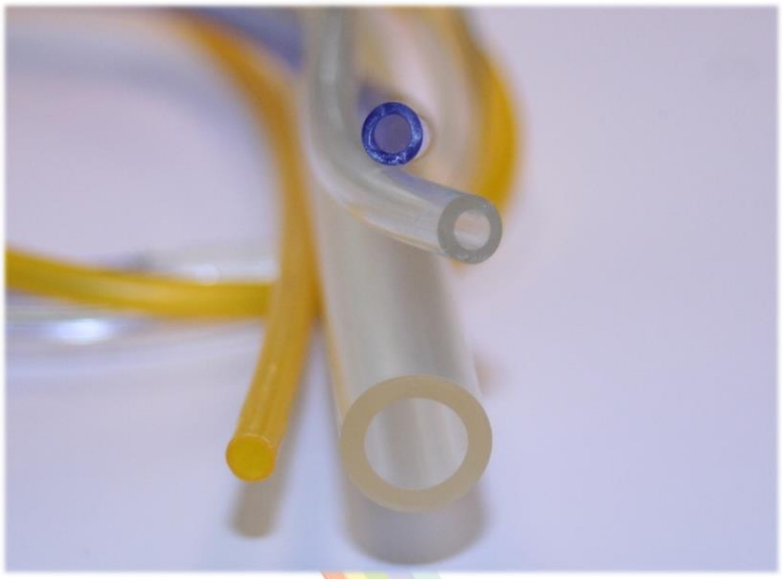
TECHNICAL SPECIFICATIONS

MEASUREMENTS FOR PLASTIC TUBE

SYSTEM DESCRIPTION



Quality control processes for production of transparent products in various shapes play an important role in view of the many applications of such objects.

In particular, the extrusion of plastic tubes for medical applications requires a high level of quality control and traceability.

One of the defects that can affect the quality of tubular product is the non-uniformity of its cross-sectional wall thickness, with negative consequences on the workability and quality of the final product.

As well as identifying defective product during manufacture itself, on-line measurements help to minimize the time and material lost during start-up of an extrusion line after a standard maintenance interval or product change.

Nirox srl provides patented complete solutions for the dimensional inspection of tubular products, including:

- m-thick optical sensor for wall-thickness measurements
- laser micrometer for outer diameter
- fixture for quick integration with simple adjustment
- high-level, user-friendly operator interface

The m-thick interferometric optical sensor measures the wall-thickness of the product at different positions along the circumference, providing great accuracy and repeatability. Meanwhile, the integrated laser micrometer measures the outer diameter at multiple axis.

The optical heads are contained within an easy-to-adjust C-frame or O-frame style unit, for easy integration into a product line.

Measurements, time trend charts and graphical representations of the tube concentricity and thickness are displayed in the View-Thick software.

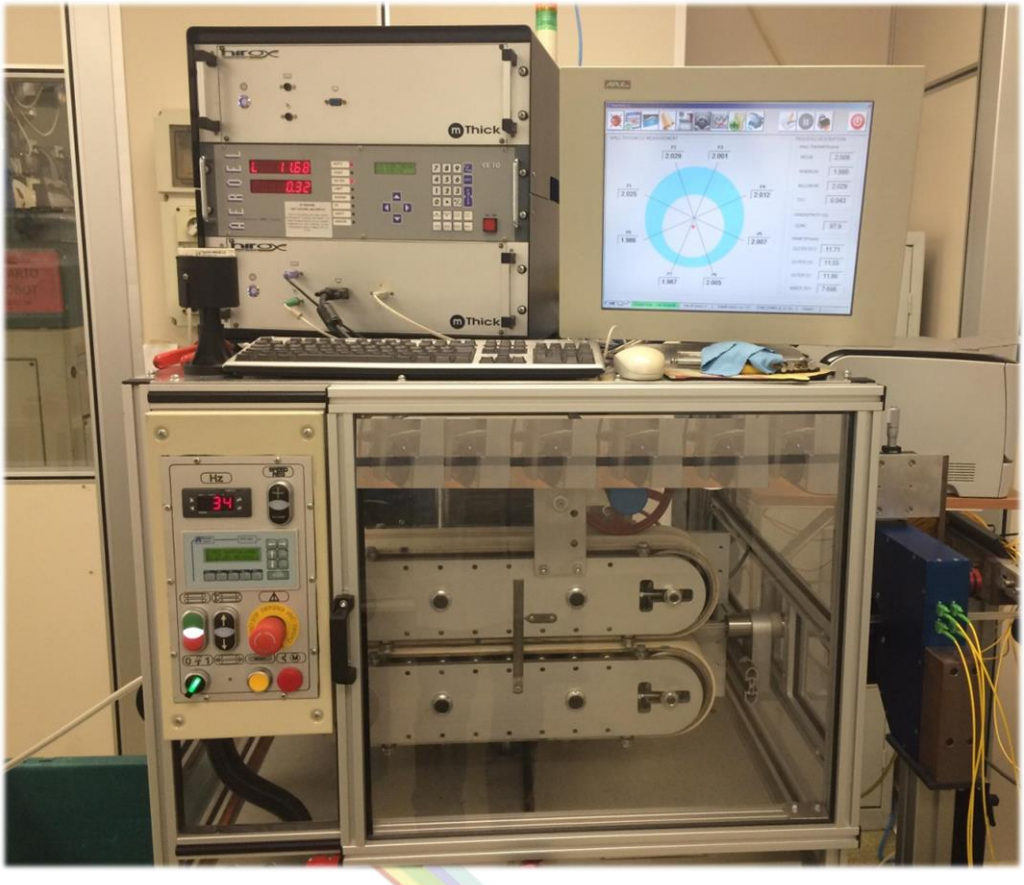
BENEFITS

- **Multiple heads optical interferometric sensor for wall-thickness**
- **Laser micrometer for outer diameter**
- **Full dimensional measurements**
- **24/7 inspection**
- **User-friendly operator interface**
- **Production report**

Data can be logged and summary reports can be generated with data histograms, statistics information and process capability indices at a selected time cadence.

INSTALLATION

Example of installation layout

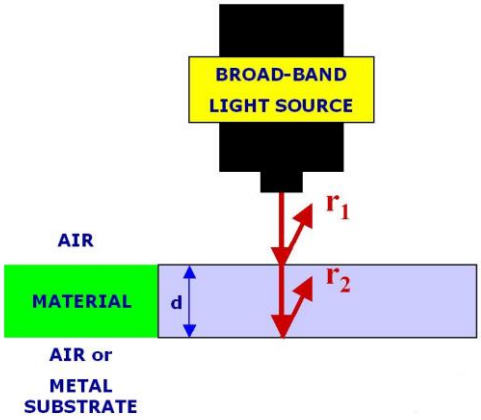


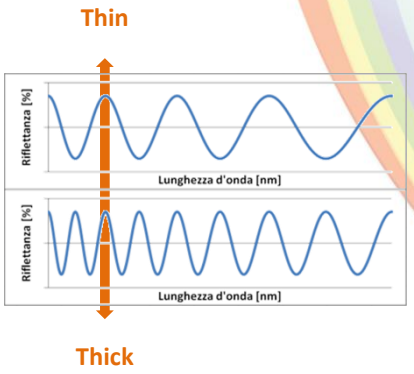
WALL THICKNESS MEASUREMENTS

The optical sensor for wall-thickness measurements is based on low-coherence interferometry.

The material is illuminated with a broadband near-infrared light source; part of this light is reflected at the air/material interface (component r1). Part of the light that travels through the material is then reflected at the material/air boundary (component r2) and it travels back toward the receiver.

The optical head collects both reflections, r1 and r2, and makes it possible to obtain the interference pattern between them.



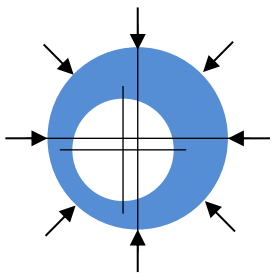


The resulting optical signal intensity has an oscillatory component whose frequency is linearly related to the thickness and to the refractive index of the material.

- **Absolute, non-contact measurements**
- **Best accuracy**
- **Up to 8 heads layout**
- **Mounting outside the water bath**

The measuring engine is made of a light source, an optical receiver and electronic processing boards that are housed inside the controller. The optical heads are connected with fiber optic cables.

MULTI-HEADS WALL AND CONCENTRICITY



The m-Thick optical sensor is equipped with an advanced optical switch that allows the same measuring engine to trigger several optical heads located around the tube in a precise sequence.

This layout allows the direct measurement of the wall-thickness profile at up to 8 points around the tube; thus the calculation of the concentricity and the determination of the minimum and maximum thickness are easily performed.

M-THICK SENSOR FOR WALL THICKNESS – TECHNICAL SPECS

The inspection system comes equipped with the sensor model best matched to the maximum and minimum wall thickness of the tube.

Specification	EP3	EP4
Wall thickness measuring range	0.05 – 1.8 mm	0.15 – 4.0 mm
Measuring rate	up to 300 Hz	
Accuracy	better than 2 micron	
Data I/O	TCP/IP and RS-485	
Size of controller	19” 3U rack, depth 357mm	

FIXTURE - TECHNICAL SPECIFICATIONS

The inspection system comes equipped with the appropriate fixture model for the number of optical heads required. Two standard models are available with 4 or 8 optical heads. Custom fixture designs are also possible according to specific requirements.

Specification	HP-4	HP-8
standard number of optical heads	4	8
Type of design	C-style	O-Style
Tube OD range	2 - 24 mm	
working distance adjustment	rotating knob with OD indicator	
optics cleaning	yes	
size	300 x 350 x 60 mm	400 x 400 x 60 mm

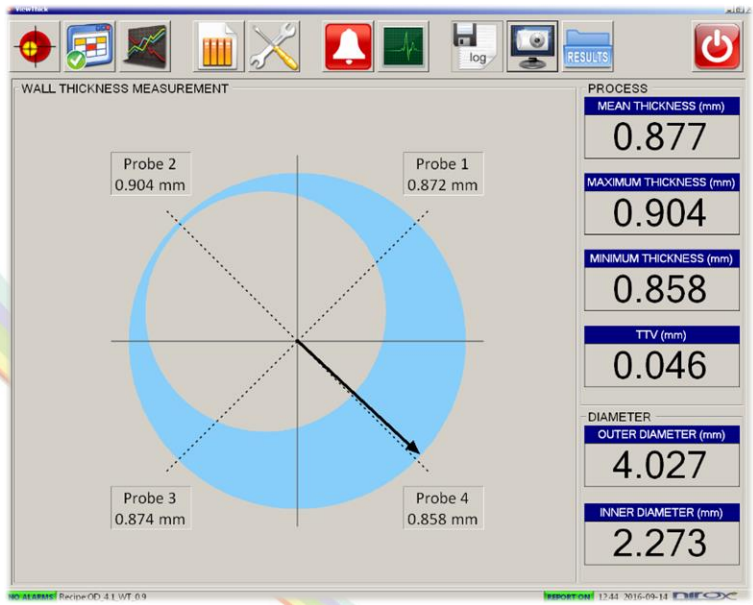
VIEWTHICK CONTROL SOFTWARE

ViewThick is the user-friendly control and operator interface software. All the measurements are visible in the main page, which also shows a graphical representation of the product cross-section. The chart page shows the time trends of the measured value for easy process overview.

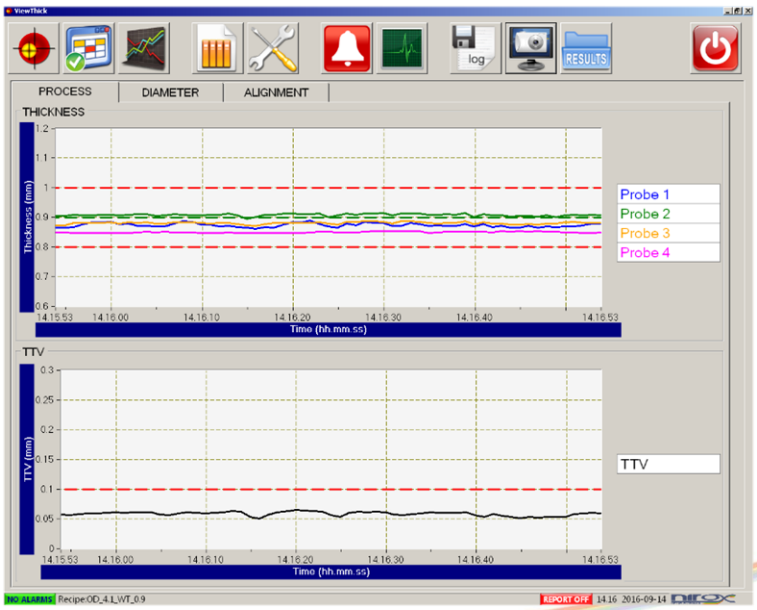
The different products and related information are managed through a recipe-style approach each containing tolerance band, parameters for the sensors and product data.

Alarms and digital output are configured through the software according to the operator requirements.

- **Tube cross-section drawing**
- **Time trend charts**
- **Data logging**
- **Production reports**
- **Alarms**



main page with data display and concentricity graph



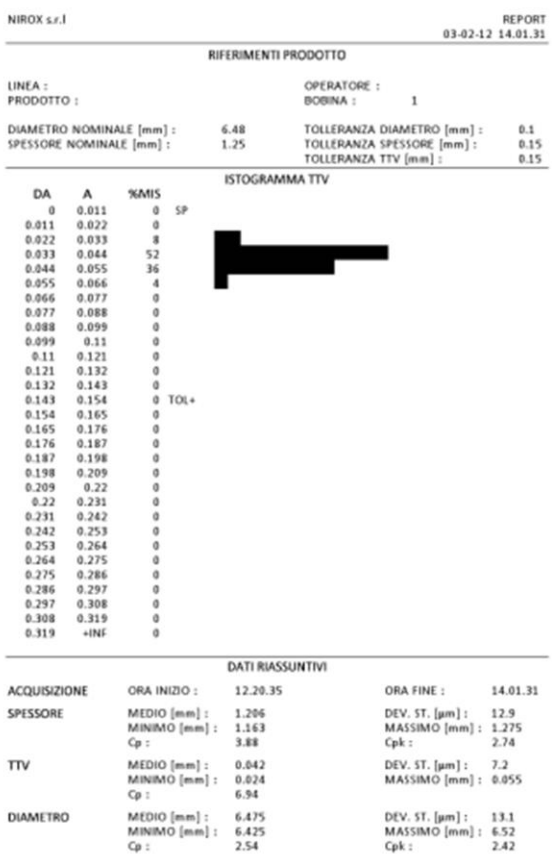
time trend chart

PRODUCTION REPORT

The ViewThick software allows generation of production reports. The system creates reports with a selectable time cadence; each document contains batch and product information, data histograms, statistics and process capability indices.

The documents are saved in the internal memory, sent out to a printer or to the plant data storage network.

production report with process capability indicators



NIROX s.r.l — REPORT 03-02-12 14.01.31

RIFERIMENTI PRODOTTO

LINEA :
PRODOTTO :
OPERATORE :
BOBINA : 1

DIAMETRO NOMINALE [mm] :	6.48	TOLLERANZA DIAMETRO [mm] :	0.1
SPESSORE NOMINALE [mm] :	1.25	TOLLERANZA SPESSORE [mm] :	0.15
		TOLLERANZA TTV [mm] :	0.15

ISTOGRAMMA TTV

DA	A	%MIS	
0	0.011	0	SP
0.011	0.022	0	
0.022	0.033	8	
0.033	0.044	52	
0.044	0.055	36	
0.055	0.066	4	
0.066	0.077	0	
0.077	0.088	0	
0.088	0.099	0	
0.099	0.11	0	
0.11	0.121	0	
0.121	0.132	0	
0.132	0.143	0	
0.143	0.154	0	TOL+
0.154	0.165	0	
0.165	0.176	0	
0.176	0.187	0	
0.187	0.198	0	
0.198	0.209	0	
0.209	0.22	0	
0.22	0.231	0	
0.231	0.242	0	
0.242	0.253	0	
0.253	0.264	0	
0.264	0.275	0	
0.275	0.286	0	
0.286	0.297	0	
0.297	0.308	0	
0.308	0.319	0	
0.319	+INF	0	

DATI RIASSUNTIVI

ACQUISIZIONE	ORA INIZIO :	12.20.35	ORA FINE :	14.01.31
SPESSORE	MEDIO [mm] :	1.206	DEV. ST. [µm] :	12.9
	MINIMO [mm] :	1.163	MASSIMO [mm] :	1.275
	Cp :	3.88	Cpk :	2.74
TTV	MEDIO [mm] :	0.042	DEV. ST. [µm] :	7.2
	MINIMO [mm] :	0.024	MASSIMO [mm] :	0.055
	Cp :	6.94		
DIAMETRO	MEDIO [mm] :	6.475	DEV. ST. [µm] :	13.1
	MINIMO [mm] :	6.425	MASSIMO [mm] :	6.52
	Cp :	2.54	Cpk :	2.42

INNER DIAMETER MEASUREMENTS

The inner diameter of the tube can play a fundamental role in many applications. The control of this dimension is possible thanks to the combined sensors.

The interferometric optical sensor measures the wall-thickness (WT) of the tube. The outer diameter (OD) is measured with a laser micrometer. The inner diameter (ID) is then calculated from the difference of these values.

Time-trend charts, reports and data logging are also available for this dimension.

MANUFACTURER

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