

# Custom Modeling Services General Proposal

F-750 & F-751 Produce Quality Meters



Felix Instruments - Model Development,  
Deployment, and Long-Term Optimization

## **Introduction:**

Felix Instruments provides custom chemometric modeling services for the F-750 and F-751 Produce Quality Meter platforms, supporting customers who require higher accuracy, greater robustness, or application-specific performance beyond standard calibrations.

Our modeling services are designed for organizations that rely on non-destructive quality measurements to make operational, commercial, or regulatory decisions. This includes applications where maturity, ripeness, or internal quality must be measured consistently across orchards, seasons, regions, or supply-chain stages.

Rather than offering a one-size-fits-all solution, Felix Instruments approaches model development as a structured scientific process. Each project is tailored to the customer's commodity, cultivars, growing conditions, operational workflow, and performance requirements. Customers may engage Felix Instruments for advisory support, full turnkey model development, or long-term model optimization depending on their needs.

This document outlines the typical stages of a custom modeling engagement, explains how projects are scoped and priced, and describes how modeling services integrate with F-750 and F-751 instrumentation.

## Overview of the Chemometric Modeling Process:

Developing a reliable spectroscopic model for fresh produce requires more than fitting spectra to reference values. Biological variability, seasonal effects, sampling bias, and instrument-to-instrument differences all influence real-world performance.

For this reason, Felix Instruments structures modeling projects around a multi-stage workflow that mirrors best practices in applied chemometrics:

- Careful planning of sampling strategy and reference methods
- Controlled, quality-assured data collection
- Iterative model development using appropriate statistical and machine-learning techniques
- Rigorous validation across relevant sources of variability
- Thoughtful deployment and operator training
- Ongoing refinement as new data becomes available

This approach ensures that models are not only accurate under laboratory conditions, but also stable, transferable, and reliable in production environments.

## Project Planning & Study Design:

Every successful modeling project begins with clear definition of the intended use-case. During the planning phase, Felix Instruments works with the customer to establish technical and operational requirements before data collection begins.

Key planning considerations typically include the target commodity and cultivars, the quality attribute(s) to be predicted (such as dry matter or soluble solids), desired accuracy levels, and how the model will be used within the customer's workflow. This may involve decisions around throughput, decision thresholds, or integration into existing quality programs.

When requested, Felix Instruments develops a custom sampling plan that defines how many samples are required and how they should be distributed across maturity stages, orchards, regions, or seasons. Proper sampling design is critical for avoiding common modeling issues such as slope compression, under-representation of extreme values, or season-specific bias.

For projects involving multiple teams or locations, Felix Instruments can also provide standard operating procedures (SOPs) for scanning, fruit handling, and destructive reference testing. These SOPs help ensure consistency across datasets and reduce variability introduced by operators or testing methods.

## Data Collection & Quality Assurance

Data collection may be performed by the customer, by Felix Instruments, or through a hybrid approach. Regardless of who collects the data, Felix Instruments emphasizes data quality control throughout the collection period, rather than waiting until modeling begins.

Because produce quality changes over time, data collection typically spans multiple months to capture early, mid, and late maturity stages, as well as environmental and regional variability. This extended collection window is essential for building models that remain reliable across real production conditions.

During data collection, Felix Instruments may perform periodic quality audits of incoming data. These reviews help identify issues such as inconsistent reference testing, operator-dependent variation, or spectral anomalies early enough to correct them. In many cases, small adjustments to sampling strategy during the season significantly improve final model performance.

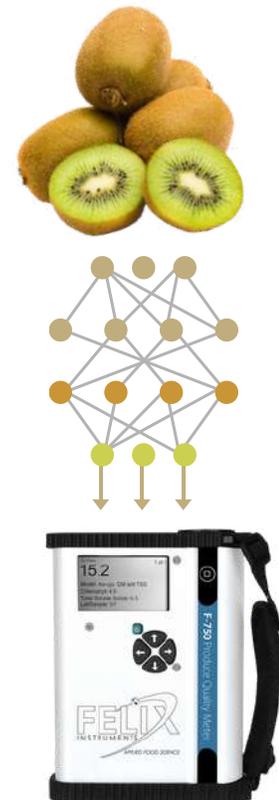
For customers requiring full turnkey support, Felix Instruments can also conduct or supervise on-site sampling to ensure SOP compliance and data integrity.

## Model Development & Validation

Once sufficient data has been collected, Felix Instruments begins the model development phase. This stage focuses on transforming raw spectral and reference data into a robust, deployable calibration that performs reliably under real-world conditions.

Model development typically begins with data cleaning and preprocessing, including spectral normalization, smoothing, and the identification of outliers caused by handling issues, reference errors, or atypical fruit physiology. Ensuring data quality at this stage is essential for preventing bias and improving model stability.

Felix Instruments then applies appropriate chemometric techniques based on the project requirements. Depending on dataset size, variability, and accuracy targets, this may include partial least squares regression (PLSR), artificial neural networks (ANN), or hybrid approaches. Feature selection and wavelength optimization are used to improve signal relevance and reduce noise, particularly for applications with tight performance tolerances.



Model performance is evaluated using rigorous validation methods, which may include internal cross-validation, independent hold-out datasets, or external validation across regions or seasons when available. Performance metrics such as RMSE, MAE, bias, slope, and confidence intervals are reviewed in detail to ensure the model meets the intended use-case. In many projects, multiple candidate models are developed and compared before a final deployment model is selected.

## **Deployment, Training & Implementation**

After a final model has been selected, Felix Instruments prepares the calibration for deployment on the F-750 and/or F-751 platform. This includes exporting the model in a device-compatible format, documenting version information, and verifying performance on representative fruit.

Deployment may be performed remotely or on-site, depending on customer preference and project scope. During this phase, Felix Instruments works with customer teams to confirm that predictions align with expectations under operational conditions and that any decision thresholds or classification logic are properly configured.

Training is an important component of successful implementation. Felix Instruments provides guidance on interpreting model outputs, minimizing operator influence, and maintaining measurement consistency over time. For customers operating multiple devices or locations, training helps ensure that results remain comparable across teams and seasons.

## **Long-Term Optimization & Model Evolution**

Produce quality models are not static. Biological systems, growing conditions, cultivars, and operational practices evolve over time. For customers seeking sustained performance, Felix Instruments offers ongoing model optimization and maintenance services.

These services may include periodic performance reviews, incorporation of new data from additional seasons or regions, and updates to model architecture or feature selection. In some cases, new sub-models are developed to address specific cultivars, regions, or specification thresholds.

Long-term engagement allows customers to protect their initial modeling investment while continuously improving accuracy, robustness, and applicability as their operation grows or changes.

## Device Strategy & Multi-Instrument Calibration

Robust model development requires accounting for instrument-to-instrument variability. For this reason, Felix Instruments typically uses multiple F-750 and/or F-751 units during the data-collection phase to ensure that the final model performs consistently across hardware.

Customers are encouraged to purchase at least one instrument for long-term deployment and validation. Owning a device allows customers to participate directly in data collection, perform on-site verification, and support future model updates without additional logistics.

During model development, Felix Instruments supplies additional calibrated instruments as needed. These loaner devices are used exclusively for project data collection and are not sold as new after use. To cover refurbishment, recalibration, and hardware depreciation, a loaner device utilization cost is included within the project pricing. This approach allows customers to benefit from multi-device calibration without the need to purchase multiple instruments upfront.

## Pricing Philosophy & Cost Drivers

Felix Instruments is committed to transparent and predictable pricing. Custom modeling projects vary widely in scope, and costs are driven by a small number of fundamental factors rather than arbitrary fees.

The primary drivers of project cost are:

- The size and diversity of the dataset
- The level of engagement required
- The accuracy and complexity of the final model

Projects involving large datasets, multiple cultivars or regions, or extended sampling periods require more quality control, analysis time, and validation effort. Similarly, projects that demand advanced machine-learning models or very tight accuracy thresholds require additional development and testing.

By structuring pricing around these drivers, Felix Instruments ensures that customers pay for the level of rigor and support their application truly requires.

## Pricing Structure & Bundled Incentives

Felix Instruments uses a modular pricing structure designed to align project cost with scope, dataset complexity, and required model performance. The table below summarizes typical pricing ranges for custom modeling engagements.

### Table 1. Custom Modeling Services - Pricing Overview

Service Component	Description	Typical Pricing Range (USD)
Base Project Fee	Project planning, sampling design, quality control of incoming data, project management, and loaner device utilization during data collection	\$5,000 - \$15,000
PLSR Model Development	Single calibration model using partial least squares regression for moderate-accuracy applications	\$5,000 - \$10,000 per model
ANN/DNN Model Development	Advanced neural network model with feature selection and iterative optimization for higher-accuracy applications	\$10,000 - \$25,000 per model
Classification Model Development	Development of qualitative or categorical models for applications such as defect detection, pass/fail screening, or quality class assignment. Models are optimized for sensitivity, specificity, and operational reliability rather than continuous prediction accuracy	\$10,000 - \$20,000 per model
Multi-Model Bundle	Multiple coordinated models (e.g., low/high maturity ranges, cultivar- or region-specific models)	Prices will vary greatly, starting at \$25,000

Pricing within these ranges depends on dataset size, number of cultivars or regions, data quality, and validation requirements. Final pricing is confirmed following project scoping and sampling-plan review.

## Pricing Structure & Bundled Incentives

To support customers who are building long-term measurement capability, Felix Instruments offers bundled incentives when a modeling engagement includes the purchase of a new instrument.

These incentives are designed to reduce initial project cost while ensuring customers have the tools needed to deploy, validate, and maintain their models over time.

**Table 2. Instrument Purchase Incentives**

Incentive Component	Description
Instrument Discount	10% discount on the purchase price of a new F-750 or F-751
Project Fee Credit	\$1,500 - \$3,000 reduction in the Base Project Fee

These incentives apply only to customer-owned instruments purchased as part of the modeling project. Additional devices supplied by Felix Instruments for data collection are provided as loaner units and are not eligible for purchase discounts.

Owning at least one F-750 or F-751 provides long-term value by enabling on-site validation, supporting future model updates, and reducing logistical complexity during deployment. While Felix Instruments supplies additional instruments during data collection to ensure multi-device robustness, customer-owned devices are intended for long-term operational use.

## Typical Project Timelines

Because produce quality evolves over time, custom modeling projects typically span several months, with data collection representing the largest portion of the timeline.

A typical engagement begins with planning and setup, followed by a multi-month data collection period designed to capture early, mid, and late maturity stages, as well as environmental and regional variability. Modeling and validation generally occur after sufficient data has been collected, followed by deployment and training.

Depending on the commodity, number of regions, and seasonal behavior, total project duration commonly ranges from four to ten months, with larger or multi-region projects extending longer. Felix Instruments works closely with customers to align timelines with harvest windows and operational constraints.

## Deliverables

Depending on the selected scope of services, customers may receive a combination of the following deliverables:

- A documented sampling plan and, if requested, standard operating procedures.
- Training sessions for data collection and model deployment.
- A cleaned and validated dataset used for model development.
- One or more final calibration models for the F-750 and/or F-751.
- A comprehensive model performance report detailing validation results.
- Deployment and training documentation.
- Recommendations for long-term optimization and future updates.



## Let's Build Together!

If you are interested in a Custom Model Building Service, Please reach out to us through one of the following channels!

- ✉ [sales@felixinstruments.com](mailto:sales@felixinstruments.com)
- ☎ (360) 833-8835
- 🌐 [Felixinstruments.com](http://Felixinstruments.com)

