Noztek Xcalibur Servo

Servo-Driven Precision Filament Extrusion

User Manual

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Introduction

The Noztek Xcalibur Servo is Noztek's most advanced desktop extruder, engineered for demanding research and industrial applications requiring exceptional torque, thermal precision, and long-run reliability.

Powered by an industrial AC servo motor (DSY-RS750L2B2-M17S) coupled to a precision TG90-G20 planetary gearbox, the Xcalibur Servo delivers the torque and control authority to process highly filled composites, engineering-grade thermoplastics, and metal-polymer blends that are beyond the reach of conventional desktop extruders. The system is purpose-built to excel in melting a wide range of materials — from traditional polymers to high-temperature thermoplastics including PEEK, PEI, and PPS, as well as innovative metal-polymer combinations.

Why a Servo Motor and Planetary Gearbox?

The servo-and-gearbox drive system delivers material advantages over conventional DC or stepper motor extruders that matter for serious research and production work:

Exceptional Torque Capability

45 Nm of continuous torque, with peak capability of 135 Nm — three times the continuous rating — allows the Xcalibur Servo to process highly filled, abrasive, or high-viscosity materials without stalling or speed fluctuation. This is critical for short-fibre composites, ceramic-loaded blends, metal-polymer materials, and high-MFI engineering polymers.

Closed-Loop Speed Accuracy

The servo system uses real-time encoder feedback to maintain exact RPM regardless of load changes. This translates directly into consistent barrel pressure and filament diameter stability — essential for research-grade work where the operating parameters need to be a known variable rather than an estimate.

Responsive and Adaptive Control

Closed-loop feedback allows the system to instantly compensate for changing conditions, maintaining stable output throughout long extrusion runs. The Xcalibur Servo is built for runs measured in hours, not minutes.

Energy Efficient and Quiet

Servo motors draw only the power needed for the instantaneous load, reducing overall energy consumption and heat generation. Combined with smooth gearbox operation, this results in quieter, cooler, and more reliable performance during extended operation.

Automation-Ready

Precise, repeatable closed-loop control makes the Xcalibur Servo well suited to integration into automated workflows, in-line measurement systems, and research instrumentation. The control interface supports USB connectivity and external data logging.

Built for Longevity

Reduced mechanical stresses across the drive train, combined with optimised power delivery, result in less wear on components, longer service life, and reduced maintenance requirements.

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Warranty

We guarantee outstanding quality for our products and services. Customers who purchase Noztek-manufactured equipment for professional use are guaranteed that they will be free from defects in workmanship and materials for 1 year from date of shipment. If your machine is found to be faulty, we will repair or replace the machine. The warranty and functional guarantee does not cover damages caused by wear and tear or improper use.

TO ENSURE THAT YOUR WARRANTY IS HELD IN EFFECT, PROPER OPERATION PROCEDURES MUST BE OBSERVED. READ THE SAFETY PRECAUTIONS BEFORE OPERATING THIS MACHINE.

Limitations of Warranty Cover

- You must own the machine.
- The original invoice is decisive as this is your warranty claim — please keep a copy.
- Repair or replacement will be determined by Noztek.
- Warranty only covers manufacturing or material defects.

Warranty Does Not Cover

- Incorrect use of the machine or damage due to misuse.
- Damage from force or fall.
- Foreign objects inside the machine.
- Water damage or dirt.
- User failing to follow proper usage instructions.
- Normal wear and tear in the machine's lifespan, including screw and barrel wear from abrasive materials.
- Unauthorised repairs by the consumer.

While we stand by the quality of our products, our liability is limited. This warranty represents your sole remedy, and there are no other expressed or implied warranties. In the rare instance of a covered defect, we offer remedies such as repair or replacement after assessing the reported fault. Noztek reserves the right to reject any warranty claim if we feel the request falls outside our limitations.

Filing a Claim: Contact our customer support team — see the contact information at the end of this manual.

Safety

Caution: Injury Risk

This equipment contains moving parts and a high-torque servo drive. To prevent injury, keep hands, fingers, and other body parts clear during operation.

Avoid wearing loose clothing or jewellery that may become entangled in moving components.

Tie back long hair and secure loose items before using the equipment.

The servo motor delivers 45 Nm of continuous torque and up to 135 Nm peak — entanglement injury risk is substantially higher than with a conventional DC drive. Always follow safety instructions.

Caution: Hot Surface

This equipment can reach extreme temperatures during operation. The Xcalibur Servo is capable of 600°C standard, with an optional upgrade to 750°C.

Avoid direct contact with exposed surfaces to prevent the risk of severe burns.

Allow the equipment to cool fully before handling or performing maintenance — cool-down from operating temperatures may take 60 minutes or more, particularly after high-temperature runs.

Exercise caution and keep out of reach of children.

Caution: High Voltage Zone

This equipment contains high-voltage components.

Do not use liquids near the machine. Keep all liquids, including water, away from the equipment.

Do not modify internal wiring. Only authorised personnel should perform any maintenance or modifications.

Caution: Material Guidelines

Ensure familiarity with the material being extruded, including melting temperatures and ventilation requirements of the workspace.

Engineering polymers such as PEEK, PEI, polycarbonate, PPS, and high-temperature polyamides can release fumes when processed at elevated temperatures. Adequate fume extraction or local ventilation is mandatory for operation above 280°C.

Failure to follow material handling guidelines may damage the machine and pose health risks to the operator.

Safety Guidelines

- Before operating, ensure you have a thorough understanding of the equipment. Carefully review this instruction manual for complete guidance.
- Understand the proper, safe usage and limitations of the equipment.
- Never use this equipment for any purpose other than its intended use.
- Do not modify the equipment in any way.
- Do not make adjustments or perform maintenance while the system is in operation or energised.
- Non-flammable cleaning only — never clean the equipment with flammable solvents.
- Avoid probing into the barrel feed section while the machine is running. Never use a metal probe; a wooden probe is recommended.
- Personal protective gear: wear a face shield and heat-insulated gloves while operating or being near the extruder during operation, particularly when handling the die, nozzle, or any heated surface. At Xcalibur Servo operating temperatures, contact burns are a serious risk.
- The feed hopper must be installed on the extruder feed section at all times when in operation.
- Never put your hands into the feed section or vent to remove material.
- Only switch on the motor when the recommended temperature has been reached. The Xcalibur Servo's motor activation is interlocked with the warm-up procedure to prevent damage from running into a cold barrel.
- Ensure adequate workspace ventilation for processing temperatures above 280°C. Fume extraction is strongly recommended for processing PEEK, PEI, PPS, and other high-performance polymers.

Product Specification

1. Product Information

- Product Name / Model: Noztek Xcalibur Servo
- Brand / Manufacturer: Noztek
- Serial Number: See invoice
- Date of Manufacture: 2026
- Certification: CE, RoHS, WEEE
- EORI (Export): GB221742634000

2. Drive System

Specification	Value
Motor	DSY-RS750L2B2-M17S Industrial AC Servo Motor
Gearbox	TG90-G20 Precision Planetary Gearbox
Continuous Torque	45 Nm
Peak Torque	135 Nm (3× continuous)
Speed Range	Variable, fully programmable via touchscreen
Control Mode	Closed-loop servo with real-time encoder feedback

3. Heating System

Specification	Value
Heater Bands	3 × independent, individually PID-controlled zones
Standard Max Temperature	600°C
Optional Max Temperature	750°C (on request)
Control	ExcaliburMCU PID — independent set points per zone
Warm-Up Time	Approximately 25 minutes to operating temperature
Sensor Monitoring	Thermocouple anomaly detection with alert notifications

4. Screw and Barrel

Specification	Value
Screw Material	Stainless steel (hardened bimetallic available on

Specification	Value
	request)
L:D Ratio	24:1
Compression Ratio	2.3:1
Feed Zone	30% of total screw length
Compression Zone	40% of total screw length
Metering Zone	30% of total screw length
Nozzle Sizes	1.75 mm and 3 mm (custom sizes available on request)
Barrel Wear Option	Wear-resistant barrel recommended for abrasive or filled materials

5. Control and Connectivity

Specification	Value
Interface	7" Capacitive Touchscreen — full manual control of temperature, RPM, and timers
Control Software	Noztek Control Hub — PC-based real-time monitoring and data logging
Data Visualisation	Live temperature and RPM charts with per-zone trend display
Data Export	CSV export of full run data via USB connectivity
Program Memory	Retains last-used temperature, speed, and timer settings on restart
USB Connectivity	USB port for PC integration and data export
PCB	Bespoke Noztek control PCB for optimised signal integrity
Safety Features	Emergency stop, motor block detection, sensor anomaly alerts

6. Output and Performance

Specification	Value
Extrusion Rate (with Tolerance Puller)	6–8 metres per minute
Production Output	Up to 360–480 metres or 2 kg of filament per hour
Hopper Capacity	50 g minimum / 5 L maximum
Compatible Materials	ABS, PLA, PET, PP, HDPE, PEEK, PEI, PBI, PPS, recycled plastics, composites, metal-polymer blends, filled materials

7. Physical and Electrical

Specification	Value
Dimensions (L × W × H)	112 cm × 18 cm × 54 cm
Weight	32 kg (approximate)
Chassis / Hopper Finish	Stainless steel or black powder coat (specify on order)
Power Supply	220 VAC or 110 VAC (specify on order)
Power Rating	25 A
Frequency	50 Hz / 60 Hz

8. Accessories Included

- Mains cable
- A-B USB cable
- Hopper
- Spare nozzle

9. Optional Accessories and Upgrades

- Tolerance Puller — active haul-off with closed-loop diameter control; essential for consistent filament diameter and quantitative diameter studies.
- Filament Winder 2.0 — motorised spooling system for continuous production runs.
- Roller Conveyor — extended cooling run for high-temperature materials.
- 750°C Heater Upgrade — extended temperature capability for specialist polymers (PEEK at the top of its window, PBI, PPS, high-temperature ceramics-filled compounds).
- Hardened Screw/Barrel — bimetallic wear-resistant upgrade recommended for metal-filled, abrasive, or highly loaded composites.
- Custom Nozzle Diameter — non-standard extrusion nozzles available to order, including custom flanged adapters for downstream tooling integration.

Set-up Instructions

1. Unpacking and Placement

Caution: do not plug the machine into the mains or turn it on during set-up.

Carefully unpack the machine and accessories. The Xcalibur Servo weighs approximately 32 kg — two-person lifting is recommended. Place the machine on an even, stable, non-flammable surface, ensuring there are no flammable materials nearby. The heaterbands can reach temperatures of up to 750°C on the upgraded variant.

2. Hopper Attachment

Attach the hopper to the barrel's feed section. Locate the two bolts in the barrel's designated holes. Unscrew these bolts, position the hopper over the holes, and securely screw the bolts back in place.

3. Power Connection

Once the initial steps are completed, plug the mains cable into the machine. Before doing so, double-check that the mains voltage (220 VAC or 110 VAC) matches the voltage specified on the machine — refer to the sticker on the back of the machine. The Xcalibur Servo draws up to 25 A on its rated voltage, particularly during initial warm-up — ensure the supply circuit is appropriately rated.

4. USB Connection (Optional)

To use the Noztek Control Hub software, connect the supplied A-B USB cable from the back of the machine to your computer. The Control Hub software is compatible with Windows machines.

Operation Instructions

Important

Ensure that you acquaint yourself with the proper handling guidelines for the material you are using, particularly its melting point and thermal degradation temperature.

Filament quality is influenced by factors beyond just the operation of the machine — room humidity, ambient temperature, material humidity, and ensuring the correct temperature settings all play crucial roles.

Most engineering and high-performance polymers (nylon, PC, PEEK, PEI, PPS) require pre-drying before extrusion. See the Material Temperature Reference section.

Step 1 — Familiarisation

Familiarise yourself with the following components of your Noztek Xcalibur Servo:

- Touch screen (7" capacitive)
- Emergency power switch (front-mounted red button)
- Mains power switch (rear, illuminated)
- USB connector (rear, for Control Hub software)
- Barrel (with three independent heaterbands)
- Hopper
- Nozzle
- Heaterbands (HB1, HB2, HB3)
- Fan (cooling)
- Servo motor (DSY-RS750L2B2-M17S)
- Planetary gearbox (TG90-G20)

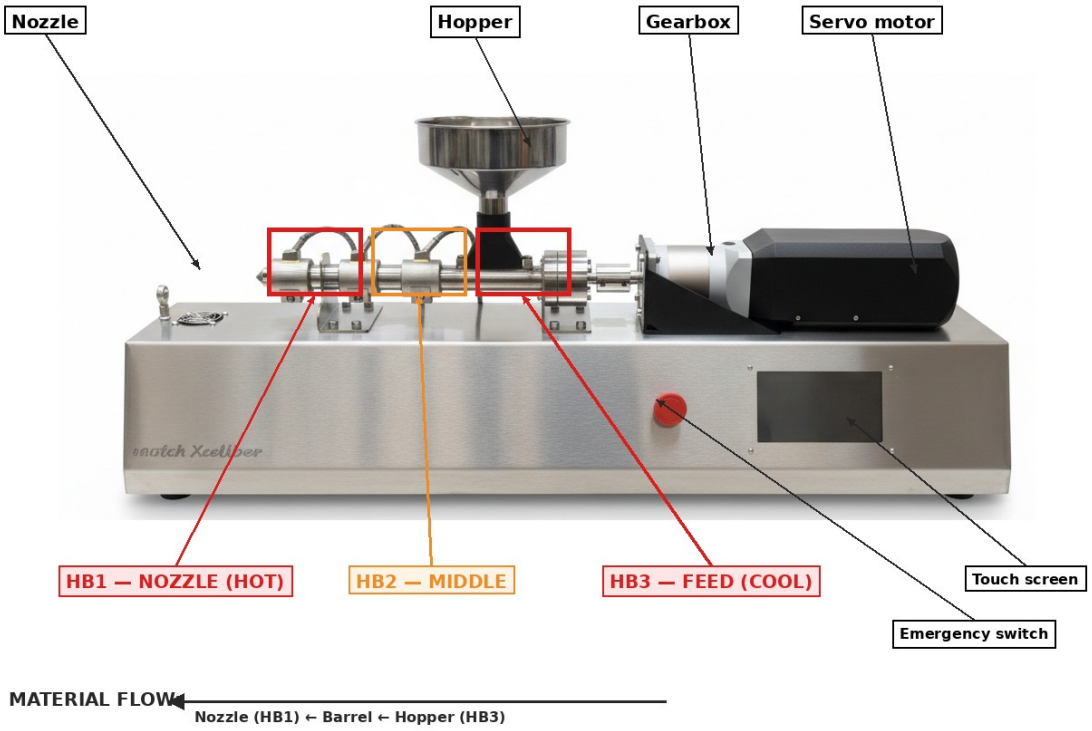

Figure 1: Noztek Xcalibur Servo component layout, with heaterband zones highlighted.

Heaterband Orientation

Important: Noztek Numbering Convention

On the Noztek Xcalibur Servo, heaterbands are numbered with the nozzle as HB1 and the feed as HB3.

HB1 = Nozzle zone (hot end, closest to where filament exits the die)

HB2 = Middle zone (transition / metering)

HB3 = Feed zone (cool end, closest to the hopper)

This convention is specific to Noztek. Some other extruder manufacturers number heaterbands in the opposite direction. When configuring temperature profiles on the Xcalibur Servo, always work with the Noztek convention.

In single-screw extrusion, the polymer travels from the feed zone (under the hopper) through the barrel to the nozzle at the opposite end. The three heaterbands on the Xcalibur Servo correspond to the three functional zones of the barrel, controlled by independent ExcaliburMCU PID loops with individual set points.

HB3 — Feed Zone (Cool End)

Located closest to the hopper. This is where solid pellets enter the barrel. The feed zone is typically the coolest of the three zones — keeping it slightly below the polymer's full melt temperature helps the screw bite into the pellets without them bridging or melting prematurely in the hopper throat. A too-hot feed zone causes pellets to soften and stick together before the screw can grip them, leading to inconsistent feeding and pressure fluctuations downstream.

HB2 — Middle Zone (Transition / Metering)

Located in the central section of the barrel. The polymer transitions from solid pellets through a softened/melted state in this zone, corresponding to the compression and metering sections of the screw. The temperature is typically set between the feed and nozzle values.

HB1 — Nozzle Zone (Hot End)

Located closest to the die and nozzle. This is the hottest zone, where the molten polymer exits as filament. The temperature here must be high enough to maintain a flowable, homogeneous melt as it passes through the nozzle, but not so high that it causes thermal degradation. For high-performance polymers operating near the top of their processing window, HB1 control accuracy is particularly critical.

Temperature Profile Guidance

A correctly configured temperature profile is critical to consistent filament production. The Xcalibur Servo uses a rising profile — coolest at the feed (HB3), hottest at the nozzle (HB1). The typical relationship is:

HB3 < HB2 ≤ HB1

As a general rule, set HB1 at the polymer's recommended extrusion temperature, then step down by approximately 10–20°C for HB2 and a further 10–20°C for HB3. This is a starting point only — fine-tune based on the appearance and consistency of the extruded filament.

Symptoms and Adjustments

Symptom	Likely Cause	Adjustment
Unmelted pellets visible in filament	HB3 or HB2 too cool, or warm-up incomplete	Increase HB3 by 5–10°C. Allow a longer warm-up.
Filament sags or droops at the nozzle exit	HB1 too hot, polymer too fluid	Reduce HB1 by 5°C and observe.
Filament emerges rough or grainy	HB1 too cool, polymer not fully homogenised	Increase HB1 by 5°C.
Filament discolours (yellow, brown, scorched)	HB1 too hot — thermal degradation	Reduce HB1 by 10–15°C immediately. Material may need replacing.
Bridging at the hopper throat	HB3 too hot — pellets softening before the screw grips	Reduce HB3 by 10°C.
Motor torque rises significantly	Barrel not fully at temperature, or polymer too viscous	Verify all three heaterbands have reached their set values. Allow further warm-up. Consider increasing HB2 by 5°C.
Filament foams or contains bubbles	Material absorbed moisture — needs drying	Stop extrusion. Dry the material per manufacturer specification (see Material Reference).
Filament diameter inconsistent	Temperature variation along the barrel, or screw speed too high	Ensure all heaterbands stable. Reduce screw RPM. Verify Control Hub data log for thermal stability.

Material Temperature Reference

The following tables provide typical starting temperature profiles for common materials processed on the Noztek Xcalibur Servo. These are recommended starting points only; final values may need to be adjusted based on the specific grade of polymer, ambient conditions, and target filament tolerance. Always consult the polymer manufacturer's processing data sheet.

Standard Polymers

Material	HB3 (Feed)	HB2 (Middle)	HB1 (Nozzle)	Notes
PLA	165°C	180°C	190°C	Air-cool acceptable.
PETG	210°C	225°C	240°C	Hygroscopic — dry at 65°C for 4 h.
ABS	215°C	230°C	245°C	Ventilation required.
TPU 95A	200°C	215°C	225°C	Slow extrusion. Pre-dry at 65°C, 4 h.
PP (homopolymer)	180°C	195°C	210°C	Low melt strength — water bath essential.
HDPE	190°C	205°C	220°C	Often used as purge for higher-temp materials.

Engineering Polymers

Material	HB3 (Feed)	HB2 (Middle)	HB1 (Nozzle)	Notes
PA6 (Nylon 6)	230°C	250°C	265°C	Highly hygroscopic — dry 80°C, 8 h.
PA12 (Nylon 12)	215°C	235°C	250°C	Dry at 80°C for 6 h.
PC (Polycarbonate)	260°C	280°C	295°C	Dry at 120°C for 6 h.
PC-ABS blend	245°C	260°C	275°C	Dry at 100°C for 4 h.
ASA	225°C	240°C	255°C	UV-stable alternative to ABS.
PPS	295°C	315°C	330°C	Dry at 150°C for 4 h. Fume extraction.

High-Performance Polymers

Material	HB3 (Feed)	HB2 (Middle)	HB1 (Nozzle)	Notes
PEI (Ultem 1010)	340°C	365°C	385°C	Dry at 150°C, 4 h. Fume extraction mandatory.

Material	HB3 (Feed)	HB2 (Middle)	HB1 (Nozzle)	Notes
PEI (Ultem 9085)	330°C	355°C	375°C	Dry at 150°C, 4 h.
PEEK (Victrex 450G)	350°C	380°C	400°C	Dry at 150°C, 4 h. Slow cooling for crystallinity.
PEKK	340°C	365°C	390°C	Dry at 150°C, 4 h.
PPSU	335°C	360°C	380°C	Dry at 135°C, 4 h.
PBI	380°C	410°C	440°C	Requires 750°C heater upgrade. Fume extraction.

Metal-Polymer and Filled Composites

Material	HB3 (Feed)	HB2 (Middle)	HB1 (Nozzle)	Notes
BASF Ultrafuse 316L	225°C	240°C	250°C	Metal-fill (~80% steel). Hardened screw advised.
BASF Ultrafuse 17-4 PH	230°C	245°C	255°C	Metal-fill. Abrasive — hardened barrel advised.
Short carbon fibre PEEK (CF20)	350°C	380°C	400°C	Hardened bimetallic upgrade strongly advised.
Short glass fibre PA6 (GF30)	245°C	265°C	280°C	Dry 80°C, 8 h. Hardened screw advised.

Drying is critical for engineering polymers

Most engineering and high-performance polymers are hygroscopic — they absorb moisture from the air. Extruding wet material causes foaming, surface defects, voids, hydrolytic degradation, and significantly reduced mechanical properties.

Drying conditions vary by polymer. Refer to your material supplier's processing data sheet, or use the guideline values in the tables above as a starting point.

A dedicated polymer dryer or vacuum oven is recommended. The Noztek Dehydrator is available as an accessory.

Operation Procedure

Step 2 — Start-up Procedure

To turn on the machine, use the illuminated mains power switch located at the back of the unit.

Step 3 — Main Screen Overview

The Xcalibur Servo's 7-inch capacitive touchscreen provides comprehensive monitoring and control. The main screen displays:

- Top row: live temperature readings in Celsius for each heaterband (HB1, HB2, HB3) and motor speed in RPM.
- Middle row: set temperatures for each heaterband and target motor RPM.
- Activation status switches for each zone and the motor.
- Menu button for access to settings.

To activate the heating bands, touch the temperature activation switch for each zone. Once activated, the Xcalibur Servo will transition to the warm-up screen. The system remains on the warm-up screen until all bands reach their set temperatures, or until the operator manually aborts the heating process. The motor switch is interlocked — it only activates after the warm-up phase, ensuring the motor cannot run into a cold barrel.

Step 3.1 — Warm-up Screen

The warm-up screen appears during the initial heating process or when any heaterband temperature falls below its target. The warm-up is essential to ensure that the barrel reaches the required operating temperature before the motor is permitted to run, protecting both the screw and motor from damage.

The screen displays the live and set temperatures for each band, alongside a countdown timer for the remaining warm-up time. Typical warm-up time to high-temperature set points is approximately 25 minutes.

Step 3.2 — Menu Screen

The Menu screen provides access to all Xcalibur Servo settings:

- SET TEMP: adjusts the target temperature for each individual heaterband (HB1, HB2, HB3 independently).
- SET SPEED: configures the target screw RPM.
- FAN ON/OFF: activates or deactivates the cooling fan.
- TIMER: sets an automatic shutdown timer for the motor and heating bands.

Step 3.3 — Temperature Setting

The temperature setting screen allows the operator to set the temperature for each heaterband. Use the sliders or the + and − buttons to adjust to the desired value, then confirm with SET. To cancel any modifications, press BACK. The Xcalibur Servo allows a maximum temperature setting of 600°C per heaterband as standard, or 750°C with the optional heater upgrade.

Step 3.4 — Motor Speed Setting

The motor speed setting screen configures the servo motor's RPM. Use the sliders or the + and − buttons to adjust, then confirm with SET. The closed-loop servo system maintains the set RPM accurately regardless of varying load — this is one of the Xcalibur Servo's key advantages over conventional DC drive systems.

Step 3.5 — Timer Setting

The timer setting allows the operator to schedule an automatic shutdown. This stops both the heating and the motor but does not power off the touchscreen. Use the + and − buttons to set hours and minutes, then confirm with SET. To cancel, press BACK.

Step 4 — Initiating Extrusion

Add your pellets to the hopper. After the warm-up procedure is complete, initiate the extrusion process by turning on the motor using the motor on/off switch. The motor will ramp up gradually under closed-loop control to your set RPM.

After a short duration, the molten polymer will emerge from the nozzle. Pull the filament through the guide. The extruded filament will be hot — always use heat-resistant gloves. Some materials require immediate cooling after extrusion; turn on the fan using the fan on/off button to facilitate this. The operational setup is now complete.

Step 5 — Shutdown Procedure

When finished, turn off the heating bands and motor via the touchscreen, then turn off the mains power switch at the back of the machine.

Important: high-temperature shutdown

Do not simply switch off after running a high-temperature polymer such as PEEK, PEI, or PPS. The polymer remaining in the barrel will solidify and may cause a difficult-to-clear blockage on next start-up.

Best practice is to purge through with a lower-temperature compatible material (typically HDPE) before reducing temperature or shutting down. This applies to any high-temperature run.

Noztek Control Hub Software

The Noztek Control Hub is Noztek's PC-based control and data acquisition application for the Xcalibur Servo. It provides real-time monitoring, comprehensive data logging, and integrated control of the extruder, with research-grade data export for post-run analysis.

Key Features

- Real-time monitoring of all three heaterband temperatures, set points, motor RPM, motor load, and motor torque.
- Live charting with per-zone temperature trend display and motor RPM history.
- Full session data export to CSV format for post-run analysis in Excel, MATLAB, Python, or similar tools.
- Configurable sample rate for the data log — fast capture for transient studies, slower capture for long-duration runs.
- Modbus interface support for integration with external research instrumentation.
- Bidirectional control — set parameters from the PC and they propagate to the touchscreen, or set them on the touchscreen and they appear in the Control Hub.
- Session screenshot capture for record-keeping and reporting.

Connecting to the Xcalibur Servo

Connect the supplied A-B USB cable from the back of the Xcalibur Servo to your Windows PC. Launch the Noztek Control Hub application; it will automatically detect the extruder on the configured COM port. If multiple Noztek devices are connected (for example, an Xcalibur Servo alongside a Tolerance Puller for diameter monitoring), the Control Hub can be configured to display data from both simultaneously.

Data Logging and Export

Once a session is active, the Control Hub records all parameters continuously. At any point during or after the run, the operator can export the full data set to a CSV file. The CSV includes timestamps, all three heaterband temperatures (live and set), motor RPM, motor load, and motor torque, making it straightforward to correlate process conditions against filament quality outcomes.

This data export capability is one of the Xcalibur Servo's most valuable research features — enabling reproducible methodology, statistical process control studies, and rigorous analysis of how process parameters affect filament properties.

System Requirements

- Windows 10 or Windows 11
- USB port (USB 2.0 or higher)
- Approximately 200 MB free disk space for installation
- Additional storage for session logs — typically 1–10 MB per hour of run time

For installation instructions, the latest software downloads, and detailed feature documentation, refer to the Noztek Control Hub Manual, available from the Downloads and Resources section of noztek.com or directly from Noztek support.

Additional Information

Quality Measures

To eliminate air bubbles and residual material from start-up, extrude approximately 5 metres of filament, then switch off the motor and cut off the excess material. Restart the motor and the filament should now run cleanly. This is particularly important after a barrel jam or after material changeovers.

Colour Mixing

Mix natural pellets with the colorant at the manufacturer's recommended ratio, then pour the mixture into the hopper. Allow 10–20 minutes for the colour change to fully propagate through the barrel.

Temperature and Diameter

Adjusting temperature affects filament diameter. Higher temperatures result in slightly thinner filament (lower melt viscosity, more die-swell relaxation), while lower temperatures result in slightly thicker filament. Make adjustments in 5°C increments and allow several minutes for the change to propagate through the barrel.

For precise, repeatable diameter control across long runs, the Tolerance Puller accessory provides closed-loop haul-off speed control synchronised to in-line laser diameter measurement. This is essential for serious filament tolerance work.

Cleaning and Purging

We recommend purging the barrel between material changes and at the end of each run. The recommended purge material depends on the polymer you have been running:

Previous Material	Recommended Purge	Notes
PLA, PETG, ABS	PLA or HDPE	Run 100–200 g at the previous temperature.
TPU, PP	HDPE	PP is itself often used as a purge for higher-temp materials.
Nylon, PC	HDPE	Run at the polymer's processing temperature, then ramp down.
PEEK, PEI, PPS	HDPE then PE wax	Always purge before cooling — solidified PEEK is very difficult to clear.
Metal-filled composites	HDPE	Use hardened screw and run extra purge to clear metal particles.

Custom Tooling and Downstream Integration

The Xcalibur Servo is well-suited to research applications where the extruder serves as the melt source for custom downstream tooling. The standard nozzle interface is M16×1.5 threaded; flanged die adapters to bespoke specifications are available on request. Researchers have successfully integrated slot dies for tape extrusion, multi-orifice dies for parallel filament production, and crosshead dies for fibre-coating applications.

When designing custom tooling, plan for the Xcalibur Servo's typical operating barrel pressure of 100–150 bar at the die inlet, and account for the M16×1.5 standard interface or the chosen custom interface in your tooling design. Contact Noztek for technical drawings or pressure-related queries.

Maintenance

Changing the Nozzle

Use heat-insulated gloves at all times. To switch between nozzle sizes, heat the unit to the temperature required to melt the material previously used. Wait 10 minutes to ensure all material is fully molten. Unscrew the nozzle using a spanner, clean any excess plastic from the internal threads, and screw on the new nozzle.

Routine Maintenance

Regular cleaning of your extrusion tooling is crucial for prolonging machine life, reducing waste, and maintaining tighter tolerances. Run purging agents through the barrel between runs. If you are unsure how to clean the barrel for a specific material, contact the Noztek helpdesk.

Barrel Jam

Depending on the material type, you may occasionally encounter a barrel jam. The motor block detection on the Xcalibur Servo will halt the motor automatically if torque rises beyond safe limits, preventing damage. If the motor starts labouring during extrusion, immediately switch off the motor.

To free a jam, increase the temperature to approximately 25–50°C above the recommended melt temperature of the material and leave it for 15–20 minutes. Then switch the motor back on — this should allow the screw to rotate and purge the barrel. Never exceed the polymer's degradation temperature.

Screw Wear (Critical for Abrasive Materials)

Processing abrasive composites — fibre-reinforced polymers, ceramic-loaded blends, graphene-filled materials, and metal-polymer compounds — accelerates wear of the screw and barrel. The Xcalibur Servo's high-torque servo drive is capable of processing these materials, but screw wear is a real consideration.

For routine work with abrasive materials, the hardened bimetallic screw and barrel upgrade is strongly recommended. Even with the upgrade, periodic inspection is recommended after every 50 hours of running with such materials. Contact Noztek for current upgrade pricing and lead times.

Servo Drive Maintenance

The DSY-RS750L2B2-M17S servo motor and TG90-G20 planetary gearbox are sealed industrial units requiring no routine user maintenance. Should the system report any error from the servo drive — torque trip, position error, or encoder fault — contact Noztek for diagnosis. Do not attempt to open the servo motor or gearbox housing; doing so will void the warranty and may damage the precision encoder.

Contact Noztek

For more in-depth troubleshooting assistance, please explore our FAQ help section at www.noztek.com. If your specific query is not addressed, please contact our team for direct support.

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