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EVALUATION CERTIFICATE

No. DK0199-R61-10.01 Revision 3

Object name **LDM 88.1**

Object type **A/D module for automatic gravimetric filling instrument**

Issued by **DELTA Danish Electronics, Light & Acoustics**

Issued in accordance with the requirements in WELMEC Guide 8.8:2008 "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring instruments under the MID".

In accordance with OIML R61:2004,
OIML D11:2004 section 12 and 13 applying severity level 3
WELMEC Guide 2.8:2008 and
WELMEC Guide 7.2:2009.

Issued to **Hauch & Bach ApS**
Femstykket 6
DK-3540 Lynge
Denmark

Manufacturer **Hauch & Bach ApS**

Characteristics An A/D module suitable to be incorporated in an automatic gravimetric filling instrument.

Description and documentation The A/D module is described and documented in the annex to this certificate.

Remarks Summary of tests involved: see annex.

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

The annex comprises 10 pages.

Issued on **2012-03-23** **Signatory: J. Hovgård**

DELTA
Danish Electronics,
Light & Acoustics

Venlighedsvej 4
2970 Hørsholm
Denmark

Tel. (+45) 72 19 40 00
Fax (+45) 72 19 40 01
www.delta.dk
VAT No. DK 12275110

Descriptive annex

Contents

1. Name and type of instrument and modules

The A/D device is designated Load cell Digitizing Module LDM 88.1, suitable to be incorporated in an automatic gravimetric filling instrument. It can be connected to a separate load receptor and peripheral equipment such as printers or other devices, as appropriate.

The LDM 88.1 shall be located on a MB 89.1 Base Board - or MB 89.2/.3/.4 Extension Board - and requires a gateway type CGM 85, PGM 86, or EGM 87 to be placed on the MB 89.1 for communication with a weighing indicator.

2. Description of the construction and function

2.1 Construction

The electronic device consists of a single circuit board, SMD populated and housed in an aluminium enclosure.

The top and the two free sides of the enclosure, when placed on a MB 89.1 Base Board, carry a non-detachable overlay where identification and metrological data are printed.

The only connections in and out of the LDM 88.1 are through its bus connector intended to be plugged into a MB 89.1 Base Board or a MB 89.2/.3/.4 Extension Board. Connectors for load cell cable and digital input / output are placed on the Base Board / Extension Boards. The RS 232 service port connector is placed on the Base Board.

The electronic sections are the quality dc input instrumentation amplifier with analogue filter, the excitation voltage conditioning circuit, the bipolar 20 bit A/D-converter and the 32 bit microprocessor which include the UART for the RS422/485 interface, the EE-PROM which holds the calibration data, the RAM and the Flash-type EPROM for the programme memory.

The EMC immunity protecting of the DC power supply port is partly placed on the MB 89.1/.2/.3/.4. Therefore the LDM 88.1 shall be installed in one of those boards.

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

The revisions of the tested hardware are the following,
LDM 88.1: 88.111.3-v.1.31
MB 89.1: 89.111.3.v.2.11
EGM 87.1: 87.111.3.v.1.02

Software

The software version may be viewed by sending “IV” to the unit, which responds with V:xxyy.
The tested software version is 2.20 (V:0220).

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.

Sealing of load cell cable and unit against exchange

A sealable metal bracket is available, which prohibits access to the load cell connection terminal found at the MB89.1/.2/.3/.4 Motherboards for the LDM88's. The bracket further hinders the LDM88 to be removed from its socket. The bracket is bolted to a riveted, threaded standoff at the motherboard using a countersink M3 screw. The sealing is achieved when applying the brittle sealing label, max 25x10mm, over the head of the M3 screw. By this each LDM88.1 unit is individually sealed.

Other mechanical sealing, which prohibits access to the load cell connection terminal, may be used.

If mechanically sealing is not possible, securing of the LDM88.1 unit and of the load receptor/load cell by writing the serial numbers on the inscription plate may be used.

CE mark and inscriptions

The CE mark of conformity is a part of the overlay located on the side of the device. Test certificate No., nmax, temperature range, manufacturer's mark, and the type designation is in addition located on the overlay. The serial number can be read out of the unit using the RS 232 service port of the gate-way.

2.2 Functions

The device 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 digitising unit is power supplied with 12 - 24 VDC - coarsely regulated.

Setting devices:

Zero-setting device:	Initial zero-setting range: 20 % max Semi-automatic zero-setting: 4 % max
Tare device(s):	Subtractive tare
Tare range:	100 % of max

3. Technical data

3.1 LDM 88.1 based automatic gravimetric filling instrument

The following technical data apply for an automatic gravimetric filling instrument based on LDM 88.1 for filling performed with a single load:

Reference class:	0.2 or 0.5 or 1
Maximum capacity (Max):	= n × d
Minimum filling (MinFill):	see table below
Minimum capacity (Min):	= Minfill (1 load per fill)
Verification scale interval (d):	≥ 0.5 g
Weighing range:	Single-interval
Number of Verification Scale Intervals (n):	≤ 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 table below
Minimum warm-up time:	see table below

Minimum filling's (MinFill) dependency of verification scale interval (d) and reference accuracy class X(x), plus verification scale interval in µV.

d	**Reference accuracy class**							
	X(0.2) for v_{min} = 1.0 µV		**X(0.2)** for v_{min} = 0.45 µV		**X(0.5)** for v_{min} = 0.45 µV		**X(1)** for v_{min} = 0.45 µV	
[g]	d	[kg]	d	[kg]	d	[kg]	d	[kg]
0.5	56	0.028	84	0.042	34	0.017	17	0.0085
1	111	0.111	1314	1.314	34	0.034	17	0.017
2	593	1.186	1314	2.628	67	0.134	17	0.034
5	593	2.965	1314	6.575	201	1.005	34	0.17
10	593	5.93	1971	19.71	201	2.01	101	1.01
20	889	17.78	1971	39.42	201	4.02	101	2.02
50	889	44.45	1971	98.55	302	15.1	101	5.05
100	889	88.9	1971	197.1	302	30.2	151	15.1
≥ 200	889		1971		302		151	

For the above MinFill the following warm-up time is needed.

d	Reference accuracy class			
	X(0.2) for v_{min} = 1.0 µV	**X(0.2)** for v_{min} = 0.45 µV	**X(0.5)** for v_{min} = 0.45 µV	**X(1)** for v_{min} = 0.45 µV
[g]	[minutes]	[minutes]	[minutes]	[minutes]
0.5	26	26	26	26
1	26	14	26	26
≥ 2	14	14	26	26

For the above MinFill the following maximum time between auto-zero is needed.

d	Reference accuracy class			
	X(0.2) for v_{min} = 1.0 µV	**X(0.2)** for v_{min} = 0.45 µV	**X(0.5)** for v_{min} = 0.45 µV	**X(1)** for v_{min} = 0.45 µV
[g]	[minutes]	[minutes]	[minutes]	[minutes]
0.5	103	71	69	69
1	102	120	69	69
≥ 2	120	120	69	69

Note: If more than 1 load per fill is to be used - selective combination weighers or cumulative weighers - the values in the three above tables have to be re-calculated for the actual setup of the automatic gravimetric filling instrument.

3.2 The A/D device LDM 88.1

Manufacturer	Hauch & Bach ApS.
Type	LDM 88.1 Load cell Digitizing Module
Accuracy class	III
Weighing range	Single-interval
Maximum number of verification scale intervals (n)	10,000
Minimum input voltage per VSI	0.45µV
Maximum capacity of interval (Max_i):	n × e
Verification scale interval, e =	Max/n
Internal resolution	± 260,000
Initial zero-setting range:	4 % 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	1200 Ohm
Load cell linearization feature:	None
Connecting cable to load cell(s):	See Section 3.1.1
Supply voltage:	12 - 24 VDC
Operating temperature range	Min / Max = -15 °C / +55 °C
Temperature effect on no-load, confirmed:	-1.4 ppm/°K
Temperature effect on span, confirmed:	0.2 ppm/°K
Peripheral interface(s)	See Section 4
Software risk class	B

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 2739 m/mm2

Maximum resistance per wire 46.3 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 = 0.0007 % / 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.

The calculation program is obtainable by downloading at www.delta.dk/weighing.

3.3 Composition of modules

Composition of modules to an automatic gravimetric filling instrument using LDM 88.1 shall satisfy WELMEC 2 (Issue 5) 2009, paragraph 11.

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 2009/23/EC.
- 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, 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

RS 485 serial bus interface

The interface is only accessible through the bus of the MB 89.1 Base Board and the MB 89.2/.3/.4 Extension Boards and is solely used for communication with the CGM 85 / PGM 86 / EGM 87 gateway.

CANopen gateway interface

The interface is only accessible using the CGM 85 gateway.

Profibus gateway interface

The interface is only accessible using the PGM 86 gateway.

Ethernet gateway interface

The interface is only accessible using the EGM 87 gateway.

RS 232 service interface

The interface is located on the gateway and is solely for setup and service used. This interface is not to be used during normal operation of the LDM 88.1.

Digital input / Outputs

The LDM 88.1 has 4 digital inputs and 4 digital outputs.

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

5. Conditions for use

None.

6. Location of seals and inscriptions

The LDM 88.1 is secured by an event counter (TAC). For sealing this number together with the device identity and serial number shall be written on a brittle sticker.

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.

Location of CE mark of conformity:

The CE mark of conformity is placed on the overlay on the side of the device.

Inscription on the overlay:

n_{max}, temperature range, Evaluation Certificate No.

Other inscriptions on the overlay:

H&B and part No.

Other inscriptions:

None.

7. Tests

The A/D device type Load cell Digitizing Unit LDM 88.1 has been tested according to OIML R76-1:2006, EN 45501:1992/AC:1993, WELMEC 2.1:2001 Guide for testing of indicators and OIML D11:2004 section 12 and 13 with severity level 3.

The test results have afterwards been re-examined against the requirements in MID - Directive 2004/22/EC Annex I and Annex MI006 chapter 1 and 3, OIML R61:2004, and WELMEC Guide 2.8:2008. The software has been examined against the requirements in WELMEC Guide 7.2:2009.

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
Short time power reductions
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
Load cell interface measurements with interruptions of the sense circuit

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

8. Documentation

Contents of the technical documentation held by the notified body under file No. A530723:

8.1 Product specification

- Description
- Drawings

8.2 Examination report

OIML R76 report no. DANAK-1910717.

OIML R61 report no. DANAK-1910743.

WELMEC 7.2 report no. DANAK-1911086

8.3 Test results

See the above mentioned examination reports.