1 DESIGN OF INSTRUMENT

1.1 Hardware

1.1.1 Description of the main hardware

Hardware type: Cargoscan embedded processor, CSN950.

1.1.1.1 Construction

CSN950 is an electronic in-motion multi-dimensional measuring instrument, which measures the length (L), width (W) and height (H) of an object that pass under it on a conveyor. The instrument is used to measure goods/parcels in combination with systems for determining, shipping and storage charges for the objects based on their dimensions.

CSN950 is scanning a laser beam in a fan shaped pattern from above the conveyor.
Only the top surface of the objects are visible to the scanner. The side faces of the objects are invisible to the scanner. The dimensioning is based on the assumption that all objects are cuboidal (rectangular), that is, with vertical side faces. Under this condition the length and width of the smallest enclosing rectangle that fully encloses the object is identical to the length and width of the top surface.

The laser diode sends a beam of light to a spinning polygon mirror, which generates a fan of laser beams down to the conveyor. The reflected light is sent back up to the photo-detector in the rangefinder.

The rangefinder measures the amount of time the light uses for travelling down to the object and back again to the range finder.

The pulse generator pulses are used during the data analysis to measure the speed of the conveyor to determine length of the object. The pulse generator is attached to the underside of the conveyor and is fitted with a wheel that touches the conveyor. When the conveyor belt moves, the wheel rotates and pulses are generated that are counted by the CPU.
In some applications, such as on cross-belt sorters, it is not possible to use a pulse encoder attached to the conveyor. In such cases, the speed pulses may be taken from the control system of the conveyor, or from other sources. For verification purposes, the speed pulses may be considered correct if the CSN950 is able to measure correctly the length and the width of all test objects.

The CPU compares the light ray travel time information and creates an intensity image and a three dimensional image by mapping the individual light ray information. These images are analyzed by the CPU to measure the dimensions of the packages on the conveyor belt.
The dimensions and additional data for each package are output to the host and the display ports.

Conveyor system:
CSN950 is approved for

- Flat conveyors (belts, rollers, cross-belt sorters etc);

1.1.1.2 Measurand sensor

The measurand sensor is a laser transmitter/receiver with electronics that measures the travelling time of the laser light between the sensor and the object to be measured.

1.1.1.3 Indication device

The instrument shall be equipped with one of the following indicating devices to be used as the instrument primary indicator. The indicator shall display the measurement results, i.e. length (L), width (W), height (H), unit of measurement and, if applicable, any status codes for the measurement.

Option 1. CS2200
The Cargoscan CS2200 display may be connected to the COM port. See Fig. 1.1.1.3

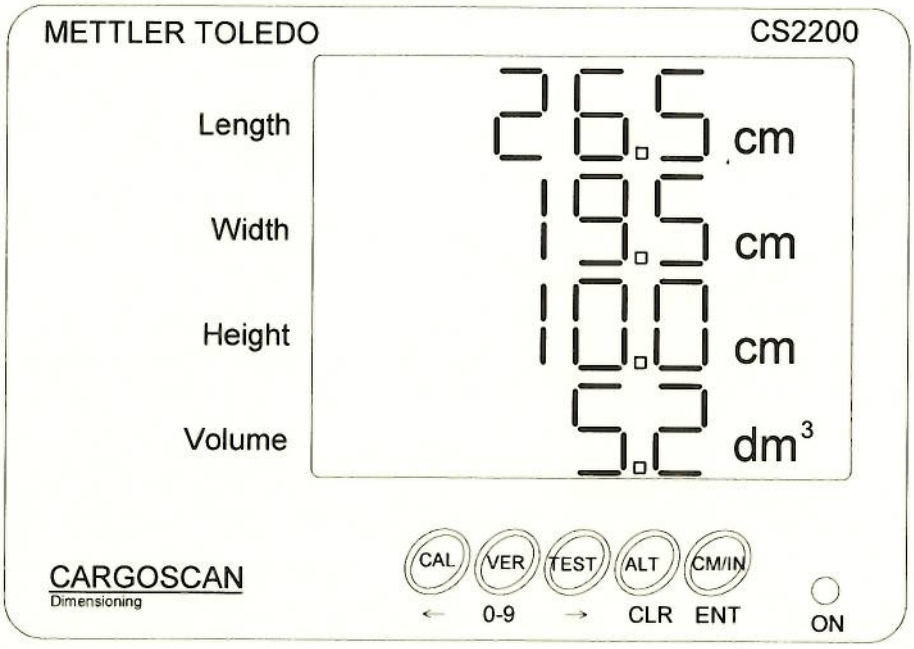

Fig. 1.1.1.3 Cargoscan CS220 Display.

Option 2 OctoCSM
The Cargoscan OctoCSM display software, in combination with a standard graphics display (VGA or equivalent). This software may be installed on the internal computer of the instrument or run on an external computer connected to the CSN950 instrument via Ethernet or serial line. The details on the layout of this display, and the procedure for verification and sealing of the display are found in the Test Certificate of the display (TC7413 issued by NMI).

Option 3
In applications where the customer is not present during the measurement process, the printout or display of the content of the alibi memory storage can be used for documenting the measurement results instead of an online display. In such cases, the alibi memory storage shall have a test certificate documenting the compliance with MID, OIML R129 and Welmec software guide 7.2.

1.1.1.4 Applied harmonised standards or normative documents and other public documents

- OIML R129 (Edition 2000): Multi-dimensional measuring instruments
- WELMEC Guide 7.2: Software Guide (Measuring Instruments Directive 2004/22/EC)

1.1.2 Description of optional hardware and integrated equipment not subject to the MID

Optional hardware: Bar Code Reader, keyboard, mouse and/or graphics display may be connected to the instrument. These devices are used for input/output of data to non-legally relevant software.

1.1.3 Description of peripherals, and information whether or not these additional devices when providing metrological results comply with the provisions of the Directive on legal metrological control

Cargoscan CS2200 display: This is a 4-line display for displaying measuring data and status codes for the measurements. The data are displayed in the format received from the instrument. No processing of data takes place inside the CS2200 display (see section 1.1.1.3)

OctoCSM: See section 1.1.1.3

Alibi Memory: See section 1.1.1.3 and 1.2.2.

1.2. Software

1.2.1 Legally relevant software, including the protective software interface

Software: Cargoscan DIM software

- Dim version number 1.7.x.y where 1.7 is fixed and will not be changed, but x & y represent bug fixes and other non-legal relevant which can be changed.

- Functional checksum
  - Flat conveyor: 0XECA0

1.2.2 Allowed functions subject to the MID

- Zeroing
- Download of approved software
- Alibi memory software for long time storage of measurement data may be installed on the instrument computer. This software must comply with directive 2004/22/EC and WELMEC Software guide 7.2, and a valid Test Certificate documenting such compliance shall be available to the inspector during verification and sealing of the instrument.

If an alibi memory software is installed and running on the instrument computer, an instrument for reading the object identity (e.g. bar code reader, RFID or equivalent) and one or more measuring instruments may be connected to instrument for communication with the alibi memory software. If required by national regulations, any connected measuring instrument shall have a valid Certificate of Type Examination for the application in question.

1.2.3 Allowed functions not subject to the MID

Cargoscan Octo or CSX software for collecting weight and bar code data for the measured object and merging these data with the object dimensions may be installed on the instrument computer. This application has a graphical user interface for the operator, and a data communication interface for transmitting measurement data to remote systems.

2. DESCRIPTION OF THE SEALING PROVISIONS:

The instrument shall be sealed to protect current set-up data. On a sealed system, it is not possible to change any legal relevant parameters. (It is possible to perform tests and look at all parameters).
The instrument is sealed by means of the build-in electronic sealing functions and hardware seals:

Hardware sealing:
Hardware sealing is described in figure 2 of annex 1 to certificate N-12/1977 revision 0.

Software sealing:
The CSN950 has electronic / software sealing by means of an event counter and an audit trail. The event counter is an electronic counter which is incremented by 1 at each change to any legal relevant parameter for the instrument. The audit trail is a protected file in which any such change are recorded with the event counter value, the date and time of the change and a short description of the change. The event counter and the audit trail are protected and cannot be manipulated. Access to the calibration mode is protected by password. The value of the event counter shall be recorded in the EC conformity declaration of the instrument at the time of sealing. During inspection of the instrument the recorded value shall be compared with the actual value at the time of inspection. Any change indicates that the sealing of the instrument has been broken. The procedure for displaying the event counter is described in the user manual of the instrument.

3 TECHNICAL DATA

3.1 Conditions for validity of the certificate

3.1.1 Information in respect of the conditions of use

3.1.1.1 Requirements of the object

The CSN950 measures only cuboidal objects. Objects of any colour and surface texture can be measured. However, the following restrictions apply:

- Maximum and minimum measurement sizes of object
- The instrument can measure any number of objects side-by-side. However, a large parcel may obscure the view of a small parcel if they are too close, giving an error code.
- A stable positioning of the object is essential for a correct measurement. Therefore, the objects must be placed with its largest and most stable side down. Also, the conveyor must be free from vibrations, jumps and other disturbances immediately in front of and behind the measuring area.
- Garment bags, sacks and other soft, flexible objects with non-cuboidal shape are not suited for measurement by CSN950. Transparent objects and objects packed in transparent wrapping material (e.g. "bubble" plastic) are not suited for this type of measuring.
- Mirror type surfaces (e.g. chrome and high gloss metal surfaces) are not suited for this type of measuring. However, the instrument can measure objects covered with shiny sealing tape and glossy plastic wrapping.
- The entire object has to be within the scan area. Therefore, if any part of the object is outside the measuring area, an error message is generated.
- Only cuboidal objects can be measured. The objects can be touching each other, provided the instrument can assume that the objects are all cuboidal.

An error message code will appear if measuring fails, indicating a reason for the failure.

3.1.1.2 Requirements of the conveyor

CSN950 may be used in combination with the following types of conveyors:

a) Flat conveyors (belts, rollers, cross-belts and equivalent);

The quality and installation of the conveyor have significant influence on the measurement accuracy. Therefore the following recommendations for the conveyor apply:

- Parcels that are partially outside the measuring field will not be dimensioned correctly, and will be marked with an error code. Conveyor width and position should not let any of the parcels get outside the side limits of the measuring field. If necessary, guides should be installed to control parcel position within the measuring field.
- For correct measuring, parcels must move undisturbed through the measuring area. Any guides to adjust parcel position must be mounted away from the scanner so that the parcels are not disturbed during measuring.
- If the conveyor is on an incline, carefully check whether the parcel is slipping. Parcel sliding on the conveyor belt during measuring will cause inaccurate measuring.

- A shiny conveyor belt may reflect the laser light and disturb the measuring. Normally, this is only a problem with new conveyors. Worn conveyors become less reflective. Shiny metal belts should not be used.
- Roller conveyor: Steel rollers are not recommended and beam stoppers under the rollers are required.
- To achieve optimum accuracy the belt seams should be no thicker than the belt material.
- Use of stapled belts may cause erroneous measurements due to thickness variation and reflective properties.
- Conveyor belt height should not vary more than 2mm, immediately in front of and behind the measuring area, while running.
- The wheel of the pulse generator must not be slipping on the belt, but represent the true motion of the conveyor under the instrument.

3.1.2 Instructions for correct operation.

3.1.2.1 Start up

It is important that the pulse counter is correctly calibrated to measure the length of the object properly.
The instrument must know the distance to the background to be able to measure the height of the objects properly. This is called zeroing. Zeroing must be done first time the instrument is powered, and repeated if the installation is ever changed.

- Turn the instrument on with the on/off switch. The CSN950 will power up and start a self test.
- After the self-test is finished successfully, the scanning will start and the instrument is ready for measurement.

3.1.2.2 Measurement

- Start conveyor belt and place the object to be measured on the belt. Always place the most stable surface down at the belt.
- No other items than the objects to be measured shall be in the area of measurement (Such as the arm of the operator).
- The results of measurements are shown on the display (see section. 1.1.1.3) and/or output on the Host port. The Host port is configurable to be either one of the NET connectors or the serial port marked COM.

3.1.2.3 Error messages

If the measurement is not successful, an error message will show up on the display together with the measurement result, to indicate that the result may be incorrect. The numerical error code of the error message indicates why the measurement failed and possible causes of the failure, such as:

- The object is outside the area of measurement.
- The object is reflecting too much or too little light.
- The object outside minimum and maximum dimensions set for the instrument.
- Non-rectangular shape of object.
- Object in shadow of another object.
- Data missing.

- The conveyor speed is higher than the maximum speed.

Some packaging materials are difficult to measure correctly. For limitations, see paragraph 3.1.1.1 above.

3.1.3 Information to ensure consistent production.

No specific requirements.

3.2 Metrological characteristics of the measuring instrument

	Flat conveyor
Accuracy Class	MPE = 1d for H, W and L
Scale Interval, Height	d ≥ 2 mm
Scale Interval Length, Width	d ≥ 5 mm
Minimum object size	H,L,W = 10d
Maximum object size	H = 900, W = 900 and L = 4000 [mm]
Max speed of the conveyor	200 m/min
Climatic	-10 /+50 ^{o}C non-condensing, indoors
EMC	E2

3.3 Information on the operation

3.3.1 Rated operating conditions

Voltage : 24Vdc.
Principle of measurement : Optical (Visible Laser Rangefinder)
Control system : Linux
Database : Proprietary

3.3.2 Adjustments

The instrument must be installed and calibrated according to the manufacturer's specifications before verification testing and sealing. After being sealed, any calibration or adjustment cannot be performed without breaking the seals.
Zeroing, in order to readjust the zero height level, is allowed on a sealed instrument.

3.3.3 Equipment for the control of the instrument
Control of the instrument shall be carried out using appropriate test objects of various sizes and of stable dimensions as described in OIML R129 11.1.4.2 and 11.2.

The following manual shall always be available:
CSN950 Verification and Sealing Procedure, version 1.0.0 or newer.

4 INTERFACES AND COMPATIBILITY CONDITIONS

- COM port
  - Output: Measurement data in digital format – e.g. to CS2200 display or to Host
  - Input: Closed shell input of commands from CS2200 display.
  - Input from Host (closed shell. Non-legal relevant commands only)

- NET 1 & 2
  - Web Server Interface
    - Access to embedded web server for instrument setup and calibration. Limited functions available (closed shell). After sealing of the instrument, all changes are recorded in the audit trail, and the internal, non-resetable event counter is incremented by 1 for each change.
  - Host communication
    - Output of measurement data in digital format to Host computer
  - Peripherial devices
    - Communication with peripheral devices such as bar code reader, weighing instruments.

- Tacho In
  - Input of signal (electrical pulses) from the pulse encoder (Tacho). No other inputs are possible
  - Output: 5V/15V power supply to the pulse encoder

- Tacho Out
  - Input: No inputs are possible
  - Output: Output of "Tacho" signals to peripheral devices (e.g. Bar code reader).

- USB 1-4
  - USB memory stick holding software and configuration parameters
  - Peripheral devices such as keyboard. No access to legal relevant software or functions is possible via such devices

- VGA/DVI
  - Connection for DVI or VGA monitor.

5 MARKINGS

A product label, in conformance to Directive 2004/22/EC article 17, shall be attached to the enclosure of the instrument

- The CE marking shall be at least 5 mm high
- Supplementary metrology marking consisting of the capital letter M and the two last digits of the year of its affixing shall immediately follow the CE marking.
- The CE marking, supplementary marking and the identification number of the notified body shall be indelible.

All marking shall be in conformance to Directive 2004/22/EC Annex 1, §9.1

- Number of the EC-type examination certificate
- Manufacturer
- Make and model
- Serial number
- Date manufactured
- Accuracy
- Scale interval
- Minimum object size
- Maximum object size

CSN950 shall be accompanied by information on its operation in conformance to Directive 2004/22/EC Annex 1, §9.3.

The following information shall be available for the operator (i.e. on a plate mounted to or nearby the instrument or in an operating manual:

WARNING:

1. CSN950 cannot measure the following objects/cargo:

- Non-cuboidal objects
- Objects wrapped in transparent plastic and "bubble" plastic
- Objects with mirror type, or high gloss surfaces [1)]

[1)] Note: Stainless steel, package tape and similar glossy materials commonly found on freight goods can be measured correctly.

2. ALWAYS place the object with the most stable surface down to ensure correct measurement.

6 LISTS OF DRAWINGS TO THE CERTIFICATE (ANNEX 1)

Figure 2. Sealing of CSN950 top cover.

7 CERTIFICATE HISTORY

Issued number	Date	Description
N-12/1977 revision 0	2012.11.07	Type examination first issued
N-12/1977 revision 1	2013.12.13	Modification to section 1.2.1. Legally relevant software. The correct functional checksum is 0XECA0. The change is due to an editorial error in the original certificate.

Figure 2 - Sealing of CSN950 top cover. Two sealing stickers shall be placed on oposite sides of the instrument. Each sticker shall overlap the housing and the top cover as shown in this picture.