



Troubleshooting Mechatronic Machines

Follow these four steps, in order:

- 1) Is everything plugged in and powered? Are all power supplies providing voltages within proper tolerances?
- 2) Do you have communications to all the devices?
- 3) **Start at mechanics and work toward electronics, then finally software.** (It is always tempting to start at the other end, however rigorous application of this concept will almost always result in far shorter de-bug sessions.)
- 4) Change only one thing at a time and check to see the results.

**The following sub-lists are common things that seem to go wrong in a machine.
They are provided mainly as a checklist.**

COMMUNICATIONS

- Check comm ports on laptop/controller
- Check for echo by shorting Tx and Rx wires on device end of cable. Hit spacebar. If cursor moves, you have the right comm port, and are sending and receiving.
- Null modem - swap receive/transmit on RS232
- Pinouts
 - 9-pin D-cell 2 Rx, 3 Tx, 5 Gnd
 - 25-pin D-cell 2 Rx, 3 Tx, 7 Gnd
- Terminal settings
 - baud rate
 - echo - on transmission lines
 - handshaking - on separate lines - parity
 - stop bit

MECHANICS

- Coupler missing, too tight, misaligned, broken, too small causing excessive windup
- Manual movement to look for
 - Binding
 - Roughness
 - Lock-up
- Visual inspection
- Belt tension
- Lack of grease, lubrication
- Check for correct components
 - Pitch
 - Wrong pinion -Gear ratio
- Preloads on bearings, etc.
- Limit switches in the wrong place

MOTOR

- Bearings
 - runaway motor can destroy bearings
 - causes roughness from wear
 - axial or radial displacement / bad coupler
- Brushes
 - see a slow deterioration in performance
- Thermal damage

- insulation melts
- smell motor
- Phase to phase shorts
- Phase to ground shorts
- Phase to case shorts
- Winding resistance not to spec
- phase to phase resistance on brushless or different from phase to phase
- end to end on steppers, brushed motors
- Hall effects
 - apply power and check w/voltmeter to see if each of the three fluctuates between 0-5v

GEARHEADS

- Bearings
- Poor manufacturing
- Poor assembly by user
- Lubrication in vertical applications
- Use motor shaft seal in vertical applications to prevent lubrication leaking from gearhead into motor; causes extra friction and noise

CABLING

- Hooked up?
- Right place?
- Right orientation of connector?
- Right cable?
- Fatigue/near/strain relief?
- Shielding, grounded in right place?
- Length – getting voltage drop due to long length? 25 ft for 5 Vdc signals
- Gauge, correct for power level

WIRING

- Whiskers/strays
- Low voltage near high voltage
- Insulation damaged
- Bad connection/hidden
- Improper stripping
 - too much/copper showing
 - too little/no connection
- Wrong place
- * Using ferrules gives a better connection, strain relief
- Neatness

AMPLIFIER

- Not enabled
- Damaged
 - burned-up, smell it
 - physical damage (dents, carbon)
 - shake test (listen)
- Wrong settings (file for digital/dip or pots for analog)
- Current loop gains
- Current level settings
- Offsets
- Polarity
- Limit switches active
- Resolver mis-wired
- Halls mis-wired

CONTROLLER

- Configured correctly
 - jumpers
 - communications - address
- Program/parameters burned into EPROM
- Tuning
- Wiring
 - feedback
 - swapping encoder polarity
- Unknown/CPU crash
- Software setup
- Master reset if all else fails
- Software debug tools if available
- Check encoder counts/rev
- Electrical noise

SOFTWARE/PROGRAMMING

- Flowchart
- "Comment" code
- use Print statements to see if program flows to end
- Remove code line by line
- Use software debug tools/trace mode
- Display variables



We'll Go First!

Chico, CA 95929-0789 | (530) 801-1983