CARGOSCAN
Dimensioning

CSN840.3 STATIC DIMENSIONING INSTRUMENT

USER MANUAL
REVISION: 1.1.1

METTLER TOLEDO

Chapter 0
Version History

Version	Rel. Date	Author	Comments
0.0.1	04.08.2006	K.Kråkenes	First draft .
0.0.2	18.12.2006	K.Kråkenes	Sections on Configuration, prepared by ØO are included.
0.0.3	29.01.2007	E.Sorensen	Main/Subdocument
0.0.4	19.03.2007	E. Sorensen	CS2200 user manual updated Text reviewed and updated.
1.1.1	30.03.2007	E. Sorensen	Updated sealing procedure

Copyright Note

www.mt.com/cargoscan

0.1 Contents

Chapter 1
Introduction

The CNS840.3 is a static dimension measurement instrument that automatically dimensions large objects up to 183 x 183 x 260 cm (72 x 72 x 102 in.) while the goods are sitting still on a relatively flat surface. The product is designed to measure palleted goods that are going to be transported as part of or a whole shipment.

The instrument consists of three CSN840 Dim Heads mounted in a frame above a measuring platform. The three Dim heads scans the object to be measured from different viewing positions. These three "views" of the object are combined into one image which is analysed by the instrument computer in order to find the Smallest Enclosing Rectangular box (SER) that the object can fit into. The dimensions of this SER are reported as the dimensions of the object.

The Reference manual contains in-depth technical information about the system design, the installation, and the use, operation and maintenance of the instrument. The document is written for the system developers, service people and the other advanced technical users of the product.

The Installation manual contains information needed by technicians that installs and maintain the instrument.

User manual contains information on how to use a system set up without external application computer. The interface is through the CS2200. This manual also contains information on how to seal the system for Legal for Trade purpose.

Host Protocol manual contains information on the communication interface to a host computer and the configuration and setup information needed to develop an application for the instrument.

The CSN840.3 is under continuous improvements, and new features will be added to the instrument. When changes are done to the CSN840.3, Cargoscan will either issue updates to this manual, or a new revision of the entire document. Contact Cargoscan for updates and/or new releases.
This version of the manual covers software versions up to and including CSN840-1.6.

Chapter 2
Safety Precautions

2.1 Laser Classification - Background

The CSN840.3 system is based on visible (red) laser diode at wavelength of 658nm.
The product is classified as class 2 laser product in accordance with the following standards:

CFR 1040.10   Used by US Federal Drug Administration (FDA). It is the law in the USA to classify any product sold in the US according to this norm.

IEC 60825   This standard shall be used when classifying products for the European (EU) market. Products bearing the CE mark are classified according to this standard. This standard is accepted in most other countries too. In the USA, FDA has stated that product classified according to this standard will be treated equally as CFR 1040 (FDA Laser Notice 50).

Class 2: This classification is used for visible laser products only. Class 2 laser products are not considered unconditional eye safe for long time viewing into the beam. However, the normal eye adversion (blinking) reflex of people with normal vision, prevent such long time viewing. Therefore, Class 2 products are considered eye safe in practical use.
Long time viewing of diffuse reflections (i.e viewing the laser scan line on a surface) is safe under all circumstances.
Direct reflections from mirror type surface should be treated identical to direct viewing of the laser beam.
Because the light is spread out from the exit window of the product, the power level decreases with distance. This means that from a laser safety point of view, the risk decreases with increased distance. The laser safety classification is done with a stationary sweep mirror. This is worst possible situation concerning radiation hazard. During normal operation, the mirror sweeps the laser beam across the scan field, which means that the user is exposed to laser light much below the exposure times used in the safety calculations.

The laser diode output power of each CSN840 is max 2.8mW. This is the max acceptable power level for this product within IEC60825, Class 2. CFR1040 class 2 allows higher output power than IEC60825.

Class 2 lasers are not eye safe during continuous (long time) viewing. Short time viewing is not considered hazardous. No special precautions are required around the instrument, as the normal eye aversion/blinking reflex will protect the eye from long time exposure. Also, because the laser is visible, and therefore, the location of the laser beam is known to the operator, the risk for accidental direct viewing is much reduced.

Tabell 2-1 Laser safety parameters of CSN840

	Mean Laser Power	Mean power at front	Laser Class
Visible (658nm)	2.8mW	0.045mW	IEC: Class 2 FDA: Class 2

Definitions:
Mean Laser Power: Output Power from laser diode.

Mean Power at Front: Mean Power collected by the eye of an observer located at the exit window of the instrument. The eye pupil of the observer is assumed to be $\varnothing$=7mm. This power is measured with the polygon rotating, but with the sweep mirror being stationary.

The CSN840 complies with all requirements of CFR1040.10 and IEC60825 as stated in the Certificate of Conformity at the end of this manual.

Complies with IEC60825-1,Ed1.2,08-2001 and USA 21 CFR 1040.10, with deviations pursuant to Laser Notice no. 50 (July 2001)

λ=660nm
Pulse Length=95-115μs
Pulse Rate=140-170Hz,
Pulse Energy=240-290nJ
Mean Power=40μW

**LASER RADIATION
DO NOT STARE INTO BEAM
CLASS 2 LASER PRODUCT**

Figur 2-1

Laser Label, Class 2, in accordance with IEC60825 and CFR1040.10

2.2 Laser Safety Precautions

In general, the following recommendations apply concerning laser safety:
Do not mount the instrument such that the laser beam is aimed directly in the eye height of a workstation, door, stairway or other location where the laser beam may hit the eyes of people unaware of the presence of the laser source. (Does not apply to trained service people doing installation, maintenance and service, as they should be aware of the presence of the laser).
If possible, beam stops should be mounted outside the measuring area of the CSN840 to stop the laser beam reaching beyond its useful area.
Avoid direct viewing into the laser beam unless absolutely necessary (general recommendation that also applies for Class 1 lasers). If direct viewing is necessary, reduce the exposure time to a minimum and do the viewing at maximum possible distance.
Never look into the laser beam with any type of optical magnification instrument such as binocular, magnifying glass, SLR camera view finders and other.
If the main cover is removed, the laser radiation hazard is not increased, unless the laser beam, inside the casing, is intercepted and redirected with a mirror or similar optical device. The instrument has built-in features to switch off the laser when such interception occurs, or if the laser beam is somehow interrupted. These safety mechanisms comply with the requirements of the laser safety standards. However, as a general precaution it is not recommended to rely on these features when working inside the unit. Therefore, when working inside the unit observe the following:

Turn off the power unless power on is absolutely necessary.
Do not intercept the laser beam with a mirror or any other reflective material or optical components.

2.3 Other Safety Precautions

In addition to the precautions described under Laser Safety, in order to avoid electrical, and other hazards the following should be observed:
Always turn power off before opening the instrument.
Do not remove the top cover on the instrument or attempt to service it, unless trained and qualified to do so.
If service or repair work inside the unit has to be carried while the polygon is rotating, safety goggles must be used to prevent eye injuries if objects or debris are thrown off the rotating polygon.
The instrument contains, internally, several RJ45 connectors for internal use. It is prohibited to connect any of these to any external public telecommunication network.
All data or signal cables connected to the instrument must be shielded by a metal shield, and the shield must be properly connected to a metal housing around the connector. Failure to provide proper shielding of any data or signal cable will invalidate the EMC approvals of the instrument.
Do not use the instrument in an environment where there are explosive materials.
See appendix for declaration of conformity.
NOTE: Removal of the CSN840 top cover shall be done by trained personnel only. Any warranty will be void if work inside the unit is done by personnel not qualified by METTLER-TOLEDO CARGOSCAN.

Chapter 3
Operator Guide using CS2200

3.1 CS2200 overview

The CS2200 is a simple display that shows output from the CSN840.3 and accepts input from the user through the buttons shown in the figure below.

Figur 3-1 Overview of the buttons on the cs2200 display:

Zero(Not applicable for csn840)

Version

Segment test

Start measuring

3.2 Turn on power

Each CSN840 has a power switch outside the enclosure. However, most systems are fitted with a central power switch which can be used to turn on/off the power to all components in the system.

Each CSN840 need appr 60 seconds to start. You will hear the polygon starting after appr 30 sec and after another 15sec the laser beam will be visible.
On the CS2200 display, during the start-up sequence, the following will be shown:
Display segment test. All segments of the display are lit for a few seconds.
Software version is displayed for approximately 5 seconds.
Ready. Start up process is complete and the system is ready for measurement.
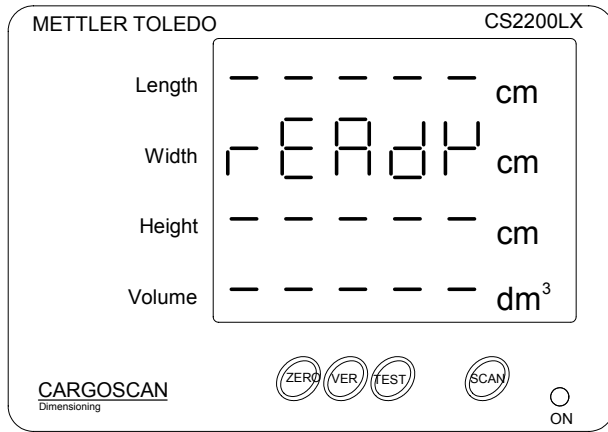
Figur 3-2: CS2200 display after successful start up of CSN840

3.3 Object requirements

Objects of any shape can be measured.

The following limitations for use apply:
The entire object must be within the limits of the measuring field.
The object must not move during measurement
Transparent and semi-transparent objects will not be measured with specified accuracy.

Protrusions: The system will include protruding parts on the object in the reported dimension depending on the size and surface properties of the protrusion:
Protrusions larger than 75x75x75mm. Will always be included in the measurement
Protrusions smaller than 50x50x50mm: Will never be included in the measurement
Protrusions between 50x50x50mm and 75x75x75mm will be included in the measured dimensions depending on detailed shape and surface properties. Bright colours and diffuse (non-glossy) surface will have higher probability to be included than dark, glossy surfaces.

Protrusions on the side of the object, below approximately 12cm height above the background, will have to be larger than 10x10x10cm before they are included in the measurements.

3.4 Measurement

Place the object on the measuring platform and press the SCAN button. The dimensions will be displayed automatically immediately after the entire object has been scanned.

The dimensions of an object will be shown until the next object is measured. If no more objects are measured, after 5 seconds, the display will time out and show READY.

3.5 Successful measurement

If the object is measured correctly, the dimensions will be shown on the display. The reported Length is always the longest dimension, and the reported Width is always the shortes dimension, in the plane of the conveyor. The Height is the height of the object normal to the plane of the conveyor.

The reported Volume is calculated by multiplying the reported values for Length, Width and Height. Note that the unit for Volume is dm^3 whereas it is cm for the dimensions.

3.6 Status messages

3.6.1 Object Messages

In case the measurement was unsuccessful, an object messages will be reported instead of the dimensions of the object. These codes are caused by problems with the measurement of an object, and do not indicate an error with the instrument itself.
A list of available objects codes, with explanations is shown in chapter 3.8 . Please observe that these codes are common to all Cargoscan instruments, and some of them are therefore not relevant for the CSN840 Pallet.
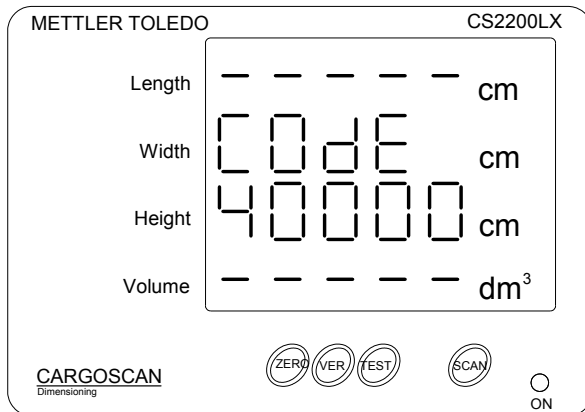
Figur 3-3: Unsuccessful measurement. See Table 6.1 for explanation of the codes.

3.6.2 System status code

System status messages are reported whenever a predefined situation occurs in the software or hardware of the instrument.
These messages are displayed spontanuously when the situation occurs and will stay on the display for 15 seconds before the display go back to ready mode.
System status codes are reported as illustrated in Figur 3-4. The meaning of the information of the display is as follows:

1st line: Error   All codes are reported as "Error", but the status can be one of the following: "Info", "Warning" or "Error"
2nd line NumberIdenty of module reporting the message
3rd line NumberCode number

If any such code appears, do the following:
Observe the display and check whether the same code or any other codes appear repeatedly.
If no more codes are reported, the instrument may be OK. Measure a known object and compare the result with the actual dimensions. If correct, the instrument can be regarded as OK.
If the same code or other codes appears repeatedly, power cycle the instrument and check if the problem disappear. If not, the instrument will need attention of a service technician.
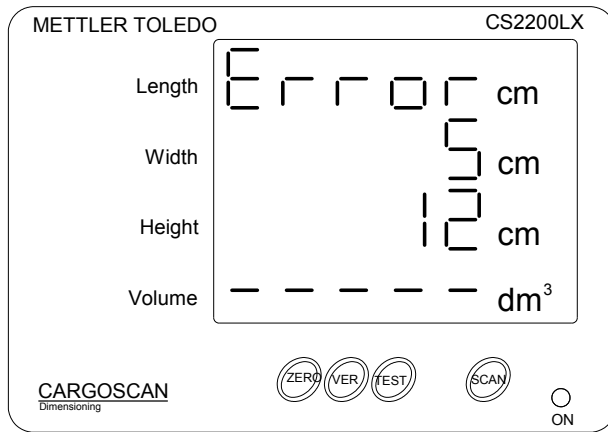
Figur 3-4: System status code.

3.7 Segment test

A segment test is performed at power-up. All segments are lit, row by row.
A segment test can also be triggered by pressing "TEST" button.
Check that all segments are lit. If any segments are dead, the display should be replaced.
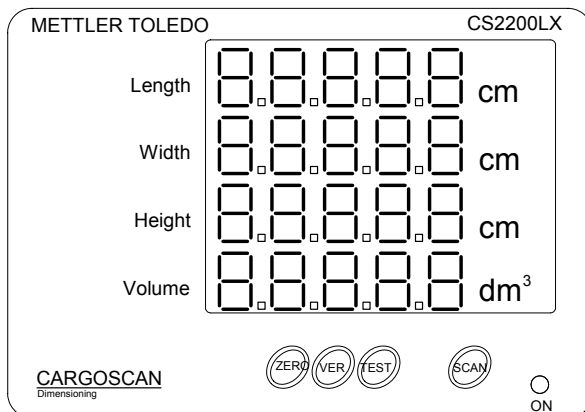
Figur 3-5: Segmentation test. Check that all segments are lit.

3.8 Error and status codes

For every object that is measured, the instrument calculates the dimensions and a status code for the measurement. The status code is a five-digit code, where each digit represents certain measurement conditions. A zero in all digits represents an OK measurement. A non zero value in more than one digit indicates a combination of more than one measurement conditions.
If the status code is zero in all digits, the dimensions of the object are shown on the CS2200 display.
If the status code is non-zero, the status code is displayed instead of the dimensions.
The available object codes are as follows:

Tabell 2 List of Object messages

Code	Description
xxxx1	Object was outside measurement field on the low value x-coordinate side
xxxx2	Object was outside measurement field on the high value x-coordinate side.
xxxx3	Combination of xxxx1 and xxxx2. Object outside measurement field on both sides.
xxxx4	Object was too long to be measured.

Code	Description
xxxx5	Combination of xxxx1 and xxxx4.
xxxx6	Combination of xxxx2 and xxxx4.
xxxx7	Combination of xxxx3 and xxxx4.
xxx1x	Width or Length too small (less than legal minimum width/length).
xxx2x	Width or Length too large (larger than legal maximum width/length).
xxx4x	Object is positioned next to a taller object such that part of the object is hidden in the shadow from the taller one.
xxx8x	Special object recognized. Currently not used by CSN840 Pallet.
xx1xx	Height too small (less than legal minimum height).
xx2xx	Height too large (larger than legal maximum height).
xx4xx	The object's match to a rectangular box is not as close to a rectangular object as required.
xx8xx	Not able to split a cluster of objects into rectangular shaped objects. Various reasons.
x1xxx	Unreliable measurement due to few measurement points, or measurement points found around edge of object are too far apart.
x2xxx	Object height is unreliable. Various reasons.
x3xxx	Combination of x1xxx and x2xxx.
x9xxx	CPU out of memory. Various reasons.
1xxxx	Dimensioning failed. Various reasons.
2xxxx	Package was outside measurement field on the low Y-value coordinate side.
4xxxx	Package was outside measurement field on the high Y-value coordinate side.
8xxxx	Package not placed correctly (e.g. not centered).

Chapter 4
Legal for Trade

4.1 Introduction

The CSN840.3 system has been tested according to OIML R129 and is approved according to the European Measuring Instrument Directive (MID). This means that the system can be used in Legal for Trade applications where such approval is required.

Key features of the system for Legal for Trade applications:

|	
Approved accuracy (MPE)	2 cm
Minimum dimensions (L x W x H)	20 x 20 x 20 cm
Maximum dimensions (L x W x H)	183 x 183 x 260 cm
Shape	No limitations
Surface colour	No limitations
Surface gloss	No limitations
Transparent/translucent	Limited use. See letter of
approval for details	

Chapter 5

Verification and Sealing

Before being put to service in a Legal for Trade application, the CSN840 must be verified and sealed in accordance to national regulations in the country which the instrument shall be used. This section describes how to seal the instrument and how to verify the sealing status.

5.1 Verification

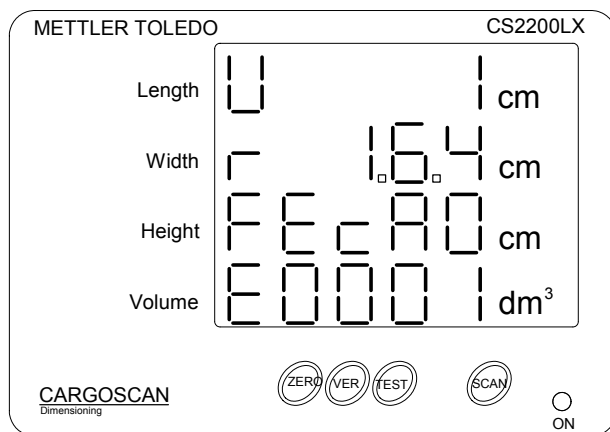Press VER button and verify that the following is shown
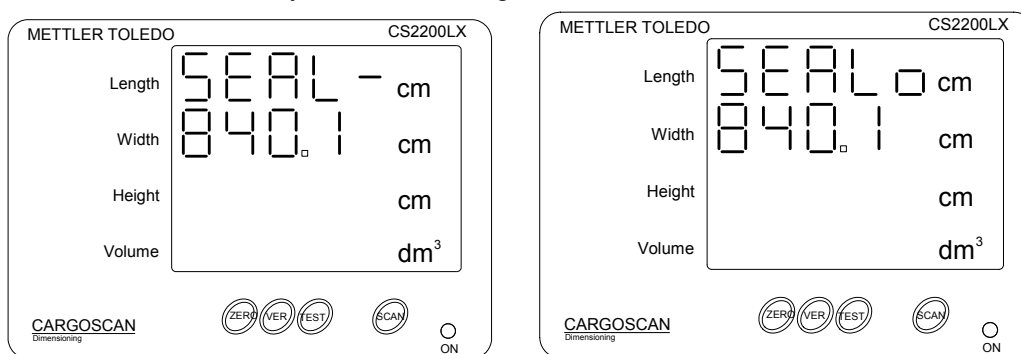
Figur 5-1   Sealing status.

      Not Sealed   (-)   Sealed (o)

Do not approve the instrument unless 'o' is displayed

Press "VER" button again and verify that the following is shown

Figur 5-2 Version information

Here
U   1   Unit no 1. (Press VER to display the other units in the system)
r   1.6.4   Software version number
F EcA0 Functional checksum of the installed software
E 0001 Current value of the Event Counter. This value counts to 10000 before starting over at 0000.

NOTE: The above listed numbers are examples only. In Legal for Trade applications, the Certificate of Approval will contain a list of legal values.

During first time verification of an instrument, verify that the software has a legal version number and legal check sum.

During inspection of a sealed instrument, compare the displayed value of the software version, functional check sum and event counters with the values recorded last time the instrument was sealed. The instrument can be regarded as sealed if these values are identical to the recorded values, and the label or the notes containing these recordings has not been tampered with.

The displayed information will stay for 60 seconds or until "SCAN" button is pressed. The display will then go back to READY mode.

5.2 Metrologic Test

When the sealing information is verified, perform a metrologic test to verify that the measurement results are within the limits specified in the Certificate of Approval for the instrument.

The metrologic test shall be carried out in accordance to national regulations for this type of instruments.

5.3 Sealing

After passing the metrologic test, the instrument can be sealed as described in the following section.

Press "VER" button to display version information.
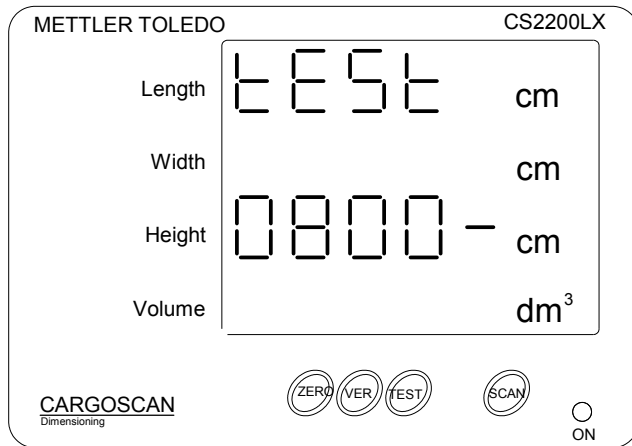
Press the following buttons in order to enter Test Mode. Each button must be released before the next button is pressed.
"TEST"   "VER"   "TEST"

Select Test "0800" with the use of the buttons on the display:
(Note that for this use the functions of the buttons are indicated below the button)
ZERO   Move cursor left
TEST   Move cursor right
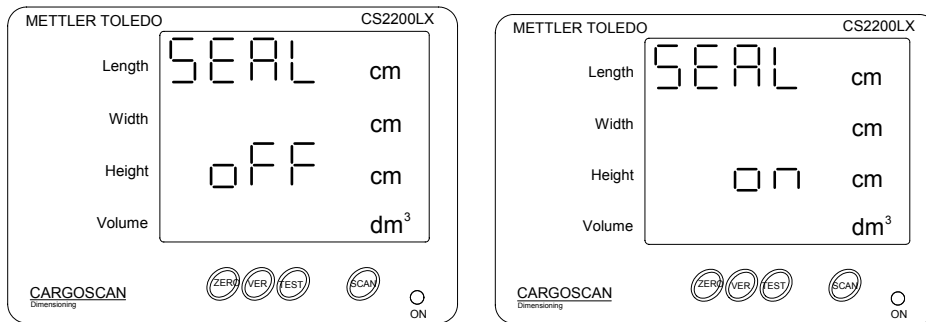VER   Increment the digit at cursor position

Figur 5-3 Entering test mode

When the display shows 0800, press SCAN to continue.

The instrument shall now enter Test Mode. If you want to exit Test Mode instead of continuing, move the cursor to position '-' and press SCAN.

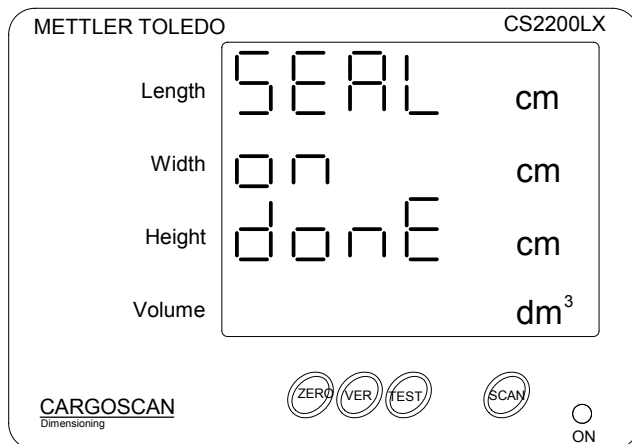The system will display SEAL On or SEAL Off depending on the sealing status.

Figur 5-4 Sealing status

Press "VER" button to toggle the display between OFF and ON.
If you want to exit without sealing, press ZERO.

For sealing, press "VER" until "SEAL On" is shown.
Press SCAN to confirm the sealing and the display will change to "SEAL On Done".

Figur 5-5 Confirmation of electronic sealing

When Sealing has been turned on, the system is sealed, and all subsequent changes to the legal relevant part of the configuration will be recorded in the audit trail, and the relevant Event Counters will be incremented by 1 at each change.

After sealing is turned on, check the event counters as described above and record the value of the Event Counters on a label, in the metrologic book, or other places as required by national regulations.

5.4 Hardware Sealing

In addition to the electronic sealing of the software and configuration, the cover of the enclosure of each CSN840 Dim Head must be sealed with a sticker as shown in the figure below:
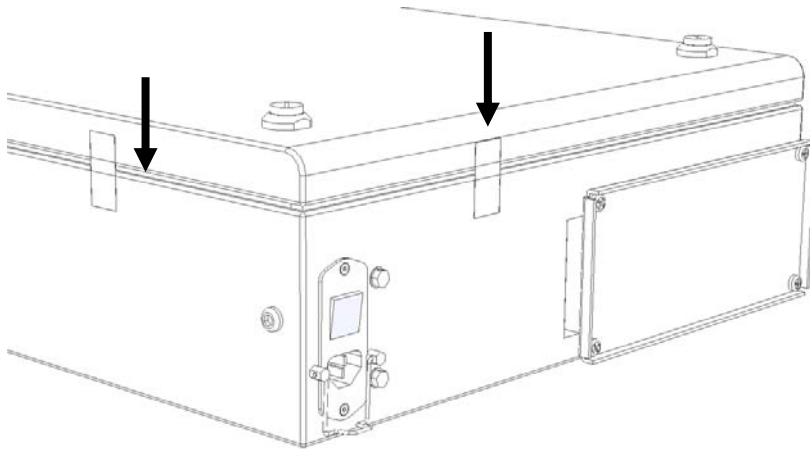
Figur 5-6 Sealing of CSN840 Pallet Enclosure cover.

Chapter 6
Technical Specifications, CSN840.3

Power inlet (specified when ordering):	115V/60HZ version. 230V/50HZ version.
Power consumption:	1,5A (115VAC) / 0,75A (230VAC)
Fuse type	2A/250V alternatively 4A/125V
Operating temperature range:	-10 to 40ºC (Legal for Trade approved). For operation below 0ºC, internal heating should be considered.
Resolution counts	11,5 bit / 3000 counts
Range resolution	1mm
Modulation frequency of laser:	14.105 MHz
Pixel sampling speed:	113.750 kHz
Accuracy:	Height: ±20mm, Length/Width ±20mm
Minimum object size	20.0cm (L) x 20.0cm (W) x 20.0cm (H)

Maximum object size   Length: 183cm
                                  Width: 183cm
                                  Height: 260cm

(Technical capability. Legal for Trade applications may have further restrictions. See Letter of Approval in each country for details.)

Typical measurement time:		<4sec
Data communication:	D1	RS232, 38400 Baud, 8-N-1
	SER.1	RS232, 38400 Baud, 8-N-1
	NET 1&2	10/100Mbs Ethernet. TCP/IP
With VGA (optional):	SER 3&4	RS232, 38400 Baud, 8-N-1
	USB	2 external, 2 internal

Chapter 7
Appendix A: LIST OF CONFORMANCES

The CSN840 is tested and found to conform to the following standards:

7.1 Electromagnetic Compatibility:

EN 61326-1:1997 + A1:1998
EN 61000-6-3:2001
EN 61000-6-2:2001
Tested by Nemko, P.O.Box 73 Blindern, N-0314 Oslo, Norway
Test report 20337, 2004.04.15

7.2 Electrical Safety:

Test Standard: IEC 60950-1:2001 and EN60950-1:2001, First Edition
CAN/CSA-C22.2 No 60950-1-03, 1st Edition
ANSI/UL Std No 60950-1, 1st Edition
Test procedure: CB-scheme
CSA certificate 1589580
Tested by Nemko, P.O.Box 73 Blindern, N-0314 Oslo, Norway
Test report 20337, 2004.04.15

7.3 Laser Safety:

SS-EN-60825-1991 + EN-60825-1-1994 + A11:1996
Tested by SP Sveriges Provnings- och Forskningsinstitutt, Box 857, 501 15 Borås, Sweden
Test report: 93F41656:1993.11.04 + FEf F026097:2000.12.18

Classification: Laser Safety Class 2 (red laser)
See chapter 2 in this manual.
See also instrument label for details.

7.4 Legal for Trade

OIML R129
Test report   xxxxxxxxx
Approval   N-02/2002   MID

Tested by Justervesenet, Fetveien 99, N-2007 Kjeller, Norway