

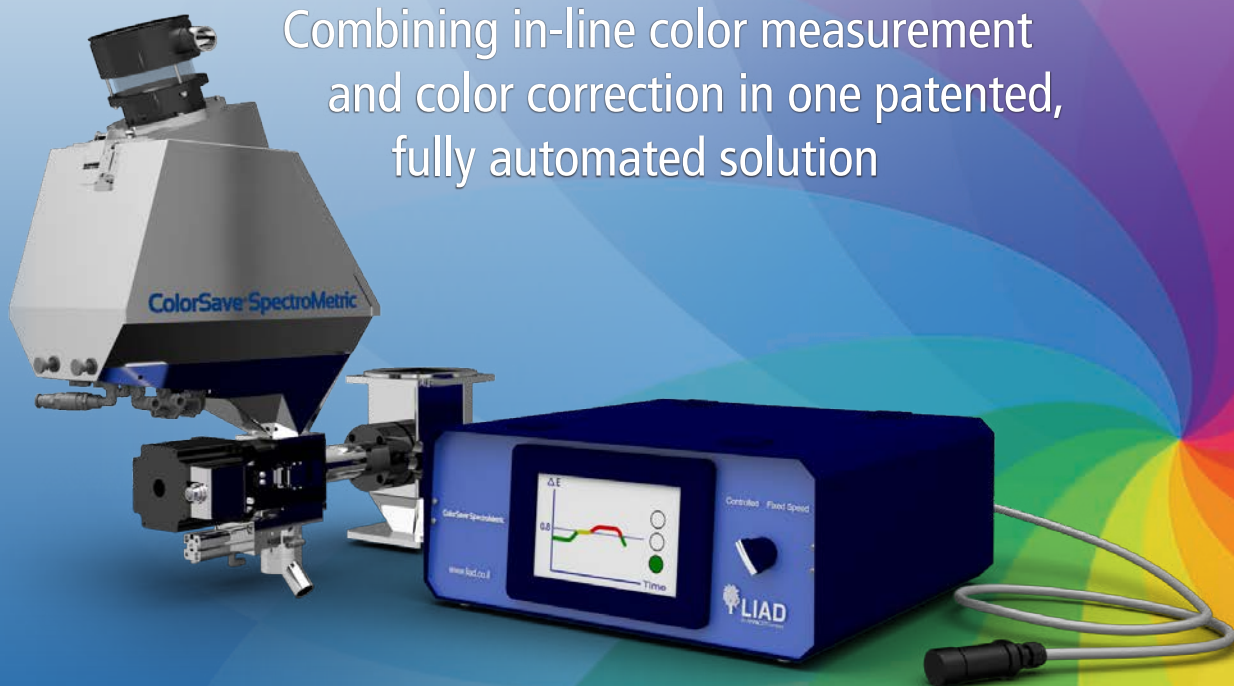
Spectro 4.0™

In-line color spectrometer that reduces downtime due to color variations during production



ColorSave® SpectroMetric

Combining in-line color measurement and color correction in one patented, fully automated solution



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Innovation
In Every Dose

Spectro 4.0 In-line Continuous Color Measurement

- The Spectro 4.0 patented in-line color measurement solution detects even minor color deviations (Delta E) in real-time.
- Accurate to a Delta E of +/- 0.05, the device provides a real-time pass/fail signal to a reject device or to an alarm unit for each machine cycle, ensuring an item's color is within the set Delta E limits.
- Automated self-calibration eliminates special tuning and complex adjustments. It filters ambient light and interference using automatic white balance correction to ensure measurement stability.
- Detects even minor color variations making it suitable for the most critical applications.
- Unique fiber optic probes allow contactless color assessment, regardless of orientation, texture, or shape.
- Can detect reflected or translucent colors, opacity, or haze with the accuracy of high-end bench top equipment.
- With an eye to Industry 4.0, the device can be equipped with wireless cloud technology allowing operators and QC managers to monitor real-time performance anywhere cellular connectivity is available.
- Automatic color verification eliminates manual QC checks for injection molding, blow molding, and extrusion.

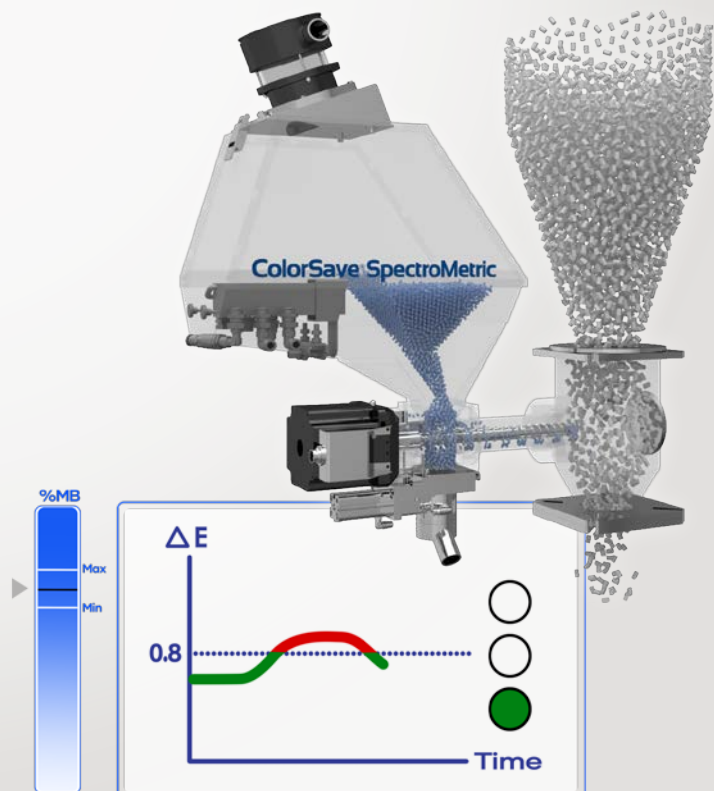


Contactless in-line spectrometer



ColorSave SpectroMetric Integrates the benefits of the Spectro 4.0 with automatic color correction

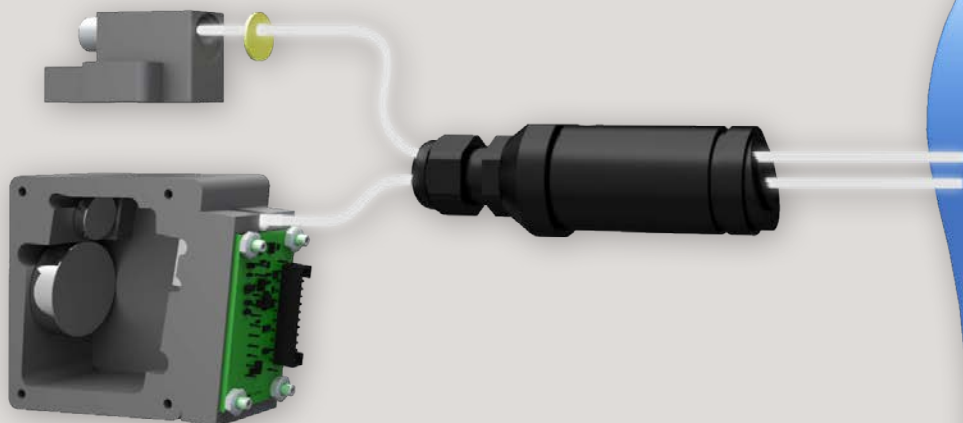
- Corrects even minor color deviations, (ΔE), in real time, while running masterbatch at the lowest possible usage rate to save on cost.
- Monitors and controls masterbatch dosing rates for each machine cycle, ensuring an item's color is within the set ΔE limits.
- Expedites production without compromising quality and minimizes masterbatch consumption for significant cost savings.



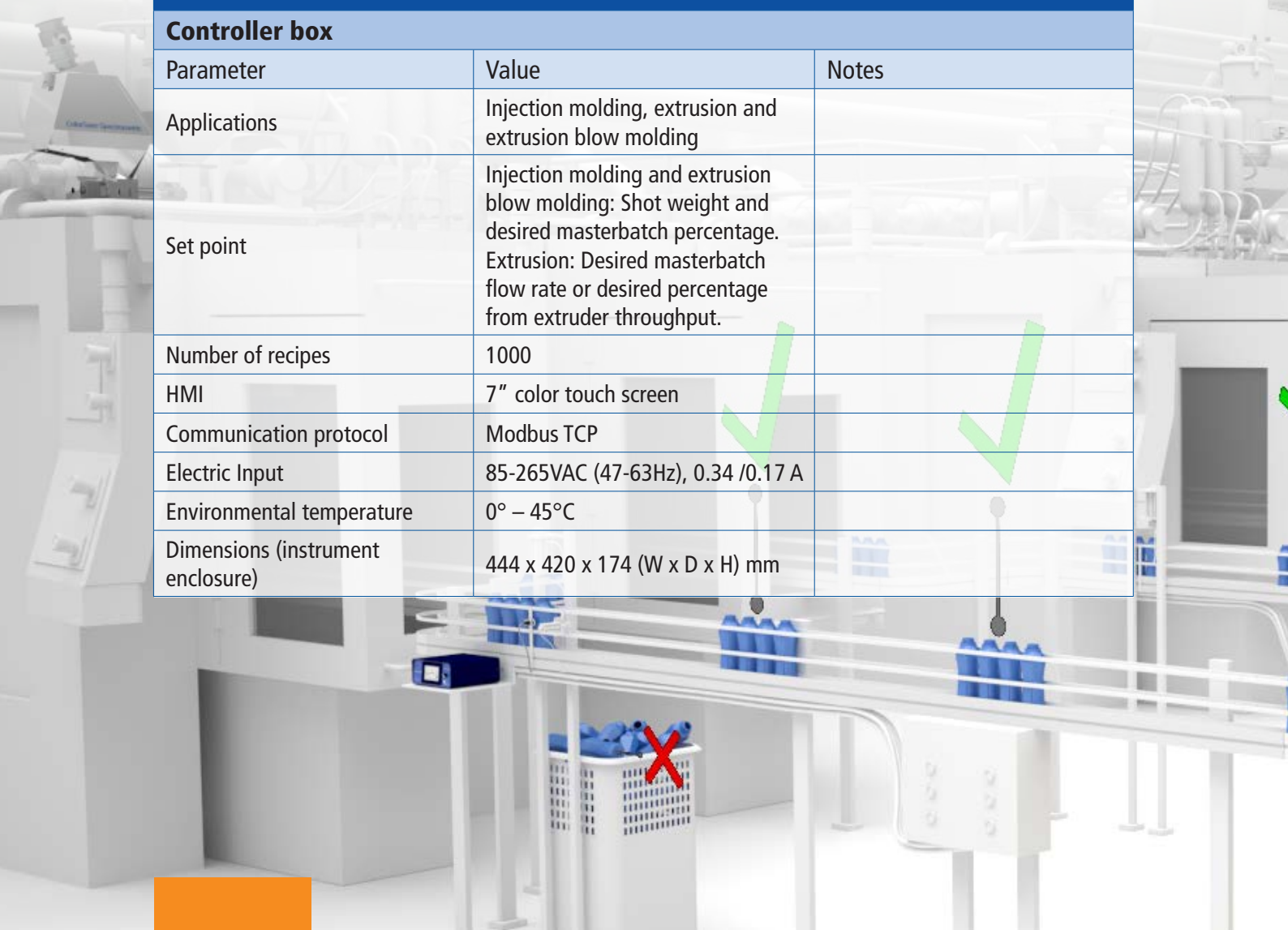
System Specifications*

Color calculation parameters		
Parameter	Value	Notes
Illuminant	D65	Any other upon request
Color Space	CIELAB	L*, a* and b*
Color Difference dE	DECMC2:1 or DE2000	Selected via instrument settings
Spectrometer optics		
Parameter	Value	Notes
Spectral range	380 nm – 700 nm	
Spectral resolution	5 nm	Measurement resolution
Measurement probes		
Parameter	Value	Notes
Probe type	Reflection	
Measured area diameter	9 mm	
Probe length	4.8 m	Custom lengths available upon request
Probe distance to measured surface (matte surface)	L,a,b change < 0.1	0 – 4 mm (without protective glass window)
	L change: ~ 0.2 per mm distance a,b change: ~ 0.05 per mm distance	Beyond 4 mm
Probe distance to measured surface (matte surface)	L,a,b change < 0.1	From -5° to +5°
	L change: ~ 0.2 per mm distance a,b change: ~ 0.05 per mm distance	Beyond 5°
Minimum probe cable bend radius	4 cm	
Sensitivity to probe cable spooling (5 m cable spooled completely)	L variation < 0.5	Spooling radius 15 cm
	L variation < 0.1	Spooling radius 20 cm
	L variation < 0.05	Spooling radius 25 cm
Sensitivity to probe cable bending (single U-shaped bend)	L variation < 0.5	Bend radius 6 cm
	L variation < 0.1	Bend radius 10 cm
	L variation < 0.05	Bend radius 15 cm

Measurement stability and noise		
Parameter	Value	Notes
Shot to shot repeatability White tile Lab = (97.65,0.12,1.51) Single shot	$\sigma[L] = 0.03$	Standard deviation (1 sigma)
	$\sigma[a] = 0.08$	
	$\sigma[b] = 0.10$	
Shot to shot repeatability White tile Lab = (97.65,0.12,1.51) Averaged for 60 sec	$\sigma[L] = 0.01$	Standard deviation (1 sigma)
	$\sigma[a] = 0.02$	
	$\sigma[b] = 0.02$	
Shot to shot repeatability Black tile Lab = (4.48,-1.40,4.21) Single shot	$\sigma[L] = 0.01$	Standard deviation (1 sigma)
	$\sigma[a] = 0.04$	
	$\sigma[b] = 0.04$	
Shot to shot repeatability Black tile Lab = (4.48,-1.40,4.21) Averaged for 60 sec	$\sigma[L] = 0.01$	Standard deviation (1 sigma)
	$\sigma[a] = 0.02$	
	$\sigma[b] = 0.02$	
Periodic calibration		
Parameter	Value	Notes
Probes calibration (using white covers on probes)	Every time new probes installed or existing probes removed At least once per 3 days (TBR, depending on application)	Manual
White reference calibration	Every shot or at least once per 30 min (TBR, depending on application)	Automatic
Ambient light calibration	Every shot or at least once per 30 min (TBR, depending on application)	Automatic
Lamp module replacement		
Parameter	Value	Notes
Typical Lamp Module Life	5000 hours	
Lamp Module Replacement, action required	Probes Calibration	
	Color Tiles Calibration	



Feeder		
Parameter	Value	Notes
Volume	3/5/10 liters	Made of stainless steel 304
Motor type	Stepper motor	
Throughput	0.3-100 kg/h	Depending on chosen screw out of 9 screws
Load cell	15 kg	
Physical connection to production machine	Hexagonal neckpiece adaptor	Includes air blow for screw cleaning
Emptying	Integrated emptying system with air pressure	
Venturi loader		
Parameter	Value	Notes
Material hose length	3 meters	Made of stainless steel 304
Filters	Mesh metal filter screen fabric filter	
Nozzle type	Aluminum	
Controller box		
Parameter	Value	Notes
Applications	Injection molding, extrusion and extrusion blow molding	
Set point	Injection molding and extrusion blow molding: Shot weight and desired masterbatch percentage. Extrusion: Desired masterbatch flow rate or desired percentage from extruder throughput.	
Number of recipes	1000	
HMI	7" color touch screen	
Communication protocol	Modbus TCP	
Electric Input	85-265VAC (47-63Hz), 0.34 /0.17 A	
Environmental temperature	0° – 45°C	
Dimensions (instrument enclosure)	444 x 420 x 174 (W x D x H) mm	



Accumulation data		
Parameter	Value	Notes
Feeding data	Total masterbatch weight and number of cycles	
Optical data	L^* , a^* , b^* , ΔE , ΔL , Δa , Δb	
Interfaces		
Parameter	Value	Notes
Cycle pulse	Digital input, dry contact	Plasticization signal for injection molding application, mold signal for extrusion blow molding application
Extruder On/Off	Digital input, dry contact	For extrusion and extrusion blow molding applications
Analog extruder synchronization	Analog input, 0-10 VDC	Optional for extrusion application, relative to extruder speed
Digital extruder synchronization	Digital input, encoder 24 VDC	Optional for extrusion application, relative to extruder speed
Part measurement trigger	Digital input, dry contact	Adjustable delay
ΔE Pass/Fail	Digital output, dry contact	Adjustable threshold
Feeding alarm	Dry contact 0V, optional 24V/30mA max.	N/O or N/C

* Product specification can be changed without notice





Spectro 4.0™



ColorSave® SpectroMetric

Patented: US 10,427,326; US 10,703,018; JP 6820385; IL 247074. Additional patents pending.



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