settable window of 0.025% to 0.2% of full range of target

9.2 Dimensions

Dimensions in mm, decimal places separated by commas in drawings




122
89
0
27,7
37,7
47,7
57,7
63,2
84,2
89,7
94,2
98,7
14
10,4
12,9
28,1
11,9
12,9
28,1
41
7
P
SENSOR
T
PZT
ZERO
SETTINGS
E-661
DIGITAL INPUT
PI
SENSOR MONITOR
ANALOG INPUT
Ansicht Vorderseite
16,8
19,05
61,55
63,8
83,7
98,7


120
6
54
48,1
21,8
10,4
15,2
SYNCRONIZATION
POWER
3
17,7
30
41
20,5
15 VDC
23
67,2

9.3 Pin Assignment

9.3.1 Internal Connector

The pinout of this internal connector is included for completeness only: the user will not usually be concerned with these lines. Digital I/O lines are jumper deactived on E-661.

Signal	Pin	Pin	Signal
+5V	c1	a1	+5V
Digital Ground	c2	a2	Digital Ground
+15V	c3	a3	+15V
-15V	c4	a4	-15V
Analog Ground	c5	a5	Analog Ground
+130V	c6	a6	+130V
-30V	c7	a7	-27V
Power Ground	c8	a8	Power Ground
NC	c9	a9	NC
Clock In 1.6MHz	c10	a10	Clock Out 1.6MHz
Clock Out 200KH z	c11	a11	Clock Out 100kHz
Position Error Output	c12	a12	Voltage Error Output
NC	c13	a13	NC
Piezo Monitor Output	c14	a14	Sensor Monitor Output
NC	c15	a15	NC
NC	c16	a16	NC
Control Input C0	c17	a17	LDAC
Control Input C2	c18	a18	Control Input C1
Data D1	c19	a19	Data D0
Data D3	c20	a20	Data D2
Data D5	c21	a21	Data D4
Data D7	c22	a22	Data D6
Data D9	c23	a23	Data D8
Data D11	c24	a24	Data D10
Data D13	c25	a25	Data D12
Data D15	c26	a26	Data D14
NC	c27	a27	NC
NC	c28	a28	NC
Address A1	c29	a29	Address A0
Address A3	c30	a30	Address A2
NC	c31	a31	Address A4
NC	c32	a32	NC

NOTE

The digital ground A2 is for the digital signals on the internal connector and not to be confused with the digital ground on the sub-D socket, which should be kept electrically isolated from other circuitry.

9.3.2 Analog Input, Sensor Monitor and Synchronization

Manufacturer:	various
Connector Type:	SMB
Positions:	1 coax

The sync signal is 100 kHz TTL.

9.3.3 Power Supply

Manufacturer:	Switchcraft, Inc. 5555 N.Elson Ave. Chicago, IL 60630	
Connector Type:	Tiny Q-G® Miniature Connectors	
Positions:	3	
Product Numbers:	Straight Female Cord Plug	TA3F

1: 0 V
2: +15 V
3: n.c.

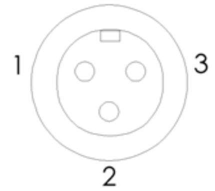


Fig. 13: View of power socket

Fig. 14: Grounding stud and synchronization socket

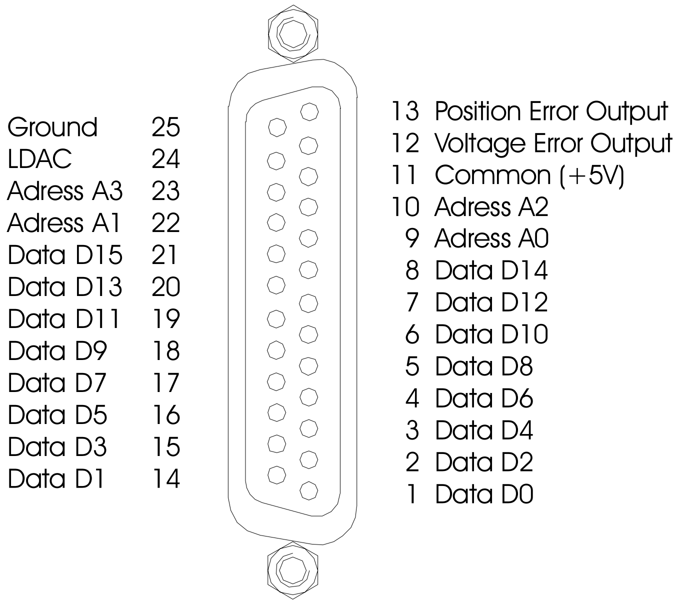
9.3.4 Grounding Stud

The E-661 case is provided with a grounding stud which must be connected to protective ground to assure compliance with safety requirements and EMC guidelines.

9.3.5 Digital Input

The digital inputs and outputs on this connector are optically isolated from other circuitry. Power is provided from the user side (pins 11 and 25). See p. 14 for application examples.

Activation of these lines depends on the Digital Interface Mode jumper setting (see p. 27)



NOTE

Pin 25 (digital signal ground) should not be connected to the shielding or connector housing if digital signal isolation is to be maintained