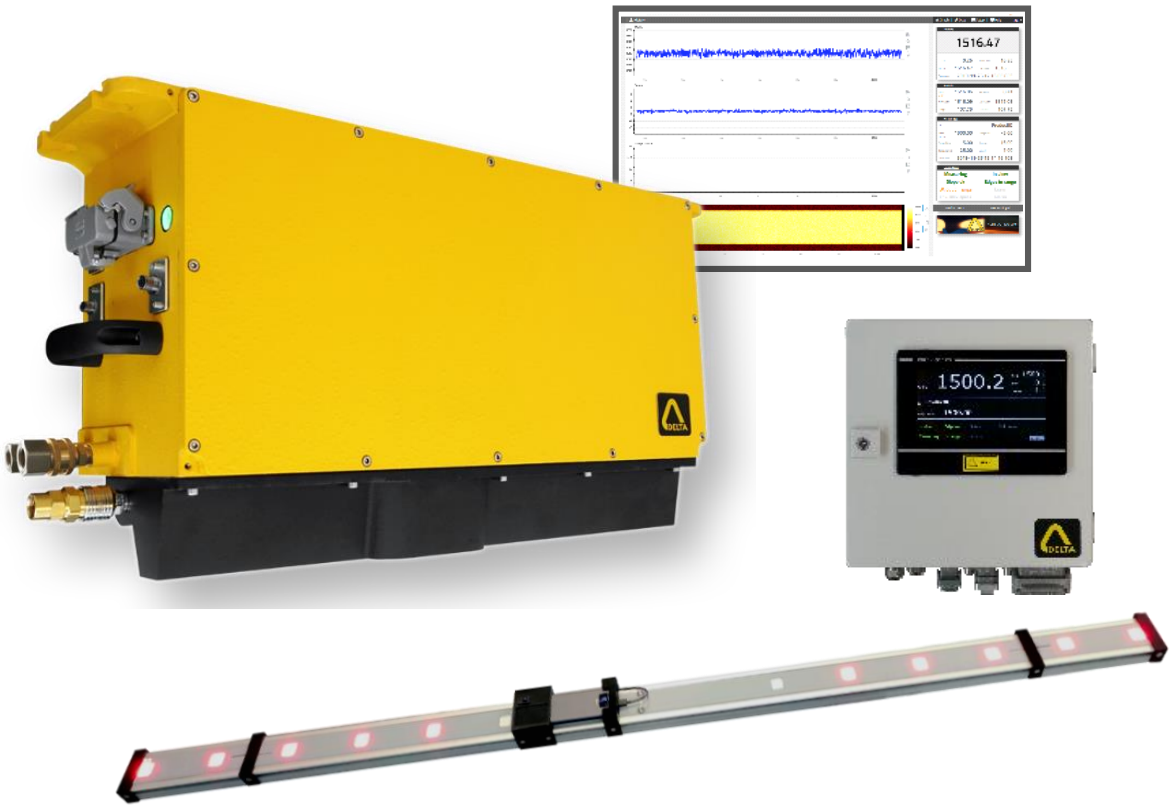
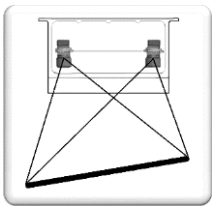
Stereoscopic Width Gauge

DigiScan

XD4100





Width - Center - CropView - Thermal Profile

Designed for extremely harsh environment

Built in Ethernet with OPC UA & Modbus TCP
Optional Industrial Network Protocol

Easy installation and maintenance

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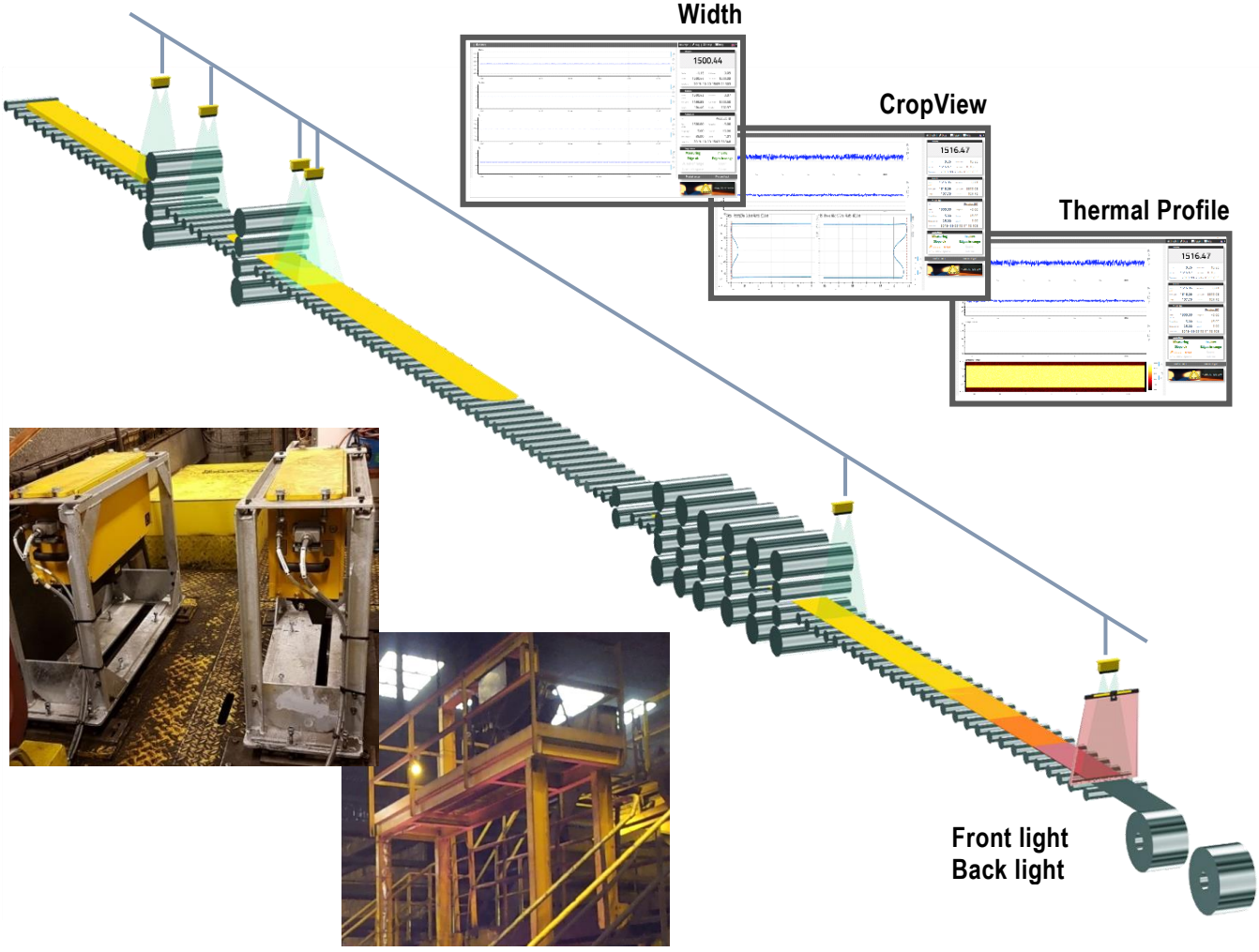
Introduction

The Stereoscopic Width Gauge **DigiScan XD4100**, designed for installation above the roll tables in hot strip and plate mills, is state-of-the-art technology for measuring the width and centerline of strips or plates.
The stereoscopic arrangement permits high on-line accuracy despite material hop, tilt, lateral movement, and thickness variation.
For use at the roughing mill or finishing mill exit, the self-emitted optical radiation of the hot strip provides sufficient contrast for width determination. An optional front light or back light mode is available for installation where the rolling temperatures are below 600 °C.



Main features

- Advanced edge detection software and data capture processor to perform edge sensing in real-time,
- Advanced stereo calibration taking into account lens distortion, with subpixel accuracy,
- On line verification and standardization to maintain high measurement accuracy,
- Setup and diagnostic of the gauge with a web browser,
- Extended communication features including built in Ethernet with Modbus TCP and OPC UA protocols,
- Optional industrial network protocol: Profibus DP, Profinet,
- Self-emission mode for temperature of product > 600°C, front light or back light mode for product < 600°C,
- Recording of measures, and advanced log features,
- Thermal profile option / CropView option
- Plug-in principle to customize: protocol, External I/O, configuration…
- Simplicity of installation and maintenance, very quick replacement of the gauge,
- Compact water cooled sealed die-cast aluminium housing, Heat Shield,
- Laser line & pointer for easy commissioning and verification of accuracy.

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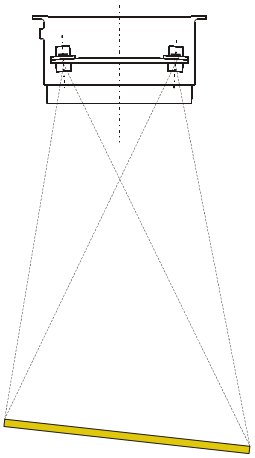
Operating principle



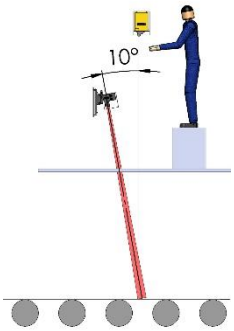
DELTA Stereoscopic Width Gauge employs an advanced digital edge detection process that captures the digitized camera data. Software routines running on the high-speed embedded processor perform sub-pixel edge determination in two-dimensional space.

The camera data are filtered using a high-speed Infinite Impulse Response (IIR) digital filter. Sub-pixel edge locations are then determined based on the second derivative of the pixel data. With two sub-pixel edges from each camera, the true width of the material is calculated using geometric triangulation. These trigonometric functions allow very accurate width measurement in spite of the influences of material pass line variations, thickness variations and flutter.

Measurement Mode

Depending on the temperature of the rolled products, there are 2 possibilities for the cameras to get the signal:

- The temperature of product is **above 600°C**: in this case, the self-emission (light mode) is enough to be seen.
- The temperature of product is **below 600°C**: in this case optional front light (light mode) or back light (dark mode) are available.



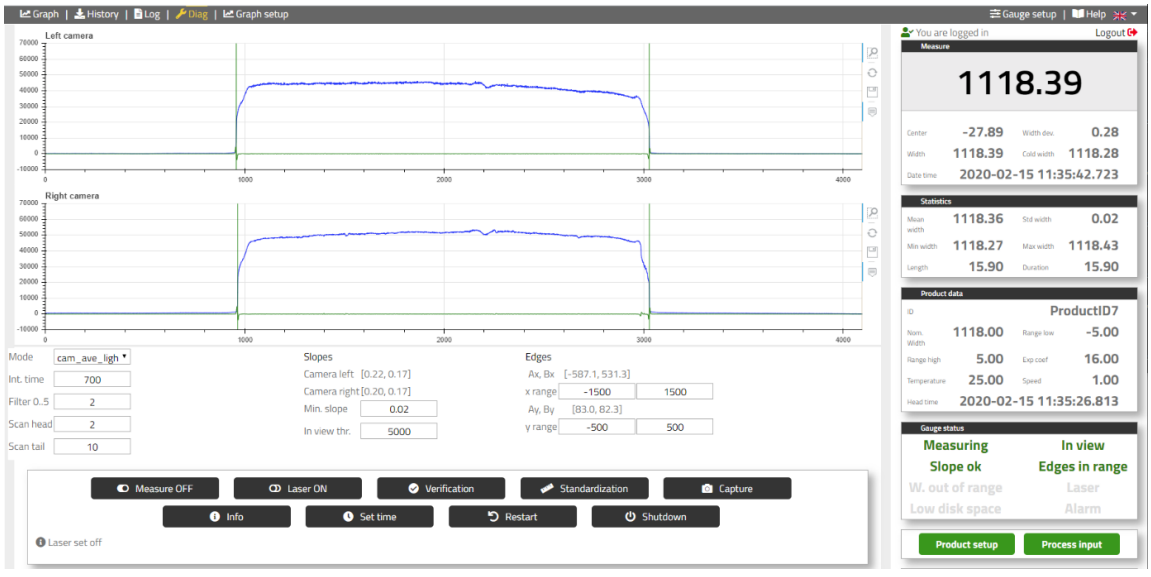
The front light **FLR-2400** is installed with a 10° angle compare to gauge vertical, in order to provide enough light intensity on the product and enough depth of field, without having too much direct reflection. The light should be emitted in between 2 rolls. The FLR-2400 includes an adjustable mounting stand, a cooling plate and a heat shield.

The back light **EMR-C** is installed below pass line, between 2 rolls.

In all cases, it's important to keep the measurement free of steam, water spray, smoke... and avoid possible reflexions on guides or rolls.

Web server

The gauge has an integrated Web server and the connection to the gauge with any Web browser, from a PC or a tablet, gives an access to gauge measurement data and configuration parameters.
Remote access is possible for diagnostic assistance.



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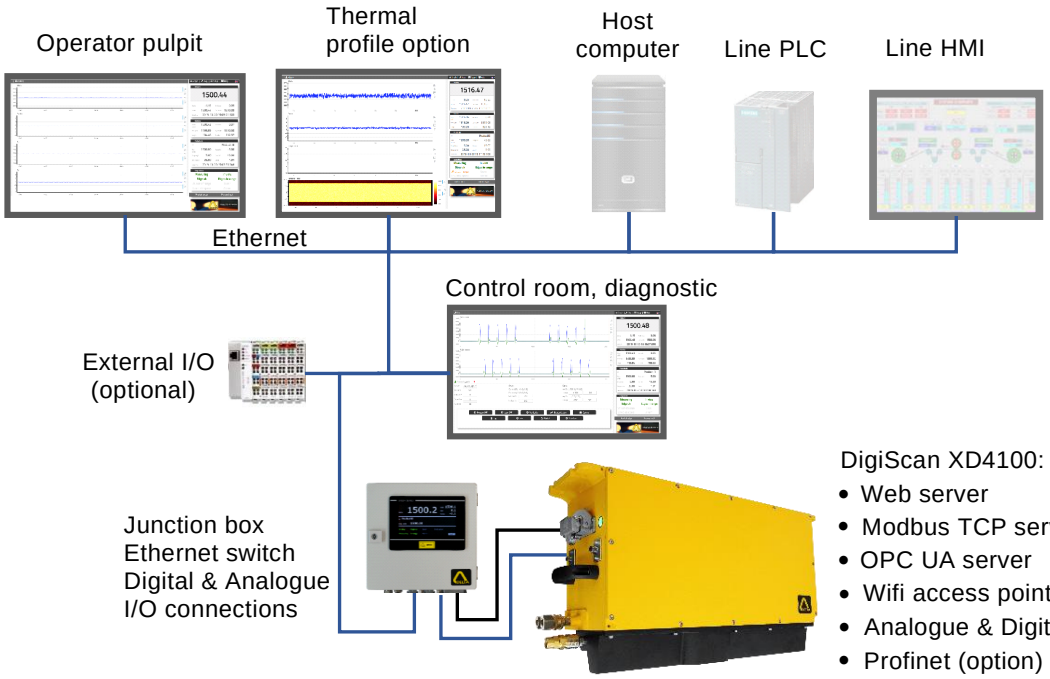
Connectivity

The **DigiScan XD4100** with built in Ethernet connection, integrated digital inputs / outputs and analogue outputs has a very flexible communication architecture and can easily be connected into any automation system.

- Integrated Modbus TCP protocol,
- Integrated OPC UA protocol,
- Optional Profinet and Profibus-DP protocol.



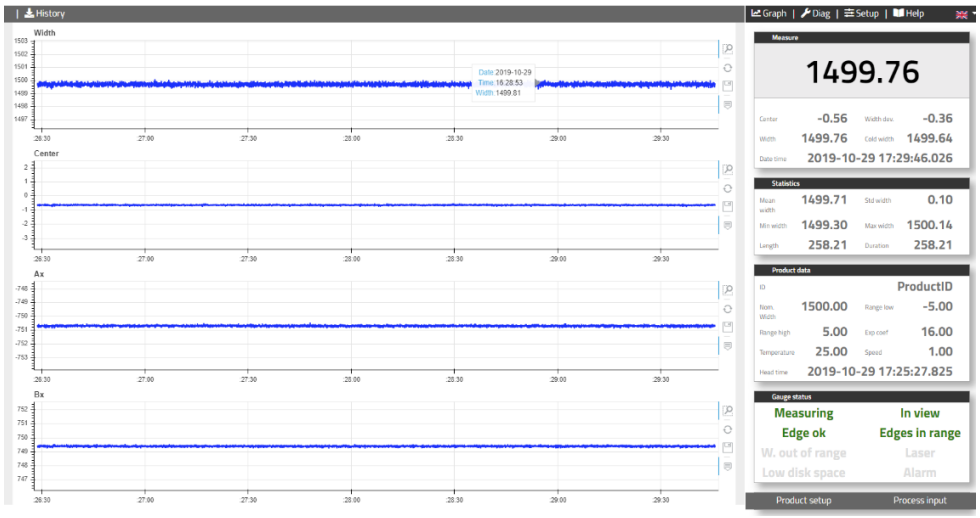
DigiScan XD4100:

- Web server
- Modbus TCP server
- OPC UA server
- Wifi access point (configurable)
- Analogue & Digital I/O
- Profinet (option)
- Profibus-DP (option)

Gauge data

Standard displayed information includes:

- **Graph**: hot and cold width, width deviation, centerline deviation, temperature map & temperature graph (option), previous bars
- **Measure values**: hot and cold width, width deviation, center
- **Statistics**: min and max width, average width, standard deviation
- **Product data**: ID number, nominal width, Temperature, Speed, Date & Time
- **Gauge status**: Measure ok, In view, Edges ok, Laser, Alarm…



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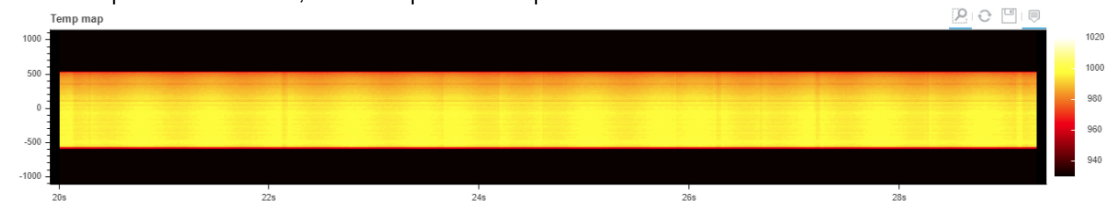
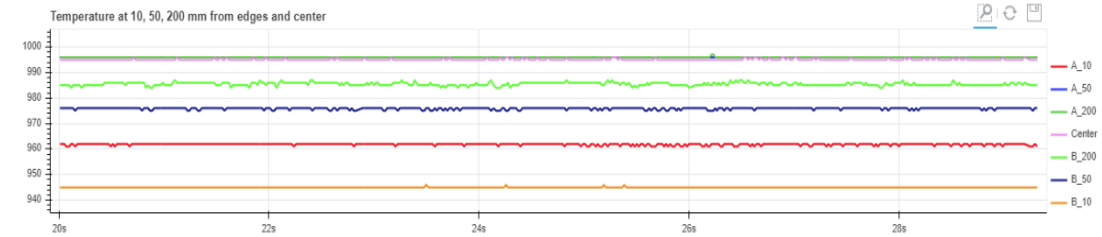
Temperature profile option

The display of temperature distribution across the strip helps for a better control of the rolling process by isolating the source of camber, hook, or skid marks from reheating furnace…
The temperature across the width of the product is obtained by calibrating the grey level output of the cameras to a temperature scale. The **DigiScan XD4100** can provide:

- Thermal profile versus time, in 2D temperature map



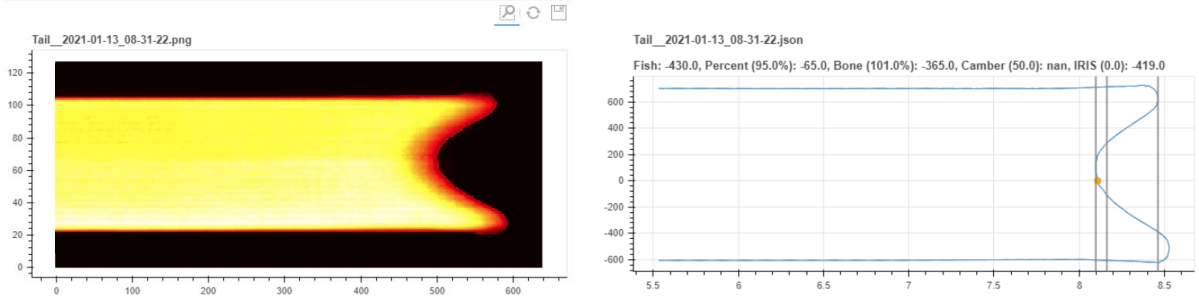
- Temperature of up to 7 adjustable points across the width of the product.



Specifications: 128 points per line, line period 25 ms, accuracy +/- 0.5% of reading plus +/- 3°C.

CropView option

For gauge positioned after rougher, this option displays head and tail shape of the bar for crop optimization.
It calculates the cutlines positions according to several configurable criterions (Fishtail line, Percent line, Dog bone and Camber) and supply to the CropShear PLC the distance between those lines and the detection point (ex: HMD like IRIS or DC4500). It's necessary to have a good speed measurement (with Velas DL4000 for example) for an accurate shape and for bar tracking. Scatter plots are transmitted through Ethernet.



Specifications: cutline position (at 3 m/s): +/- 4 mm for XD41•0-N / +/- 8 mm for XD41•0-H

Software Plug in

The DigiScan XD4100 is based on different customization through software plugin. Some examples:

- Specific Protocols TCP/IP or UDP
- Management of grade table
- Shape of head - tail - strip
- Other: feasibility to be analyzed by Delta engineer…

Any specificity linked to the end user is available in the plugin.
Plugins can be activated/deactivated on request for each gauge: the idea is that a spare unit could be installed easily at several positions, by activating the corresponding plugin.

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Calibration

Two-dimensional calibration is performed prior to delivery by placing a calibration fixture at several positions.
Calibration is accomplished by collecting camera pixel data and then the stereo optical parameters are estimated.
The width gauge is delivered calibrated in our factory. The installation's position is not critical as the stereoscopic cameras will compensate for any variation in the distance between the strip and the gauge.

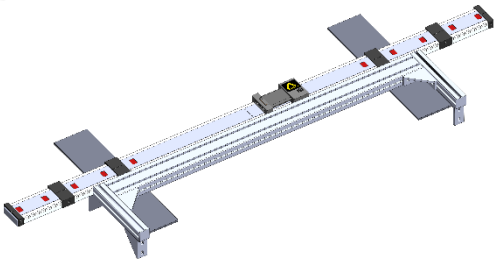
Verification of accuracy and standardization

The **DigiScan XD4100** is supplied with an active verification fixture, including a certified mask with 10 slots plus red LED simulating different strip widths. It is battery powered and weighs less than 6 kg for an easy installation on the rolls.

If the accuracy does not comply with the specification, a standardization can be made and the correction coefficients will be computed based on the measurements of the mask.

The verification is executed in a few seconds. All data are logged and can easily been retrieved from the web browser.

In addition of this verification fixture, a mechanical support is delivered to provide user a quick and simple possibility to position the fixture on the rolls at passing line during verification of accuracy and standardization.

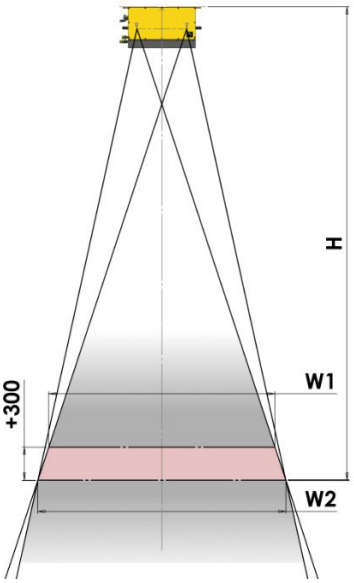


Measuring range

Based on the possible mounting height (H) and the maximum strip/plate position in width, the table below gives the gauge reference.
The optimized field of view with the highest accuracy (red area on graph beside), is given at pass line (W2) and at pass line +300 mm (W1), but measurement is also possible when the product is above and below (grey area on graph).

Model	***XD4150-•***							
W1 (mm)	1600	1750	2000	2200	2400	2700	3000	3300
W2 (mm)	1700	1900	2150	2400	2550	2850	3150	3450
H (mm)	3400	3700	4100	4500	4800	5300	5800	6400
Accuracy 2 σ (± mm)	0.3	0.3	0.35	0.4	0.45	0.50	0.55	0.6

Model	***XD4130-•***								
W1 (mm)	2300	2550	2900	3200	3500	3950	4300	4850	5300
W2 (mm)	2500	2750	3100	3400	3700	4100	4550	5050	5550
H (mm)	3400	3700	4100	4500	4900	5400	5900	6500	7100
Accuracy 2 σ (± mm)	0.4	0.45	0.5	0.55	0.6	0.65	0.70	0.8	0.9



The accuracy in this table is given for a vertical field of 300 mm.

For special application: strip size, mounting height, installation constraints…: please contact us.

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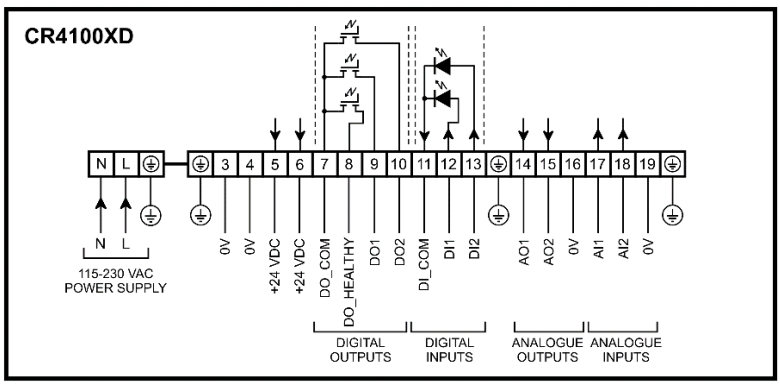
Characteristics

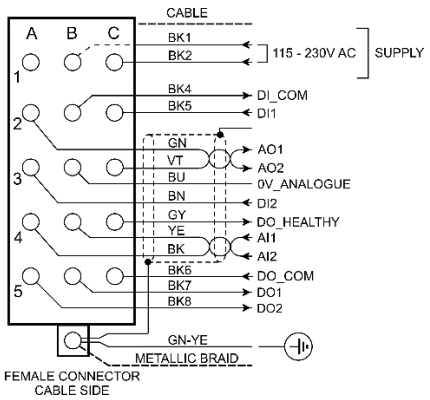
Model	***XD41•0-N***	***XD41•0-H***
Camera	2 digital cameras 4096 pixels, 16 bits (65536 grey level)	
Min. product T°	800°C	600°C
Thermal Profile	Option, range: 800 to 1250 °C	Option, range: 600 to 1100 °C
CropView	Option	
Front Light	Not available	Option
Back Light	Option	
Build in protocol (Ethernet)	Modbus TCP server, OPC UA server, html server	
Industrial network (option)	Profibus-DP, Profinet	
Software Plugin	Option	
Wifi	Wifi access point *(1)*	
2 Digital Inputs	24 VDC - 8 mA	
3 Digital Outputs	Optocoupled Solid State Relay: Impedance: 50 Ω, Switching capacity: +/- 350 V peak +/- 100 mA peak	
2 Analogue Outputs	4 – 20 mA (500 Ω max) - Linearity 0.1% - Temperature drift : 50 ppm/°C	
2 Analogue Inputs	4 – 20 mA - Linearity 0.1% - Temperature drift: 50 ppm/°C	
Operating voltage	110 V (-10%) to 230 V (+10%) - 50/60 Hz	
Power consumption	50 VA	
Laser line / pointer for alignment	Class 2M (IEC 60825-1:2014)	
Cables	Connector fitted with silicone cable with protective steel braid. Standard length of 5 m, 8 m, 10 m and 15 m	
Weight	31 kg	
Protection rating	IP 66 (aluminium case)	
Working temperature	0 to 50 °C (32 to 122 °F) without water cooling. Up to 120 °C (250 °F) with industrial quality water 10 l/min for max water temperature of 25 °C (77 °F), or 20 l/min for 35°C (95 °F)	
Air purging	Protection of the optic with dry and clean instrument air	

(1) Wifi can be activated during commissionning setting.

CE

Connection





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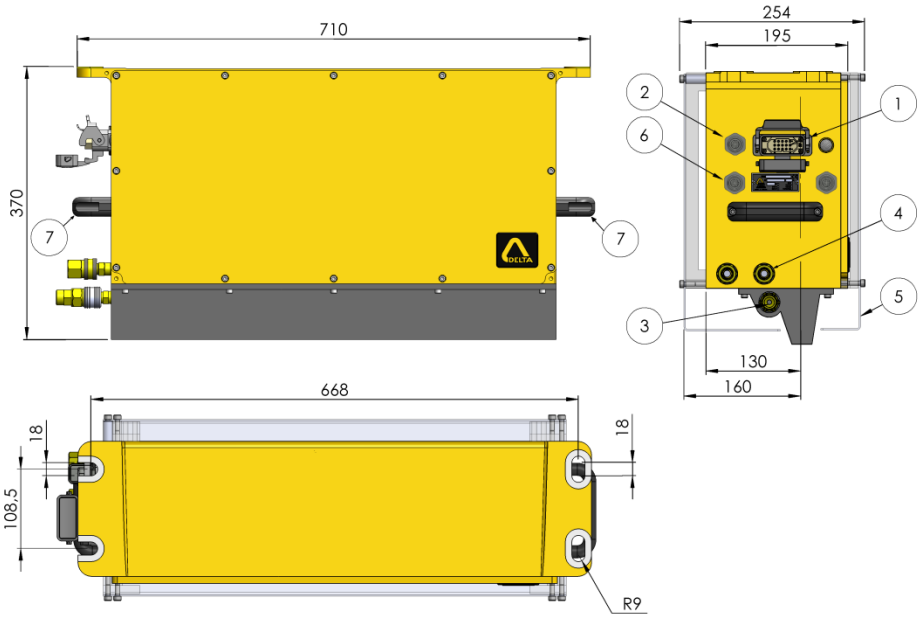
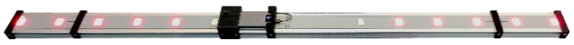
Dimensions



① I/O connector
② Ethernet: 1x M12 connector 4 pins D-coded Female
③ Air connection
④ Water connection
⑤ Heat Shield
⑥ Profibus option: 2x M12 connector: 5 pins B-coded male (IN) and female (OUT)
⑥ Profinet option: 2x M12 connector: 4 pins D-coded, male
⑦ Handle

Accessories included

- **Junction box**, with Ethernet switch and 7" panel display
  Dimensions: 300 x 300 x 190 mm. Power supply 115/230 VAC



- Active **verification fixture**, battery powered
- Mechanical support to position the verification fixture on the rolls
- Heat Shield to protect the XD4100 from direct radiations

- Power and I/O cable for **XD4100**, with protective metallic braid.
  Length to be specified: 5 m / 8 m / 10 m / 15 m / other on request.

- **Ethernet** cables (and for **Profinet** option), with 2x Male D-coded M12 connectors and protective metallic braid.
  Length to be specified: 5 m / 8 m / 10 m / 15 m / other on request.
- Cables for **Profibus-DP**, Male / Female B-coded M12 connectors, with protective metallic braid
  Length to be specified: 5 m / 8 m / 10 m / 15 m / other on request.

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