Quality Electronics for Industrial Weighing H&B

Load Cell Digital Module

Type LDM 64.1

TECHNICAL MANUAL FIRMWARE TYPE 0 (BASIC)
INCLUDING COMMUNICATION PROFILE
CANOPEN

Firmware Version 64.181.v.3.00 or higher
Hardware Version 64.105.v.1.xx
Document No. X64 Rev 1.30 EN

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1. Table of Contents:

RIGHTS AND LIABILITIES

2. Safety Instructions

CAUTION READ this manual BEFORE operating or servicing this equipment. FOLLOW these instructions carefully. SAVE this manual for future reference. DO NOT allow untrained personnel to operate, clean, inspect, maintain, service, or tamper with this equipment. ALWAYS DISCONNECT this equipment from the power source before cleaning or performing maintenance.
CALL Hauch & Bach ApS for parts, information, and service.

WARNING ONLY PERMIT QUALIFIED PERSONNEL TO SERVICE THIS EQUIPMENT. EXERCISE CARE WHEN MAKING CHECKS, TESTS AND ADJUSTMENTS THAT MUST BE MADE WITH POWER ON. FAILING TO OBSERVE THESE PRECAUTIONS CAN RESULT IN BODILY HARM.

WARNING FOR CONTINUED PROTECTION AGAINST SHOCK HAZARD CONNECT TO PROPERLY GROUNDED OUTLET ONLY. DO NOT REMOVE THE GROUND PRONG.

WARNING DISCONNECT ALL POWER TO THIS UNIT BEFORE REMOVING THE FUSE OR SERVICING.

WARNING BEFORE CONNECTING/DISCONNECTING ANY INTERNAL ELECTRONIC COMPONENTS OR INTERCONNECTING WIRING BETWEEN ELECTRONIC EQUIPMENT ALWAYS REMOVE POWER AND WAIT AT LEAST THIRTY (30) SECONDS BEFORE ANY CONNECTIONS OR DISCONNECTIONS ARE MADE. FAILURE TO OBSERVE THESE PRECAUTIONS COULD RESULT IN DAMAGE TO OR DESTRUCTION OF THE EQUIPMENT OR BODILY HARM.

CAUTION OBSERVE PRECAUTIONS FOR HANDLING ELECTROSTATIC SENSITIVE DEVICES.

3. Declaration of Conformity

EG-Konformitätserklärung
EC-Declaration of Conformity

Monat/Jahr: *month/year:*	01/2020
Hersteller: *Manufacturer:*	Hauch & Bach ApS
Anschrift: *Address:*	Femstykket 6 DK-3540 Lynge Dänemark / Denmark
Produktbezeichnung: *Product name:*	LDM 64.1

Das bezeichnete Produkt stimmt mit folgenden Vorschriften der Europäischen Richtlinien überein:
This product confirms with the following regulations of the Directives of the European Community

Richtlinie 2014/30/EU des Europäischen Parlaments und des Rates vom 26. Februar 2014 zur Angleichung der Rechtsvorschriften der Mitglied-staaten über die elektromagnetische Verträglichkeit und zur Aufhebung der Richtlinie 2004/108/EC.	***Directive 2014/30/EU*** *of the European Parliament and of the Council of 26th February 2014 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 2004/108/EC.*
Diese Erklärung bescheinigt die Übereinstimmung mit den genannten Richtlinien, beinhaltet jedoch keine Zusicherung von Eigenschaften.	*This declaration certifies the conformity with the listed directives, but it is no promise of characteristics.*
Richtlinie 2014/35/EU Niederspannungs-Richtlinie	***Directive 2014/35/EU*** *Low Voltage Directive*

Folgende Normen werden zum Nachweis der Übereinstimmung mit den Richtlinien eingehalten:
As a proof of conformity with the directives following standards are fulfilled:

DIN EN 45501	Metrologische Aspekte nichtselbsttätiger Waagen; Deutsche Fassung EN 45501:2015 *Anhang B.3: Funktionsprüfungen unter Störeinflüssen* *Anhang C: Verfahren für die Prüfung der Störfestigkeit gegen hochfrequente elektromagnetische Felder.*

Michael Bach
Managing Director

4. Introduction and Specifications

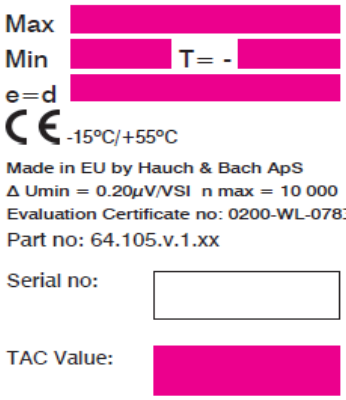
The model LDM 64.1 is a very precise high-speed digital amplifier for weighing and force measurements with strain gauge (SG) sensors. The LDM 64.1 can be used in legal for trade (requires OIML R-76:2006 Part 1) as well as for industrial applications.
The **LDM 64.1** features are **CAN interface** (supports CANopen protocol) and a full duplex **RS232 interface** (supports a straight- forward ASCII command set).
The LDM 64.1 and the wellknown LDU 78.1, both use nearly the same ASCII command set. The LDM 64.1 with its accurate A to D converter and a sample rate of up to 1200 measurement values per second, is particularly suitable for static or dynamic measurements and control purposes.

Specifications

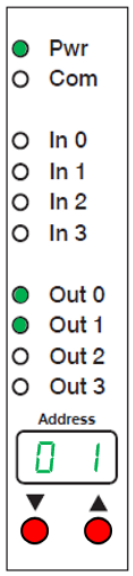
Accuracy class		III or IIII
Test certificate according OIML R76		10 000 intervals or n x 10 000 intervals (n = 1, 2, 3)
Maximum number of verification scale intervals (n)		10 000
Minimum input voltage per VSI	µV	0.2
Measuring range (FS)	mV/V	±3.3
Maximum resolution at FS (approx.)	incr.	±880000
Measuring rate	Hz	9.4 to 1200
Digital filter cut-off frequency (-3dB)	Hz	0.25 to 18
Bridge excitation voltage	V_{DC}	5
Linearity error (relative to full scale)	%	±0.0005
Temperature effect on zero (relative to full scale)	%/10 K	±0.0003 (Typical)
Temperature effect on span	%/10 K	±0.001 (Typical)
Interface 1 (of LDM 64.1)		**CAN**
Bit rate	kbits/s	10 to 1000
Protocol		CAN Open (CAN2.0B)
Interface 2 (of LDM 64.1)		**RS-232**
Baud rate	bits/s	9600 to 460800
Frame format		8 data bits, 1 stop bit, no parity bits
Protocols		Readable ASCII
DIN Rail Port (of LDM 64.1)		**CAN**
Bit rate	kbits/s	10 to 1000
Protocol		CAN Open (CAN2.0B)
Communication LDM 64.1 to Gateway EGM 187.1		CAN Open (CAN2.0B)
Address range		1 to 99
Logical inputs		**4**
Maximum input voltage	V_{DC}	30
Threshold voltage (approx.)	V_{DC}	6
Input resistance (approx.)	kΩ	8
Logical outputs		**4**
Maximum voltage	V_{DC}	30
Maximum current	A	1.0
Supply voltage	V_{DC}	10 to 30
Power consumption @ 24VDC and 350 Ω Load Cell	W	<0.75
Operating temperature range	°C	-15 to +55
Storage temperature range	°C	-30 to +70

5. Hardware and Wiring

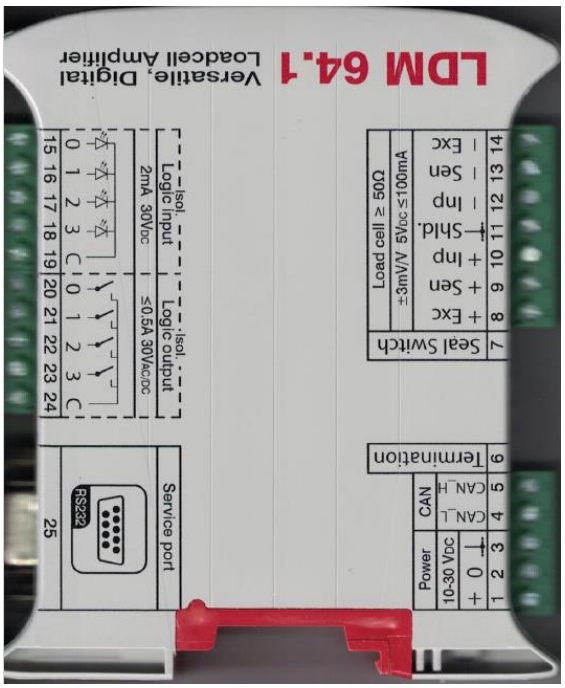
5.1. Housing & Terminals



Scale informations for 'legal for trade' use

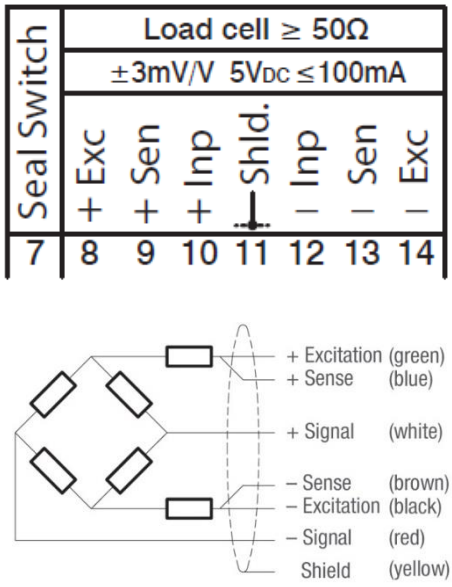


Front Panel



Terminals of LDM 64.1

5.2. Terminals Load Cell Connection



Colour code of standard load cells (e.g. Flintec)

LDM 64.1 Pin no.	Load cell input	Function
8	+ Exc	+ Excitation for load cell
9	+ Sen	+ Sense for load cell
10	+ Inp	+ Signal of load cell
11	Shld.	Shield load cell
12	– Inp	– Signal of load cell
13	– Sen	– Sense for load cell
14	– Exc	– Excitation for load cell

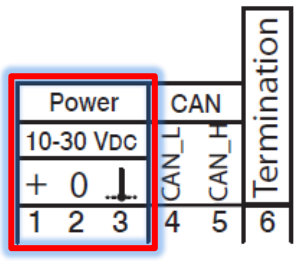
5.3. Load Cell Connection

The load cell wiring should be made carefully before energizing to avoid damages to the amplifier and the load cells. The input resistance of the load cells that you want to connect should be ≥ 50 Ω (ohms).

In case of using a load cell/scale with 4 wire cable, you have to short-circuit (bridge) the pins 8 & 9 and 13 & 14.

Remark: Please don't shorten the 4 wire cable of a load cell, as the cable is part of the factory calibration (signal & temperature compensation).

5.4. Terminals Power Supply



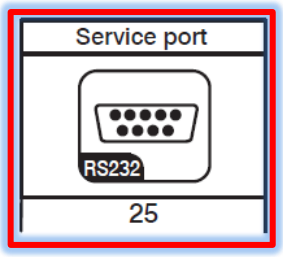
LDM 64.1 Pin no.	Power in	Function
1	+	Power supply +10...30 V DC
2	-	Common ground / 0 V DC
3	Shld.	Chassis ground

Depending on the grounding concept of the plant/scale, terminal 2 has to be connected to terminal 3. Terminal 11 (shld. load cell) and 3 (Ground chassis) are internal connected.

Note: The power supply must be able to supply about 0.75W per LDM 64.1.

5.5. Service Port RS 232

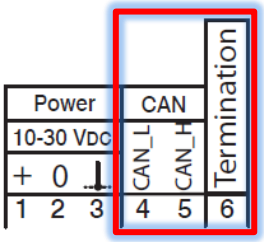
The service port RS 232 can be used for communication with a PC or PLC system, in parallel to the CAN open interface.



LDM 64.1 Pin no.	RS 232	Function
3	Rx	Receive Data
2	Tx	Transmit Data
5	GND	Signal ground RS 232

The serial port supports ASCII Protocol.

5.6. CANbus Interface

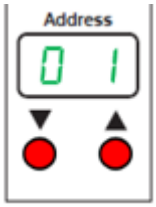


The CANbus interface can be used for communication in a CANopen network with transmission speed 10 ... 1000 kbit/s.

- The CAN lines CANH (5) and CANL (4) can be connected to a CANopen master.
- Termination resistors must be present in the CAN network. A 120 Ω resistor inside the LDM 64.1 can be switched ON/OFF (using jumper 6).
- When used with the Gateway EGM 187.1, one 120Ω termination resistor is present inside the gateway. The last LDM on the CAN bus must also have its termination resistor connected.

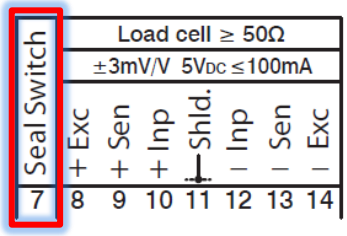
The factory default settings for communication are **address 1** and transmission speed **500 kbit/s**.

Note: CANopen communication profile is described in this manual, see chapter 9 (pages 39 ff).



For changing the CAN address via front panel, just use the Up/Down buttons below the Address display.

5.7. Seal Switch



Setup or changes of calibration can only be performed with an open seal switch (7). Changes lead to get a new TAC value of +1.

Running a legal for trade application needs the jumper connected to the switch pins and a seal. A broken seal shows up changes of calibration, which are not allowed.

➡ Protected commands see below.

Traceable Access Code (TAC) protected calibration commands

In case the seal switch is closed, the following commands or menus can't be proceeded:

- Calibration Zero
- Calibration Gain
- Calibration Absolute Zero
- Calibration Absolute Gain
- Calibration Minimum
- Calibration Maximum
- Zero Tracking
- Zero Range
- Display Step Size
- Decimal Point
- Calibration Save
- Factory Default
- Non Volatile Tare
- Non Volatile Zero
- Initial Zero @ power ON

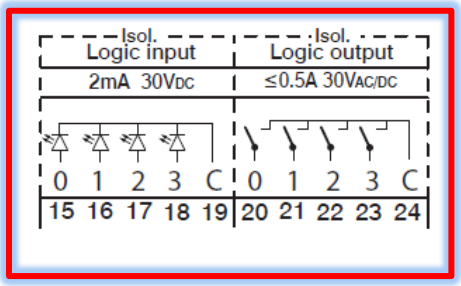
5.8. Logic Inputs & Outputs

The LDM 64.1 offers 4 isolated logic inputs and 4 isolated logic outputs, all "floating".

The input 0 can get the function to act as Trigger Button for a measurement, see chapter 8.12.6.

The 4 outputs act as switches for setpoints with hysteresis, switch behavior etc. Several bases can be used like gros weight, net weight or average weight value, see chapter 8.9.x.

Terminal	Connection	Function
15	IN 0	Logic Input 0
16	IN 1	Logic Input 1
17	IN 2	Logic Input 2
18	IN 3	Logic Input 3
19	C	Common of Input's 0/1/2/3: 0V
20	OUT 0	Logic Output 0
21	OUT 1	Logic Output 1
22	OUT 2	Logic Output 2
23	OUT 3	Logic Output 3
24	C	Common of Output's 0/1/2/3: 12 ... 24V or 0V



Note for Logic Inputs: The pulse duration must be at least 50ms.

Note for Logic Outputs: The connection C can be used for either 'high' level (24V AC/DC) or 'low' level (0V).

6. Communication and Getting started

6.1. Serial Interface

Communicating with the LDM 64.1 is carried out e.g. via serial port RS 232.
The data format is the familiar 8/N/1 structure (8 data bits, no parity, 1 stop bit).
Available baud rates via RS232 port are: 9600, 19200, 38400, 57600, 115200, 230400 and 460800 baud.

Factory default: 115200 baud

6.2. Command Language

The command setup is based on a simple ASCII format (2 letters). This enables the user to setup the device, get results or check parameters.

Example: Connect the LDM 64.1 via the RS232 port to a PC / PLC system. You want to get the identity, firmware version or net weight.

Remark: In this manual means: Space "_" and Enter (CR/LF) "↵ "

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
ID↵	**D:6410**	Identity of the device
IV↵	**V:0131**	Firmware version of the device
GN↵	**N+1234.56**	Net weight with algebraic sign/floating point

6.3. Baud Rate

For baud rate setup use command BR, see chapter 8.10.4.

Factory default: 115200 baud

6.4. Getting Started

You will require:

- PC or PLC with a RS232 communication port.
- One LDM 64.1, connected to a load cell or scale.
- A 12 to 24 VDC power supply capable of delivering approximately 0.75 W.
- One or more LDM 64.1
- A suitable ASCII communication software **

Refer to the wiring diagram in chapter 5.

**

You can easily communicate between a PC and a LDM 64.1 using programs such as Procomm, Telemate, Kermit, HyperTerminal or HTerm etc.

Additional the powerful software **DOP 4** (version 2.1.0.0 or higher) with graphical user interface and oscilloscope function for the operating systems Windows XP / Vista / 7 / 8 / 10 is available.

7. Commands – Overview

Command	Short description	Parameter value	Page
AD	Communication: Device Address	0...255	29
A'n'	Allocation source for a set point	0, 1 or 2	28
AZ	Absolute zero point calibration	± 33000	18
AG	Absolute gain calibration	± 33000	18
BR	Communication: Baud Rate	9600…460800 baud	30
CE	Calibration: Open Calibration Sequence; Read TAC Counter	0...65535	14
CG	Calibration: Set Calibration Gain (Span) at Load > Zero	1...999999 d	16
CI	Calibration: Minimum Output Value	–999999...0 d	15
CL	Close communication (For compatibility only)	None	
CM'n'	Calibration: Set Maximum Output Value (n = 1, 2 or 3)	0...999999 d	14
CS	Save the Calibration Data (CM, CI, DS, DP, etc.) to the EEPROM	None	18, 31
CZ	Calibration: Set Calibration Zero Point – Scale without Load	None	16
DP	Calibration: Set Decimal Point Position	0...6	15
DS	Calibration: Set Display Step Size	1, 2, 5, 10, …, 500 d	15
DT	Trigger function: Calculation Time for Short-time Average	0...65535 ms	35
DX	Communication: Set Full-duplex (1) (For compatibility only)	1 (fix)	
FD	Factory default settings: Write Data to the EEPROM (TAC protected)	None	16
FM	Digital filter: Filter Mode	0…1	20
FL	Digital filter: Filter Cut-off Frequency	0...8	20
FT	Firmware Type	0, 1 or 3	19
GA	Output: Get Triggered Average Value	None	23, 32
GG	Output: Get Gross Value	None	23
GI	Retrieves an image file from the LDU's EEPROM	None	31
GL	Output: Get Data String "Average/Gross/Status"	None	24
GN	Output: Get Net Value	None	23
GS	Output: Get ADC Sample Value	None	23
GT	Output: Get Tare Value	None	23
GW	Output: Get Data String "Net/Gross/Status"	None	23
H'n'	Setpoints: Hysteresis for Setpoint S0 (H0), S1 (H1) etc.	-32768…+32767d	27
HT	Trigger function: Hold time for Violation of Setpoint Limit	0...65535 ms	28
ID	Device information: Identify Device	None	13
IN	Logical Input: Input Status	None	26
IO	Logical Output: Output Status	0000…1111	26
IS	Device information: Identify Device Status	None	13
IV	Device information: Identify Firmware Version	None	13
IZ	Calibration: Correction of System Zero	None	17
MR	Calibration: Define Multi-interval (0) or Multi-range (1)	0 or 1	15
MT	Trigger function: Measuring Time for Averaging	0...3000 ms	32
NA	Network Address (CAN Open address)	1 …127	29
NR	Motion detection: No-motion Range	0...65535 d	19
NS	Network Settings (CAN Interface, Serial channel)	0 …1	29
NT	Motion detection: No-motion Time Period	0...65535 ms	19
OF	Output Format of Data String GL and GW	0…3	24
OM	Output Mask	0000…1111	26
ON	Open communication and send net weight (For compatibility only)	1…255	
OP	Open communication (For compatibility only)	1…255	
PI	Download a saved image file to the LDU's EEPROM	None	31
PF	Pre-filter (anti aliasing filter) ON / OFF	0 or 1	20

Command	Short description	Parameter value	Page
RS	Device information: Read serial number	None	14
RT	Scale function: Reset Tare	None	22
RW	Trigger function: Trigger Window for Re-trigger Function	0...65535 d	35
RZ	Scale function: Reset Zero Point	None	22
SA	Auto-transmit: Send Triggered Average Value automatically	None	25, 33
SD	Trigger function: Start Delay	0... 65535 ms	32
SG	Auto-transmit: Send Gross Value continuously	None	25
SL	Auto-transmit: Send Data String „Average/Gross/Status“ continuously	None	25
SN	Auto-transmit: Send Net Value continuously	None	25
S‘n‘	Setpoints: Setup of Setpoints S0 to S3	-999999...+999999 d	27
SP	Preset Tare value	0...999999 d	22
SR	Software Reset	None	14
SS	Save the Setpoint Data (Sx, Hx, Ax) to the EEPROM	None	31
ST	Scale function: Set Tare	None	22
SW	Auto-transmit: Send Data String “Net/Gross/Status“ continuously	None	25
SX	Auto-transmit: Send ADC Sample Value continuously	None	25
SZ	Scale function: System Zero Point	None	21
TD	Transmit delay (For compatibility only)	0…255 ms	
TE	Trigger function: Trigger on Rising Edge (1) or Falling Edge (0)	0 or 1	32
TI	Trigger function: Averaging Time for Automatic Tarring	0...65535 ms	36
TL	Trigger function: Trigger Level	0...999999 d	33
TM	Calibration: Tare mode	0…3	17
TN	Calibration: Set/Clear non-volatile tare	0 or 1	18
TR	Trigger function: Software Trigger	None	32
TS	Trigger function: Stop Value for Re-trigger Function	0...65535 d	35
TT	Trigger function: Averaging Time for Re-trigger Function	0...65535 ms	35
TW	Trigger function: Window for Automatic Tarring	0...65535 d	36
UR	Digital filter: Update Rate	0, 1, 2...7	21
WP	Save the Setup Data (FL, NR, NT, AD, BR, DX) to the EEPROM	None	31
ZI	Calibration: Initial Zero Range	0...999999 d	17
ZN	Calibration: Set/Clear non-volatile zero	0 or 1	18
ZR	Calibration: Zero Range	0...999999 d	17
ZT	Zero Tracking: Range	0…255	16

8. Commands Description

For better clarity, all commands are divided into groups as described on the following pages.
Note:
In the blue brakets and letters [….] you see the CANbus index 0xYYYY and sub-index 0xZZ; if [n.a.] is mentioned, the command is not available for CANbus.

8.1. System Diagnosis Commands – ID, IV, IS, SR, RS

Use these commands you get the LDM 64.1 type, firmware version or device status. These commands are sent without parameters.

8.1.1. ID Get Device Identity

[SDO 2900 sub 08]

Master (PC / SPS) sends	Slave (LDM 64.1) responds
ID↵	**D:6410**

The response to this request gives the actual identity of the device. This is particularly useful when trying to identify different device types on a bus.

8.1.2. IV Get Firmware Version

[SDO 2900 sub 09]

Master (PC / SPS) sends	Slave (LDM 64.1) responds
IV↵	**V:0300**

The response to this request gives the firmware version of the device.

8.1.3. IS Get Device Status

[SDO 2900 sub 0A]

Master (PC / SPS) sends	Slave (LDM 64.1) responds
IS↵	**S:067000** (example)

The response to this request comprises of two 3-digit decimal values (067 and 000), which can be decoded according to the table below:

Bit	Leftmost 3-digit value		Rightmost 3-digit value	
0	1	Signal stable (no motion)	1	(not used)
1	2	Zeroing action performed	2	(not used)
2	4	Tare	4	(not used)
3	8	Center zero	8	(not used)
4	16	Input 0	16	(not used)
5	32	Input 1	32	(not used)
6	64	Setpoint 0	64	(not used)
7	128	Setpoint 1	128	(not used)

The example decodes the result **S:067000** as follows:

- Signal stable (no motion) [= 1]
- Zeroing action performed [= 2]
- Tare not active [= 0]
- Weight <> 0 [= 0]
- Input 0 not active [= 0]
- Input 1 not active [= 0]
- Setpoint 0 active [= 64]
- Setpoint 1 not active [= 0]

8.1.4. SR Software Reset

[SDO 2007 sub 04]

Master (PC / SPS) sends	Slave (LDM 64.1) responds
SR↵	**OK**

This command will respond with 'OK' and after maximum 400 ms perform a complete reset of the LDM. It has the same functionality as power OFF and ON again.

8.1.5. RS Read Serial Number

[SDO 2900 sub 0C]

Issuing the RS command will return the current serial number in the format S+12345678.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
RS↵	**S+00244373**	Request: SN = 244373

8.2. Calibration Commands – CE, CM n, CI, MR, DS, DP, CZ, CG, ZT, FD, IZ, ZR, ZI, TM, TN, ZN, AZ, AG, CS

8.2.1. CE Read TAC* Counter / Open Calibration Sequence

[SDO 2300 sub 03]

With this command you can read the TAC counter (*TAC = Traceable Access Code) or you can open a calibration sequence.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**CE+00017 (example)**	TAC counter = 17
CE17↵	**OK**	Calibration sequence active

This command must be issued PRIOR to any attempt to set the parameters in the calibration group of commands. In legal for trade applications the TAC counter can be used to check if critical parameters have been change without re-verification. After each calibration save (CS) the TAC counter increases by +1.

8.2.2. CM n Set Maximum Output Value

[CM / CM1: SDO 2300 sub 07] [CM2: SDO 2300 sub 0E] [CM3: SDO 2300 sub 0F]

This command (CM n with n = 1, 2 or 3) is used to set up the maximum output value (respective the switching point in multi range applications). Permitted values are from 0 to 999999.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CM1↵	**M+030000**	Request: CM1 = 30000 d
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
CM1_50000↵	**OK**	Setup: CM1 = 50000 d

This value will determine the point at which the output will change to "oooooo", signifying over-range respective the point at which the output will change the measuring range / interval size.

Application	CM 1 = MAX 1	CM 2 = MAX 2	CM 3 = MAX 3
Single range	CM 1 = 1...999999	CM 2 = 0 (means CM 2 not used)	CM 3 = 0 (means CM 3 not used)
Dual range or dual interval (→ Command **MR**)	CM 1 = 1...MAX 1	CM 2 = MAX 1...999999	
Triple range or triple interval (→Command **MR**)	CM 1 = 1...MAX 1	CM 2 = MAX 1...MAX 2	CM 3 = MAX 2...999999

It is necessary: 1 ∗ MAX 1 < MAX 2 < MAX 3 ∗ 999999

Note: The range, in which a scale can be set to zero (SZ) or automatic zero tracking (ZT) is active, is +/- 2% of CM value. Factory default: CM1 = 999999, CM 2 = 0, CM 3 = 0

8.2.3. CI Set Minimum Output Value

[SDO 2300 sub 08]

This command is used to set up the minimum output value. Permitted values are from – 999999 to 0.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CI↵	**I–000009**	Request: CI = –9 d
CE↵	**E+000017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
CI-10000↵	**OK**	Setup: CI = -10000 d

This value will determine the point at which the output will change to “uuuuuuu”, signifying under-range.

Note: In bipolar applications (e.g. force- or torque measurements) this parameter defines the max. output value for input signals with negative sign.
Factory default: CI = –999999

8.2.4. MR Set Multi-range / Multi-interval

[SDO 2300 sub 0D]

This command is only relevant, if CM 2 > 0 or CM 3 > 0. Is this the case, then this command defines, if the application is multi-range or multi-interval. Permitted values are 0 (Multi-interval) or 1 (Multi-range).

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
MR↵	**M+00000**	Request: MR = 0 (Multi-interval)
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
MR1↵	**OK**	Setup: MR = 1 (Multi-range)

Note: Single range applications ignore this parameter.

8.2.5. DS Set Display Step Size

[SDO 2300 sub 0C]

This command allows the output to step up or down by a unit other than 1.
Permitted values are 1, 2, 5, 10, 20, 50, 100, 200 and 500.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
DS↵	**S+00002**	Request: Step size 2
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
DS50↵	**OK**	Setup: Step size 50

Legal for trade applications allow for up to 10000 intervals. The allowed step size has to be considered.

8.2.6. DP Set Decimal Point Position

[SDO 2300 sub 0B]

This command allows the decimal point to be positioned anywhere between leftmost and rightmost digits of the 6-digit output result. Permitted values are 0, 1, 2, 3, 4, 5 and 6. Position 0 means no decimal point.
Factory default: DP = 3

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
DP↵	**P+00003**	Request: Position of decimal point 3
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
DP0↵	**OK**	Setup: no decimal point

8.2.7. CZ Set Calibration Zero Point

[SDO 2300 sub 0A]

This is the reference point for all weight calculations, and is subject to TAC control. The calibration will be terminated with an error message (“ERR“) if the signal is not stable within 10 seconds.

Factory default: approx. 0 mV/V input signal

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
CZ↵	**OK**	Zero point saved

8.2.8. CG Set Calibration Gain (Span)

[SDO 2300 sub 04]

This is the reference point for calibration under load, and is subject to TAC control.
Permitted values are from 1 to 999999.

Factory default: 20000 = 2.000 mV/V input signal

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CG↵	**G+010000**	Request: Calibration weight = 10000 d
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
CG15000↵	**OK**	Setup: Calibration weight = 15000 d

For calibrating an input signal near the display maximum (CM) will give the best system performance. The minimum calibration load of at least 20% are recommended. The calibration will be terminated with an error message if the signal is not stable within 10 seconds. Or if the input signal difference to the zero point calibration is less than approx. ±0.02mV/V then the LDM will respond with an error message (“ERR”), too.

8.2.9. ZT Enable / Disable Zero Tracking

[SDO 2100 sub 12]

This command enables or disables the zero tracking. ZT = 0 disables the zero tracking and ZT = 1 or higher enables the zero tracking. Issuing the command without any parameter returns the current ZT value. Permitted values are 0 to 255.

Factory default: ZT = 0 [Disable]

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
ZT↵	**Z:001**	Request: ZT status
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
ZT0↵	**OK**	Setup: ZT = Disable

Zero tracking will be performed only on results less than ZT range at a rate of 0.4 d/sec, where d = display step size (see DS command). The zero can only be tracked to +/- 2% of maximum (see CM n command).

ZT = 1 means ±0.5 d and ZT = 100 means ±50 d

8.2.10. FD Reset to Factory Default Settings

[SDO 2006 sub 02]

This command puts the LDM 64.1 back to a known state. The data will be written to the EEPROM and the TAC will be incremented by +1.

Note: All calibration and setup information will be lost by issuing this command!

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
FD↵	**OK**	Factory default setting

Note for CANbus port: The command FD does not change any of the CANbus settings after proceeding a FD. The setting of firmware type FT remains unchanged, too.

8.2.11. IZ Correction of System Zero

[n.a.]

This command can correct the system zero after a successful calibration, e.g. to correct the unknown weight of a mounting accessory which was used to hold the calibration weight during the calibration procedure. By a simple parallel shift of the gain curve the sensitivity of the scale will stay unaffected.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
IZ↵	**OK**	System zero corrected

8.2.12. ZR Zero Range

[SDO 2300 sub 11]

Sets the zero range manually – this is the range in increments within which the weighing scale can be zeroed. Issuing the ZR command without any parameter will return the current value. Permitted values are between the lower limit of 0 (= factory default setting) and the upper limit of 999999. A value of zero enables the standard zero range of +/-2% of max.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
ZR100↵	**OK**	Setup: Zero range = 100 d

8.2.13. ZI Initial Zero Range

[SDO 2300 sub 10]

Define the initial zero range (0...999999 d). If ZI is non-zero the device will perform an automatic Set-Zero when the weight stabilizes with the No-motion settings and the weight is within the ZI range.
Factory default: 0.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
ZI100↵	**OK**	Setup: Initial Zero range = 100 d

8.2.14. TM Tare mode

[SDO 2300 sub 12]

This command sets the tare mode. The tare modes are defined in the table below.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
TM1↵	**OK**	Setup: Tare mode = 1

Tare modes:

TM	Allow tare of negative values	Clear preset tare at return to range 1
0 (Default)	**Yes**	**Yes**
1	**No**	**Yes**
2	**Yes**	**No**
3	**No**	**No**

Note: For OIML R76 compatible applications a tare mode of 1 must be used.

8.2.15. TN Set / Clear Non-Volatile Tare

[SDO 2300 sub 13]

This command sets the tare mode to volatile or non-volatile. Value range is 0 or 1; Factory default is 0 (volatile). If set to 1 (non-volatile), every set/clear tare will write the value directly to the EEPROM.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
TN↵	**T:000**	Actual setting: TN = volatile
TN1	**OK**	Setup: TN = non-volatile

8.2.16. ZN Set / Clear Non-Volatile Zero

[SDO 2300 sub 14]

This command sets the zero mode to volatile or non-volatile. Value range is 0 or 1; Factory default is 0 (volatile). If set to 1 (non-volatile), every set/clear zero will write the value directly to the EEPROM.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
ZN↵	**Z:000**	Actual setting: ZN = volatile
ZN1	**OK**	Setup: ZN = non-volatile

8.2.17. AZ Absolute zero point calibration (eCal)

[SDO 2300 sub 02]

The command AZ is used as reference point for all weight calculations and will setup in mV/V.
Permitted values are ± 33000 (= ± 3.3000 mV/V).

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
AZ↵	**Z+00796**	Request: Zero point @ 0.0796 mV/V
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
AZ_00500↵	**OK**	New: Zero point @ 0.0500 mV/V

Factory default: 00 000d @ 0.0000mV/V input signal.

8.2.18. AG Absolute gain calibration (eCal)

[SDO 2300 sub 01]

The command AG is used as absolute gain (or measuring range) for all weight calculations and will setup in mV/V. Permitted values are ± 33000 (= ± 3.3000 mV/V).

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
AG↵	**G+001868,+010000**	Request: gain 10 000d @ 0.1868 mV/V
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
AG_+011200_+005000↵	**OK**	New: gain 5 000d @ 1.12 mV/V

Factory default: 20 000d @ 2.0000mV/V input signal.

8.2.19. CS Save the Calibration Data

[SDO 2004 sub 02]

This command results in the calibration data being saved to the EEPROM and causes the TAC to be incremented by 1.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
CS↵	**OK**	Calibration values saved

The CS command saves all of the calibration group values, as set by CZ, CG, CM'n', DS, DP and ZT. The command returns ERR and has no updating action unless it is proceded by the cmd CE_XXXXX.

8.2.20. FT Firmware Type

[SDO 2300 sub 0x15]

The LDM 64.1 with firmware version 64.181.v.3.00 or higher can be used to run different applications. The respective firmware type can be freely selected with the FT command.

The firmware types FT:

FT = 0 is the basic version with checkweigher and re-trigger functions, content of this manual.
The device ID for this firmware type is **6410**.

FT = 1 is the version for optimized 'DOSE IN' of fluids, e.g. a weighing filler for bottles with coarse, medium and fine feed. The device ID for this firmware type is **6414**.

FT = 3 is the version for 'DOSE OUT' materials, e.g. into a keg / bag / bottle etc. with coarse, medium and fine feed. The device ID for this firmware type is **6416**.

Factory default: FT=0.

Note:
Please note that the firmware type selection is locked in the same way as the calibration, that means it must be unlocked with the command "CE n" before the firmware type can be set. After new FT setting, it must be saved with the command "CS".

8.3. Motion Detection Commands – NR, NT

The motion detection facility provides a means of disabling certain functions whenever a condition of instability, or "motion", is detected. The "no motion" or "stable" condition is achieved whenever the signal is steady for the period of time set by NT, during which it cannot fluctuate by more than NR increments. The stable condition activates the relevant bit of responses to "Info Status" (IS).
Following functions are disabled if motion is detected: "Calibrate Zero" (CZ) "Calibrate Gain" (CG) "Set Zero" (SZ) and "Set Tare" (ST). After such a command the system returns an error ("ERR"), if the signal is not stable.

8.3.1. NR Set No-motion Range

[SDO 2100 sub 0A]

This is the range within which the weighing signal is allowed to fluctuate and still be considered as "stable". Permitted values are from 0 to 65535.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
NR↵	**R+00010**	Request: NR = 10 d
NR2↵	**OK**	Setup: NR = 2 d
WP↵	**OK**	Setup saved

Example: For NR = 2 the fluctuations within a maximum of ± 2 d, in the period NT, will be considered "stable".

Factory default: NR = 1 [= ±1d]

8.3.2. NT Set No-motion Time

[SDO 2100 sub 0B]

This is the period of time (in milliseconds) over which the weight signal is checked to be "stable" or not. The weight signal has to vary by less than NR divisions over the period of time NT to be considered 'stable'. Permitted values are from 0 to 65535.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
NT↵	**T+01000**	Request: NT = 1000 ms
NT500↵	**OK**	Setup: NT = 500 ms
WP↵	**OK**	Setup saved

If the value of NT = 500 milliseconds, the output must not fluctuate more than NR increments within 500 milliseconds in order to be considered "stable".

Factory default: NT = 1000 [ms]

8.4. Filter Setting Commands – FM, FL, UR

A digital filter can be set which will eliminate most of the unwanted disturbances. The commands **FM** and **FL** are used to define the digital filter settings, the command **UR** is used to define an averaging of up to 128 measurement values. Please note that these filters are positioned immediately after the A/D Converter and therefore affect all aspects of the weighing operation.

8.4.1. FM Filter Mode

[SDO 2100 sub 09]

This command defines the filter mode. Choose the filter mode for your application.
Permitted values are "0" for IIR filter and "1" for FIR filter.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
FM↵	**M+00000**	Request: FM = 0 (IIR filter)
FM0↵	**OK**	Setup: FM = 0 (IIR filter)
WP↵	**OK**	Setup saved

The digital IIR filter operates as 2nd order low pass filter and Gaussian characteristics. The attenuation is 40dB/decade (12 dB/octave).

The digital FIR filter works as a low-pass filter with quick response; damping see table mode 1.

Factory default: 0 (IIR filter)

8.4.2. FL Filter setting

[SDO 2100 sub 04]

This command defines the 3dB filter cut-off frequency.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
FL↵	**F+00003**	Request: FL = 3 (4 Hz)
FL1↵	**OK**	Setup: FL = 1
WP↵	**OK**	Setup saved

The permitted settings are from 0 to 8 (see below table).

Factory default: 3.

Mode 0 (IIR filter) Settings / Characteristics

FL	Settling time to 0.1% (ms)	3 dB Cut-off frequency (Hz)	Damping @ 300 Hz (dB)	Output rate* (samples/s)
0	**No filtering**	**		1172
1	55	18	57	1172
2	122	8	78	1172
3	242	4	96	1172
4	322	3	104	1172
5	482	2	114	1172
6	963	1	132	1172
7	1923	0.5	149	1172
8	3847	0.25	164	1172

* Output rate = $1172/2^{UR}$ samples/s ** Pre-filter 18 Hz

**** Note**: The pre-filter can be switch ON and OFF with the command **PF** – settings are 0 (OFF) or 1 (ON).
- This feature can be used with ASCII communication or CANbus [SDO 2100 sub 16].
- The use is for specialists only.

Mode 1 (FIR filter) Settings / Characteristics

FL	Settling time to 0.1% (ms)	3 dB Cut-off frequency (Hz)	20 dB damping at freq. (Hz)	40 dB damping at freq. (Hz)	Damping in the stopband (dB)	Stopband (Hz)	Output rate* (samples/s)
0	**No filtering**	**					1221
1	23	40	98	130	>90	>163	1172
2	46	20	49	65	>90	>81	586
3	69	13	33	43	>90	>53	391
4	92	10	24	33	>90	>41	293
5	114	8	20	26	>90	>33	234
6	138	6.5	16	22	>90	>26	195
7	161	5.7	14	18	>90	>22	167
8	183	5	12	16	>90	>20	147

* Output rate = Table value/2^{UR} samples/s ** Pre-filter 18 Hz

8.4.3. UR Update Rate and Averaging

[SDO 2100 sub 11]

Depending on the selected filter mode this command defines an averaging for the output value. The permitted settings are from 0 to 7 (see table below). The average value is always calculated from 2^{UR} measurement values.

LDM 64.1 allows for UR the following settings:

UR	0	1	2	3	4	5	6	7
Average of 2^{UR} values	1	2	4	8	16	32	64	128

Check / Setup of the averaging:

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
UR↵	**U+00003**	Request: Averaging of 8 values
UR7↵	**OK**	Setup: Averaging of 128 values
WP↵	**OK**	Setup saved

Factory default: 0

8.5. Taring and Zeroing Commands – SZ, ZA, RZ, ST, RT, SP

The following commands allow you to set and reset the zero and tare values. The zero set up during calibration remains the 'true zero' but the new 'current zero' can be set up by using the SZ command. If the SZ command is issued and accepted then all weight values will then be based on the new 'current zero'. Please remember that the zero value will be subject to the Zero tracking function if enabled. If the weight signal is not stable (as defined by No motion range NR and No motion time NT) then both, the set zero SZ and set tare ST commands will be disabled. Also the set zero SZ command is not allowed if the new zero value required and the 'calibration zero' differ by more than 2 % of the CM value (maximum allowable value).
See chapter 9 Used in "Approved" applications.

8.5.1. SZ Set System Zero

[RPDO1,02]

This command sets a new "current zero" which is then the basis of all weight values until further updated by the zero tracking function, another SZ command or the "reset zero" command RZ.

Master (PC / SPS) sends	Slave (LDM 64.1.1) responds	Meaning
SZ↵	**OK**	Set zero performed

The SZ command will fail (LDM 64.1 responds with ERR) if the new "current zero" is more than 2%* (of CM) higher or lower than the "true zero" set during calibration. The SZ command will also fail if the weight signal is not stable as defined by No motion range (NR) and No motion time (NT). If the weight signal is "stable", the response to the IS command (Device Status) will show the "signal stable" bit active and the SZ command will be accepted (OK). If the "signal stable" bit is not active, the SZ command will be rejected and the LDM will respond with ERR (error).
* Note: Tis value can also be user defined – use ZR command.

8.5.2. RZ Reset Zero

[RPDO1,01]

This command cancels the SZ command and the zero reading reverts to that set by the CZ command during calibration.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
RZ↵	**OK**	Zero point CZ active

The LDM responds to the RZ command with either OK or ERR. If OK is returned then the “zero action performed” bit in the Device Status (IS) response will be set to “0”.

8.5.3. ST Set Tare

[RPDO1,08]

This command will activate the net weighing function by storing the current weight value as a tare value. The weight signal must be “stable” within the limits set by NR (No Motion Range) and NT (No Motion Time) commands for the “signal stable” bit to be active and set tare command to be accepted.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
ST↵	**OK**	Tare performed / Net operation

If the weight signal is “stable”, the response to the IS command (Device Status) will show the “signal stable” bit active and the ST command will be accepted (OK). If the “signal stable” bit is not active, the ST command will be rejected and the LDM will respond with ERR (error).

8.5.4. RT Reset Tare

[RPDO1,04]

This command resets the tare and the weighing signal returns to gross mode.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
RT↵	**OK**	Tare de-activated / Gross operation

The LDM responds to the RT command with either OK or ERR. If OK is returned then the “tare active” bit in the Device Status (IS) response will be set to “0”.

8.5.5. SP Set Preset Tare

[SDO 2100 sub 17]

This command sets a preset tare value.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
SP↵	**T+000000**	Tare value 0 (factory default
SP1000	**OK**	Setup tare value 1000d

8.6. Output Commands – GG, GN, GT, GS, GW, GA, GL, OF

The following commands “Get’s” the gross, net, tare and ADC sample values from the LDM 64.1.

8.6.1. GG Get Gross Value

[SDO 2900 sub 01]

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
GG↵	**G+001.100**	Gross value: 1.100 d

8.6.2. GN Get Net Value

[SDO 2900 sub 02]

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
GN↵	**N+001.000**	Net value: 1.000 d

8.6.3. GT Get Tare Value

[SDO 2900 sub 03]

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
GT↵	**T+000.100**	Tare value: 100 d

8.6.4. GS Get ADC Sample Value

[SDO 2900 sub 07]

This command gets the actual Analogue to Digital Converter (ADC) value. This can be useful during development or when calibrating to see how much of the ADC range is being used.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
GS↵	**S+125785**	ADC sample value = 125785 d

For service purposes it may be helpful to note the GS values for the “no-load” or “zero” output and when the “calibration load” is applied.

8.6.5. GW Get Data String “Net, Gross and Status“

[n.a.]

Master (PC / SPS) sends	Slave (LDM 64.1) resp.	Meaning
GW↵	**W+000100+00110005AB (example)**	Net value: +000100 d (no decimal point) Gross value: +001100 d (no decimal point) Status bits 1: **0** (Hex) Status bits 2: **5** (Hex) Check sum: **AB** (Hex)

The status bits 1 and 2 are defined as follows:

Status				
	Value = 1	Value = 2	Value = 4	Value = 8
Status bits 1	Input 0	Input 1	Setpoint 0	Setpoint 1
Status bits 2	Signal stable	Set zero performed	Tare active	Center 0

The check sum is the negative value of the sum of all ASCII values within the data string without the check sum itself.

8.6.6. GA Get Triggered Average Value

[SDO 2900 sub 06]

This command reads the measurement result of a measurement cycle. The measurement value has been averaged according the defined measuring time. The trigger commands can be found in chapter 8.12 and 8.13.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
GA↵	**A+001.100**	Request: GA = 1100 g

Note: For preventing errors during the read out of the data, the register GA has stored the value 999999 at the beginning of the measurement cycle. The measurement result can only be read after the defined measuring time MT has been elapsed and before a new measurement cycle has been started.

8.6.7. GL Get Data String "Average, Gross and Status"

[n.a.]

Master (PC / SPS) sends	Slave (LDM 64.1) resp.	Meaning
GL↵	**L+000100+00110005B6 (example)**	Average value: +000100 d (no decimal point) Gross value: +001100 d (no decimal point) Status bits 1: **0** (Hex) Status bits 2: **5** (Hex) Check sum: **B6** (Hex)

For check sum, status bits 1 and status bits 2, see command GW.

8.6.8. OF Output Format for Data String GW and GL

[n.a.]

This command puts the range information and/or the decimal point into the "long" data strings of the GW and GL output response.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
OF1↵	**OK**	Setup: OF = 1

Output Format		
Parameter setting	Range Information	Decimal Point in GW/GL response
0 (= factory default)	No	No
1	Yes	No
2	No	Yes
3	Yes	Yes

E.g. when the range information is selected, the data strings will change from G+000000 to Gn+000000, where 1 ≤ n ≤ 3.

8.7. Auto–transmit Commands – SG, SN, SX, SA, SL

The following commands allow the gross weight or net weight values to be continuously sent. Continuous transmission starts as soon as the relevant command has been issued and finishes when any other valid command is accepted by the LDM 64.1.

The continuous transmission of either the gross or net values will stop when another valid command is received.

Note: All commands in this chapter: CANbus [n.a.]

8.7.1. SG Send Gross Value continuously

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
SG↵	**G+001.100**	Gross value: 1,100 d

8.7.2. SN Send Net Value continuously

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
SN↵	**N+001.000**	Net value: 1,000 d

8.7.3. SX Send ADC Sample Value continuously

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
SX↵	**S+125785**	ADC sample value = 125785 d

8.7.4. SA Send Triggered Average Value automatically

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
SA↵	**OK**	Auto-Transmit: triggered average value

This command will start to auto-transmit the measurement value of the current trigger cycle. The trigger setup commands are described in the chapters 8.12 and 8.13.

8.7.5. SL Send Data String “Average, Gross and Status“ automatically

Master (PC / SPS) sends	Slave (LDM 64.1) resp.	Meaning
SL↵	**L+000100+00110005B6 (example)**	Average value: +000100 d (no decimal point) Gross value: +001100 d (no decimal point) Status bit 1: 0 (Hex) Status bit 2: 5 (Hex) Check sum: B6 (Hex)

For check sum, status bit 1 and status bit 2 - see command SW.

8.7.6. SW Send Data String “Net, Gross and Status“ continuously

Master (PC / SPS) sends	Slave (LDM 64.1) resp.	Meaning
SW↵	**W+000100+00110005AB (example)**	Average value: +000100 d (no decimal point) Gross value: +001100 d (no decimal point) Status bit 1: 0 (Hex) Status bit 2: 5 (Hex) Check sum: AB (Hex)

Issuing the SW command, which has no parameters, will return continously the net weight, the gross weight, the status and the checksum values, all combined into one single string in the format **W+000100+00110005AB**.

For more detailed information of the data string see command GW (chapter 8.6.5).

8.8. Commands for External I/O Control – IN, IO and OM

8.8.1. IN Read status of the logic inputs

[SDO 2100 sub 07]

This command reads the status of the logic inputs.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
IN↵	**IN:0000**	All Inputs inactive
IN↵	**IN:0001**	Input 0 active
IN↵	**IN:0010**	Input 1 active

The status response is in the form of a four digit code where 0 = false and 1 = true (inputs are active 'high'). The least significant bit corresponds to Input 0.

8.8.2. IO Read / modify the status of the logic outputs

[SDO 2100 sub 06]

This command reads and can modify the status of the logic outputs (if enabled by the OM command). The status response is in the form of a four digit code where 0 = false and 1 = true (outputs are normally open, open drain MOSFET's), the least significant bit corresponds to Output 0.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
IO↵	**IO:0001**	Output 0 is active
IO↵	**IO:0010**	Output 1 is active

The status of the outputs can be changed by issuing the IO command with the appropriate 4 digit code e.g. IO 0001 where in this example output 0 will be activated (FET conducting). Please note that the status of the logic outputs is normally determined by the internal setpoints (see section 8.9.3) and therefore setting the logic output status using the IO commands is **not** allowed.

Setting

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
IO_0010↵	**OK**	Set output 1 active
IO_0011↵	**OK**	Set outputs 0 and 1 active

However, the OM command can be used to allow the status of the logic outputs to be set via the IO command.

8.8.3. OM Control of the logic outputs by the host application

[SDO 2100 sub 0C]

The logic outputs can be controlled by the host application (as opposed to the normal internal setpoints) if they are enabled by the OM command and the appropriate 4 digit code.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
OM↵	**OM:0001**	Setting Output 0 is enabled
OM↵	**OM:0011**	Setting Outputs 0 and 1 are enabled

A "1" bit in the code enables the corresponding logic output to be controlled by the host application using the IO command. A "0" in the code leaves the corresponding logic output controlled by the internal setpoint. Logic output 0 is again the least significant bit.

Setting

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
OM_0010↵	**OK**	Enables output 1
OM_ 0011↵	**OK**	Enables outputs 0 and 1

Note: When reading the status of the logic outputs using the IO command, the setpoint status will be returned regardless of the OM setting. Sending OM_0000 disables the external logic output control.

8.9. Setpoint Output Commands – S'n', H'n', A'n', HT

Each logic output can be assigned to an independent setpoint value (S'n') with a corresponding hysteresis/switch action (H'n') and allocation (A'n' – source is the Gross, Net or Average weight).

8.9.1. S'n' Setpoint Value

[**S0**: SDO 2600 sub 01] [**S1**: SDO 2600 sub 02] [**S2**: SDO 2600 sub 03] [**S3**: SDO 2600 sub 04]

A setpoint is the trigger level that causes action of the output channel relay, according to the settings of the controls A'n' and H'n'.

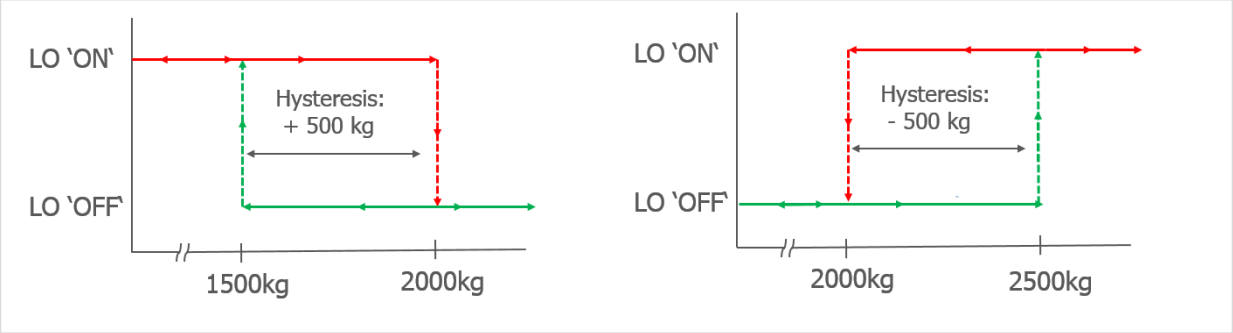
Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
S0↵	**S0:+010000**	Request: Setpoint S0 = 10000 d
S0_3000↵	**OK**	Setup: Setpoint S0 = 3000 d
S1↵	**S1:+011000**	Request: Setpoint S1 = 11000 d
S1_5000↵	**OK**	Setup: Setpoint S1 = 5000 d

8.9.2. H'n' Hysteresis and Switching Action for a Setpoint

[**H0**: SDO 2700 sub 01] [**H1**: SDO 2700 sub 02] [**H2**: SDO 2700 sub 03] [**H3**: SDO 2700 sub 04]

The setpoint switching logic is defined by the numeric value and polarity of the hysteresis.

Examples of the switching actions for a Setpoint value of 2 000kg



Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
H0↵	**H0:+00001**	Request: setup hysteresis of setpoint S0
H0_100↵	**OK**	Setup: pos. hysteresis 100d for setpoint S0
H1↵	**H1:+00001**	Request: setup hysteresis of setpoint S1
H1_-5000↵	**OK**	Setup: neg. hysteresis -5000d for setpointS1

Allowed hysteresis values are within the range from -32768 to 32767 at a step size of 1.

8.9.3. A'n' Allocation source for a Setpoint

[**A0**: SDO 2800 sub 01] [**A1**: SDO 2800 sub 02] [**A2**: SDO 2800 sub 03] [**A3**: SDO 2800 sub 04]

Set the source for setpoint 'n'. This source will trigger the required action of the output channel relay, according to the settings of the controls S'n' and H'n'.

Choose the source for the setpoint 'n':

0 – Gross weight
1 – Net weight
2 – Average weight

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
A0↵	**A0:+00000**	Request: Source Gross for setpoint S0
A0_1↵	**OK**	Setup: Source Net for setpoint S0
A0↵	**A0:+00001**	Request: Source Net for setpoint S0
A1_1↵	**OK**	Setup: Source Net for setpoint S1

Note: All changes to the setpoint settings have to be stored in the EEPROM using the SS command. See chapter 8.11.3

8.9.4. HT Hold time for all Setpoints

[SDO 2500 sub 05]

This command defines the hold time for the setpoint limit. The signal has to exceed the setpoint limit continuously at least for this time period before a switch event will be initiated (see chapter 8.9 for setpoint setup).

Note: This setup will affect all setpoints.

Permitted value rang eis 0 to 65535 ms.

Default setting: HT = 0 ms.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
HT↵	**H+00000**	Request: HT = 0 ms
HT200↵	**OK**	Setup: HT = 200 ms

8.10. Communication Setup Commands – AD, CR, NA, NS, BR, DX

8.10.1. AD Device Address – Serial channel

[n.a.]

This command can set up the device address in the range from 0 to 255.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
AD↵	**A:000**	Request: Address 0 (= factory default)
AD49↵	**OK**	Setup: Address 49

Setting the device address to “0“ will cause the device to be permanently active, listening and responding to every command on the bus without the need for an OP command.

Note: After editing the address you first have to save the changes (command WP) and then restart the device.

8.10.2. NA Network Address - CANbus

[SDO 2007 sub 02]

This command displays or sets a network address for the CAN interface. The permitted range is from1 to 127.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
NA↵	**A:001**	Show CAN interface address
NA_15↵	**OK**	Set CAN interface address to15

Factory default: 1

8.10.3. NS Network Settings – For Serial Channel and CAN Interface

[n.a.]

The command **NS** <Interface> <Param> [New Value] can display or set various communication parameters in the device.

The parameter "Interface" addresses the physical interface on the device and the parameter "Param" addresses the available parameters for this interface. All LDM devices have a serial channel (UART) and a CAN interface.

Serial channel ("Interface" = 0)

The following parameters are defined for the serial channel:

"Param"	Parameter name	Allowed values
0, *Note 1*	Device ID (Read only)	N/A
1, *Note 2*	Baud rate	9600, 19200, 38400, 57600, 115200, 230400 and 460800 bit/sec.
2, *Note 3*	Loop address	0 to 255
4, *Note 4*	Tx Delay	0 to 255

Notes for the interfaces 0 (serial)
Note 1: Identical to the ID command. Note 2: Identical to the BR command.
Note 3: Identical to the AD command. Note 4: Identical to the TD command.

CAN Interface ("Interface" = 1)

The following parameters are defined for the CAN interface:

"Param"	Parameter name	Allowed values
0, *Note 1*	Device ID (Read only)	N/A
1, *Note 2*	CANopen address	1 to 127
2	Bit rate	10, 20, 50, 125, 250, 500, 800 and 1000 kbit/s
6	TPDO1 Divider	0…65535

Notes for the interfaces 1 (CAN)
Note 1: Identical to the ID command.
Note 2: Identical to the NA command.

Examples:

Master (PC / PLC) sends	Slave (LDM) responds	Meaning
NS_0_0↵	**D:6410**	The device type is LDM 64.1
NS_0_1↵	**B 115200**	The serial channel baud rate is 115200
NS_0_2↵	**A:000**	The serial channel address is 0
NS_0_1_230400↵	**OK**	Set the serial channel baud rate to 230400

8.10.4. BR Baud Rate – Serial channel

[n.a.]

With this command the following baud rates can be setup: 9600, 19200, 38400, 57600, 115200, 230400 and 460800 Baud.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
BR↵	**B 115200**	Request: 115200 Baud (= factory default)
BR230400↵	**OK**	Setup: 230400 Baud

Factory default: 115200 baud

Note: After editing the baud rate you first have to save the changes (command WP) and then restart the device.

8.10.5. DX Full Duplex – Serial channel

[n.a.]

Master (PC / SPS) sends	Slave (LDM 64.1) resp.	Meaning
DX↵	**X:001**	Request: DX = 1 (Full duplex, factory default))
DX1↵	**OK**	Setup: DX = 1 (Full duplex)

Note: The LDM 64.1 *always* operates in full duplex mode.

8.11. Save Calibration and Setup Data Commands – CS, WP, SS, GI, PI

The calibration and setup parameters can be divided in 3 groups:

- **Calibration**: CM, DS, DP, CZ, CG, ZT, IZ and FD, etc. saved by command **CS**
- **Setup**: FL, FM, NR, NT, BR, AD, DX and others, saved by command **WP**
- **Setpoints:** S0, S1, H0, H1, A0, A1 saved by command **SS**

Note: Calibration data can only be saved if the TAC code is known and precedes the CS command. See the **CE** and **CS** commands in chapter 8.2.

The setup data and the setpoint data will be stored non-volatile in the EEPROM using the **WP** respective **SS** command.

8.11.1. CS Save the Calibration Data

[SDO 2004 sub 02]

This command results in the calibration data being saved to the EEPROM and causes the TAC to be incremented by 1.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
CS↵	**OK**	Calibration values saved

The CS command saves all of the calibration group values, as set by CZ, CG, CM'n', DS, DP and ZT. The command returns ERR and has no updating action unless it is preceded by the CE_XXXXX.

8.11.2. WP Save the Setup Parameters

[SDO 2004 sub 03]

With this command the settings of the "Filter" (FL, FM), the "No-motion" (NR, NT) and the communication (AD, BR, DX) will saved in the EEPROM.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
WP↵	**OK**	Setup data saved
WP↵	**ERR**	Error

8.11.3. SS Save Setpoint Parameters

[SDO 2004 sub 05]

With this command the setpoints (S'n'), the setpoint hysteresis (H'n') and the setpoint allocation (A'n') will be saved in the EEPROM.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
SS↵	**OK**	Setpoint parameters saved
SS↵	**ERR**	Error

8.11.4. GI Get an Image File from the EEPROM

[n.a.]

Retrieves a HEX-INTEL formatted EEPROM image file from the EEPROM of the source LDM64.1. The image file contains all stored information. It does contain the calibration data but the precision will be limited when it is transferred to another LDM. This image file can be downloaded to any LDM64.1 with the same firmware type and revision No. as the source LDM64.1.

8.11.5. PI Download an Image File to the EEPROM

[n.a.]

Downloads a HEX-INTEL formatted EEPROM image file to the target LDM64.1 EEPROM. The image file contains all stored information.

Attention: The target LDM64.1must have same firmware type and revision no. as the source LDM64.1.

8.12. Trigger Commands – SD, MT, GA, TE, TR, TL, SA

The trigger commands can be used for **control weighing** or **checkweigher** measurements. Base for this is the high output rate of up to 1,200 measurements per second.

Note: All changes of trigger commands have to be stored in the EEPROM using the WP command. See 8.11.2.

8.12.1. SD Start Delay Time

[SDO 2100 sub 0E]

This command defines a time delay between the trigger and the start of the measurement.
Setting range: 0 ms to 65535 ms.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
SD↵	**S+00100**	Request: SD = 100 ms
SD200↵	**OK**	Setup: SD = 200 ms

Default setting: SD = 0 ms; time plot of a typical checkweigher cycle see below.

8.12.2. MT Measuring Time

[SDO 2100 sub 08]

This command defines the measuring time for the averaged measurement result.
Setting range: 0 ms to 3000 ms.

Master (PC / SPS) sends	Slave (179.1) responds	Meaning
MT↵	**M+00100**	Request: MT = 100 ms
MT500↵	**OK**	Setup: MT = 500 ms

Note: The setting MT = 0 disables the trigger function and the averaging.
Default setting: MT = 0 [= trigger function disabled]; time plot of a typical checkweigher cycle see below

8.12.3. GA Get Triggered Average Value

[SDO 2900 sub 06]

This command reads the measurement result of a measurement cycle. The measurement value has been averaged according the defined measuring time.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
GA↵	**A+001.100**	Request: GA = 1100 g

Note: For preventing errors during the read out of the data the register GA has stored the value 999999 at the beginning of the measurement cycle. The measurement result can only be read after the defined measuring time MT has been elapsed and before a new measurement cycle has been started.

8.12.4. TE Trigger Edge

[SDO 2500 sub 02]

This command defines the trigger edge. Allowed settings are “0” for falling edge and “1” for rising edge. This command can only be used in conjunction with a hardware trigger on the digital input channel 0.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
TE↵	**E:001**	Request: TE = 1 (rising edge)
TE0↵	**OK**	Setup: TE = 0 (falling edge)

Default setting: TE = 0 [= falling edge]; time plot of a typical checkweigher cycle see next page.

8.12.5. TR Software Trigger

[RPDO2,80]

This command starts a measurement cycle. Its execution is similar to hardware trigger via input IN0.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
TR↵	**OK**	Trigger event

8.12.6. TL Trigger Level

[SDO 2500 sub 01]

This command defines a level for a rising edge trigger on the measurement signal. Setting range: 0 to 999999.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
TL↵	**T+999999**	Request: TL = 999999
TL1000↵	**OK**	Setup: TL = 1000

In the example a new measurement cycle would automatically start, if the signal exceeds 1000 d (e.g. 100,0 g; trigger commands SD and TL).
Default setting: TL = 999999 [= trigger level disabled]

Note: All trigger possibilities are always available in parallel. If a software trigger (command TR) or a hardware trigger (digital input IN0) will be used the trigger level should be set to its maximum value (TL = 999999). This setting disables the trigger level.

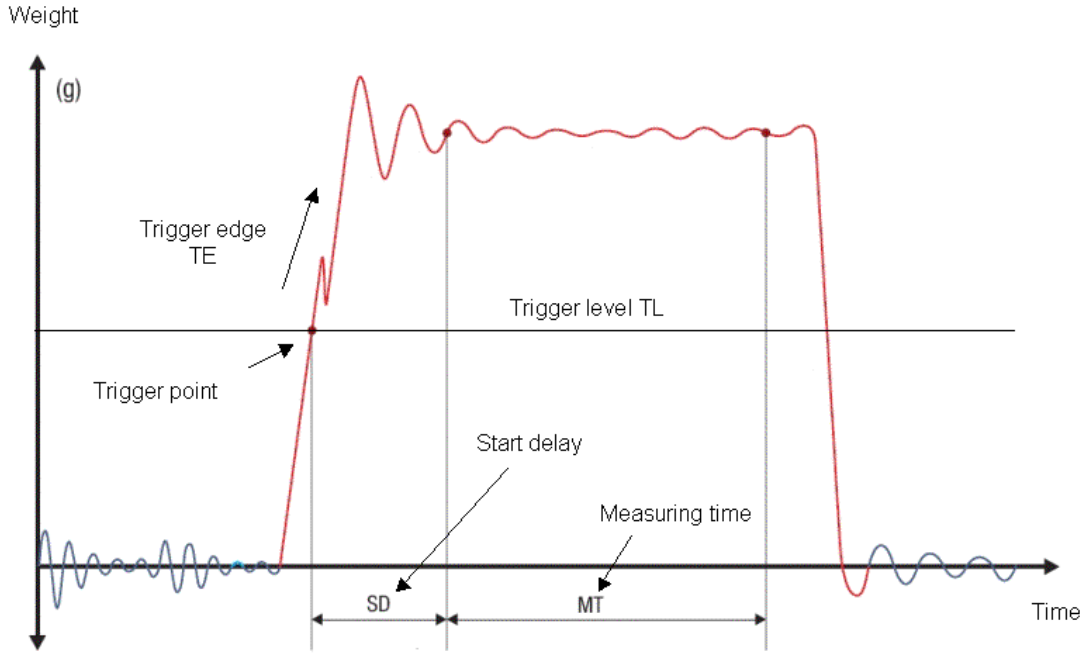


Figure: Time plot of a typical checkweigher cycle

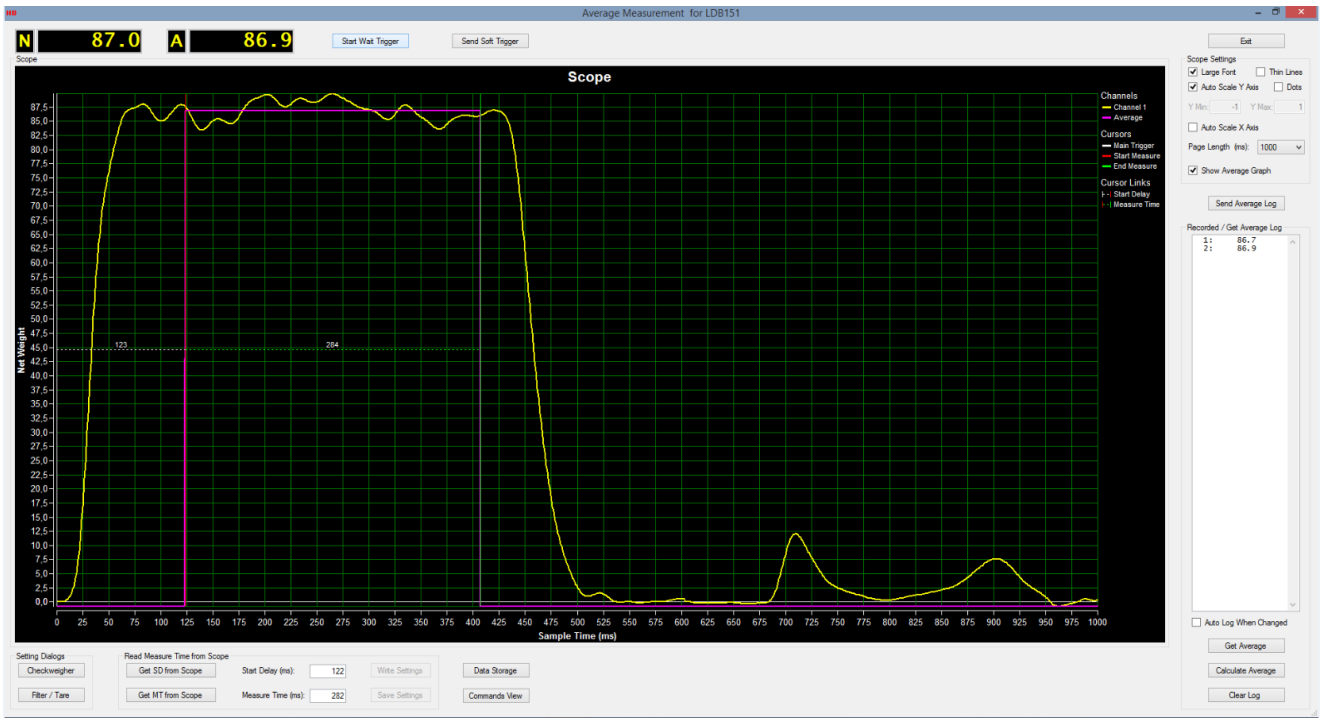
8.12.7. SA Send Triggered Average Value automatically

[n.a.]

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
SA↵	**OK**	Auto-Transmit: triggered average value

This command will start to auto-transmit the measurement value of the current trigger cycle.

8.12.8. Example of Live Checkweigher Measurement with DOP4



This is an example of recording a checkweigher measurement while passing the weighing belt.

8.13. Re-Trigger Commands – RW, TT, TS, DT, TW and TI

The re-trigger commands, together with the trigger commands, can be used for **multihead scale applications**. Base for this are the high output rate of up to 1,200 measurements per second and all the re-trigger features.

Note: All changes of re-trigger commands have to be stored in the EEPROM using the cmd WP. See 8.11.2

8.13.1. RW Trigger Window for Re-Trigger Function

[SDO 2500 sub 03]

This command defines a trigger window in unit d (digits) around the current cycle average value. If the signal leaves this window even for one sample, then the averaging over the time period TT will be started again.
For using the automatic re-trigger function, it is required to define a short-time averaging period (command DT, see below) before you can use this function.
Default value: RW = 65535 d.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
RW↵	**R+65535**	Request: RW = 65535 d
RW500↵	**OK**	Setup: RW = 500 d

8.13.2. TT Averaging Time for Re-trigger Function

[SDO 2500 sub 04]

This command defines a special average time while the re-trigger function is active. If this time period has been elapsed, the measurement cycle will be finished.
The setting TT = 0 disables the re-trigger function. Default setting: TT = 65535 ms.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
TT↵	**T+65535**	Request: TT = 65535 ms
TT300↵	**OK**	Setup: TT = 300 ms

8.13.3. TS Stop Value for Re-trigger Function

[SDO 2500 sub 08]

This command defines a stop criteria in unit d (digits) for the re-trigger function. If the signal falls more than this value TS below the cyclic average value, then the measurement cycle will be finished.
Default setting: TS = 0 d.

Master (PC / SPS) sends	Slave (LDU179.1) responds	Meaning
TS↵	**T+65535**	Request: TS = 65535 d
TS480↵	**OK**	Setup: TS = 480 d

8.13.4. DT Short-time Averaging Period

[SDO 2500 sub 0B]

This command defines a time period in milliseconds to calculate short-time averages. If the short-time average falls outside the trigger window, then the measurement will be started again.

Default setting: DT = 50ms

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
DT↵	**T+00050**	Request: DT = 50 ms
DT25↵	**OK**	Setup: DT = 25 ms

8.13.5. TW Window for Automatic Taring

[SDO 2500 sub 06]

This command defines an amplitude window for the automatic taring. The setting TW = 100 means, that the system calculates a new tare value, if the averaged net value of the empty scale falls within 100 digits of the net zero point. The new tare value will be averaged over the time period TI (see below). If the averaged tare value falls outside this window, then the tare value will not be updated.
Default setting: TW = 0 [= automatic taring disabled]

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
TW↵	**T+00000**	Request: TW = 0 d
TW100↵	**OK**	Setup: TW = 100 d

8.13.6. TI Averaging Time for Automatic Taring

[SDO 2500 sub 07]

This command defines the averaging time for the automatic taring. Within this time period the system calculates an averaged tare value. Default setting: TI = 0 ms.

Master (PC / SPS) sends	Slave (LDM 64.1) responds	Meaning
TI↵	**T+00000**	Request: TI = 0 ms
TI200↵	**OK**	Setup: TI = 200 ms

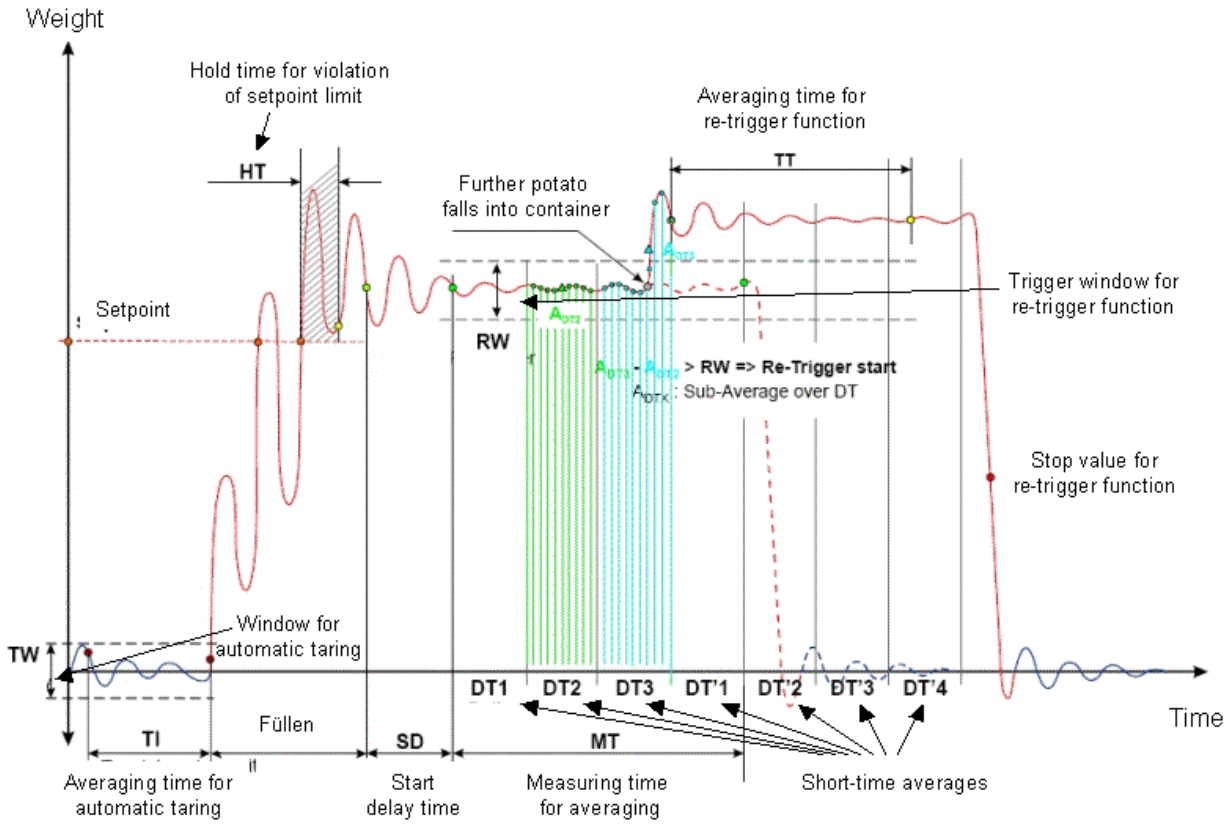
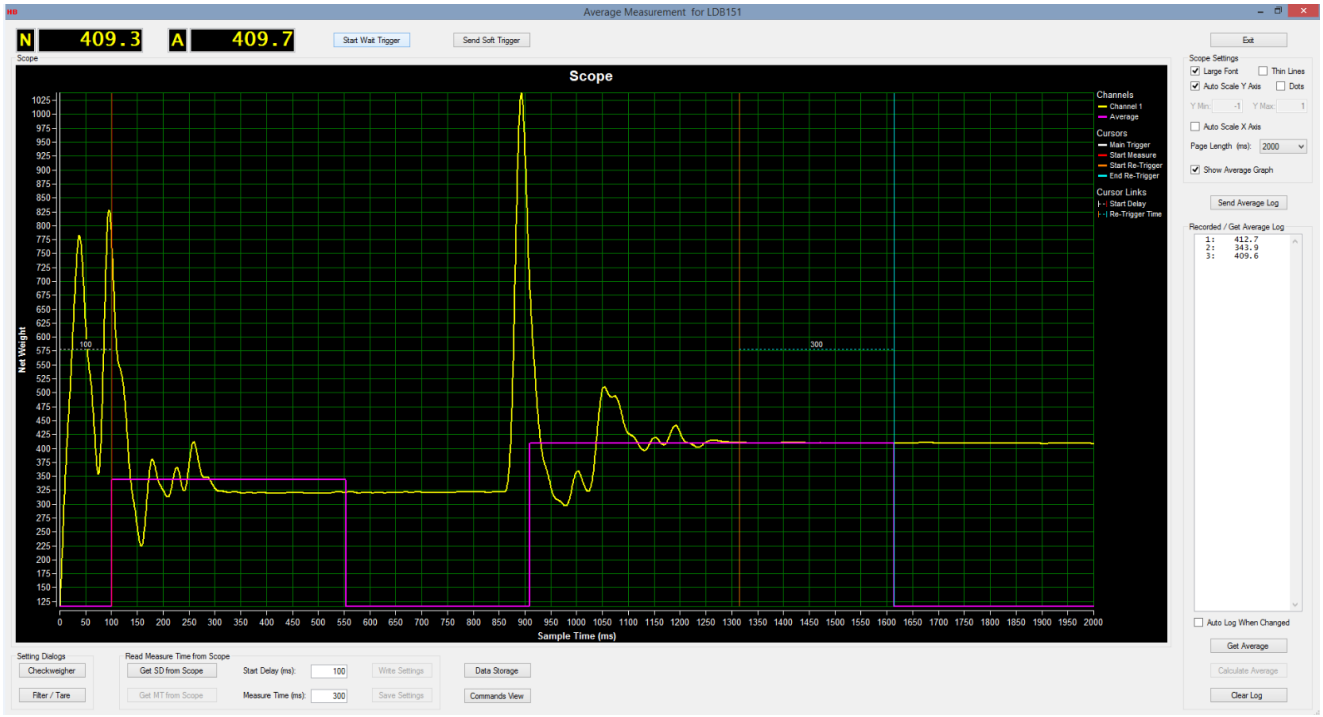


Figure: Time plot of a measurement cycle with the re-trigger function

8.13.7. Example of Live Multihead Scale Measurement with DOP4



This is an example of recording a multihead scale measurement while potatoes fall into the scale.

9. CANopen interface

9.1. General

The CAN interface follows the CAN2.0B recommendations. It receives both - 11 bit identifiers, and tolerates 29 bit identifiers. It only transmits 11 bit identifiers.

The **CAN rate** is setup as default to **500 kbit/s**.

The LDM 64.1 is always quiet on the CAN bus until the NMT Start command is received, except for the very first ‘node guard’ message.

When started by the NMT Start the LDM 64.1 starts transmitting TPDO1 messages with weight and status.

The default is the net value. When filling is in progress the gateway transmits a TPDO2 every time a module changes state to ‘wait for trigger’. This TDPO2 contains the module number, the module status and the dosed weight. In checkweigher applications the TPDO2 is used to send triggered measurements.

With RDPO1 frames you can send simple commands without an acknowledgement. The functions are: select gross or net value in TPDO1, set or clear system zero, set or clear tare.

With RPDO2 frames you can send triggers or stop triggers. For the filling application the trigger can be used to start the filling cycle. On checkweigher applications the trigger can start measurements and a stop-trigger will stop further internal re-triggers.

RPDO3 and RPDO4 are ignored by the LDM 64.1.

SDOs are handled according to profile and CANopen recommendation.

The LDM supports both - ‘node guarding’ and ‘heart beat’.

9.2. The PDOs

The Weight and status is sent using TPDO1. One TPDO1 is sent each time a new measurement is ready. The high measuring rate of the LDM 64.1 will result in approx. 1200 TPDO1's per second. If the PLC system can't handle 1.200 meas./sec., the output rate can be reduced – see the command NS1_6 (index 2007 sub 6), only for CANbus available.
The TPDO2 is sent when an average measurement is ready. The TPDO2 has the same format as TPDO1.
The TPDO3 is sent when the tare changes. It has the same format as TPDO1.

The format of the TPDO1, TPDO2 and TPDO3 is:

32 bit	16 Bit	8 bits	8 Bit
Weight	Qualifier	Module Number	Type

The first field is a single precision float value carrying weight information, gross or net value if it is a TDPO1, average weight if it is a TPDO2 and tare value if it is a TPDO3.

The qualifier follows as a 16 bit field with the following values defined:

0x0001 - Under range,
0x0002 - Over range,

0x0008 - Center zero,
0x0010 - No motion,
0x0020 - Tare set,

0x0080 – ADC Error,
0x0100 - Set-point 0 (source>limit),
0x0200 - Set-point 1,
0x0400 Set-point 2,
0x0800 Set-point 3,
0x1000 Filling in progress,
0x2000 Filling complete,
0x4000 Average data ready.

The third field is the module number (CAN Open address) as an unsigned 8 bit value.

The fourth field is a code identifying the type of the weight field defined as:

0x00 = Gross weight.
0x01 = Net weight.
0x02 = Tare weight.
0x03 = Average weight.

TPDO1

- Weight values are available at all times
- The following table shows the information of TPDO1:

32 bit	16 bit	8 bit	8 bit
Weight	Module Status	Module Number	0 or 1

- Default: Net weight.
- Refresh time: Controlled by the setup of command UR.
- Format: Floating point single precision (IEEE 754)

TPDO2

- Average weight GA is available and refreshes when a new measurement is ready.

TPDO3

- Tare weight GT is available and refreshes when a new tare value is set.

RPDO1

- The following commands can be executed direct:

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
SG				ST	RT	SZ	RZ
128				08	04	02	01

Examples: - Setting tare: Transmit RPDO1 [08]
- Setting gross weight in TPDO1: Transmit RPDO1 [128]

RPDO2

- The following commands can be executed direct:

bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
TR							
128							

Example: - Setting trigger start: Transmit RPDO2 [128]

9.3. The SDOs

The CANopen SDOs is a confirmed service, and overrun does not occur if the CAN controller only communicates with the LDM in the PRE-OPERATIONAL state. When a SDO has been received by the controller no further communication takes place until the service has been acknowledged (or a timeout occurs).

SDO's

- Are only available on request
- See tables 6.5 Object Directory
- Can be used for complete setup of the LDM 64.1 via CAN bus master, e.g:
  - Filter setting: Index 2100, Subindex 4
  - Filter Mode setting: Index 2100, Subindex 9
- Can be used to get information regarding all the commands available, e.g:
  - Net weight: Index 2900, Subindex 2
  - AD sample: Index 2900, Subindex 7

9.4. Communication Profile

The parameters, which are critical for communication, are determined in the communication profile.
This includes the data for manufacturer's product nomenclature, for identification, or the parameters for object mapping.

Abbreviations used in Tables:

ro	read only
rw	read / write
wo	write only (read will not be regarded as an error, but returns undefined results)
UI8	Unsigned 8
UI16	Unsigned 16
UI32	Unsigned 32
I32	Signed 32
REAL32	32 bit IEEE754 floating point
VS	Visible String

9.5. Object Directory

The object directory of the CAN communication system is described below.

Communication Profile (Tables)

Index	Sub-index	Name	Type	Attri-bute	Default-value	Meaning
0x1000	0x00	Device Type	UI32	ro	0	Non standard device profile
0x1001	0x00	Error Register	UI8	ro	0	Not used
0x1002	0x00	Status register	UI32	ro	0	Not used
0x1005	0x00	COB-ID Sync message	UI32	ro	0x80	COB-ID of the SYNC object
0x1006	0x00	Communication cycle period	UI32	rw	0	Not used
0x1007	0x00	Synchronous Window Length	UI32	rw	0	Not used
0x100C	0x00	Guard Time	UI16	rw	320	Cycle time in ms, set by the NMT Master or the configuration tool. Index 0x100C and 0x100D are used if index 0x1017 is zero.
0x100D	0x00	Life Time Factor	UI8	rw	3	Life time is set by the NMT Master or the configuration tool.
0x1014	0x00	COB-ID Emergency Message	UI32	ro	0x80 + Node ID	COB-ID of the Emergency Object
0x1017	0x00	Heartbeat Time	UI16	rw	0	Producer Heartbeat time in ms. If index 0x1017 is non-zero the Heartbeat protocol is used, otherwise the Node-guard protocol is used.
0x1018	0x00 0x01 0x02 0x03 0x04	Identity Object Vendor ID Product Code Revision Number Serial Number	UI8 UI32 UI32 UI32 UI32	ro ro ro ro ro	4 0x269 0x6410 - -	Number of entries Vendor ID Product Code Revision Number Serial Number
0x1400	0x00 0x01 0x02	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 0x200 + Node ID 0xFF	Communication parameters of 1st Receive PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.
0x1401	0x00 0x01 0x02	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 0x300 + NodeID 0xFF	Communication parameters of 2nd Receive PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.

Index	Sub-index	Name	Type	Attri-bute	Default-value	Meaning
0x1402	0x00 0x01 0x02	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 0x80000400 + NodeID 0xFF	Communication parameters of 3rd Receive PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.
0x1403	0x00 0x01 0x02	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 0x80000500 + NodeID 0xFF	Communication parameters of 4th Receive PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.
0x1600	0x00 0x01	Entries in Rx PDO 1 1st Object Cmd. Byte	UI8 UI32	ro ro	2 0x20060308	Mapping parameters of the 1st Receive-PDO Object is a bitwise command: Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 Bit0 Cmd: SnG ST RT SZ RZ
0x1601	0x00 0x01	Entries in Rx PDO 2 1st Object Cmd. Byte	UI8 UI32	ro ro	2 0x20060408	Mapping parameters of the 2nd Receive-PDO Object is a bitwise command: Bit7 Bit6 Bit5 Bit4 Bit3 Bit2 Bit1 Bit0 Cmd: TR
0x1602	0x00	Number of mapped Entries in Rx PDO 3	UI8	ro	0	Mapping parameters of the 3rd Receive- PDO (disabled)
0x1603	0x00	Number of mapped Entries in Rx PDO 4	UI8	ro	0	Mapping parameters of the 4th Receive-PDO (disabled)
0x1800	0x00 0x01 0x02	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 0x180 + Node ID 0xFF	Communication parameters of 1st Transmit PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.
0x1801	0x00 0x01 0x02	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 0x280 + Node ID 0xFF	Communication parameters of 2nd Transmit PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.
0x1802	0x00 0x01 0x02	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 0x380 + NodeID 0xFF	Communication parameters of 3rd Transmit PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
0x1803	0x00	Number of elements	UI8	ro	2	Communication parameters of 4th Transmit PDO
	0x01	COB-ID	UI32	ro	0x80000480 + NodeID	Determined using the CANopen minimum system ID assignment procedure.
	0x02	Transmission type	UI8	ro	0xFF	Asynchronous communication. (Not used, will not be transmitted)
0x1A00	0x00	Number of mapped Entries in Tx PDO 1	UI8	ro	4	Mapping parameters of the 1st Transmit-PDO
	0x01	1st Object	UI32	ro	0x29000220	32 bit IEEE754 floating point weight value.
	0x02	2nd Object	UI16	ro	0x29000D10	Qualifier
	0x03	3rd Object	UI8	ro	0x20070208	Module number
	0x04	4th Object	UI8	ro	0x00000000	Value type
0x1A01	0x00	Number of mapped Entries in Tx PDO 2	UI8	ro	4	Mapping parameters of the 2nd Transmit-PDO
	0x01	1st Object	UI32	ro	0x29000620	32 bit IEEE754 floating point average value.
	0x02	2nd Object	UI16	ro	0x29000D10	Qualifier
	0x03	3rd Object	UI8	ro	0x20070208	Module number
	0x04	4th Object	UI8	ro	0x00000000	Value type
0x1A02	0x00	Number of mapped Entries in Tx PDO 3	UI8	ro	4	Mapping parameters of the 3rd Transmit- PDO
	0x01	1st Object	UI32	ro	29000320H	32 bit IEEE754 floating point Tare
	0x02	2nd Object	UI16	ro	29000D10H	Qualifier
	0x03	3rd Object	UI8	ro	0x20070208	Module number
	0x04	4th Object	UI8	ro	0x00000000	Value type
0x1A03	0x00	Number of mapped Entries in Tx PDO 4	UI8	ro	0	Mapping parameters of the 4th Transmit-PDO (disabled)
0x2000	0x00	Number of entries.	UI8	ro	0x06	Number of entries.
	0x01	Gross weight.	REAL32	ro	-	Get gross weight – GG command.
	0x02	Net weight.	REAL32	ro	-	Get net weight – GN command.
	0x03	Tare.	REAL32	ro	-	Get tare weight – GT command.
	0x04	Dosed weight	REAL32	ro	-	Get dosed weight – GD command.
	0x05	Dosed tare	REAL32	ro	-	Get dosed tare weight – DT command.
	0x06	Average weight	REAL32	ro	-	Get average weight – GA command.

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
0x2001	0x00	Number of entries.	I32	ro	0x06	Number of entries.
	0x01	Gross weight.	I32	ro	-	Get gross weight – GG command.
	0x02	Net weight.	I32	ro	-	Get net weight – GN command.
	0x03	Tare.	I32	ro	-	Get tare weight – GT command.
	0x04	Dosed weight	I32	ro	-	Get dosed weight – GD command.
	0x05	Dosed tare	I32	ro	-	Get dosed tare weight – DT command.
	0x06	Average weight	I32	ro	-	Get average weight – GA command.
0x2004	0x00	Number of entries.	UI8	ro	0x05	Number of parameters.
	0x01	Dummy	UI8	wo	-	Not used
	0x02	Calibration	UI8	wo	-	Save calibration settings (TAC protected) – CS command
	0x03	General set-up	UI8	wo	-	Save general set-up parameters – WP command
	0x04	Save Dosed	UI8	wo	-	Save dosing setup parameters command – SD command
	0x05	Set-points	UI8	wo	-	Save set-point parameters – SS command
0x2005	0x00	Number of entries.	UI8	ro	0x03	Number of entries.
	0x01	Start command.		wo	-	Start Cycle – SC command.
	0x02	Stop command.		wo	-	Abort Cycle – AC command.
	0x03	Trigger command		wo	-	Trigger – TR command
0x2006	0x00	Number of entries.	UI8	ro	0x04	Number of entries.
	0x01	Dummy	UI8	wo	-	Not used
	0x02	Factory Default	UI8	wo	-	Set factory default values (TAC protected) – FD command.
	0x03	Command byte 1	UI8	wo	-	See RPDO1
	0x04	Command byte 2	UI8	wo	-	See RPDO2
0x2007	0x00	Number of entries.	UI8	ro	0x06	Number of entries.
	0x01	CAN network address.	UI8	rw	1	CAN address – NS1 1 command.
	0x02	CAN speed.	UI16	rw	500	CAN speed – NS1 2 command.
	0x03	Dummy.	UI8	rw	0	Dummy.
	0x04	Software reset.	UI8	wo	-	Software reset – SR command.
	0x05	Dummy.	UI8	rw	0	Dummy.
	0x06	Reduce CAN output rate	UI16	rw	1	Reduce the output rate for slow CAN systems – NS1 6 command.

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
0x2100	0x00	Number of entries.	UI8	ro	0x17	Number of parameters.
	0x01	Dummy	UI32	rw	0	Not used.
	0x02	Dummy	UI32	rw	0	Not used.
	0x03	Dummy	UI32	rw	0	Not used.
	0x04	Filter setting	UI8	rw	3	Filter setting –FL command.
	0x05	Dummy	UI32	rw	0	Not used.
	0x06	Logic outputs	UI8	rw	-	Digital Outputs – IO command.
	0x07	Logic inputs	UI8	ro	-	Digital Inputs – IN command
	0x08	Measure Time	UI16	rw	0	Measuring Time – MT command.
	0x09	Filter Mode	UI8	rw	0	Filter mode – FM command.
	0x0A	No motion Range	UI16	rw	1	No-motion range – NR command.
	0x0B	No motion Time	UI16	rw	1000	No-motion time – NT command.
	0x0C	Output Mask	UI8	rw	0	Digital outputs mask – OM command.
	0x0D	Dummy	U32	rw	0	Not used.
	0x0E	Start Delay	UI16	rw	0	Start Delay – SD command.
	0x0F	Dummy	UI32	rw	0	Not used.
	0x10	Dummy	UI32	rw	0	Not used.
	0x11	Update Rate	UI8	rw	0	Update rate –UR command.
	0x12	Zero Tracking	UI8	rw	0	Zero track (TAC protected) – ZT command.
	0x13	Dummy	UI32	rw	0	Not used.
	0x14	Dummy	UI32	rw	0	Not used.
	0x15	Dummy	UI32	rw	0	Not used.
	0x16	Pre-filter	UI8	rw	1	Pre-filter – PF command.
	0x17	Preset Tare	I32	rw	0	Preset Tare.

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
0x2200	0x00	Number of entries.	UI8	ro	0x17	Number of parameters
	0x01	Pre-fill mode	I32	rw	0	PreFill Mode – PD1 command.
	0x02	In-flight correction factor	I32	rw	0	Inflight Correction – PD2 command.
	0x03	Zero check time	I32	rw	0	Zero Check time – PD3 command.
	0x04	Tare delay	I32	rw	0	Tare Delay – PD4 command.
	0x05	Tare average time	I32	rw	0	Tare Average Time – PD5 command.
	0x06	Delay after prefill	I32	rw	0	Delay After Prefill – PD6 command.
	0x07	Blanking time	I32	rw	0	Blanking Time – PD7 command.
	0x08	In-flight delay time	I32	rw	0	Inflight Delay Time – PD8 command.
	0x09	Dosed weight average time	I32	rw	0	Fill Weight Average Time – PD9 command.
	0x0A	Zero tolerance	I32	rw	0	Zero Tolerance – PD10 command.
	0x0B	Tare reference	I32	rw	0	Tare Reference – PD11 command.
	0x0C	Tare tolerance	I32	rw	0	Tare Tolerance – PD12 command.
	0x0D	Pre-fill level	I32	rw	0	Prefill Level 1 – PD13 command.
	0x0E	Fine fill weight	I32	rw	0	Fine Fill Weight – PD14 command.
	0x0F	Filling weight	I32	rw	0	Filling Weight – PD15 command.
	0x10	In-flight value	I32	rw	0	Inflight Value – PD16 command.
	0x11	Pre fill level for 2nd prefill	I32	rw	0	Prefill Level 2 – PD17 command.
	0x12	Timeout value for filling cycle	I32	rw	0	Fill Timeout Value – PD18 command.
	0x13	Underweight post fill time	I32	rw	0	Underweight Post Fill Time – PD19 command.
	0x14	Tare interval	I32	rw	1	Tare Interval – PD20 command.
	0x15	Bag Rupture blanking	I32	rw	0	Bag Rupture Blanking – PD21 command.
	0x16	Medium fill weight	I32	rw	0	Medium Fill Weight – PD22 command.
	0x17	Production counter	I32	rw	0	Production Counter – PD23 command.

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
0x2300	0x00	Number of entries.	UI8	ro	0x15	Number of calibration parameters.
	0x01	Absolute gain	I32	rw	20000	Absolute gain calibrate (TAC protected) – AG command.
	0x02	Absolute zero	I32	rw	0	Absolute zero calibrate (TAC protected) – AZ command.
	0x03	Calibrate enable	I32	rw	-	Calibrate enable (enables TAC when the TAC is written) – CE command.
	0x04	Calibrate gain	I32	rw	20000	Calibrate gain (TAC protected) – CG command.
	0x05	Dummy	I32	rw	0	Not used.
	0x06	Dummy	I32	rw	0	Not used.
	0x07	Calibrate max 1	I32	rw	999999	Calibrate max 1 (TAC protected) – CM1 command.
	0x08	Calibrate min	I32	rw	-999999	Calibrate min (TAC protected) – CI command.
	0x09	Dummy	I32	rw	0	Not used.
	0x0A	Calibrate zero	I32	rw	0	Calibrate zero (TAC protected) – CZ command.
	0x0B	Decimal point	I32	rw	3	Decimal point (TAC protected) – DP command.
	0x0C	Display step size	I32	rw	1	Display step size (TAC protect) – DS command.
	0x0D	Multi Range	I32	rw	0	Multi range / multi interval selection (TAC protected) – MR command.
	0x0E	Calibrate max 2	I32	rw	0	Calibrate max 2 (TAC protected) – CM2 command.
	0x0F	Calibrate max 3	I32	rw	0	Calibrate max 3 (TAC protected) – CM3 command.
	0x10	Initial zero range	I32	rw	0	Initial zero range (TAC protected) – ZI command.
	0x11	Zero Range	I32	rw	0	Zero range (TAC protected) – ZR command.
	0x12	Tare mode	I32	rw	0	Tare mode (TAC protected) – TM command.
	0x13	Non volatile tare	I32	rw	0	Non volatile / volatile tare select (TAC protected) – TN command.
	0x14	Non volatile zero	I32	rw	0	Non volatile / volatile zero select (TAC protected) – ZN command.
	0x15	Firmware type	I32	rw	0	Firmware type (TAC protected) – FT command.
0x2400	0x00	Number of entries.	UI8	ro	0x01	Number of entries.
	0x01	Get Dose Info	I32	ro	-	Dose Status Info – DI command.
0x2500	0x00	Number of entries.	UI8	ro	0x0B	Number of Check-Weigher parameters.
	0x01	Trigger Level	I32	rw	999999	Trigger Level – TL command.
	0x02	Trigger Egde	I32	rw	0	Trigger Egde – TE command.
	0x03	ReTrigWindow	I32	rw	65535	ReTrigWindow – RW command.
	0x04	ReTrigTime	I32	rw	0	ReTrigTime – TT command.
	0x05	HoldTime	I32	rw	0	HoldTime – HT command.
	0x06	TareWindow	I32	rw	0	TareWindow – TW command.
	0x07	TareTime	I32	rw	0	TareTime – TI command.
	0x08	ReTrigStop	I32	rw	65535	ReTrigStop – TS command.
	0x09	Dummy	I32	rw	0	Not used.
	0x0A	Dummy	I32	rw	0	Not used.
	0x0B	Δ Time	I32	rw	50	Delta time – DT command.

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
0x2600	0x00	Number of entries.	UI8	ro	0x04	Number of Set-points
	0x01	Set-point 1 value	I32	rw	5000	Set-point 1 value – S0 command.
	0x02	Set-point 2 value	I32	rw	10000	Set-point 2 value – S1 command.
	0x03	Set-point 3 value	I32	rw	15000	Set-point 3 value – S2 command.
	0x04	Set point 4 value	I32	rw	20000	Set-point 4 value – S3 command.
0x2700	0x00	Number of entries.	UI8	ro	0x04	Number of Set-point parameters.
	0x01	Hysteresis set-point 1	I32	rw	1	Set-point 1 hysteresis – H0 command.
	0x02	Hysteresis set-point 2	I32	rw	1	Set-point 2 hysteresis – H1 command.
	0x03	Hysteresis set-point 3	I32	rw	1	Set-point 3 hysteresis – H2 command.
	0x04	Hysteresis set-point 4	I32	rw	1	Set-point 4 hysteresis – H3 command.
0x2800	0x00	Number of entries.	UI8	ro	0x04	Number of Set-point parameters.
	0x01	Alloc. source set-point 1	UI8	rw	0	Set-point 1 allocation source – A0 command.
	0x02	Alloc. source set-point 2	UI8	rw	0	Set-point 2 allocation source – A1 command.
	0x03	Alloc. source set-point 3	UI8	rw	0	Set-point 3 allocation source – A2 command.
	0x04	Alloc. source set-point 4	UI8	rw	0	Set-point 4 allocation source – A3 command.
0x2900	0x00	Number of entries	UI8	ro	0x0D	Number of entries in info array.
	0x01	Gross weight	REAL32	ro	-	Get gross weight – GG command.
	0x02	Net Weight	REAL32	ro	-	Get net weigt – GN command.
	0x03	Tare	REAL32	ro	-	Get tare weight – GT command.
	0x04	Dosed Weight	REAL32	ro	-	Get dosed weight – GD command.
	0x05	Dosed Tare	REAL32	ro	-	Get dosed tare weight – DT command.
	0x06	Average weight	REAL32	ro	-	Get average weight – GA command.
	0x07	A/D sample	I32	ro	-	Get A/D sample value – GS command.
	0x08	H&B Device ID	UI32	ro	0x1064	Get ID – ID command.
	0x09	H&B FW Version	UI32	ro	-	Get firmware version – IV command.
	0x0A	Device Status	UI32	ro	-	Get status – IS command.
	0x0B	Dummy	UI32	ro	0	Not used.
	0x0C	Serial Number	UI32	ro	-	Get serial number – RS command.
	0x0D	Extended status	UI32	ro	-	See TPDO's

10. Use in “Approved” Applications

The term “approved” applies whenever the weighing application is intended to be used for “legal-for-trade” weighing – that is, money will change hands according to the weight result. Such applications are bound by the legal metrology regulations of the relevant governments around the World, but most countries will comply with either the relevant EN’s (Euro Norms) or the relevant OIML (Organisation Internationale de Metrologie Legale) recommendations.

The LDM 64.1 has been certified as a module for use in scales according to OIML recommendation R76, the highest performance level approved being Class III, 10 000 intervals(e) in single range, multi-range and multi-interval applications. The approval Authority was the Danish Electronics, Light & Acoustics (DELTA), and the evaluation certificate number is DK0200-WL-07834.

This approval will allow the use in approved weighing systems throughout Europe, and in many other countries of the World. To achieve approval on a particular application, it will be necessary to satisfy the relevant Governmental Trading Standards Authority that the requirements of the various rules and regulations have been satisfied. This task is greatly simplified if the key components of the weighing system, namely the load cells and the weighing indicator or digitizer, are already approved as “components”.
Usually, a discussion with the Weighing Equipment Approvals Officers at the relevant National Weights & Measures Office will then reveal the extent of any pattern testing that may be necessary to ensure compliance.

Restrictions upon usage when in “Approved” applications

A number of performance restrictions must come into force. These restrictions are the number of display divisions, which become limited to 10000 divisions, and the sensitivity per display division, which becomes 0.2 µV per division. Once installed in the application, an “approved” application will require “stamping” by an Officer of the relevant Governmental Trading Standards Department. This certifies the equipment or system as being in accordance to the relevant regulations and within calibration limits.

The Traceable Access Code (TAC)

The user software must then provide a guard against improper access of the calibration commands (see the “Calibration Commands” section). The LDM 64.1 digitizer features the “Traceable Access Code” or TAC method of controlling the access to the calibration commands group. This means that a code is maintained within the device, and is incremented whenever any change to any of the calibration commands is saved. When performing the “stamping” test, the Trading Standards Officer will make a note of the TAC, and advise the user that any change to this code which occurs prior to the regular re-inspection by the Trading Standards Office, will result in legal prosecution of the user.
The user software is required as a condition of approval, to make the TAC available to the weight display indicator or console, on demand.