



Australian Government
Department of Industry and Science

National Measurement Institute

Supplementary Certificate of Approval NMI S433

Issued by the Chief Metrologist under Regulation 60
of the
National Measurement Regulations 1999

This is to certify that an approval for use for trade has been granted in respect of the instruments herein described.

Cardinal Model 220 Digital Indicator

submitted by Cardinal Scale Manufacturing Co
203 East Daugherty Street
Webb City MO 64870
USA

NOTE: This Certificate relates to the suitability of the pattern of the instrument for use for trade only in respect of its metrological characteristics. This Certificate does not constitute or imply any guarantee of compliance by the manufacturer or any other person with any requirements regarding safety.

This approval has been granted with reference to document NMI R 76, *Non-automatic weighing instruments, Parts 1 and 2*, dated July 2004.

This approval becomes subject to review on **1/04/20**, and then every 5 years thereafter.

DOCUMENT HISTORY

Rev	Reason/Details	Date
0	Pattern & variants 1 to 3 approved – interim certificate issued	2/03/04
1	Pattern & variants 1 to 3 approved – certificate issued	12/05/04
2	Variants 4 & 5 approved – certificate issued	24/01/07
3	Variant 5 amended – notification of change issued	23/03/07
4	Variant 6 approved – certificate issued	12/09/08
5	Pattern & variants 1 to 6 reviewed – Variant 7 approved – interim certificate issued	2/10/09
6	Pattern & variants 1 to 6 reviewed – Variant 7 approved – certificate issued	2/11/09
7	Variants 8 to 10 approved – interim certificate issued	30/03/15
8	Pattern & variants 1 to 7 reviewed & updated – variants 8 to 10 approved – certificate issued	17/09/15

CONDITIONS OF APPROVAL

General

Instruments purporting to comply with this approval shall be marked with pattern approval number 'NMI (or NSC) S433' and only by persons authorised by the submitter.

Instruments incorporating a component purporting to comply with this approval shall be marked 'NMI (or NSC) S433' in addition to the approval number of the instrument, and only by persons authorised by the submitter.

It is the submitter's responsibility to ensure that all instruments marked with this approval number are constructed as described in the documentation lodged with the National Measurement Institute (NMI) and with the relevant Certificate of Approval and Technical Schedule. Failure to comply with this Condition may attract penalties under Section 19B of the National Measurement Act and may result in cancellation or withdrawal of the approval, in accordance with document NMI P 106.

Auxiliary devices used with this instrument shall comply with the requirements of General Supplementary Certificates No S1/0/A or No S1/0B.

The values of the performance criteria (maximum number of scale intervals etc.) applicable to an instrument incorporating the pattern approved herein shall be within the limits specified herein and in any approval documentation for the other components.

This approval shall NOT be used in conjunction with General Certificate No 6B/0.

The pattern as approved herein or with substitute NMI-approved load cells and/or indicators, and in other capacities, or with different platform sizes, shall comply with General Certificate No 6B/0.

Signed by a person authorised by the Chief Metrologist
to exercise their powers under Regulation 60 of the
National Measurement Regulations 1999.

A handwritten signature in black ink, appearing to be 'A. Rawlinson', with a horizontal line underneath.

Dr A Rawlinson

TECHNICAL SCHEDULE No S433

1. Description of Pattern

approved on 2/03/04

A Cardinal model 220 digital mass indicator which may be configured to form part of:

- A class III weighing instrument with a single weighing range of up to 10 000 verification scale intervals; or
- with two partial weighing ranges (each with its own verification scale interval) in which case it is approved for use with up to 10 000 verification scale intervals per partial weighing range, i.e. a multi-interval instrument.

Instruments may be fitted with output sockets (output interfacing capability) for the connection of auxiliary and/or peripheral devices.

Instruments are powered directly by mains AC power.

This approval does not include the use of the indicator as an automatic weighing instrument, unless specifically mentioned in a certificate of approval for such an instrument.

TABLE 1 – Specifications

Maximum number of verification scale intervals	10 000 or 10 000 per range
Minimum sensitivity	0.9 μV /scale interval
Excitation voltage	12 V DC
Maximum excitation current	480 mA

1.1 Zero

A zero tracking device may be fitted.

Note: For multi-interval operation, zero is automatically corrected to within $\pm 0.25e_1$ whenever the instrument comes to rest within $0.5e_1$ of zero.

The instrument has a semi-automatic zero setting device (to set the instrument to within $\pm 0.25e$ of zero) with a nominal range of not more than 4% of the maximum capacity of the instrument.

The instrument has an initial zero-setting device with a nominal range of not more than 20% of the maximum capacity of the instrument.

1.2 Tare

A semi-automatic subtractive taring device of up to the maximum capacity of the instrument may be fitted. A pre-set taring device of up to the maximum capacity (or of up to the Max_1 for multi-interval instruments) may also be fitted.

1.3 Display Check

A display check is initiated whenever power is applied.

1.4 Additional Features


The pattern also has certain additional functions (totalising, counting, set point controls (including for filling purposes), under/over checkweighing, weight grading, batching).

However this approval does not include the use of the indicator as an automatic weighing instrument, unless specifically mentioned in a certificate of approval for such an instrument.

The additional functions (other than the indications of measured mass, i.e. gross, tare, net, totals, displayed either on the indicator or on an auxiliary or peripheral device) are not approved for trade use.

1.5 Markings and Notices

Instruments carry the following markings:

Manufacturer's mark, or name written in full	Cardinal Scale
	Manufacturing Co
Name or mark of manufacturer's agent
Indication of accuracy class	
Maximum capacity	<i>Max</i> kg #1
Minimum capacity	<i>Min</i> kg #1
Verification scale interval	<i>e</i> = kg #1
Maximum subtractive tare	<i>T</i> = - kg #2
Serial number of the instrument
Pattern approval number for the indicator	NMI (or NSC) No S433
Pattern approval number for other components #3

#1 These markings are also shown near the display of the result if they are not already located there.

#2 This marking is required if *T* is not equal to *Max*.

#3 May be located separately from the other markings.

In addition, instruments not greater than 100 kg capacity shall carry a notice stating NOT TO BE USED FOR TRADING DIRECT WITH THE PUBLIC, or similar wording.

Note:

For multi-interval instruments the markings shall be as above, with the exception of the following:

Maximum capacity *Max*/..... kg *
Verification scale interval *e* =/..... kg *

1.6 Verification Provision

Provision is made for the application of a verification mark.

1.7 Sealing Provision

Provision is made for the calibration adjustments to be sealed by use of a lead and wire seal to prevent removal of the calibration access screw on the back of the indicator (Figure 2).

2. Description of Variant 1 **approved on 2/03/04**

The Cardinal model 200 indicator is a single interval instrument (Figure 3). This model is similar to the pattern but has basic functions only and is in a different style enclosure. This model does not have the pre-set tare facility.

2.1 Sealing Provision

Provision is made for the calibration adjustments to be sealed by use of one or more lead and wire seals to prevent removal of the two calibration access screws on the back of the indicator (Figure 4).

3. Description of Variant 2 **approved on 2/03/04**

The Cardinal model 205 indicator (Figure 5) is a single interval instrument which is similar to the pattern but has basic functions only. This model does not have the pre-set tare facility.

3.1 Sealing Provision

As described in clause 1.7 for the model 220 (the pattern).

4. Description of Variant 3 **approved on 2/03/04**

The Cardinal model 210 indicator (Figure 6) is a single interval instrument which is similar to variant 2 (model 205) but has a different keypad including numeric keys, and has some additional functions (e.g. counting, time).

4.1 Sealing Provision

As described in clause 1.7 for the model 220 (the pattern).

5. Description of Variant 4 **approved on 23/01/07**

The Cardinal model 215 is a single interval instrument which is similar to variant 3 (model 210) but has a larger display and case size.

6. Description of Variant 5 **approved on 23/01/07**

The pattern and variants may also be known as certain models of the Nuweigh 300 or JAC 300 series, as listed below:

- Cardinal model 200 aka Nuweigh model 305 or JAC 305
- Cardinal model 205 aka Nuweigh model 315 or JAC 315
- Cardinal model 210 aka Nuweigh model 318 or JAC 318
- Cardinal model 215 aka Nuweigh model 320 or JAC 320
- Cardinal model 220 aka Nuweigh model 330 or JAC 330

7. Description of Variant 6 **approved on 11/09/08**

The Cardinal model 210-FE which is similar to the model 210 (variant 3) but has a larger display, keyboard and housing.

This model may also be known as a Nuweigh model JAC 318-FE (Figure 7).

Note that the '-FE' suffix is not necessarily shown in the instrument markings.

8. Description of Variant 7

approved on 2/10/09

The Cardinal model 225 (Table 2) which is similar to the pattern (model 220) except that it is fitted with a QWERTY-type keyboard, up to three analogue basework inputs, and a summing function.

This model may also be known as a Nuweigh model JAC 350 (Figure 8).

Provision is made for access to the calibration adjustments to be sealed by applying destructible adhesive labels in at least two places on the back cover of the instrument.

TABLE 2 – Specifications for Variant 7

Maximum number of verification scale intervals	10 000 or 10 000 per range
Minimum sensitivity	0.7 μ V/scale interval
Excitation voltage	12 V DC
Maximum excitation current (per basework input)	275 mA

8.1 Facility for up to three analogue baseworks, and summing function

Up to three baseworks may be connected to the indicator (requiring the use of a 'Two Scale Input Board').

The indication corresponding to a particular basework is identified by a number (either 1, 2 or 3) above the kg symbol in the indication. In addition, the summed indication is indicated by 'TOT' above the kg symbol in the indication. This facility is similar to a summing indicator as described in NMI General Supplementary Certificate of Approval No S1/0/A.

When operating in this mode:

- Each basework shall be of the same configuration, and shall not be a multi-interval or multiple range configuration.
- The summed indication will display '-----' if any of the basework indications is below zero or above Max+9e.
- Operation of the semi-automatic zero setting device operates on all baseworks simultaneously.
- The individual basework indications always display Gross mass.
- Where a tare is in operation, the summed ('TOT') indication may display Gross or Net.
- Pre-set tare may be operational.
- Each basework shall be clearly identified to correspond to the appropriate scale display shown on the indicator. That is, there shall be a clear correspondence between the basework identification, and the particular scale displays ('1', '2' or '3'). Trade Measurement Authorities may require additional markings or signs to ensure that these relationships are clear.

Note: The symbol 'CZ' (centre zero) is used as the zero indication.





9. Description of Variant 8

approved on 30/03/15

The Cardinal model 225 which is similar to variant 7 (Figure 8) but has surface mounted printed circuit boards.

This model may also be known as a Nuweigh model JAC 350.



This variant may be configured to form part of:

- A class  weighing instrument with a single weighing range of up to 10 000 verification scale intervals; or
- A class  weighing instrument with a single weighing range of up to 1000 verification scale intervals; or
- A class  multi-interval weighing instrument with up to two partial weighing ranges (each with its own verification scale interval) in which case it is approved for use with up to 10 000 verification scale intervals per partial weighing range; or
- A class  multi-interval weighing instrument with up to two partial weighing ranges (each with its own verification scale interval) in which case it is approved for use with up to 1000 verification scale intervals per partial weighing range.

The instrument has a stainless steel enclosure with a LED display for display of the weight value.

Instruments are fitted with a linearisation correction facility having a single correction point.

TABLE 3 – Specifications for Variant 8

Maximum number of verification scale intervals	10 000 (class  1000 (class )
Minimum sensitivity	0.5 μ V/scale interval
Excitation voltage	12 V DC
Maximum excitation current	275 mA
Fraction of maximum permissible error	$p_i = 0.5$
Minimum load cell impedance	43.8 Ω
Maximum load cell impedance	1100 Ω
Measuring range minimum voltage	1 mV
Measuring range maximum voltage	40 mV
Maximum tare range	- Max
Operating temperature range	-10°C to +40°C
Load cell connection	4 or 6 wire plus shield

9.1 Sealing Provision

Provision is made for access to the calibration switch within the instrument to be sealed by means of destructible labels placed over opposite sides of a join in the instrument housing as shown in Figure 9.

Alternatively the indicator is sealed by recording the audit trail counter on verification.

Access to allow changing of set-up parameters including calibration parameters must be protected by a passcode.

The indicator automatically increments a configuration and/or calibration value (audit trail number) each time the indicator is re-configured and/or calibrated.

The value(s) of these counters may be recorded on a destructible adhesive label attached to the instrument (e.g. as CONFIGURATION COUNTER, CALIBRATION COUNTER).

Any subsequent alteration to the calibration or configuration will be evident as the recorded values and the current counter values will differ.

The instructions for accessing the configuration and calibration audit trail are as follows (starting from the normal weighing mode):

- Press the 'SHIFT' key and then press the Navigation 'ENTER' key (red square key), and then the SETUP/REVIEW MENU is displayed.
- Enter 2 to enter COUNTER MENU. The Calibration and Configuration counter values are displayed.
- Press any key to exit.

10. Description of Variant 9

approved on 30/03/15

The Cardinal model 212GX (Figure 10) is single interval instrument which is similar to the pattern but having a separate PCB for a 15-segment LCD display, a 24-key keypad and a polycarbonate housing.

This model may also be known as a Nuweigh model JAC 312GX.

10.1 Sealing Provision

Provision is made for the calibration adjustments and configuration parameters to be sealed by means of destructible labels placed over the span switch access hole and opposite sides of a join in the instrument housing. Sealing arrangements are shown in Figures 11a and 11b.

11. Description of Variant 10

approved on 30/03/15

The Cardinal model 212G is single interval instrument which is similar to the model 212GX (variant 9) but having a smaller LCD display.

This model may also be known as a Nuweigh model JAC 312G.

11.1 Sealing Provision

As described in clause 10.1 for the variant 9.

TABLE 4 – Specifications for Variants 9 and 10

Maximum number of verification scale intervals	10 000 (class Ⅲ)
Minimum sensitivity	1000 (class Ⅲ) 0.7 μV /scale interval; or 0.9 μV /scale interval (#)
Excitation voltage	12 V DC
Maximum excitation current	275 mA; or 480 mA (#)
Fraction of maximum permissible error	$p_i = 0.5$
Minimum load cell impedance	43.8 Ω ; or 25 Ω (#)
Maximum load cell impedance	1000 Ω
Measuring range minimum voltage	1 mV
Measuring range maximum voltage	40 mV
Maximum tare range	- Max
Operating temperature range	-10°C to +40°C
Load cell connection	4 or 6 wire plus shield

(#) When used with a model 220 indicator (the pattern)

TEST PROCEDURE

Instruments shall be tested in accordance with any relevant tests specified in the National Instrument Test Procedures.

The instrument shall not be adjusted to anything other than as close as practical to zero error, even when these values are within the maximum permissible errors.

Maximum Permissible Errors

The maximum permissible errors are specified in the *National Trade Measurement Regulations 2009*.

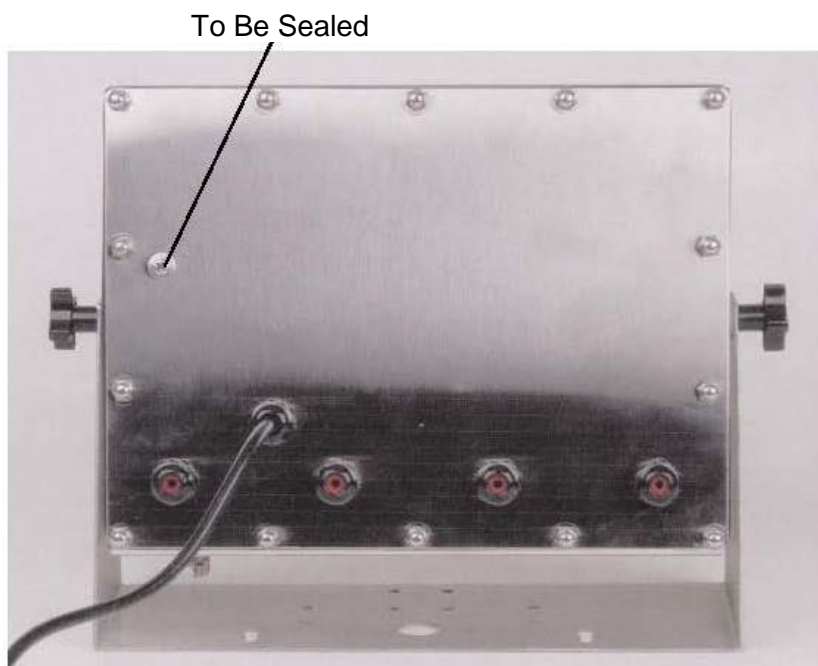
For multi-interval and multiple range instruments with verification scale intervals of $e_1, e_2 \dots$, apply e_1 for zero adjustment, and maximum permissible errors apply $e_1, e_2 \dots$, as applicable for the load.

FIGURE S433 – 1



Cardinal Model 220 Digital Indicator (Pattern)

FIGURE S433 – 2



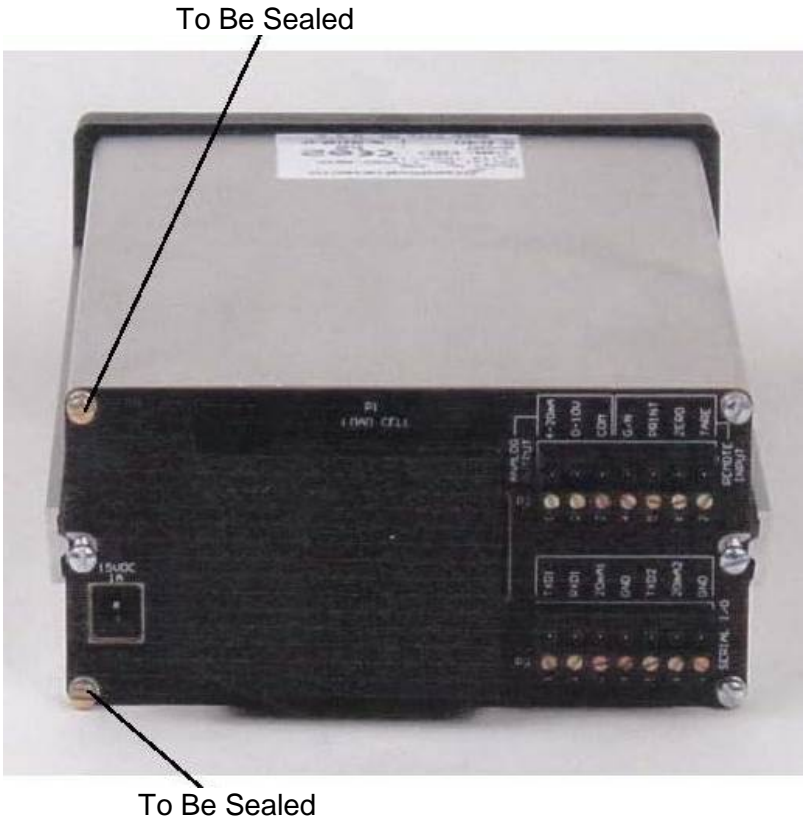
Typical Mechanical Sealing (Pattern & some variants)

FIGURE S433 – 3



Cardinal Model 200 Digital Indicator (Variant 1)
(aka Nuweigh Model 305 or JAC 305)

FIGURE S433 – 4



Typical Mechanical Sealing (Variant 1)

FIGURE S433 – 5



Cardinal Model 205 Digital Indicator (Variant 2)
(aka Nuweigh Model 315 or JAC 315)

FIGURE S433 – 6



Cardinal Model 210 Digital Indicator (Variant 3)
(aka Nuweigh Model 318 or JAC 318)

FIGURE S433 – 7



Nuweigh Model JAC 318-FE Digital Indicator (Variant 6)
(aka Cardinal Model 210-FE)

FIGURE S433 – 8



(a) Nuweigh Model JAC 350 Digital Indicator (Variant 7)
(aka Cardinal Model 225) – Indicator and keyboard

FIGURE S433 – 8



(b) Nuweigh Model JAC 350 Digital Indicator (Variant 7)
(aka Cardinal Model 225) – Indication showing summing and
'centre zero' ('CZ') display

FIGURE S433 – 9



Typical Mechanical Sealing (Variant 8)

FIGURE S433 – 10



Cardinal Model 212GX Digital Indicator (Variant 9)
(aka Nuweigh Model JAC 312GX)

FIGURE S433 – 11



Typical Mechanical Sealing (Variants 9 & 10)

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