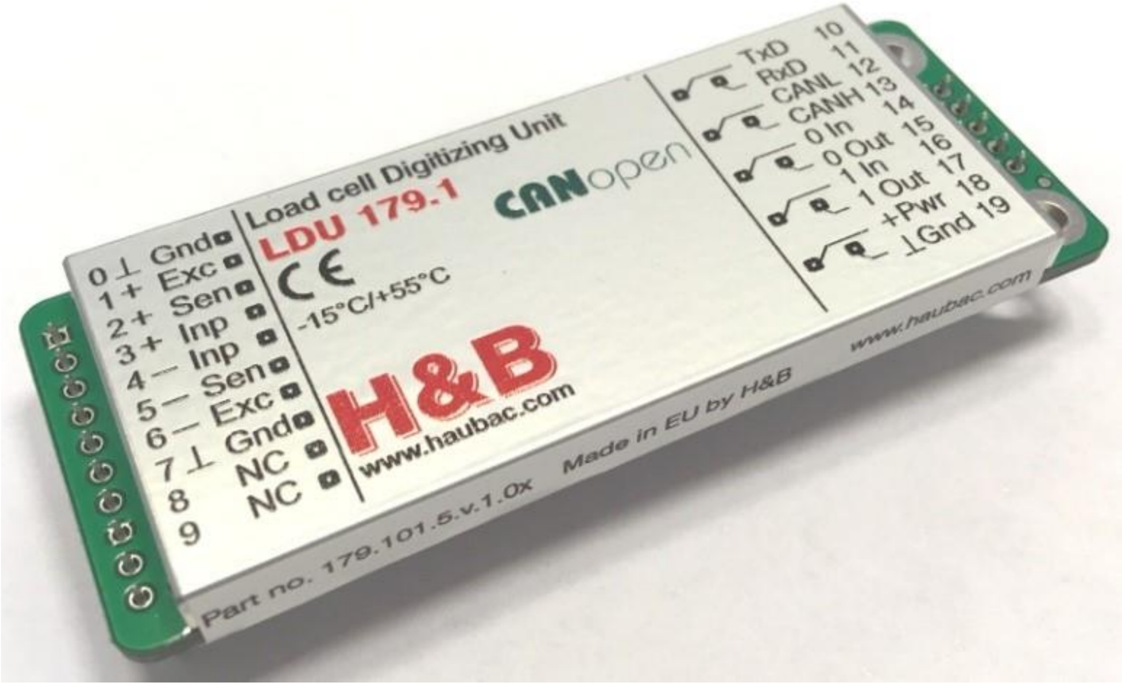
Load Cell Digitizing Unit

Type LDU 179.1

TECHNICAL MANUAL



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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.

2. Declaration of Conformity

EG-Konformitätserklärung
EC-Declaration of Conformity

Monat/Jahr: *month/year:*	02/2019
Hersteller: *Manufacturer:*	Hauch & Bach ApS
Anschrift: *Address:*	Femstykket 6 DK-3540 Lynge Dänemark / Denmark
Produktbezeichnung: *Product name:*	LDU 179.1

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 Mitgliedstaaten 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:

OIML R-76-1	Nicht-Selbsttätig Waagen – Metrologische und technische Anforderungen (OIML R-76:2006 Teil 1) *Non-automatic weighing systems – Metrological and technical requirements (OIML R-76:2006 Part 1)*
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.*

M. Bach

Michael Bach
Managing Director

3. Introduction and Specifications

The model LDU 179.1 is a very precise high-speed digital amplifier for weighing and force measurements with strain gauge (SG) sensors. The LDU 179.1 can be used in legal for trade as well as for industrial applications. The device features a CAN interface with support for the CANopen protocol as well as a full duplex RS232 interface using a straightforward ASCII command set. The LDU 179.1 and the well known LDU 78.1, both use nearly the same command set. The LDU 179.1 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
Maximum bridge excitation current	mA	115
Load cell cable length (for n = 10 000)	m/mm^2	726
Maximum resistance per wire (for n = 10 000)	Ω	12.3
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		**CAN**
Bit rate	kbits/s	10 to 1000
Protocol		CAN Open
Interface 2		**RS-232**
Baud rate	bits/s	9600 to 460800
Frame format		8 data bits, 1 stop bit, no parity bits
Protocol		Readable ASCII
Logical inputs		**2**
Maximum input voltage	V_{DC}	30
Threshold voltage (approx.)	V_{DC}	6
Input resistance (approx.)	kΩ	8
Logical outputs		**2**
Maximum voltage	V_{DC}	30
Maximum current	A	0.5
Supply voltage	V_{DC}	10 to 30
Power consumption (without load cells)	mW	<250
Operating temperature range	°C	-15 to +55
Storage temperature range	°C	-30 to +70
Dimensions (LxWxH) excluding pins	mm	81.3 x 30.7 x 6.5
Weight	g	28
Protection		IP20

4. Communications and Getting started

4.1. Serial Interface

Communicating with the LDU 179.1 digitizer is carried out via serial RS 232 port.
The data format is the familiar 8/N/1 structure (8 data bits, no parity, 1 stop bit).
Available baud rates via the RS232 port are as follows: 9600, 19200, 38400, 57600, 115200, 230400 and 460800 baud.

Factory default: 115200 baud

4.2. Command Language

The command set of the LDU 179.1 is based on a simple ASCII format (2 letters). This enables the user to setup the device, get results or check parameters.

Example: LDU 179.1 is connected 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 (LDU 179.1) responds	Meaning
ID↵	**D:1790**	Identity of the device
IV↵	**V:0107**	Firmware version of the device
GN↵	**N+1234.56**	Net weight with algebraic sign/floating point

4.3. Baud Rate

For baud rate setup use command BR, see chapter 8.10.4

Factory default: 115200 baud

4.4. Getting Started

You will require:

- PC or PLC with a RS232 communication port
- A load cell / scale with test weights or a load cell simulator
- A 12-24 VDC power supply capable of delivering approximately 100mA
- One or more LDU 179.1
- A suitable ASCII communication software **

Refer to the following wiring diagram in chapter 5.

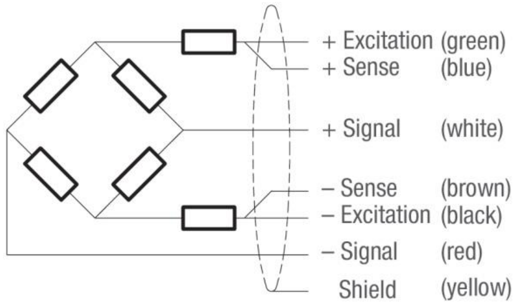
**

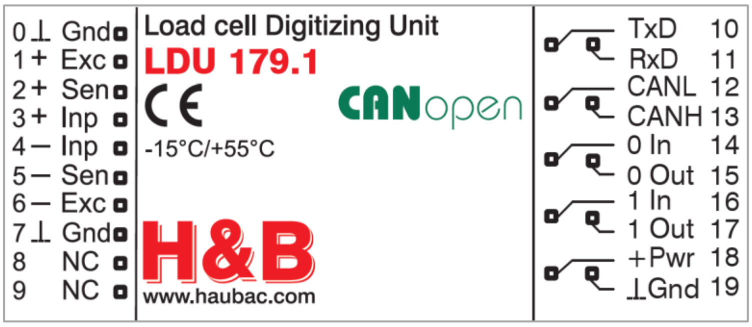
You can easily communicate between a PC and a LDU 179.1 using programs such as Procomm, Telemate, Kermit, HyperTerminal or HTerm etc.

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

5. Hardware and Wiring

5.1. Wiring

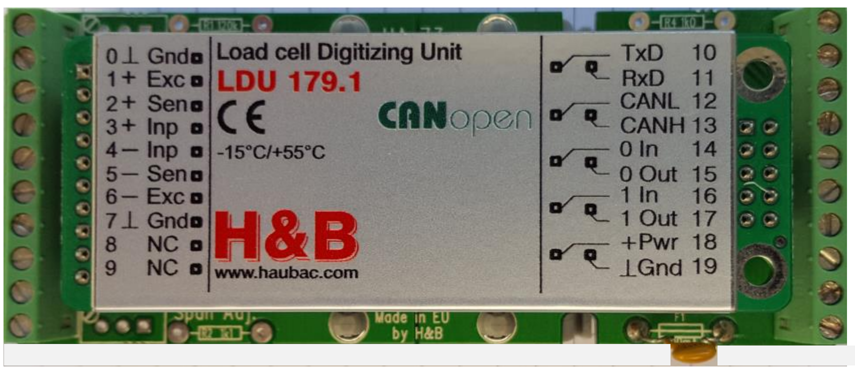




Colour code of standard **Flintec** load cells

Pins of the LDU 179.1

5.2. With Unit Adapter UA 73.2



Serial Port: Terminal 10, 11, and 19 (Gnd).

CAN Port: Terminal 12, 13, and 19 (Gnd).

In/Out 0: Terminal 14, 15

In/Out 1: Terminal 16, 17

Power supply 12...30 VDC
Terminal 18: +Pwr
Terminal 19: Gnd

Note: The power, supplied to the LDU179.1, must be limited to 15VA with a suitable current limit device, e.g. a fuse".

5.3. Terminal Configuration

LDU 179.1 Pin no.	Load cell
0	Shield
1	+ Excitation
2	+ Sense
3	+ Signal
4	– Signal
5	– Sense
6	– Excitation
7	Shield
8	NC
9	NC

LDU 179.1 Pin no.	Pin	Function
10	TxD	RS232 TxD
11	RxD	RS232 RxD
12	CANL	CAN line low
13	CANH	CAN line high
14	In 0	Logical input 0
15	Out 0	Logical output 0
16	In 1	Logical input 1
17	Out 1	Logical output 1
18	+ Pwr	Power supply +10..+30 VDC
19	Gnd	Power supply -

5.4. Load Cell Connection

The load cell wiring should be made carefully before applying power to avoid damages to the amplifier and the load cells. The input resistance of the load cells that you want to connect should be ≥ 43 Ω (ohms). In case of a four wire load cell the sense wires must be connected to the excitation i.e. pin 1 to pin 2 and pin 5 to pin 6, or use the solder pads SW1 and SW2 on the underside.

5.5. Serial Port Connection

The RS232 port can be used for communication with a PC, PLC system or other devices. The Gnd terminal (pin 19) must be used as signal ground for the RS232 interface.

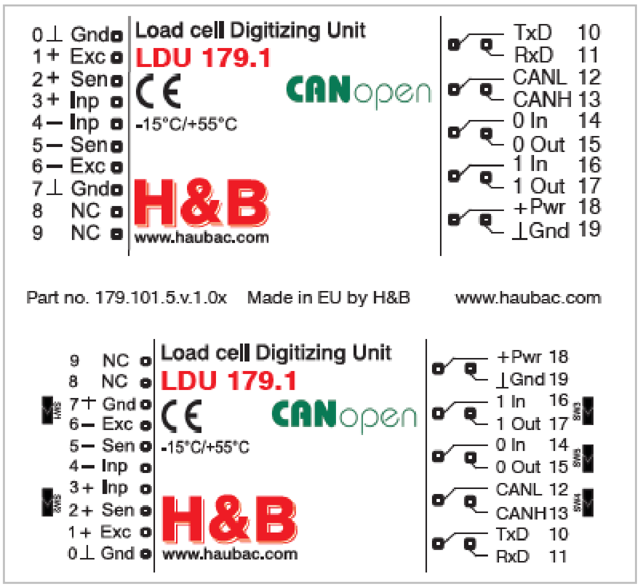
Note: The serial port (Interface 2) can be switched into Modbus mode and back to ASCII mode. In Modbus mode, this interface can run Modbus RTU protocol. The procedure to switch between the modes and the Modbus RTU communication is described in the sepperate manual **LDx_Modbus Comm_rev.1.0.**

5.6. CAN Connection

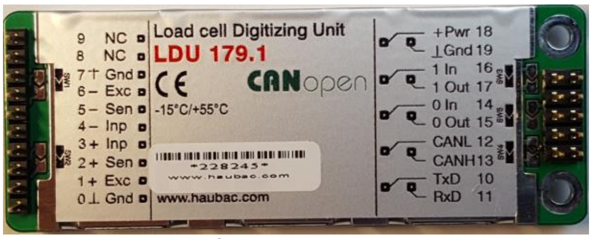
The CAN lines can be connected to a CANopen master. Termination resistors must be present in the CAN network, but there are no such resistors inside the LDU179.1. The Gnd terminal (pin 19) must be used as signal ground for the CAN interface.

5.7. Function of the solder pads

The solder pads have the functions as described below. The label print and the photos shows the position of the solder pads SWx.



LDU179.1 Top View



LDU179.1 Bottom View

Functions of the solder pads on bottom side:

SW1 & SW2 : Close for 4-wire load cells.

SW3 : Close to enter configuration mode.

SW4 : Do NOT close – used for program download only.

SW5 : This switch can connect the power supply ground to the shield.

6 CANopen interface

6.1 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 LDU 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 LDU 179.1 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.

In case of an overrun, error or failure an EMERGENCY message is sent to the CAN controller indicating the nature of the error or failure.

RPDO3 and RPDO4 are ignored by the LDU.

SDOs are handled according to profile and CANopen recommendation.

The LDU supports both ‘node guarding’ and ‘heart beat’.

6.2 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 LDU 179.1 will result in approx. 1200 TPDO1's per second. If the system can't handle so many messages the update rate can be reduced – see the UR command.
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	Status	0	0

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.

Then status follows as a 16 bit field with the following values defined:

$0001 - Under range,
$0002 - Over range,

$0008 - Center zero,
$0010 - No motion,
$0020 - Tare set,

$0080 – ADC Error,
$0100 - Set-point 0 (source>limit),
$0200 - Set-point 1,

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	0	0

- 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	SN			ST	RT	SZ	RZ
128	64			08	04	02	01

<u>Examples:</u>
- 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]

6.3 The SDOs

The CANopen SDOs is a confirmed service, and overrun does not occur if the CAN controller only communicates with the LDU 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 LDU 179.1 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

6.4 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

6.5 Object Directory

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

These entries are in the documentation for the sake of mapping information. These functions must be used through Process Data Objects (PDO).

Communication Profile (Tables)

Index	Sub-index	Name	Type	Attri-bute	Default-value	Meaning
1000	0	Device Type	UI32	ro	0	Non standard device profile
1001	0	Error Register	UI8	ro	0	Bit 0: Generic error Bit 4: Communication error Bit 7: Manufacturer specific error
1002	0	Manufacturer Status Register	UI32	ro	0	Not used
1005	0	COB-ID Sync message	UI32	rw	80H	COB-ID of the SYNC object
1006	0	Communication cycle Period	UI32	rw	0	Not used
1007	0	Synchronous Window Length	UI32	rw	0	Not used
100C	0	Guard Time	UI16	rw	320	Cycle time in ms, set by the NMT Master or the configuration tool. Index 100Ch and 100Dh are used if index 1017h is zero.
100D	0	Life Time Factor	UI8	rw	3	Life time is set by the NMT Master or the configuration tool.
1014	0	COB-ID Emergency Message	UI32	ro	80H + Node ID	COB-ID of the Emergency Object
1017	0	Heartbeat Time	UI16	rw	0	Producer Heartbeat time in ms. If index 1017h is non-zero the Heartbeat protocol is used, otherwise the Node-guard protocol is used.
1018	0 1 2 3 4	Identity Object Vendor ID Product Code Revision Number Serial Number	UI8 UI32 UI32 UI32 UI32	ro ro ro ro ro	4 269H - - -	Number of entries Vendor ID Product Code Revision Number Serial Number
1400	0 1 2	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 200H + Node ID FFH	Communication parameters of 1st Receive PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.
1401	0 1 2	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 300H + NodeID FFH	Communication parameters of 2nd Receive PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.

<table>
<tr><th>Index</th><th>Sub-index</th><th>Name</th><th>Type</th><th>Attri-bute</th><th>Default-value</th><th>Meaning</th></tr>
<tr><td>1402</td><td>0
1

2</td><td>Number of elements
COB-ID

Transmission type</td><td>UI8
UI32

UI8</td><td>ro
ro

ro</td><td>2
80000400H +
NodeID
FFH</td><td>Communication parameters of 3rd Receive PDO
Determined using the CANopen minimum system ID assignment procedure.
Asynchronous communication.</td></tr>
<tr><td>1403</td><td>0
1

2</td><td>Number of elements
COB-ID

Transmission type</td><td>UI8
UI32

UI8</td><td>ro
ro

ro</td><td>2
80000500H +
NodeID
FFH</td><td>Communication parameters of 4th Receive PDO
Determined using the CANopen minimum system ID assignment procedure.
Asynchronous communication.</td></tr>
<tr><td>1600</td><td>0
1</td><td>Entries in Rx PDO 1
1st Object Cmd. Byte</td><td>UI8
UI32</td><td>ro
ro</td><td>2
20060308H</td><td>Mapping parameters of the 1st Receive-PDO
Object is a bitwise command:
<table><tr><td></td><td>Bit7</td><td>Bit6</td><td>Bit5</td><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>Cmd:</td><td>SnG</td><td>SnN</td><td></td><td></td><td>ST</td><td>RT</td><td>SZ</td><td>RZ</td></tr></table></td></tr>
<tr><td>1601</td><td>0
1</td><td>Entries in Rx PDO 2
1st Object Cmd. Byte</td><td>UI8
UI32</td><td>ro
ro</td><td>2
20060408H</td><td>Mapping parameters of the 2nd Receive-PDO
Object is a bitwise command:
<table><tr><td></td><td>Bit7</td><td>Bit6</td><td>Bit5</td><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>Cmd:</td><td>TR</td><td></td><td></td><td></td><td></td><td></td><td></td><td>TS</td></tr></table></td></tr>
<tr><td>1602</td><td>0</td><td>Number of mapped Entries in Rx PDO 3</td><td>UI8</td><td>ro</td><td>0</td><td>Mapping parameters of the 3rd Receive- PDO (disabled)</td></tr>
<tr><td>1603</td><td>0</td><td>Number of mapped Entries in Rx PDO 4</td><td>UI8</td><td>ro</td><td>0</td><td>Mapping parameters of the 4th Receive-PDO (disabled)</td></tr>
<tr><td>1800</td><td>0
1

2</td><td>Number of elements
COB-ID

Transmission type</td><td>UI8
UI32

UI8</td><td>ro
ro

ro</td><td>2
180H +
Node ID
FFH</td><td>Communication parameters of 1st Transmit PDO
Determined using the CANopen minimum system ID assignment procedure.

Asynchronous communication.</td></tr>
</table>

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
1801	0 1 2	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 280H + Node ID FFH	Communication parameters of 2nd Transmit PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.
1802	0 1 2	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 380H + NodeID FFH	Communication parameters of 3rd Transmit PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication.
1803	0 1 2	Number of elements COB-ID Transmission type	UI8 UI32 UI8	ro ro ro	2 480H + NodeID FFH	Communication parameters of 4th Transmit PDO Determined using the CANopen minimum system ID assignment procedure. Asynchronous communication. (Not used, will not be transmitted)
1A00	0 1 2	Number of mapped Entries in Tx PDO 1 1st Object 2nd Object	UI8 UI32 UI32	ro ro ro	2 29000120H 29000D10H	Mapping parameters of the 1st Transmit-PDO 32 bit IEEE754 floating point weight value. Status
1A01	0 1 2	Number of mapped Entries in Tx PDO 2 1st Object 2nd Object	UI8 UI32 UI32	ro ro ro	2 29000620H 29000D10H	Mapping parameters of the 2nd Transmit-PDO 32 bit IEEE754 floating point average value. Status
1A02	0 1 2	Number of mapped Entries in Tx PDO 3 1st Object 2nd Object	UI8 UI32 UI32	ro ro ro	2 29000320H 29000D10H	Mapping parameters of the 3rd Transmit- PDO 32 bit IEEE754 floating point Tare Module Status
1A03	0	Number of mapped Entries in Tx PDO 4	UI8	ro	0	Mapping parameters of the 4th Transmit-PDO (disabled)

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
2004	0	Number of entries.	UI8	ro	5	Number of parameters.
	1	Dummy	UI8	wo	-	Not used
	2	Calibration	UI8	wo	-	Save calibration settings (TAC protected)
	3	General set-up	UI8	wo	-	Save general set-up parameters
	4	Dummy	UI8	wo	-	Not used
	5	Set-points	UI8	wo	-	Save set-point parameters.
2006	0	Number of entries	UI8	ro	2	Number of system entries.
	1	Dummy	UI8	wo	-	Not used
	2	Factory Default	UI8	wo	-	Set factory default values (TAC protected)
	3	Command byte 1	UI8	wo	-	See RPDO1
	4	Command byte 2	UI8	wo	-	See RPDO2
2100	0	Number of entries.	UI8	ro	23	Number of parameters.
	1	Dummy	I32	rw	0	Not used
	2	Dummy	I32	rw	0	Not used
	3	Dummy	I32	rw	0	Not used
	4	Filter setting	I32	rw	3	Filter setting
	5	Dummy	I32	rw	0	Not used
	6	Logic outputs	I32	rw	-	Digital Outputs
	7	Logic inputs	I32	ro	-	Digital Inputs
	8	Measure Time	I32	rw	0	Measuring Time
	9	Filter Mode	I32	rw	0	Filter mode
	10	No motion Range	I32	rw	1	No-motion range
	11	No motion Time	I32	rw	1000	No-motion time
	12	Output Mask	I32	rw	0	Digital outputs mask
	13	Dummy	I32	rw	0	Not used
	14	Start Delay	I32	rw	0	Start Delay
	15	Dummy	I32	rw	0	Not used
	16	Dummy	I32	rw	0	Not used
	17	Update Rate	I32	rw	0	Update rate
	18	Zero Tracking	I32	rw	0	Zero track (TAC protected)
	19	Dummy	I32	rw	0	Not used
	20	Dummy	I32	rw	0	Not used
	21	Dummy	I32	rw	0	Not used
	22	Reserved	I32	rw	1	For internal use – do not change
	23	Preset Tare	I32	rw	0	Preset Tare

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
2300	0	Number of entries.	UI8	ro	20	Number of calibration parameters.
	1	Absolute gain	I32	rw	20000	Absolute gain calibrate (TAC protected)
	2	Absolute zero	I32	rw	0	Absolute zero calibrate (TAC protected)
	3	Calibrate enable	I32	rw	-	Calibrate enable (enables TAC when the TAC is written)
	4	Calibrate gain	I32	rw	20000	Calibrate gain (TAC protected)
	5	Dummy	I32	rw	0	Not used
	6	Dummy	I32	rw	0	Not used
	7	Calibrate max 1	I32	rw	999999	Calibrate max 1 (TAC protected)
	8	Calibrate min	I32	rw	-999999	Calibrate min (TAC protected)
	9	Dummy	I32	rw	0	Not used
	10	Calibrate zero	I32	rw	0	Calibrate zero (TAC protected)
	11	Decimal point	I32	rw	3	Decimal point (TAC protected)
	12	Display step size	I32	rw	1	Display step size (TAC protect)
	13	Multi Range	I32	rw	0	Multi range / multi interval selection (TAC protected)
	14	Calibrate max 2	I32	rw	0	Calibrate max 2 (TAC protected)
	15	Calibrate max 3	I32	rw	0	Calibrate max 3 (TAC protected)
	16	Initial zero range	I32	rw	0	Initial zero range (TAC protected)
	17	Zero Range	I32	rw	0	Zero range (TAC protected)
	18	Tare mode	I32	rw	0	Tare mode (TAC protected)
	19	Non volatile tare	I32	rw	0	Non volatile / volatile tare select (TAC protected)
	20	Non volatile zero	I32	rw	0	Non volatile / volatile zero select (TAC protected)
2500	0	Number of entries.	UI8	ro	11	Number of Check-Weigher parameters
	1	Trigger Level	I32	rw	0	Trigger Level
	2	Trigger Egde	I32	rw	0	Trigger Egde
	3	ReTrigWindow	I32	rw	65535	ReTrigWindow
	4	ReTrigTime	I32	rw	0	ReTrigTime
	5	HoldTime	I32	rw	0	HoldTime
	6	TareWindow	I32	rw	0	TareWindow
	7	TareTime	I32	rw	0	TareTime
	8	ReTrigStop	I32	rw	65535	ReTrigStop
	9	Dummy	I32	rw	0	Not used
	10	Dummy	I32	rw	0	Not used
	11	Δ Time	I32	rw	50	Delta time
2600	0	Number of entries.	UI8	ro	2	Number of Set-point parameters.
	1	Set-point 1	I32	rw	5000	Set-point 1 value
	2	Set-point 2	I32	rw	10000	Set-point 2 value

Index	Sub-Index	Name	Type	Attri-but	Default Value	Meaning
2700	0 1 2	Number of entries. Set-point 1 Set-point 2	UI8 I32 I32	ro rw rw	2 1 1	Number of Set-point parameters. Set-point 1 hysteresis Set-point 2 hysteresis
2800	0 1 2	Number of entries. Set-point 1 Set-point 2	UI8 UI8 UI8	ro rw rw	2 0 0	Number of Set-point parameters. Set-point 1 source Set-point 2 source
2900	0 1 2 3 4 5 6 7 8 9 10 11 12 13	Number of entries Gross weight Net Weight Tare Dummy Dummy Average weight A/D sample H&B Device ID H&B FW Version Device Status Dummy Serial Number Extended status	UI8 REAL32 REAL32 REAL32 UI32 UI32 REAL32 I32 UI32 UI32 UI32 UI32 UI32 UI32	ro ro ro ro ro ro ro ro ro ro ro ro ro ro	12 - - - 0 0 - - - - - 0 - -	Number of entries in info array. Not used Not used Not used See TPDO’s

7. Commands – Overview

Command	Short description	Parameter value	Page
AD	Communication: Device Address	0...255	38
A'n'	Allocation source for a set point	0, 1 or 2	36
AZ	Absolute zero point calibration	± 33000	28
AG	Absolute gain calibration	± 33000	28
BR	Communication: Baud Rate	9600…460800 baud	39
CE	Calibration: Open Calibration Sequence; Read TAC Counter	0...65535	24
CG	Calibration: Set Calibration Gain (Span) at Load > Zero	1...999999 d	26
CI	Calibration: Minimum Output Value	–999999...0 d	24
CL	Close communication (For compatibility only)	None	
CM'n'	Calibration: Set Maximum Output Value (n = 1, 2 or 3)	0...999999 d	24
CS	Save the Calibration Data (CM, CI, DS, DP, etc.) to the EEPROM	None	28, 40
CZ	Calibration: Set Calibration Zero Point – Scale Without Load	None	25
DP	Calibration: Set Decimal Point Position	0...5	25
DS	Calibration: Set Display Step Size	1, 2, 5, 10, …, 500 d	25
DT	Trigger function: Calculation Time for Short-time Average	0...65535 ms	43
DX	Communication: Set Full-duplex (1) (For compatibility only)	0…1	39
FD	Factory default settings: Write Data to the EEPROM (TAC protected)	None	26
FM	Digital filter: Filter Mode	0…1	29
FL	Digital filter: Filter Cut-off Frequency	0...8	30
GA	Output: Get Triggered Average Value	None	33, 41
GG	Output: Get Gross Value	None	32
GI	Retrieves an image file from the LDU's EEPROM	None	40
GL	Output: Get Data String "Average/Gross/Status"	None	33
GN	Output: Get Net Value	None	32
GS	Output: Get ADC Sample Value	None	33
GT	Output: Get Tare Value	None	32
GW	Output: Get Data String "Net/Gross/Status"	None	33
H'n'	Setpoints: Hysteresis for Setpoint S0 (H0) and S1 (H1)	-9999...+9999 d	36
HT	Trigger function: Hold time for Violation of Setpoint Limit	0...65535 ms	37
ID	Device information: Identify Device	None	23
IN	Logical Input: Input Status	None	35
IO	Logical Output: Output Status	00…11	35
IS	Device information: Identify Device Status	None	23
IV	Device information: Identify Firmware Version	None	23
IZ	Calibration: Correction of System Zero	None	26
MR	Calibration: Define Multi-interval (0) or Multi-range (1)	0 or 1	25
MT	Trigger function: Measuring Time for Averaging	0...3000 ms	41
NA	Network Address (CAN Open address)	1 …127	38
NR	Motion detection: No-motion Range	0...65535 d	29
NS	Network Settings (CAN Interface, Serial channel)	0 …2	38
NT	Motion detection: No-motion Time Period	0...65535 ms	29
OF	Output Format of Data String GL and GW	0…3	33
OM	Output Mask	00…11	35
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	40

Command	Short description	Parameter value	Page
RS	Device information: Read serial number	None	24
RT	Scale function: Reset Tare	None	32
RW	Trigger function: Trigger Window for Re-trigger Function	0...65535 d	43
RZ	Scale function: Reset Zero Point	None	
SA	Auto-transmit: Send Triggered Average Value automatically	None	34, 42
SD	Trigger function: Start Delay	0... 65535 ms	41
SG	Auto-transmit: Send Gross Value continuously	None	34
SL	Auto-transmit: Send Data String „Average/Gross/Status“ continuously	None	34
SN	Auto-transmit: Send Net Value continuously	None	34
S‘n‘	Setpoints: Setup of Setpoints S0 and S1	-999999...+999999 d	36
SP	Preset Tare value	0...999999 d	32
SR	Software Reset	None	23
SS	Save the Setpoint Data (Sx, Hx, Ax) to the EEPROM	None	40
ST	Scale function: Set Tare	None	32
SW	Auto-transmit: Send Data String “Net/Gross/Status“ continuously		
SX	Auto-transmit: Send ADC Sample Value continuously	None	34
SZ	Scale function: System Zero Point	None	31
TD	Transmit delay (For compatibility only)	0…255 ms	
TE	Trigger function: Trigger on Rising Edge (1) or Falling Edge (0)	0 or 1	41
TI	Trigger function: Averaging Time for Automatic Tarring	0...65535 ms	44
TL	Trigger function: Trigger Level	0...999999 d	42
TM	Calibration: Tare mode	0…3	27
TN	Calibration: Set/Clear non-volatile tare	0 or 1	27
TR	Trigger function: Software Trigger	None	42
TS	Trigger function: Stop Value for Re-trigger Function	0...65535 d	43
TT	Trigger function: Averaging Time for Re-trigger Function	0...65535 ms	43
TW	Trigger function: Window for Automatic Tarring	0...65535 d	44
UR	Digital filter: Update Rate	0, 1, 2...7	31
WP	Save the Setup Data (FL, NR, NT, AD, BR, DX) to the EEPROM	None	40
ZA	Scale function: Set System Zero Point using TI setting	None	31
ZI	Calibration: Initial Zero Range	0...999999 d	27
ZN	Calibration: Set/Clear non-volatile zero	0 or 1	28
ZR	Calibration: Zero Range	0...999999 d	27
ZT	Zero Tracking: Range	0…255	26

8. Commands Description

For better clarity, all commands are divided into groups as described on the following pages.
Note: In the brakets [….] you see the CAN bus index and sub-index; if [n.a.] is mentioned, the command is not available over CAN bus.

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

Use these commands you get the LDU 179.1 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 (LDU 179.1) responds
ID↵	**D:1790**

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 (LDU 179.1) responds
IV↵	**V:0107**

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 (LDU 179.1) 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:

Leftmost 3-digit value		Rightmost 3-digit value	
1	Signal stable (no motion)	1	(not used)
2	Zeroing action performed	2	(not used)
4	Tare active	4	(not used)
8	Center zero	8	(not used)
16	Input 0	16	(not used)
32	Input 1	32	(not used)
64	(Setpoint-) output 0 active	64	(not used)
128	(Setpoint-) output 1 active	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]
- Output 0 active [= 64]
- Output 1 not active [= 0]

8.1.4. SR Software Reset

[n.a.]

Master (PC / SPS) sends	Slave (LDU 179.1) responds
SR↵	**OK**

This command will respond with ‘OK’ and after maximum 400 ms perform a complete reset of the LDU. 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 (LDU179.1) responds	Meaning
RS↵	**S+00138547**	Request: SN = 138547

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 (LDU 179.1) responds	Meaning
CE↵	**E+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 (LDU 179.1) 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 “ooooooo”, 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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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.
Factory default: approx. 0 mV/V input signal

Master (PC / SPS) sends	Slave (LDU179.1) 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.

Master (PC / SPS) sends	Slave (LDU 179.1) responds	Meaning
CG↵	**G+10000**	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% is recommended. Is the calibration weight smaller than 1% of display maximum (CM), the LDU will respond with an error message (“ERR”).
Factory default: 20000 = 2.000 mV/V input signal

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.

Master (PC / SPS) sends	Slave (179.1) 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
ZT = 100 means ±50 d

Factory default: ZT = 0 [Disable]

8.2.10. FD Reset to Factory Default Settings

[SDO 2006 sub 02]

This command puts the LDU 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 (LDU 179.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE17↵	**OK**	Calibration sequence active
FD↵	**OK**	Factory default setting

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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) responds	Meaning
AZ↵	**Z+000796**	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 (LDU 179.1) 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 (LDU 179.1) 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.

8.3. 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 (LDU 179.1) responds	Meaning
NR↵	**R+000010**	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 (LDU 179.1) responds	Meaning
NT↵	**T+001000**	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 (LDU 179.1) 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.

Default setting: 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 (LDU 179.1) 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).

Default setting: 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	**		1221
1	55	18	57	1221
2	122	8	78	1221
3	242	4	96	1221
4	322	3	104	1221
5	482	2	114	1221
6	963	1	132	1221
7	1923	0.5	149	1221
8	3847	0.25	164	1221

* Output rate = $1221/2^{UR}$ samples/s ** Prefilter 18 Hz

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	1221
2	46	20	49	65	>90	>81	611
3	69	13	33	43	>90	>53	407
4	92	10	24	33	>90	>41	305
5	114	8	20	26	>90	>33	244
6	138	6.5	16	22	>90	>26	204
7	161	5.7	14	18	>90	>22	174
8	183	5	12	16	>90	>20	153

* Output rate = Table value/2^{UR} samples/s ** Prefilter 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.

LDU 179.1 allows for 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 (LDU 179.1) responds	Meaning
UR↵	**U+00003**	Request: Averaging of 8 values
UR7↵	**OK**	Setup: Averaging of 128 values
WP↵	**OK**	Setup saved

Default setting: 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 the No motion range NR and the 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 (LDU 179.1.1) responds	Meaning
SZ↵	**OK**	Set zero performed

The SZ command will fail (LDU 179.1 responds with ERR) if the new “current zero” is more than 2% (of the CM value) 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 the No motion range (NR) and the 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 LDU will respond with ERR (error).

8.5.2. ZA Set Averaged System Zero

[n.a.]

This command will set the system zero as SZ, but using an average over the **TI** time period.

8.5.3. 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 (LDU 179.1) responds	Meaning
RZ↵	**OK**	Zero point CZ active

The LDU 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”.

8.5.4. 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 (LDU 179.1) 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 LDU will respond with ERR (error).

8.5.5. RT Reset Tare

[RPDO1,04]

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

Master (PC / SPS) sends	Slave (LDU 179.1) responds	Meaning
RT↵	OK	Tare de-activated / Gross operation

The LDU 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”.

8.5.6. SP Set Preset Tare

[SDO 2100 sub 17]

This command sets a tare value.

Master (PC / SPS) sends	Slave (LDU 179.1) 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 LDU 179.1.

8.6.1. GG Get Gross Value

[SDO 2900 sub 01]

Master (PC / SPS) sends	Slave (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) responds	Meaning
GS↵	**S+0125785**	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 (LDU 179.1) resp.	Meaning
GW↵	**W+000100+0011005109 (example)**	Net value: +000100 d (no decimal point) Gross value: +001100 d (no decimal point) Status bit 1: 5 (not used) Status bit 2: 1 (Hex) Check sum: 09 (Hex)

The status bits 1 and 2 are defined as follows:

Status				
	Value = 1	Value = 2	Value = 4	Value = 8
Status bit 1	Not used	Not used	Output 0 active	Output 1 active
Status bit 2	Signal stable	Set zero performed	Tare active	Not used

The check sum is the reciprocal 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 (LDU 179.1) 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 (LDU 179.1) resp.	Meaning
GL↵	**L+000100+0011005109 (example)**	Average value: +000100 d (no decimal point) Gross value: +001100 d (no decimal point) Status bit 1: 5 (not used) Status bit 2: 1 (Hex) Check sum: 09 (Hex)

For check sum, status bit 1 and status bit 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 (LDU 179.1) 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 $1 \leq n \leq 3$.

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 LDU 179.1.

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

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

8.7.1. SG Send Gross Value continuously

Master (PC / SPS) sends	Slave (LDU 179.1) responds	Meaning
SG↵	**G+001.100**	Gross value: 1,100 d

8.7.2. SN Send Net Value continuously

Master (PC / SPS) sends	Slave (LDU 179.1) 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 (LDU 179.1) responds	Meaning
SX↵	**S+125785**	ADC sample value = 125785 d

8.7.4. SA Send Triggered Average Value automatically

Master (PC / SPS) sends	Slave (LDU 179.1) 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 8.11 and 8.12.

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

Master (PC / SPS) sends	Slave (LDU 179.1) resp.	Meaning
SL↵	**L+000100+0011005109 (example)**	Average value: +000100 d (no decimal point) Gross value: +001100 d (no decimal point) Status bit 1: 5 (not used) Status bit 2: 1 (Hex) Check sum: 09 (Hex)

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

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 (LDU 179.1) responds	Meaning
IN↵	**IN:0000**	Input 0 and 1 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 (LDU 179.1) 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 10.9.2) and therefore setting the logic output status using the IO commands is **not** allowed.

Setting

Master (PC / SPS) sends	Slave (LDU 179.1) 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 (LDU 179.1) 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 (DAD 179.1) 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]

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'.

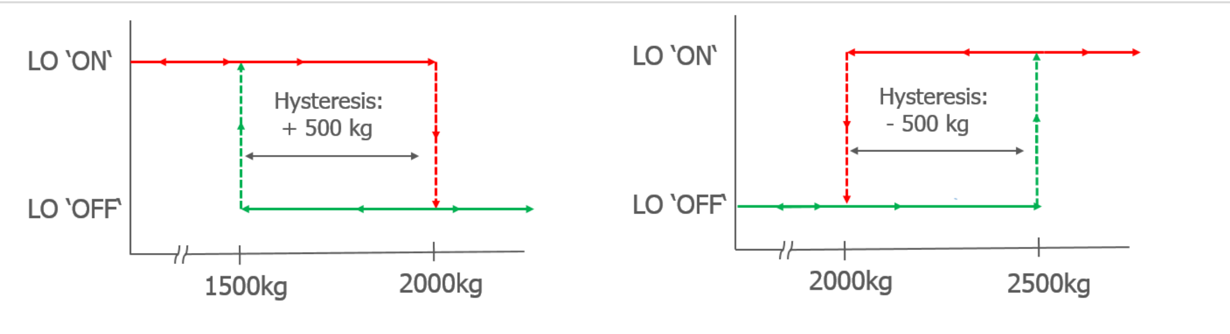
Master (PC / SPS) sends	Slave (LDU 179.1) responds	Meaning
S0↵	**S0:+010000**	Request: Setpoint S0 = 10000 d
S0_3000↵	**OK**	Setup: Setpoint S0 = 3000 d
S1↵	**S1:+011000**	Request: Setpoint S1 = 11000 d
S1_5000↵	**OK**	Setup: Setpoint S1 = 5000 d

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

[**H0**: SDO 2700 sub 01] [**H1**: SDO 2700 sub 02]

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 (LDU 179.1) 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 –9999 to +9999 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]

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 (LDU 179.1) 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 both setpoints.

Permitted value rang eis 0 to 65535 ms.

Default setting: HT = 0 ms.

Master (PC / SPS) sends	Slave (LDU 179.1) responds	Meaning
HT↵	**T+00000**	Request: HT = 0 ms
HT200↵	**OK**	Setup: HT = 200 ms

8.10. Communication Setup Commands – AD, 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 (LDU 179.1) 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 - CAN

[n.a.]

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

Master (PC / SPS) sends	Slave (LDU 179.1) 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 LDx device have a serial channel (UART) and some of the LDx devices also have 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
3	Serial mode	See table below
4, *Note 4*	Tx Delay	0 to 255

The Serial mode is a bit mapped 16 bit value.
- bit 0 controls parity: 1 = enabled. *Note 5.*
- bit 1 controls parity type: 0 = odd, 1 = even. *Note 5.*
- bit 7 controls the duplex mode: 0 = Full duplex, 1 = Half duplex.
- bit 15..8 specify the protocol in use: 0 = ASCII, 1 = Modbus RTU.

Allowed bit combinations:

Bit 15..8	Bit 7	Bit 1	Bit 0	= Hexadecimal	= Decimal
0	0	0	0	0x0000	0
0	1	0	0	0x0080	128
1	0	0	0	0x0100	256
1	0	0	1	0x0101	257
1	0	1	0	0x0102	258

Bit 15..8	Bit 7	Bit 1	Bit 0	= Hexadecimal	= Decimal
1	0	1	1	0x0103	259
1	1	0	0	0x0180	384
1	1	0	1	0x0181	385
1	1	1	0	0x0182	386
1	1	1	1	0x0183	387

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	CANopen address	1 to 127
2	Bit rate	10, 20, 50, 125, 250, 500, 800 and 1000 kbit/sec.

Notes for the interfaces 0 (serial) and 1 (CAN)
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.
Note 5: Parity check/generation is only available for Modbus RTU.

Examples:

Master (PC / PLC) sends	Slave (LDx) responds	Meaning
NS_0_0↵	**D:1790**	The device type is LDU 179
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_3↵	**S 00000**	The serial channel mode is ASCII protocol and full duplex.
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 (LDU 179.1) 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.]

The LDU 179.1 *always* operate in full duplex mode.

Master (PC / SPS) sends	Slave (LDU 179.1) resp.	Meaning
DX↵	**X:001**	Request: DX = 1 (Full duplex, factory default))
DX1↵	**OK**	Setup: DX = 1 (Full duplex)

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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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 LDU. The image file contains all stored information except the calibration data. This image file can be downloaded to any LDU with the same firmware type and revision No. as the source LDU.

8.11.5. PI Download an Image File to the EEPROM

[n.a.]

Downloads a HEX-INTEL formatted EEPROM image file to the target LDU EEPROM. The image file contains all stored information except the calibration data.
Attention: The target LDU must have same firmware type and revision no. as the source LDU.

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

Note: All changes to the trigger commands have to be stored in the EEPROM using the WP command. See chapter 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 (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) 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 can be compared to a hardware trigger on the digital input channel 0.

Master (PC / SPS) sends	Slave (LDU 179.1) 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 (LDU 179.1) 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 0) will be used the trigger level should be set to its maximum value (TL = 999999). This setting disables the trigger level.

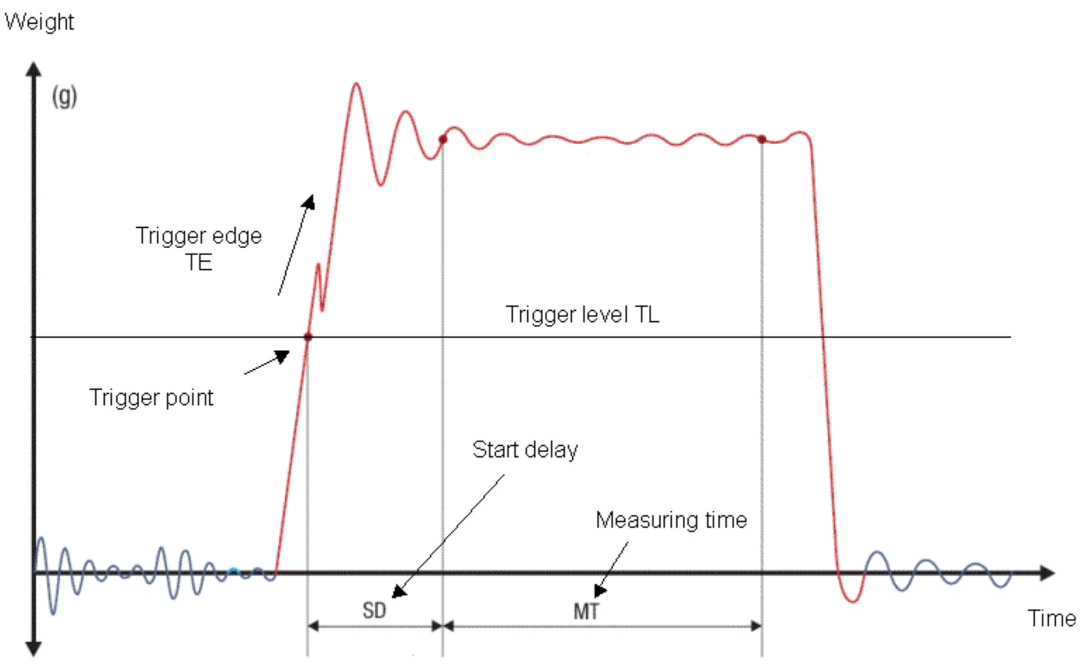


Figure: Time plot of a typical checkweigher cycle

8.12.7. SA Send Triggered Average Value automatically

[n.a.]

Master (PC / SPS) sends	Slave (LDU 179.1) responds	Meaning
SA↵	**OK**	Auto-Transmit: triggered average value

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

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

Note: All changes to the re-trigger commands have to be stored in the EEPROM using the WP command. See chapter 11.12

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 (LDU 179.1) 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 an averaging time for calculating the cycle average value. If this time period has been elapsed, the measurement cycle will be finished at the latest.
The setting TT = 0 disables the re-trigger function. Default setting: TT = 65535 ms.

Master (PC / SPS) sends	Slave (LDU 179.1) 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 to calculate short-time averages. If the short-time average falls outside the trigger window, then the measurement will be started again.

Master (PC / SPS) sends	Slave (LDU 179.1) 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 (LDU 179.1) 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 (LDU 179.1) responds	Meaning
TI↵	**T+00000**	Request: TI = 0 ms
TI200↵	**OK**	Setup: TI = 200 ms

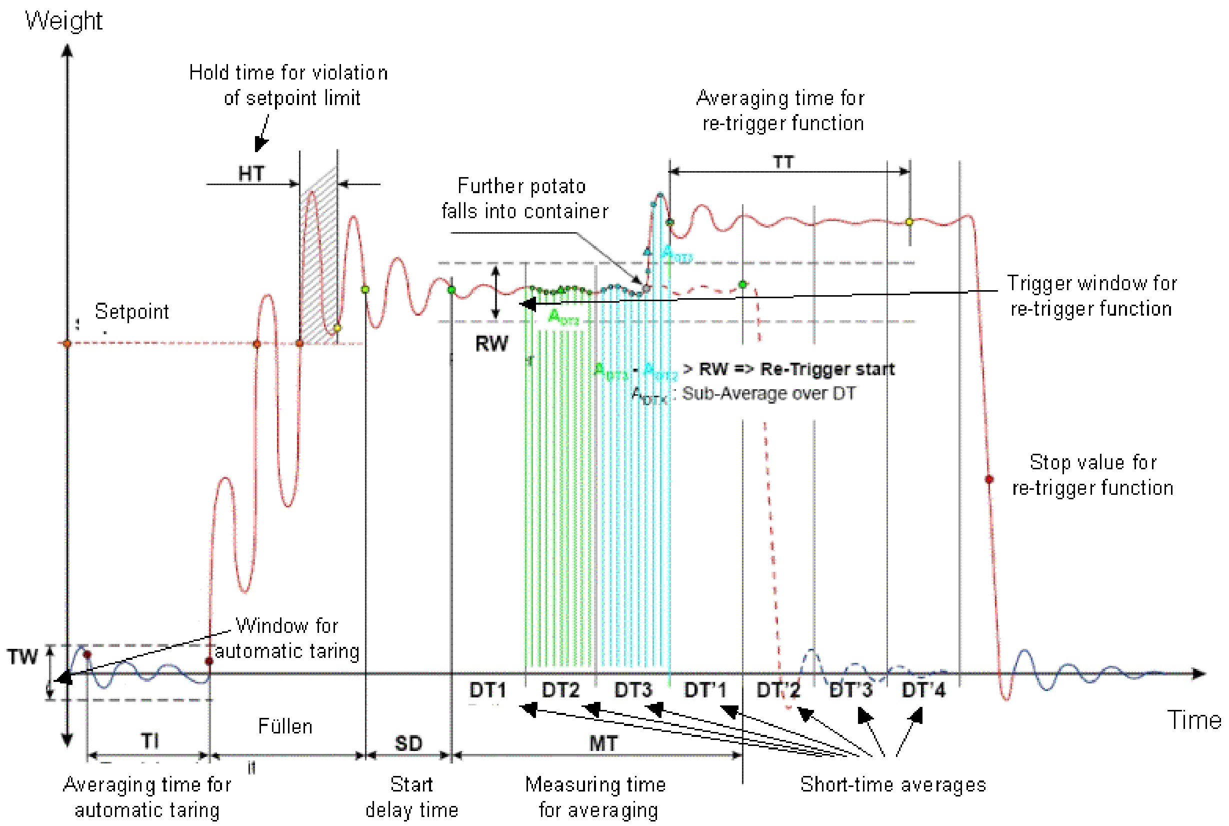


Figure: Time plot of a measurement cycle with the re-trigger function

9. 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 LDU 179.1 has been approved as a component for use in weighing systems 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 approval certificate number is DK0199-R76-xxxxx

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 LDU 179.1 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.

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