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EC Type-Approval Certificate

No. DK 0199.436 Revision 1

MV2

NON-AUTOMATIC WEIGHING INSTRUMENT

Issued by **DELTA Danish Electronics, Light & Acoustics**
EU - Notified Body No. 0199

In accordance with the requirements for the non-automatic weighing instrument of EC Council Directive 2009/23/EC.

Issued to **Cardinal Scale Manufacturing Company**
203 East Daugherty
P.O. Box 151
Webb City, MO 64870
USA

In respect of Non-automatic weighing instrument designated MV2 with variants of modules of load receptors, load cells and peripheral equipment.
Accuracy class III or IIII, single-interval
Maximum capacity, Max: From 3 kg up to 600 kg
Verification scale interval: e = Max / n
Maximum number of verification scale intervals: n = 6000 (however, dependent on environment and the composition of the modules).

The conformity with the essential requirements in annex 1 of the Directive is met by the application of the European Standard EN 45501:1992/AC:1993 and OIML R76:2006.

The principal characteristics and approval conditions are set out in the descriptive annex to this certificate.

The annex comprises 13 pages.

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Descriptive annex

Contents

1. Name and type of instrument

The weighing instrument is designated the MV2 series, which is a system of modules consisting of an electronic indicator connected to a separate load receptor and peripheral equipment such as printers or other devices, as appropriate. The instrument is a Class III or IIII, self-indicating weighing instrument with single-interval and an external AC mains power supply or internal battery. The weight indicating instrument is available in a single version, which is designed to be mounted to a column that is part of the load receptor or on a horizontal or vertical surface using the optional bracket. It consists of analog to digital conversion circuitry, microprocessor control circuitry, keyboard, non-volatile memory for storage of calibration and weight data, and a weight display contained within a single painted steel enclosure with plastic end caps.

The modules are listed in Sections 3.1 to 3.4. The principle of composition is set out in Sections 6.1 and 10.

2. Description of the construction and function

2.1 Construction

2.1.1 Indicator

The indicator is specified in Section 3.1.

2.1.2 Enclosures and keyboard

The Model MV2 is housed in a painted steel enclosure 172 mm wide × 194 mm high × 45 mm deep and can be mounted on a load receptor column using a bracket with a ball and socket or on a vertical or horizontal surface using an optional bracket. This enclosure is designed to meet an IP55 rating. It is designed primarily for use with medical scales, but can be used with industrial types as well.

The Model MV2 keyboard contains 19 membrane keys used to control the functions of the instrument.

The front panels of the indicator comprise:

- A 7-segment LCD display 22.2 mm in height with a total of five digits and appropriate status indicators to display weight.
- A 7-segment LCD display 12.7 mm in height with a total of four digits to display patient height.
- A 7-segment LCD display 12.7 mm in height with a total of three digits to display BMI (Body Mass Index).
- A 14-segment LCD display 8.9 mm in height with a total of fourteen digits to display patient ID number.
- A keyboard containing 19 keys used to enter commands or data to the weight indicator. Each key is identified with a name and / or pictograph.

The rear panel of the enclosure contains the following:

- A circular connector for a 12 VDC input voltage from the external modular power supply.
- A 9-pin "D" sub-miniature female connector for connection to the load cell or load cell junction box.
- A 9-pin "D" sub-miniature male connector for RS232 connection to a peripheral device.
- A USB Connector.

- A connector for an optional digital height rod (not part of this certification).
- A battery compartment cover with retaining latch.
- An internal connector within the end cap covers for a WIFI interface.

2.1.3 Electronics

The Model MV2 weight indicating instrument uses a single printed circuit board, which contains all of the instrument circuitry including a Free scale MK40DX256VLQ10 32-bit microcontroller. Included are 256Kb of dedicated flash memory, 256 Kb of flex NVM and 64Kb SRAM and 4Kb flex RAM. A 24-bit Sigma Delta CS5530 A/D converter with fixed gain is used to convert the load cell signal into a digital value. All instrument calibration and metrological setup data are contained in non-volatile memory. The power supply is an external universal switching type and can accept an input voltage from the power mains of from 100 to 240 VAC 50 or 60 Hz and supplies 12VDC to the indicator. The indicator produces a load cell excitation voltage of 5 VDC.

2.1.4 Load cells

Set out in Section 3.3.

2.1.5 Load receptors

Set out in Section 3.4.

2.1.6 Interfaces and peripheral equipment

Set out in Section 4.

2.2 Function

The Model MV2 weight indicating instrument is a microcontroller based electronic weight indicator that requires the external connection of strain gauge load cells. The weight information appears in the digital display located on the front panel and may be transmitted to peripheral equipment for recording, processing or display. The Model MV2 operates at an input voltage of 12 VDC from an external power supply connected to the power mains at 100 to 240 VAC 50 or 60 Hz or it can operate from 6 C cell batteries contained within the indicator enclosure. These cells may use either Ni-Cad or NiMH technology, but all six cells must be of the same type.

The primary functions provided are detailed below:

2.2.1 Power up

On power up, the weight indicator will perform a display test, then show the current weight using the previously established zero reference or, if configured to do so, will automatically establish the current weight as the new zero reference. At the same time, the software revision is displayed in the ID display. After a few seconds, the software revision will be turned off and normal weighing operations may begin.

2.2.2 Test function

On power up, the weight indicator will test all memory functions followed by a display test. The display test consists of turning on all display elements including each segment of each digital display and all annunciators.

2.2.3 Display test

A self-test routine is initiated by pressing the ON / OFF key to turn the instrument off then pressing it again to turn the instrument ON. The test routine consists of turning on and off all of the display segments to verify that the display is fully functional.

2.2.4 Display range

The weight indicators will display weight from –6000e to Max +9e (gross weight) within the limits of the display capacity.

2.2.5 Zero-setting

Pressing the ZERO key causes a new zero reference to be established and the ZERO annunciator to turn on indicating the display is at the centre of zero.

Zero-setting range:	±2% of Max.
Zero-tracking range:	±2% of Max.
Initial zero setting range:	≤ ±10% of Max.

Zero-setting can only take place when the weight display is not in motion.

2.2.6 Zero-tracking

The weight indicator is equipped with a zero-tracking feature, which operates over a range of 4% of Max and only when the indicator is at gross zero and there is no motion in the weight display.

2.2.7 Units

The weight can only be displayed in units of kilograms. No other weight units are available.

2.2.8 Tare

The Model MV2 indicator is provided with semi-automatic tare and preset tare features.

2.2.8.1 Semi-automatic tare

Press the TARE key, then press the ID/HEIGHT key. Next, enter a number between 0 and 99 and press the PRINT/ENTER key to store the currently displayed weight value as the new tare weight value under the selected memory or patient location. The weight display will automatically change to the net weight display mode and turn the NET annunciator on. This tare value can be cleared by repeating the procedure when there is no load on the load receptor. The tare entry cannot take place if the load receptor is in motion or if a print operation is taking place.

2.2.8.2 Preset tare

Pressing the TARE key then entering a numeric weight value using the numeric keys followed by pressing the ID/HEIGHT key then enter the location (0 through 99) and press the PRINT/ENTER key to store the entered weight value as the new tare weight assigned to the selected ID or patient location. On pressing the PRINT/ENTER key, the indictor will automatically enter the net weight display mode and turn the NET annunciator on. This tare value can be cleared by repeating the procedure using a zero tare weight. The tare entry cannot take place if the load receptor is in motion or if a print operation is taking place.

2.2.9 Net / gross indication

Once a valid tare weight, other than zero, has been stored, the weight display can be switched from a gross weight display mode to a net weight display mode by pressing the NET / GROSS key. Each time the key is pressed, the display will alternate between the net and gross display modes. If there is no tare value, pressing this key will cause the ID display to show "No Tare".

2.2.10 Printing

A printer may be connected to the serial data port. In the net display mode, the indicator will transmit the gross, tare, and net weights along with patient ID and height, BMI and time and date to the printer each time the PRINT key is pressed. In the gross mode, only the gross weight is transmitted in addi-

tion to the patient ID and height, BMI and time and date. The weight indicator will accept a downloaded print format to include additional data in the form of customer name or number on the printed record. The print will not take place if the load receptor is not stable, if the gross weight is less than zero, if the weight exceeds Max or during data entry from the keyboard.

2.2.11 Gravity compensation

The indicator has a device for compensating for difference in gravity at different geographical locations.
If the weighing instrument is to be used a different place than the one of verification, then the g-value for the place of verification shall be entered before the calibration and verification are performed.
After the verification the operating gravity shall be set to the g-value for the place of use.
This adjustment is sealed.

2.2.12 Operator information messages

The indicator has several general and diagnostic messages, which are described in detail in the MV2 Owner's Manual.

2.2.13 Software version

The software revision level is displayed during the power up sequence of the instrument.

The version format is x-yy-zz, where x is the legal version no., while yy and zz are major and minor version numbers for changes and corrections not influencing the legal function of the software.

The approved software version is 1-yy-zz.

2.3 Available options

2.3.1 Digital Height Rod

A Digital Height Rod (DHR) may be connected to the MV2 indicator to automatically input the patient's height. This device is not part of this certification.

2.3.2 Ethernet Interface

An optional internal pc board assembly is used to add an Ethernet interface for connection to compatible devices.

2.3.3 WiFi Interface

An optional wireless interface board can be used to enable a WiFi interface.

3. Technical data

The Model MV2 weighing instrument is composed of separate modules, which are set out as follows:

3.1 Indicator

The indicator model has the following characteristics:

Type:	Model MV2
Accuracy class:	III and IIII
Weighing range:	Single-interval
Maximum number of Verification:	Scale Intervals: 6000 (class III). 1000 (class IIII)
Internal resolution:	> 100,000 counts
Maximum tare effect:	-Max within display limits
Factional factor:	p'I = 0.5
Minimum input-voltage per VSI:	0.83 μV
Excitation voltage:	5 VDC
Minimum input signal voltage:	0.5 mV
Maximum input signal voltage:	15 mV
Circuit for remote sense:	Active
Minimum input-impedance:	87.5 ohm (4 load cells of 350 ohm)
Maximum input-impedance:	1000 ohm
Temperature range:	+5°C to +40°C
Mains power supply:	12 VDC / 100-240 VAC, 50/60 Hz using external adapter, or 6 C batteries (optional)
Peripheral interface:	Set out in Section 4

3.1.1 Connecting cable between the indicator and the junction box for load cells

Cable between Indictor and load cell(s): 4 wires, shielded

Maximum length between indicator and junction box for load cell(s) if any: 10 m / mm^2

3.2 Load receptors, load cells, and load receptor supports

Removable platforms shall be equipped with level indicators.

3.2.1 General acceptance of modules

Any load cell(s) may be used for instruments under this certificate of type approval provided the following conditions are met:

1) A test certificate (EN 45501) or OIML Certificate of Conformity (R60), respectively issued for the load cell by a Notified Body responsible for type examination under the Directive 2009/23/EC.

2) The certificate contains the load cell types and the necessary load cell data required for the manufacturer's declaration of compatibility of modules (WELMEC 2, Issue 5, 2009), and any particular installation requirements). A load cell marked NH is allowed only if humidity testing to EN 45501 has been conducted on this load cell.

3) The compatibility of load cells and indicator is established by the manufacturer by means of the compatibility of modules form, contained in the above WELMEC 2 document, or the like, at the time of EC verification or declaration of EC conformity of type.

4) The load transmission must conform to one of the examples shown in the WELMEC 2.4 Guide for load cells.

3.2.2 Load cells

The load cells, which are set out below are approved as modules in the weighing instrument:

Manufacturer	Load cell type
Cardinal	CB6
Cardinal	TSP
Cardinal	TB
Cardinal	LFB

3.2.3 Load receptors

Construction in brief:	Steel construction
Reduction ratio:	1
Junction box:	Mounted in or on the platform, if present
Load cells:	Load cell according to Sections 3.2.1 and 3.2.2
Drawings:	Various

3.3 Composition of modules

In case of composition of modules, EN 45501 paragraph 3.5 and 4.12 shall be satisfied.

3.4 Documents

The documents filed at DELTA (reference No. T205886) are valid for the weighing instruments described here.

4. Interfaces and peripheral equipment

4.1 Interfaces

The interfaces are characterised as "Protective Interfaces" according to paragraph 8.4 in the Directive.

4.1.1 Load cell interface

A 9-pin female D-sub miniature connector for the load cell is positioned on the rear panel of the indicator enclosure.
The connected cable shall be less than 3 m long.

4.1.2 Serial I/O interface

A 9-pin male D-sub miniature connector for the serial RS232 interface is positioned on the rear panel of the indicator enclosure.
The connected cable shall be less than 3 m long.

4.1.3 USB interface

A USB interface with type 2 connector is positioned on the rear panel of the indicator enclosure.
The connected cable shall be less than 1.8 m long.

4.1.4 Ethernet interface

An optional Ethernet interface is available and is accessed by a P10 Ethernet connector located on the rear panel of the indicator enclosure.
The connected cable shall be less than 3 m long.

4.1.5 Digital Height Rod interface

An optional Digital Height Rod (DHR) input is accessed by a RJ11 type connector located on the rear panel of the indicator enclosure.
The connected cable shall be less than 1.8 m long.

4.1.6 4.1.5 WIFI interface

A connector located behind the right end cap will accept an optional card to add a WIFI interface.

4.2 Peripheral equipment

Connection between the weight indicator and peripheral equipment is allowed by screened cable.

The instrument may be connected to any simple peripheral device with a CE mark of conformity.

5. Approval conditions

5.1 Measurement functions other than non-automatic functions

Measurement functions that will enable the use of the instrument as an automatic weighing instrument are not covered by this type approval.

5.2 Lock function

The lock function HOLD shall be disabled.

5.3 Height measurement

The height measurement - if present - is not covered by this type approval.

5.4 Compatibility of modules

In the case of composition of modules, WELMEC (Issue 5), July 2009, paragraph 11 shall be satisfied.

6. Special conditions for verification

6.1 Composition of modules

The environmental conditions should be taken into consideration by the composition of modules for a complete weighing instrument, for example instruments with load receptors placed outdoors and having no special protection against the weather.

The composition of modules shall agree with Section 5.4.

An example of a declaration of conformity document is shown in Section 10.

7. Securing and location of seals and verification marks

7.1 Securing and sealing

Seals shall bear the verification mark of a notified body or alternative mark of the manufacturer according to ANNEX II, section 2.3 of the Directive 2009/23/EC.

7.1.1 Indicator

Access to the configuration and calibration facility is achieved by, with the indicator on, pressing and holding the calibration switch until the weight display says "SEtUP", then releasing the switch. Access to the calibration switch is gained by removing the screws from the left end cap on the instrument enclosure and then removing the end cap. The recessed calibration switch is accessed through the small hole at the top of the enclosure. Sealing of the switch is accomplished with wire and seal or with stickers. In order to seal the indicator first place the end cap and then install the retaining screws.
To seal with wire and seal the sealing wire is then passed through the holes in the heads of the two retaining screws used to hold the left end cap to the enclosure.
To seal with stickers the heads of the two screws used to hold the left end cap to the enclosure are covered with a sticker each.

7.1.2 Indicator – load cell connector – load receptor

Securing of the indicator, load receptor, and load cell combined is done by one of the following ways:

- Sealing of the load cell connector / cable by a lead wire seal or using brittle stickers.

In special cases where the place of installation makes it impossible to use the above sealing:

- Inserting the serial number of the load receptor as part of the principal inscriptions contained on the indicator identification label.

- The load receptor bears the serial number of the indicator on its data plate.

7.1.3 Junction box for load cells

Access to the junction box, if any, is prevented by the use of lead wire seals or by sealing it with brittle plastic stickers.

7.1.4 Peripheral interfaces

All peripheral interfaces are "protective"; they neither allow manipulation with weighing data or Legal Setup, nor change the performance of the weighing instrument in any way that would alter the legality of the weighing.

7.2 Verification marks

7.2.1 Indicator

The green M-sticker may be placed on the top side of the indicator.

The sticker with verification marks may be placed on or next to the inscription plate or on the top side of the indicator

7.2.2 Printers used for legal transactions

Printers covered by this type approval and other printers according to Section 4.2, which have been subject to the conformity assessment procedure, shall not bear a separate green M-sticker in order to be used for legal transactions.

8. Location of CE mark of conformity and inscriptions

8.1 CE mark

A sticker with the CE mark of conformity and year of production is located on the identification plate which is located on the top of the enclosure.

8.2 Inscriptions

8.2.1 Indicator

Manufacturer's trademark and name and the type designation is located on the front panel overlay.

On a single brittle plastic sticker located on the top of the Model MV2.

- Certificate No. and the accuracy class

On a single brittle plastic sticker located on the front panel overlay:

- Max, Min, e=

On a label located on the top of the Model MV2.

- Model No., Serial No., electrical data and other inscriptions

8.2.2 Load receptors

On a data plate:

- Manufacturer's name, type, serial number, capacity

In special cases as provided in Section 7.1.2:

- Serial no. of the indicator

9. Pictures

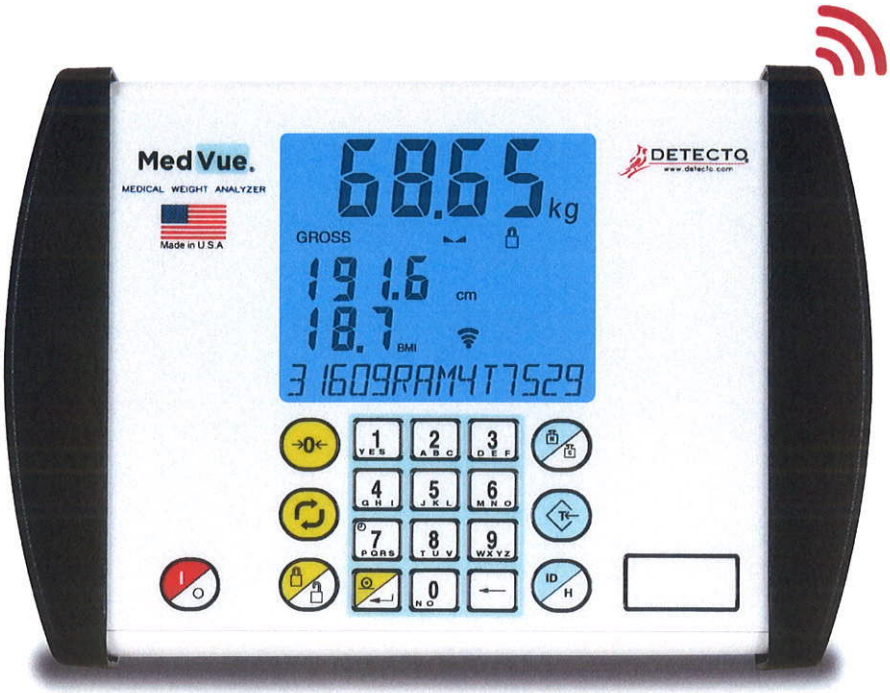

Figure 1 Model MV2 Front panel.

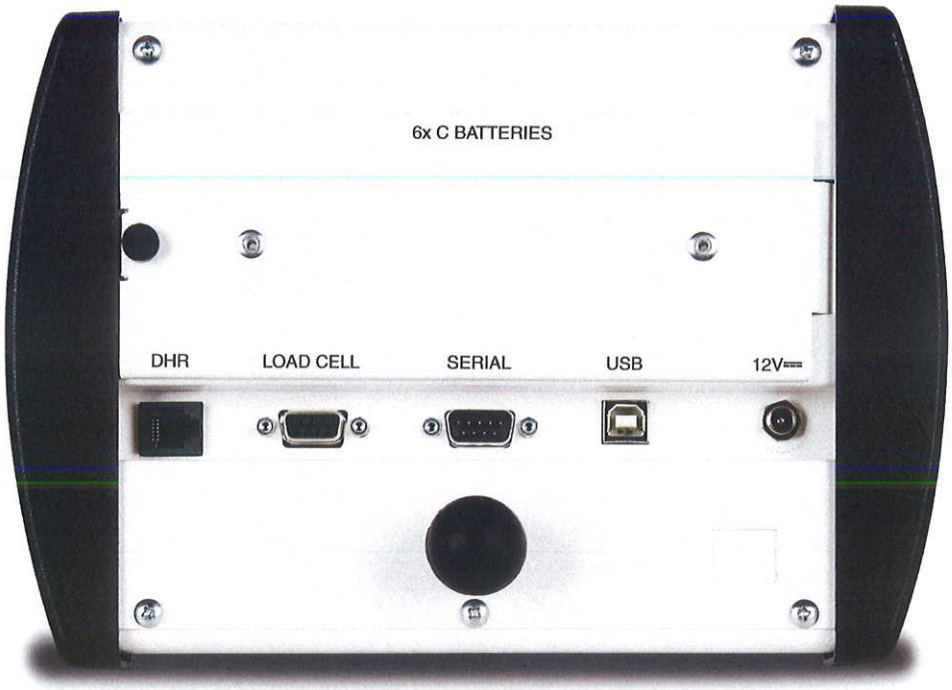

Figure 2 Model MV2 Rear Panel

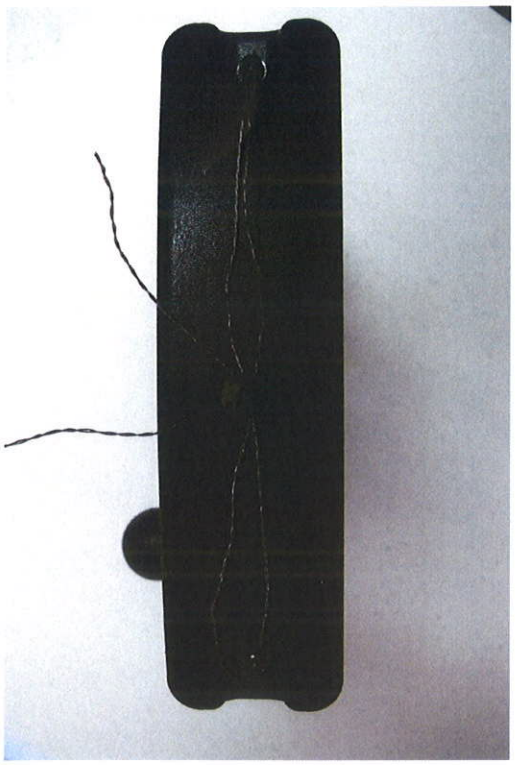

Figure 3 Model MV2 sealing with wire and seal.

Figure 4 Model MV2 sealing with stickers.

10. Composition of Modules – an example

COMPATIBILITY OF MODULES

Ref.: WELMEC 2

Non-Automatic Weighing Instrument, single-interval

Certificate of EU Type-Approval N°: TAC: DK0199.436

INDICATOR A/D (Module 1)	Type:	MV2				
Accuracy class according to EN 45501 and OIML R76:		$Class_{ind}$ (I, II, III or IIII)		III		
Maximum number of verification scale intervals (n_{max}):		n_{ind}		6000		
Fraction of maximum permissible error (mpe):		p_1		0,5		
Load cell excitation voltage:		U_{exc}	[Vdc]	5		
Minimum input-voltage per verification scale interval:		Δu_{min}	[µV]	0,83		
Minimum load cell impedance:		R_{Lmin}	[Ω]	87,5		
Coefficient of temperature of the span error:		Es	[% / 25°C]			
Coefficient of resistance for the wires in the J-box cable:		Sx	[% / Ω]			
Specific J-box cable-Length to the junction box for load cells:		$(L/A)_{max}$	[m / mm²]			
Load cell interface:				4-wire (no sense)		
Additive tare, if available:		T^+	[% of Max]	0		
Initial zero setting range:		IZSR	[% of Max]	-2	/	2
Temperature range:		T_{min} / T_{max}	[°C]	5	/	40
Test report (TR), Test Certificate (TC) or OIML Certificate of Conformity:						
LOAD RECEPTOR (Module 2)	Type:					
Construction:				Platform		
Fraction of mpe:		p_2		0,5		
Number of load cells:		N		1		
Reduction ratio of the load transmitting device:		$R=F_M / F_L$		1		
Dead load of load receptor:		DL	[% of Max]	5		
Non uniform distribution of the load:	(NUD = 0 is acceptable)	NUD	[% of Max]	0		
Correction factor:	$Q = 1 + (DL + T^+ + IZSR^+ + NUD) / 100$			1,07		
LOAD CELL ANALOG (Module 3)	Type:	TSSP-200kgw				
Accuracy class according to OIML R60:		$Class_{LC}$ (A, B, C or D)		C		
Maximum number of load cell intervals:		n_{LC}		3000		
Fraction of mpe:		p_3		0,7		
Rated output (sensitivity):		C	[mV / V]	2		
Input resistance of single load cell:		R_{LC}	[Ω]	350		
Minimum load cell verification interval:	($v_{min\%}$ = 100 / Y)	$v_{min\%}$	[% of Emax]	0,0125		
Rated capacity:		E_{max}	[kg]	230		
Minimum dead load, relative:		$(E_{min} / E_{max}) * 100$	[%]	0		
Temperature range:		T_{min} / T_{max}	[°C]	-10	/	40
Test report (TR) or Test Certificate (TC/OIML) as appropriate:		R60/2000-DK-04.05				
COMPLETE WEIGHING INSTRUMENT		Single-interval				
Manufacturer: Cardinal	Type:	MV2 platform scale				
Accuracy class according to EN 45501 and OIML R76:		$Class_{WI}$ (I, II, III or IIII)		III		
Fractions: $p_i = p_1^2 + p_2^2 + p_3^2$:		p_i		1,0		
Maximum capacity:		Max	[kg]	150		
Number of verification scale intervals:		n		3000		
Verification scale interval:		e	[kg]	0,05		
Utilisation ratio of the load cell:	$\alpha = (Max / E_{max}) * (R / N)$			0,65		
Input voltage (from the load cells):	$\Delta_u = C * U_{exc} * \alpha * 1000 / n$		[µV/e]	2,17		
Cross-section of each wire in the J-box cable:		A	[mm²]			
J-box cable-Length:		L	[m]			
Temperature range to be marked on the instrument:		T_{min} / T_{max}	[°C]	5	/	40
Peripheral Equipment subject to legal control:						

Acceptance criteria for compatibility				Passed, provided no result below is < 0	
$Class_{WI}$	<=	$Class_{ind}$ & $Class_{LC}$	(WELMEC 2: 1)	$Class_{WI}$:	PASSED
pi	<=	1	(R76: 3.5.4.1)	1 - pi =	0,0
n	<=	n_{max} for the class	(R76: 3.2)	n_{max} for the class - n =	7000
n	<=	n_{ind}	(WELMEC 2: 4)	n_{ind} - n =	3000
n	<=	n_{LC}	(R76: 4.12.2)	n_{LC} - n =	0
E_{min}	<=	DL * R / N	(WELMEC 2: 6d)	(DL * R / N) - E_{min} =	7,5
$v_{min} * \sqrt{N} / R$	<=	e	(R76: 4.12.3)	e - (v_{min} * $\sqrt{N}$ / R) =	0,021
or (if v_{min} is not given)				Alternative solutions: ↑ ↓	
$(E_{max} / n_{LC}) * (\sqrt{N} / R)$	<=	e	(WELMEC 2: 7)	e - ((E_{max} / n_{LC}) * ($\sqrt{N}$/ R)) =	
Δu_{min}	<=	Δu	(WELMEC 2: 8)	$\Delta u - \Delta u_{min}$ =	1,34
R_{Lmin}	<=	R_{LC} / N	(WELMEC 2: 9)	(R_{LC} / N) - R_{Lmin} =	263
L / A	<=	$(L / A)_{max}^{WI}$	(WELMEC 2: 10)	$(L / A)_{max}^{WI}$ - (L / A) =	Not applicable
T_{range}	<=	T_{max} - T_{min}	(R76: 3.9.2.2)	(T_{max} - T_{min}) - T_{range} =	5
Q * Max * R / N	<=	E_{max}	(R76: 4.12.1)	E_{max} - (Q * Max * R / N) =	69,5

Signature and date:

Conclusion . . . . . ***PASSED***

This is an authentic document made from the program "Compatibility of NAWI-modules version 3.2".