DANAK
PROD Reg. nr 7026

FORCE Certification

EVALUATION CERTIFICATE

No. 0200-WL-11025

Object name	**LDU 78.1 version 3**
Object type	**A weight transmitter for automatic gravimetric filling instruments**
Issued by	**FORCE Certification** EU - Notified Body No. 0200
In accordance with	OIML R61:2004, OIML D11:2004 section 12 and 13 applying severity level 3 WELMEC Guide 2.8:2012 WELMEC Guide 7.2:2019 WELMEC Guide 8.8:2017.
Issued to	**Hauch & Bach ApS** Femstykket 6 DK-3540 Lynge Denmark
Manufacturer	**Hauch & Bach ApS**
In respect of	A weight transmitter suitable to be incorporated in automatic gravimetric filling instruments.
Description and documentation	The weight transmitter is described and documented in the annex to this certificate.
Remarks	Summary of tests involved: See the annex to this certificate.

Note: This certificate is a revised edition which replaces DK0199-R61-10.10

This evaluation certificate cannot be quoted in an EU type examination certificate without permission from the holder of the certificate mentioned above.

The annex comprises 14 pages.

Issued on **2021-07-15**

Jens Hovgård Jensen
2021-07-15

Digitally signed by Jens Hovgård Jensen
jhje@force.dk
Certification Manager

FORCE Certification references:
Task no.: 121-27804.90.10 and ID no.: 0200-WL-11025

Signatory: Jens Hovgård Jensen

Descriptive annex

Contents

1. Name and type of instrument and modules

The A/D device is designated Load cell Digitizing Unit LDU 78.1 version 3, suitable to be incorporated in an automatic gravimetric filling instrument.

2. Description of the construction and function

2.1 Construction

The electronic device consists of a single circuit board, SMD populated at one side and housed in a tinned mild steel shielding enclosure.

The front of the enclosure carries a non-detachable overlay where the metrological data etc. are printed. Small sections of the circuit board, one in each end of the device, act as connection areas for the input header, respectively output and power supply wires.

The input header consists of 10 terminals, as a single row pins 2.54 mm pitch: 6 terminals for the load cell wires, 2 terminals for the cable shield and 2 terminals not connected.

The output header consists of 10 terminals, suitable for two row pins 2.54 mm pitch: 4 terminals are for the full duplex interface ports, 4 terminals are for two protected logic inputs and two protected logic outputs, and 2 terminals are for the power supply lines.

All the non-ground I/O terminals are supplied with T-filter barriers.

The electronic sections are the quality dc input instrumentation amplifier, the 20 bit A/D-converter and the 16 bit microprocessor which include the UART for the RS422/485 interface, the RAM and the Flash-type EPROM for the program memory. On board is further found an EE-PROM which holds the calibration data, an interface receiver / driver, the logic input and output conditioning circuit and the non-isolated power conditioning regulator and power watch makes further parts of the circuitry.

All instrument calibration and metrological setup data are held in the non-volatile EE-PROM memory.

Software

The software version may be viewed by sending “IV” to the unit, which responds with V:xxyy
The tested software version is 2.46 (V:0246) for single-interval and software version 2.47 (V:0247) for single-interval / multi-range / multi-interval.

Access to metrological characteristics and span adjustment

Access to the configuration and calibration facility is achieved by sending a Traceable Access Code (TAC), which is a non-volatile number, which is automatically incremented each time the calibration modus is left by the operator. The TAC may be reviewed by sending CE to the unit, which responds the status code as CExxxxx. The code increments up to 65535.

Securing of metrological characteristics and span adjustment

Access to the configuration and calibration facility is secured by the TAC.

2.2 Functions

The LDU 78.1 is a microprocessor based electronic digitising unit for a load cell signal, which enables the production of a weight indicating instrument that requires the external connection of strain gauge load cells and a weight display unit. Furthermore, the weight information may be transmitted to peripheral equipment for recording, processing, or display. The LDU 78.1 digitising unit is available for operation from a coarsely regulated DC-supply 12 - 24 VDC. If the impedance of the connected load cell(s) is below 350 ohm, the LDU 78.1 should only be supplied with 12 – 14 VDC in order to avoid inappropriate heating of the unit.

The primary groups of functions provided are as follows,

2.2.1 Power monitoring

2.2.2 System Diagnostics

2.2.3 Calibration functions

2.2.4 Motion detection functions

2.2.5 Filter settings

2.2.6 Output configuring

2.2.7 Auto transmit

2.2.8 Remote input/output commands

2.2.9 Communication set-up

2.2.10 Identification number

2.2.11 Legal setup consecutive number

2.2.12 Save setup parameters

3. Technical data

3.1 LDU 78.1 version 3 based automatic gravimetric filling instrument

The following technical data apply for an automatic gravimetric filling instrument based on LDU 78.1 version 3 for filling performed with a single load:

Reference class Ref(x):	0.5
Accuracy class X(x):	0.5 or 1 or 2
Maximum capacity (Max):	= n × d
Minimum filling (MinFill):	see tables in section 3.1.1 below
Minimum capacity (Min):	= Minfill (1 load per fill)
Verification scale interval (d):	≥ 0.5 g
Weighing range:	Single-interval, multi-range or multi-interval
Number of Verification Scale Intervals (n_i):	≤ 10000
Maximum tare effect:	≤ 100 % of Max
Temperature range:	-15° to 55° C
Weighing mode:	static
Electromagnetic class:	E2
Humidity:	Non-condensing
Maximum time between automatic zero-setting:	see tables in section 3.1.1 below
Minimum warm-up time:	see values in section 3.1.1 below

3.1.1 MinFill's dependency of verification scale interval (d) and accuracy class.

Case I Verification scale interval: 0.3 µV ≤ d < 0.6 µV and Extra warm-up time: 16 minutes

MinFill

d	Accuracy class X(0.5)		X(1)		X(2)	
[g]	d	[kg]	d	[kg]	d	[kg]
0.1	237	0.0237	60	0.006	15	0.0015
0.2	237	0.0474	60	0.012	15	0.003
0.5	710	0.355	60	0.03	15	0.0075
1	1420	1.42	119	0.119	15	0.015
2	1420	2.84	178	0.356	15	0.03
5	1420	7.1	355	1.775	30	0.15
10	2130	21.3	355	3.55	45	0.45
20	2130	42.6	355	7.1	89	1.78
50	2130	106.5	533	26.65	89	4.45
100	2130	213	533	53.3	89	8.9
200	2130	426	533	106.6	134	26.8
≥ 500	2130	-	533	-	134	-

Maximum time between automatic zero-setting

Accuracy class		
X(0.5)	**X(1)**	**X(2)**
120 minutes	105 minutes	52 minutes

Case II Verification scale interval: 0.3 µV ≤ d < 0.6 µV and Extra warm-up time: 12 minutes

MinFill

d	Accuracy class					
	X(0.5)		X(1)		X(2)	
[g]	d	[kg]	d	[kg]	d	[kg]
0.1	474	0.0474	119	0.0119	30	0.003
0.2	947	0.1894	119	0.0235	30	0.006
0.5	2841	1.4205	237	0.1185	30	0.015
1	2841	2.841	355	0.355	30	0.03
2	2841	5.682	710	1.42	60	0.12
5	4261	21.305	710	3.55	89	0.445
10	4261	42.61	710	7.1	178	1.78
20	4261	85.22	1065	21.3	178	3.56
50	4261	213.05	1065	53.25	178	8.9
100	4261	426.1	1065	106.5	267	26.7
200	4261	852.2	1065	213	267	53.4
≥ 500	4261	-	1065	-	267	-

Maximum time between automatic zero-setting

Accuracy class		
X(0.5)	**X(1)**	**X(2)**
120 minutes	120 minutes	105 minutes

Case III Verification scale interval: 0.6 µV ≤ d < 1.0 µV and Extra warm-up time: 16 minutes

MinFill

d	Accuracy class					
	X(0.5)		X(1)		X(2)	
[g]	d	[kg]	d	[kg]	d	[kg]
0.1	119	0.0119	30	0.003	8	0.0008
0.2	119	0.0238	30	0.006	8	0.0016
0.5	237	0.1185	30	0.015	8	0.004
1	355	0.355	30	0.03	8	0.008
2	710	1.42	60	0.12	8	0.016
5	710	3.55	89	0.445	8	0.04
10	710	7.1	178	1.78	15	0.15
20	1065	21.3	178	3.56	23	0.46
50	1065	53.25	178	8.9	45	2.25
100	1065	106.5	267	26.7	45	4.5
200	1065	213	267	53.4	45	9
≥ 500	1065	-	267	-	67	-

Maximum time between automatic zero-setting

Accuracy class		
X(0.5)	X(1)	X(2)
120 minutes	105 minutes	52 minutes

Case IV Verification scale interval: 0.6 µV ≤ d < 1.0 µV and Extra warm-up time: 12 minutes

MinFill

d	Accuracy class					
	X(0.5)		X(1)		X(2)	
[g]	d	[kg]	d	[kg]	d	[kg]
0.1	237	0.0237	60	0.006	15	0.0015
0.2	237	0.0474	60	0.012	15	0.003
0.5	711	0.3555	60	0.03	15	0.0075
1	1421	1.421	119	0.119	15	0.015
2	1421	2.842	178	0.356	15	0.03
5	1421	7.105	355	1.775	30	0.15
10	2131	21.31	355	3.55	45	0.45
20	2131	42.62	355	7.1	89	1.78
50	2131	106.55	533	26.65	89	4.45
100	2131	213.1	533	53.3	89	8.9
200	2131	426.2	533	106.6	134	26.8
≥ 500	2131	-	533	-	134	-

Maximum time between automatic zero-setting

Accuracy class		
X(0.5)	**X(1)**	**X(2)**
120 minutes	120 minutes	105 minutes

Case V **Verification scale interval: 0.6 µV ≤ d < 1.0 µV and Extra warm-up time: 8 minutes**

MinFill

d	Accuracy class					
	X(0.5)		**X(1)**		**X(2)**	
[g]	d	[kg]	d	[kg]	d	[kg]
0.1	356	0.0356	89	0.0089	23	0.0023
0.2	711	0.1422	89	0.0178	23	0.0046
0.5	2132	1.066	89	0.0445	23	0.0115
1	2132	2.132	178	0.178	23	0.023
2	2132	4.264	533	1.066	23	0.046
5	3197	15.985	533	2.665	67	0.335
10	3197	31.97	533	5.33	134	1.34
20	3197	63.94	800	16	134	2.68
50	3197	159.85	800	40	134	6.7
100	3197	319.7	800	80	200	20
200	3197	639.4	800	160	200	40
≥ 500	3197	-	800	-	200	-

Maximum time between automatic zero-setting

Accuracy class		
X(0.5)	**X(1)**	**X(2)**
120 minutes	120 minutes	120 minutes

Case VI Verification scale interval: 1.0 µV ≤ d and Extra warm-up time: 16 minutes

MinFill

d	Accuracy class					
	X(0.5)		X(1)		X(2)	
[g]	d	[kg]	d	[kg]	d	[kg]
0.1	71	0.0071	18	0.0018	6	0.0006
0.2	71	0.0142	18	0.0036	6	0.0012
0.5	71	0.0355	18	0.009	6	0.003
1	142	0.142	18	0.018	6	0.006
2	213	0.426	18	0.036	6	0.012
5	426	2.13	36	0.18	6	0.03
10	426	4.26	107	1.07	11	0.11
20	426	8.52	107	2.14	17	0.34
50	639	31.95	107	5.35	33	1.65
100	639	63.9	160	16	33	3.3
200	639	127.8	160	32	33	6.6
≥ 500	639	-	160	-	50	-

Maximum time between automatic zero-setting

Accuracy class		
X(0.5)	X(1)	X(2)
120 minutes	105 minutes	65 minutes

Case VII Verification scale interval: 1.0 µV ≤ d and Extra warm-up time: 12 minutes

MinFill

d	Accuracy class					
	X(0.5)		X(1)		X(2)	
[g]	d	[kg]	d	[kg]	d	[kg]
0.1	143	0.0143	36	0.0036	9	0.0009
0.2	143	0.0286	36	0.0072	9	0.0018
0.5	285	0.1425	36	0.018	9	0.0045
1	427	0.427	36	0.036	9	0.009
2	853	1.706	71	0.142	9	0.018
5	853	4.265	213	1.065	9	0.045
10	853	8.53	213	2.13	18	0.180
20	1279	25.58	213	4.26	54	1.08
50	1279	63.95	320	16	54	2.7
100	1279	127.9	320	32	54	5.4
200	1279	255.8	320	64	80	16
≥ 500	1279	-	320	-	80	-

Maximum time between automatic zero-setting

Accuracy class		
X(0.5)	**X(1)**	**X(2)**
120 minutes	120 minutes	105 minutes

Case VIII Verification scale interval: 1.0 µV ≤ d and
Extra warm-up time: 8 minutes

MinFill

d	Accuracy class					
	X(0.5)		X(1)		X(2)	
[g]	d	[kg]	d	[kg]	d	[kg]
0.1	214	0.0214	54	0.0054	14	0.0014
0.2	214	0.0428	54	0.0108	14	0.0028
0.5	640	0.32	54	0.027	14	0.007
1	1279	1.279	107	0.107	14	0.014
2	1279	2.558	160	0.32	14	0.028
5	1279	6.395	320	1.6	27	0.135
10	1919	19.19	320	3.2	40	0.4
20	1919	38.38	320	6.4	80	1.6
50	1919	95.95	480	24	80	4
100	1919	191.9	480	48	80	8
200	1919	383.8	480	96	120	24
≥ 500	1919	-	480	-	120	-

Maximum time between automatic zero-setting

Accuracy class		
X(0.5)	**X(1)**	**X(2)**
120 minutes	120 minutes	120 minutes

MinFill for verification scale interval d = 1.0 µV

d	Reference accuracy class							
	X(0.2)		X(0.5)		X(1)		X(2)	
[g]	d	[kg]	d	[kg]	d	[kg]	d	[kg]
0.5	89	0.0445	36	0.0180	18	0.0090	9	0.0045
1	178	0.178	36	0.036	18	0.018	9	0.009
2	533	1.066	71	0.142	18	0.036	9	0.018
5	533	2.665	213	1.065	36	0.180	+	0.045
10	533	5.33	213	2.13	107	1.07	18	0.18
20	799	15.98	213	4.26	107	2.14	54	1.08
50	799	39.95	320	16.00	107	5.35	54	2.70
100	799	79.9	320	32.0	160	16.0	54	5.4
≥ 200	799		320		160		80	

Note: The above tables apply only for single fill – not for instruments using more than 1 load per fill such as selective combination weighers or cumulative weighers.

3.2 The A/D device LDU 78.1 version 3

Manufacturer	Hauch & Bach ApS.
Type	LDU 78.1 version 3 Load cell Digitizing Unit
Accuracy class	III or IIII
Weighing range	Single-interval, multi-range or multi-interval
Maximum number of verification scale intervals (n_i)	10,000
Minimum input voltage per VSI (e_i)	0.3 µV
Maximum capacity (Max_i):	$n_i \times e_i$
Internal resolution	± 260,000
Initial zero-setting range:	20 % of Max
Maximum tare effect:	100 % of Max
Fractional factor (p_i)	0.5
Excitation voltage	5 VDC
Minimum dead load (D_{min}):	0 mV
Maximum analogue range	±11 mV
Circuit for remote sense	Active, (see below)
Minimum input impedance	87.5 Ohm
Nominal input-impedance:	350 Ohm
Maximum input impedance	1150 Ohm
Load cell linearization feature:	None
Connecting cable to load cell(s):	See Section 3.1.1
Supply voltage:	12 - 24 VDC for input impedance ≥ 350 Ohm 12 - 14 VDC for input impedance < 350 Ohm
Operating temperature range	-15 °C to +55 °C
Max. allowed power consumption (excl. load cells)	1.3 W
Temperature effect on span (E_s/25), confirmed:	0.2 ppm/°K
Span change (S_x), confirmed:	6.1 ppm/Ohm
Peripheral interface(s)	See Section 4

3.2.1 Connecting cable between the A/D module and the junction box for load cell(s), if any

3.2.1.1 4-wire system

Maximum length	The certified cable length for the load cell.
Line	4 wires, shielded

3.2.1.2 6-wire system

Line	6 wires, shielded

Option 1:

Maximum length	2243 m/mm^2
Maximum resistance per wire	37.9 Ohm

In case the (n) for the weighing instrument is less than (n_{max}) mentioned above, the following applies:

Option 2:

Coefficient of temperature of the span error of the indicator: Es = 0.0004 % / 25°K
Coefficient of resistance for the wires in the J-box cable: Sx = 0.0006 % / ohm

L/A_{max} = 295.86 / Sx * (emp / n - Es) [m / mm²] in which emp = p'i * mpe * 100 / e

From this, the maximum cable length for the weighing instrument may be calculated with regard to (n) for the actual configuration of the instrument.

Reference: WELMEC 2.1, annex 5.

3.3 Composition of modules

Composition of modules to an automatic gravimetric filling instrument using LDU 78.1 version 3 shall satisfy OIML R76-1:2006 annex F.

4. Interfaces

4.1 Load cell interface

Refer to Section 3.2.1.

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

- There is a respective test certificate (EN 45501) or an OIML Certificate of Conformity (R60) issued for the load cell by a Notified Body responsible for type examination under the Directive 2014/31/EU.
- The certificate contains the load cell types and the necessary load cell data required for the manufacturer's declaration of compatibility of modules (WELMEC 2:2015, section 11), and any particular installation requirements. A load cell marked NH is allowed only if humidity testing to EN 45501 has been performed.
- 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.
- The load transmission must conform to one of the examples shown in the WELMEC 2.4 Guide for load cells.

4.2 Peripheral interfaces

4.3 Peripheral interfaces

Serial I/O interface

Of the dual row 10 pin header located in the right-hand end of the device, does the 4 terminals provide bi-directional RS422 or RS485 compatible serial interface.

Logic Level Inputs and Outputs

Of the dual row 10 pin header located in the right-hand end of the device, does the 4 terminals provide two logic level inputs and two logic level outputs.

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

5. Conditions for use

The module ID (returned by command ID) shall be 781n, where $0 \leq n \leq 9$.

The software version (returned by command IV) shall be V:02xx, where $xx \geq 46$ for single-interval and $xx \geq 47$ for multi-range and multi-interval.

Depending on the size of the calibrated verification scale interval and accuracy class the warm-up time for the module shall not be set (by the parameter WT) to a value less than what is specified in section 3.1.

6. Location of seals and inscriptions

Seals shall bear the verification mark of a notified body or alternative mark of the manufacturer according to ANNEX F or D of the Directive 2014/32/EU.

Access to the configuration and calibration facilities is achieved by sending a Traceable Access Code (TAC) which is a non-volatile number which is automatically incremented each time the calibration modus is left by the operator. The audit trail may be reviewed by sending CE to the unit, which responds the status code as CExxxxx. The code increments up to 65535. For sealing this number together with the device identity and serial number shall be written on a brittle sticker.

7. Location of CE mark of conformity and inscriptions.

The CE mark of conformity is a part of the overlay located on the side of the device. Evaluation certificate No., n_{max}, temperature range, manufacturer's mark, and the type designation are in addition located on the overlay. The serial number can be read out of the unit using the serial port

8. Tests

The LDU 78.1 version 3 Load cell Digitising Unit has been tested according to OIML R76-1:2006, EN 45501:1992/AC:1993, WELMEC 2.1:2001 Guide for testing of indicators, WELMEC Guide 7.2:2009 Software Guide as type P with risk class C and OIML D11:2004 section 12 and 13 applying severity level 3.

The tested LDU 78.1 had the following version number:

Hardware: 78.111.3.v.3.00
Software: 78.183.V:0246 and 78.183.V:0247

The test results have afterwards been re-examined against the requirements in MID - Directive 2014/32/EU Annex I and Annex MI006 chapter 1 and 3, OIML R61:2004 and WELMEC Guide 2.8:2008.

Examination / tests

Temperature tests: 20/55/-15/5/20 (tested at minimum input-voltage sensitivity)
Temperature effect on no-load indication
Temperature effect on span
Repeatability
Warm-up time
Voltage variations
Electrical bursts
Surge
Electrostatic discharges
Immunity to radiated electromagnetic fields
Immunity to conducted electromagnetic fields
Damp heat, steady state
Span stability
Examination of construction
Maximum load cell cable length and impedance of cable to load cell
Software examination

The test item fulfilled the maximum permissible errors at all tests.

9. Documentation

Contents of the technical documentation is held by FORCE filed under No.: A530895 and 121-26908.

9.1 Product specification

- Description
- Drawings
- Etc.

9.2 Test & Examination report

OIML R76 report no. DANAK-1911008.

OIML R61 report no. 121-26908.10