Quality Electronics for Industrial Weighing H&B

Weighing Indicator for Rail Mount (TS35)

Type DAD 141.1

Communication via RS 422/485 & Ethernet Port

TECHNICAL MANUAL - BASIC -

Firmware Version 141.181.v.1.48 or higher
Hardware Version 141.10x.v.1.01
Document No. E 223 Rev. 3.5.x EN

Hauch & Bach ApS
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0. Table of Contents:

RIGHTS AND LIABILITIES

1. 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.

2. Declaration of Conformity

EG-Konformitätserklärung
EC-Declaration of Conformity

Monat/Jahr: *month/year:*	02/2018
Hersteller: *Manufacturer:*	Hauch & Bach ApS
Anschrift: *Address:*	Femstykket 6 DK-3540 Lynge Dänemark / Denmark
Produktbezeichnung: *Product name:*	DAD 141.1

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/EG.	***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	Nicht-Selbsttätige Waagen – Metrologische und technische Anforderungen (OIML R-76:2006) *Non-automatic weighing systems – Metrological and technical requirements (OIML R-76:2006)*
EN 45501	Metrologische Aspekte nichtselbsttätiger Waagen (EN 45501:2015) *Metrological aspects of non-automatic weighing instruments (EN 45501:2015).*

Michael Bach
Managing Director

3. Introduction and Specifications

The **all-in-one** Digital Amplifier DAD 141.1 is a universal device for any weighing, filling or loss-in-weight operation and for force measurements with strain gage sensors. The DAD141 is for DIN (TS35) rail mount.

To grant the quality and allow legal weighing, the DAD141.1 is OIML R-76 approved and meet the MID E2 requirements to EMC.

The standard device includes all the communication facilities needed for industrial weighing, control and registration, i.e. analog current or voltage output (0/4…20 mA, 0…5V, 0…10V, -5V…+5V and -10V…+10V), Ethernet, RS 422/485 and logic I/O's for direct control of valves or bars etc.

The device can be controlled either by the front keys, via RS422/485 port or Ethernet port. 2 logic inputs and 3 logic outputs make complex control functions easy. The 3 logic outputs can be controlled external, too.

The device features fullfills multi-drop communications capability and can be programmed via a straightforward ASCII command set. It is theoreticaly possible to connect 256 nodes on a network using the type of RS485 transceivers the DAD 141.1 use. The addressing allow 255 units (1 to 255).

DAD 141.1 Specifications	
Accuracy class	III
Test certificate according OIML R76	EU Type approved for 10000 intervals
AD converter	Delta-Sigma, ± 24 bit
Analog input range	±15 mV bipolar (± 3 mV/V @ 5 VDC excitation)
Minimum input sensitivity	0.2 µV/e (legal for trade); 0.05 µV/d (non legal for trade)
Linearity	< 0.001 % FS
Temperature effect on zero	< ±4 ppm/°K (typical < ±2 ppm/°K)
Temperature effect on span	< ±8 ppm/°K (typical < ±4 ppm/°K)
Excitation	5 V DC, load cell(s) resistance 50 - 2000 ohms; 6 wire technic
Conversion rate	Max. 600 values/second, selectable in 8 steps
Resolution external	± 600 000 counts @ ± 3 mV/V input signal
CALIBRATION & WEIGHING FUNCTIONS	
Calibration	Electronical calibration in mV/V (eCal) or with test weight(s)
Digital low pass filter	FIR Filter 2.5 to 19.7 Hz or IIR Filter 0.25 to 18 Hz - adjustable in 8 steps
Weighing functions	Zero, gros, tare, net, filter, etc.
Application modes	None automatic weighing instrument (NAWI) or triggered measurement
Communication & Setup	
Communication ports	RS 422/485 and Ethernet
Setup & Calibration	Panel buttons or Windows software 'DOP 4' or smartphone App 'AnDOP'
Display	6 digit 7 segments, green LED's, 5.08mm, 8 status LED green, spectral filter 565 nm for improved contrast
Keyboard	4 pcs, Ø 3mm robust, for setup / calibration, zero, tare
Power supply	12 ... 24 V DC ±10 %, < 4 W
Environmental Conditions	
Operating temperature	-15 °C to +55 °C at maximal 85% rh, non condensing
Storage temperature	-30 °C to +70 °C
Enclosure & protection	Plastic housing, for DIN rail mount (TS35) , protection IP40
Dimensions and weight	120 x 105 x 22.5 mm (H x L x W), weight approx. 170 g
EMC performance	EN61326 according to MID E2 for industrial applications (in full accordance with 2004/22/EC)
Vibration resistance	2.5g @ operation, 5g @ storage
Serial Interface	RS 422/485, 9600 ... 115200 Baud – half/full duplex
Protocol & Address range	ASCII; address range 1 … 31
Modbus RTU	Binary data
Ethernet interface	RJ45, 10/100 Mbit/s, isolated
Ethernet TCP/IP – protocol & port	protocol ASCII, TCP port 23
Modbus TCP – protocol & port	Embedded in TCP/IP packages, protocol binary data, TCP port 502
IP address	Setup via serial port or panel buttons – Factory default: **192.168.0.100**
Analog current output	0 – 20mA or 4 – 20mA, 500ohm, isolated or
Analog voltage output	0 – 10V, 0 – 5V, ±5V, ±10V, 10kohm, isolated
Digital logic inputs	2 inputs (10 – 30V, 1 – 3mA), commond ground, isolated
Digital logic outputs	3 outputs (semiconductor relais) 30 V DC/AC, 0.5 A, common ground, isolated

4. Communications and Getting started

4.1. Serial Interface

Communicating with the digital device DAD 141.1 is carried out via serial port RS 422/485.
The data format is the familiar 8/N/1 structure (8 data bits, no parity, 1 stop bit).
Available baud rates of RS422/485 port are as follows: 9600, 19200, 38400, 57600 or 115200 baud.

Factory default: 115200 baud

4.2. Command Language

The command set of the DAD 141.1 is based on a simple ASCII format (2 letters). This enables the user to setup the device, get results or check parameters.

Example: DAD 141.1 is connected via the RS 485 port to a PC / PLC system. You want to get the identity, firmware version or net weight.

Remark: In this manual means: "_" Space in the setup command and "↵ " Enter (CR). Sending of a linefeed (LF) is not required and will be ignored by the device, if neccessary.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
ID↵	**D:1410**	identity of the active device
IV↵	**V:0101**	Firmware version of the active device
GN↵	**N+123.45**	Net weight with algebraic sign; decimal point is fixed as setup with command DP

4.3. Baud Rate

For baud rate setup use the command BR, see chapter 10.10.3.

Factory default: 115200 baud

4.4. Getting Started Via RS422/485

You will require:

- PC or PLC with a RS 422/485 communication port
- A load cell / scale with test weights or a load cell simulator
- A 12-24 VDC power supply capable of delivering approximately 200mA for each DAD 141.1 and load cell(s)
- One or more DAD 141.1
- A suitable ASCII communication software **

Refer to the wiring diagrams in chapter 5.

**
You can easily communicate between a PC and a DAD 141.1 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.

Hint:
A download of a new firmware version can be done with the software **DAD141 Programmer 1.6** (or later). The download can be done via RS485 at a baud rate of 115200 or via Ethernet interface.

4.5. Getting Started Via Ethernet Interface

You will require:

- PC or PLC with an Ethernet port
- A load cell / scale with test weights or a load cell simulator
- A 12-24 VDC power supply capable of delivering approximately 200mA for each DAD 141.1 and load cell(s)
- One or more DAD 141.1 in the Ethernet LAN
- Ethernet TCP/IP, protocol ASCII, TCP port 23
- Modbus TCP, embedded in TCP/IP packages, protocol binary data, TCP port 502

The factory default TCP/IP address of DAD 141.1 is **192.168.0.100**. You can change the address via the front panel buttons in the menu 8.6 (chapter 7.10) or via the command NA (network address).

In case you have your DAD 141.1 connected in a LAN (local area network), which offers additional WLAN (wireless local area network) access, we offer the Smartphone App '**AnDOP**' for OS Android.
This 'State Of The Art' software offers you an easy access to the DAD 141.1 like:

- Display of gros, net and average value
- Proceed a calibration
- Change of setup
- Data recording of static & dynamic measurements
- Recorded data showing as graph.

4.6. Modbus TCP or Modbus RTU

The DAD 141.1 supports both, Modbus RTU (via RS422/485 port) and Modbus TCP (via Ethernet port).

- Modbus TCP, embedded in TCP/IP packages, protocol binary data, TCP port 502
- Modbus RTU (binary data).

For Modbus comunication please use the separate manual.

In this manual you find only for each command the corresponding Modbus Index. In case of no index, the command is <u>not</u> available for Modbus use.

5. Hardware and Wiring

5.1. Housing & Terminals

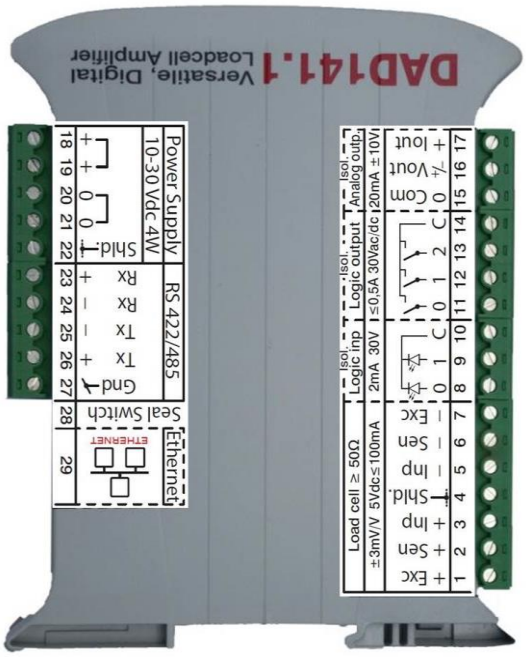
Max [redacted]
Min [redacted] T= - [redacted]
e=d= [redacted]
CE [redacted]
-15°C/+55°C
Δ Umin = 0.20 V/VSI n max = 10 000
☐ EU Type Exami..ation Cert. no: DK0199.422
☐ Evaluation Certificate no: DK0199-17.01
EMC approval: EN 61326 to MID-E2
Part no: 141.101.v.1.1x

Serial no:

TAC Value:

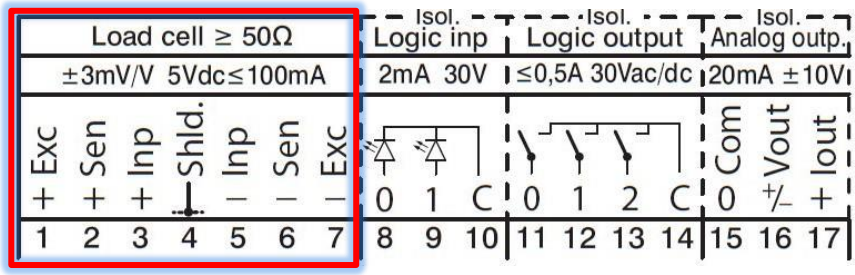
Made by Hauch&Bach ApS, Femstykket 6, 3540 Lynge, DK

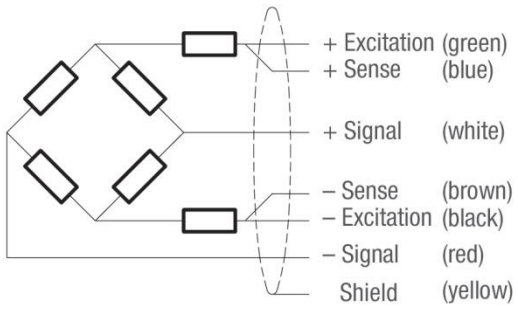
Scale informations for 'legal for trade' use



Terminals of DAD 141.1

5.2. Terminals Load Cell Connection





Colour code of e.g. standard Flintec load cells

DAD 141.1 Pin no.	Load cell input	Function
1	+ Exc	+ Excitation for load cell
2	+ Sen	+ Sense for load cell
3	+ Inp	+ Signal of load cell
4	Shld.	Shield load cell
5	– Inp	– Signal of load cell
6	– Sen	– Sense for load cell
7	– Exc	– Excitation for load cell

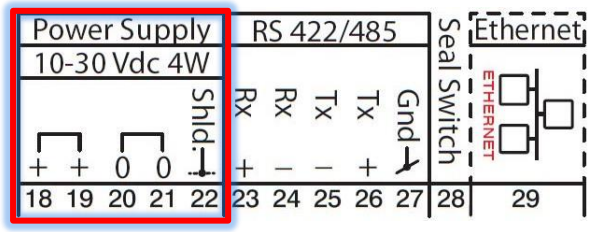
5.3. Load Cell Connection

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 1 & 2 and 6 & 7.

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



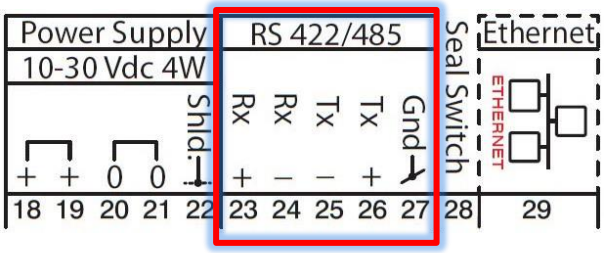
DAD 1411 Pin no.	Power in	Function
18	+	Power supply +12..24 V DC
19	+	Power supply +12..24 V DC
20	-	Common ground / 0 V DC
21	-	Common ground / 0 V DC
22	Shld.	Chassis ground

Depending on the grounding concept of the plant/scale, terminal 20 or 21 has to be connected to terminal 22. Terminal 4 (shld load cell) and 22 (Ground chassis) are internal connected.

Note: The power supply must be able to support about 200mA per DAD 141.1.

5.5. Terminals Serial Port RS 422/485

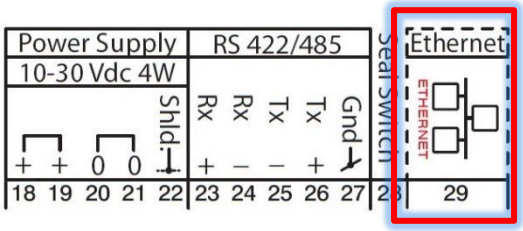
The RS422/485 port can be used for communication with a PC or PLC system.



DAD 141.1 Pin no.	RS 422/485	Function
23	+ Rx	+ Receive Data
24	- Rx	- Receive Data
25	- Tx	- Transmit Data
26	+ Tx	+ Transmit Data
27	GND	Signal ground RS422/485

The serial port supports two protocols:
- ASCII (characters) and
- Modbus RTU (binary data).

5.6. Ethernet Port

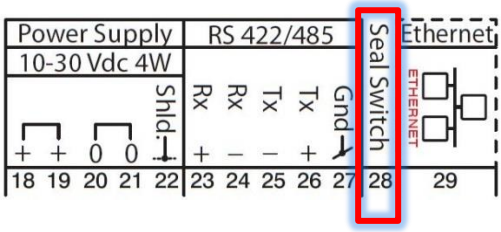


The Ethernet port (29, RJ45) can be used for communication in a local area network (LAN) with 10/100 Mbit/s.

The Ethernet port supports:
- Ethernet TCP/IP, protocol ASCII, TCP port 23
- Modbus TCP, embedded in TCP/IP packages, protocol binary data, TCP port 502.

The default IP address is **192.168.0.100**, which can be changed by the user.

5.7. Seal Switch



Setup or changes of calibration can only be performed with an open seal switch (28). 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 next page.

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

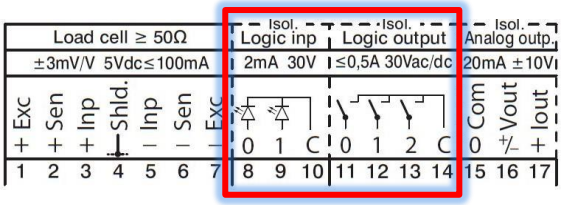
5.8. Logic Inputs & Outputs

The DAD 141.1 offers 2 isolated logic inputs and 3 isolated logic outputs, all "floating".

The 2 inputs can e.g. get the function to act as the ZERO or TARE button, see chapter 10.8.1.

The 3 outputs act as switches for setpoints with hysteresis, switch behavior etc. Several bases can be used like net weight, peak weight value or average value, see chapter 10.9.x.

DAD 141.1 Pin no.	Logic In- / Output	Function
8	0	'High': +12 ... +24VDC
9	1	'High': +12...+24VDC
10	C	'Low' Common 0/1: 0V
11	0	Logic output 0
12	1	Logic output 1
13	2	Logic output 2
14	C	Common 0/1/2: 12 ... 24V oder 0V



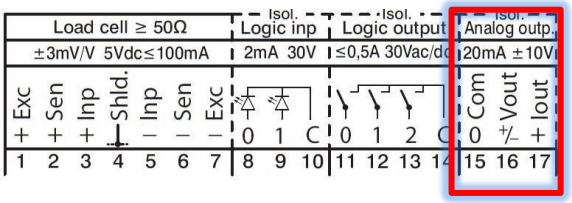
Note Logic Inputs:
The pulse duration must be at least 50ms.

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

5.9. Analog Outputs

The DAD 141.1 offers 2 isolated analog outputs for current and voltage. For your application you can choose one of the six modes like:

- 4 to 20mA / 0 to 20mA
- 0 to +5V / 0 to +10V
- -5 to +5V / -10 to +10V.



DAD 141.1 Pin no.	Analog Outputs	Function
15	0 Com	Signal ground analog output
16	+/- Vout	Voltage output
17	Iout	Current output

6. Menu Structure For Keybord Setup

To Enter the DAD 141.1 setup menu, press the 'UP' or 'DOWN' arrow button for 3 seconds. To enable calibration, remove the jumper from **seal switch** (pins 28)

1.x Zero	2.x Span	3.x Display	4.x Filter & Motion	5.x Analog out	6.x Input 0/1	7.x Output 0/1/2	8.x Data communicat.
1. Switch ON or OFF Zero Tracking	1. Increments 'n' at which the span calibration is performed. Reference 2.2 or 2.3	1.o Number of increments 'n' at which the display shows overload "oooooo"	1. Cut-off frequency of the low pass filter, see below.	1. Set number of increments 'n' corresponding to minimum output level, e.g. 4mA	x.1. Assign an logical input to a specific function, e.g. the Tare button.	x.1.1 Set number of increments 'n' corresponding to the setpoint.	1. Select the baud rate
2. Set system Zero as based on the actual input (weight)	2. Calibration of Span as based on the actual input (weight)	.o1 for CM1	***Mode IIR FIR***	2. Set number of increments 'n' corresponding to maximum output level, e.g. 20mA		x.1.2 Switch characteristic for Setpoint 'on' or 'off'	2. Select RS422 for point2point communication or RS485 for networks
3. Set System Zero electronically via mV/V setup	3. Calibration of Span electronically via mV/V setup	.o2 for CM2	1.1 18Hz 19.7Hz	3. Select the base for the analog output, e.g. gross weight.		x.2. Setup Hysteresis in increments for the setpoint	3. Select device address for RS485 networks (0 for point2point)
4.1 Enable / disable actual Tare value non-volatile.	4. Display shows the actual load cell input signal in mV/V	.o3 for CM3	1.2 8Hz 9.8Hz	4. Select the analog output mode, e.g. 4-20mA or 0 – 10V		x.3. Select the base for the setpoint, e.g. gross weight.	4. Autotransmit data at power ON
4.2 Enable / disable actual Zero value non-volatile.	5. Display of the Firmware Version	1.U Number of increments 'n' at which the display shows underload "UUUUUU".	1.3 4Hz 6.5Hz	5. Test the selected current or voltage output		x.4. Test mode LOs: Open / Close contacts by using UP/DOWN buttons.	5. Set delay in miliisseconds before any transmission starts
4.3 Enable / disable initial zero @ power ON.	6. Display of the TAC counter value	2. Display step size (1, 2, 5, 10, 20 etc.) per division 'd'.	1.4 3Hz 4.9Hz	***Range of test signals:***		3. Set Hold Time for all Setpoints. This is the time period before a switch event will be initiated.	6.x Set the IP-Address used by the Ethernet interface in decimal notation, e.g. **192.168.0.100**
4.4 Set Zero Range and Zeroing		3. Set decimal point position.	1.5 2Hz 3.9Hz	'4_20': 3.9 to 20.1 mA			7. Modbus parity check **no - odd - even**
		4. Choose Multi-Range or Multi-Intervall	1.6 1Hz 3.2Hz	'0_20': -0.1 to 20.1 mA			8. Protocol serial port **SER** = ASCII **RTU** = binary data
		MR = 1	1.7 0.5Hz 2.8Hz	'0_5': -0.1 to +5.1 V			9. User Setup **STORE:** save in EEPROM **RECALL:** restore f. EEPROM
		MI = 0	1.8 0.25Hz 2.5Hz	'0_10': -0.1 to +10.1 V			
			2. Select Filter Mode **IIR** or **FIR**	'-5_5': -5.1 to +5.1 V			
			3. Number of updates per second from averaging filter	'-10_10': -10.1 to +10.1 V			
			4.1 Set No-Motion range in increments				
			4.2 Set No-Motion time in millisecods				

7. Setup Via Front Panel Keyboard

7.1. Keyboard Buttons

This is the ZERO button. This button can be used for zeroing in scale status 'NO Motion' within the setup limits and to clear TARE.

This is the TARE button. This button can be used for taring the scale in status 'NO Motion'.

The two UP/DOWN buttons will be used for setup via the menu.

7.2. Use of Keyboard Buttons

Press the UP or DOWN button for more than 3 seconds to enter the setup menu of front panel. In setup menu use these buttons to select one of the menus 1 to 8 and make your selection in the sub-menus or to setup single characters of the display.

Remark: To enable calibration – menu 1, 2 and 3 – you have to remove the jumper of seal switch (28). The TAC counter will increase by one after changes.

Enter in menu X to the different sub-menus of X. After choosing the setting with the UP or DOWN button, use this key again for storing. This is the ENTER button.

To leave menu X or sub-menu of X.
Leave with: press 1x TARE button for back to menu X.1 – 1st level
or press 2x TARE button for back to menu X

					Menu 7.0.1.1 – Setup Value 001000
X			**Menu X**	Select with UP / DOWN buttons Enter with ZERO button Leave with TARE button	X X
	X.1		Menu X - 1st level	Enter with ZERO button Select with UP / DOWN buttons Back with ZERO button Leave with TARE button	X
		X.1.1	Menu X - 2nd level	Enter with ZERO button Select with UP / DOWN buttons Enter with ZERO button Leave with TARE button	
			X.1.1.1 Menu X - 3rd level	Enter with ZERO button Select with UP / DOWN buttons Enter with ZERO button Use UP / DOWN buttons for single characters Use TARE button for next number Back with ZERO button Leave with: 1x TARE button back to menu **X.1** 2x TARE button back to menu **X**	X X X 0 0 1 0 0 0 x x x x x x X X

7.3. Menu 1 – System Zero

Remark: Activate a new calibration with 1x Power OFF & ON !

1.			**ZERO setup** (Menu 1.1 to 1.4) TAC protected – see chapter 10.2.1
	1.1		**Automatic Zero Tracking - Enable / Disable** (command ZT) Setting range: 0 … 255 d - Disabled @ 00000, no ZERO Tracking Enabled @ 00001 or higher (max 00255) - Setting 00001 sets a zero tracking range of ±0.5d - Setting 00002 up to 00255 sets a zero track range of ±1d up to ±127.5d, independent of decimal point setting
	1.2		**Calibrate system ZERO - gravimetric by weight / load** (command CZ) - Display shows the actual input signal in mV/V. Press ENTER button to store ZERO. **Remark:** Scale should/must be unloaded.
	1.3		**Calibrate system ZERO - electronic by mV/V value** (command AZ) - Use the UP/DOWN & MOVE RIGHT keys to setup the mV/V value at which the device should read ZERO
	1.4		**System ZERO & TARE function**
		1.4.1	**Store TARE value non volatile: ON / OFF** (command TN) - ON: store non-volatile @ power OFF - OFF: delete @ power OFF
		1.4.2	**Store ZERO value non volatile: ON / OFF** (command ZN) - ON: store non-volatile @ power OFF - OFF: delete @ power OFF
		1.4.3	**Initial ZERO @ power ON: ON / OFF** (command ZI) - ON: proceed initial Zero @ power ON - Range is ±10% of Max
		1.4.4	**ZERO range (increments)** (command ZR) - Set the zero setting range in divisions. The setting is independent of decimal point setting. - Disabled @ 00000, no ZEROing possible - Enabled @ 00001 or higher (max 999999) In a legal for trade application, the standard value is ±2 % of Max. The setup for a scale with 3 000e is i.e.: - Max (CM) = 1 500 kg - Step Size (SZ) = 0.5 kg - Zero Range (ZR) of ±2 % = ± 30 kg, which is ± 60 d.

7.4. Menu 2 – System Span

Remark: Activate a new calibration with 1x Power OFF & ON !

2.			**SPAN setup** (Menu 2.1 to 2.4) TAC protected – see chapter 10.2.1
	2.1		**Set SPAN Calibration value** (command CG) - Set display value equivalent to calibration weight or to mV/V value derived from load cell(s) test data.
	2.2		**Calibrate system SPAN - gravimetric by weight / load** - Display shows the actual input signal in mV/V. - Apply test weight equivalent to calibration value (2.1). - Press ENTER button to store new SPAN signal.
	2.3		**Calibrate system SPAN - electronic by mV/V input** (command AG) - Use the UP/DOWN & MOVE RIGHT keys to setup the mV/V value at which the device should read SPAN. - Press ENTER button to store new SPAN signal.
	2.4		**Display the input signal in mV/V** - This function displays the actual input signal of the load cell(s).
	2.5		**Display the firmware version, e.g. 1.47** (command IV) - Read and display the firmware version.
	2.6		**Display the actual TAC value, e.g. 34** (command CE) - Read and display the TAC value of the actual calibration.

7.5. Menu 3 – Display

Remark: Activate a new calibration with 1x Power OFF & ON !

3.			**Display setup** (Menu 3.1 to 3.4) TAC protected – see chapter 10.2.1
	3.1		**Display limits - Overrange / Underrange** (commands CMn/CI)
		3.1.o1	Display overrange limit CM1 (maximum value +999999) (CM1) Use the UP/DOWN & MOVE RIGHT keys to setup the maximum display value, above which the display shows over range (all dashes in the top of the display).
		3.1.o2	Display overrange limit CM2 (maximum value +999999) (CM2)
		3.1.o3	Display overrange limit CM3 (maximum value +999999) (CM3)
		3.1.U	Display underrange limit (minimum value -999999) (CI) Use the UP/DOWN & MOVE RIGHT keys to setup the minimum display value, above which the display shows under range (all dashes in the bottom of the display).
	3.2		**Display step size - in digits [d]** (command DS) - choose one out of 1, 2, 5, 10, 20, 50, 100, 200, 500
	3.3		**Decimal point position on the display** (command DP) - choose one out of 0, 0.0, 0.00, 0.000, 0.0000, 0.00000
	3.4		**Setup of Multi-interval or Multi-range** (command MR) - Choose 0 for Multi-interval or 1 for Multi-range scale.

7.6. Menu 4 – Filter & Motion Detection

Remark: Activate a new setup with 1x Power OFF & ON !

4			**Digital filter & No Motion setup** (Menu 4.1 to 4.4)
	4.1		**Low pass filter cut off frequency** (command FL) - Settings: 0 - 8 with UP/DOWN buttons
		4.1.x	**Cut off frequency:**

	IIR mode	FIR mode
4.1.0	No digital filter	No digital filter
4.1.1	18 Hz	19.7 Hz
4.1.2	8 Hz	9.8 Hz
4.1.3	4 Hz	6.5 Hz
4.1.4	3 Hz	4.9 Hz
4.1.5	2 Hz	3.9 Hz
4.1.6	1 Hz	3.2 Hz
4.1.7	0.5 Hz	2.8 Hz
4.1.8	0.25 Hz	2.5 Hz

	4.2		**Digital filter Mode - IIR or FIR** (command FM) - Choose IIR or FIR
	4.3		**Update rate and averaging** (command UR)
		4.3.x	**Averaging** (from 1 to 128 readings)
		4.3.0	0 - each reading
		4.3.1	1 - average of 2 readings
		4.3.2	2 - average of 4 readings
		4.3.3	3 - average of 8 readings
		4.3.4	4 - average of 16 readings
		4.3.5	5 - average of 32 readings
		4.3.6	6 - average of 64 readings
		4.3.7	7 - average of 128 readings
	4.4		**Motion detection**
		4.4.1	**No motion range** (value range from 1 to 65 535 d) (command NR) Weight value changes within this range will be considered as 'stable'
		4.4.2	**No motion time** (value range from 1 to 65 535 ms) (command NT) Time span for the no motion detection where the signal has to be 'stable'

7.7. Menu 5 – Analog Output

Remark: Activate a new setup with 1x Power OFF & ON !

5			**Analog output setup** (Menu 5.1 to 5.5)
	5.1		**Weight value for minimum analog output** (command AL) - Set the weight value which corresponds to minimum output **Examples for scale 0 … 3 000kg** **Minimum 0kg or with 600kg preload** - output mode 4 … 20mA: 0kg = 4mA - setting 00000 600kg = 4mA - setting 00600 - output mode 0 … 20mA: 0kg = 0mA - setting 00000 600kg = 0mA - setting 00600
	5.2		**Weight value for maximum analog output** (command AH) - Set the weight value which corresponds to maximum output **Examples for scale 0 … 3 000kg** **Maximum 3 000kg** - output mode 4 … 20mA: 3 000kg = 20mA - setting 03000 - output mode 0 … 20mA: 3 000kg = 20mA - setting 03000
	5.3		**Analog output base** (command AA) GroS - analogue output follows **Gross** value nEt - analogue output follows **Net** value PEA - analogue output follows **Peak** value (Maximum) AUEr - analogue output follows **Average** value HoLd - analogue output follows **Hold** value PP - analogue output follows **Peak - Peak** value UALL - analogue output follows **Valley** value (Minimum) d ,SP - analogue output follows **Display** value oFF - analogue output is switched **OFF** FLo – analogue output follows **Mass Flow** (firmware type 2)
	5.4		**Analog output mode** (command AM)
		4_20	4 to 20mA
		0_20	0 to 20mA
		0 _ 5	0 to +5V
		0 _ 10	0 to +10V
		- 5 _ 5	-5 to +5V
		- 10 _ 10	-10 to +10V
	5.5		**Setup of test signal current or voltage analog output** The test signal, independent of the measuring signal, is based on the choosen mode in menu **5.4**. The setup uses 6 digits, e.g. 004.000 for 4mA (decimal point position is fixed). For each mode you can use the output range plus -/+ 0.1 ! Setup of a negative value via left figure/"-" sign (left status LED).

7.8. Menu 6 – Logic Inputs

Remark: Activate a new setup with 1x Power OFF & ON !

6			**Logic input setup** (Menu 6.0 to 6.1)
	6.0		**Logic Input "0"** (command AI'n' – n=0)
		6.0.x	**Functions** (x = choose one from 00 to 18 with 'up'/'down' buttons) 00 - Input "0" has no function 01 - Input "0" acts as **Zero** button 02 - Input "0" acts as **Tare** button 03 - Input "0" acts as **Up arrow** button 04 - Input "0" acts as **Down arrow** button 05 - Input "0" starts the **Trigger** function 06 - Input "0" displays the **Average** value 07 - Input "0" displays the **Peak** value (maximum) 08 - Input "0" deletes the **Peak** value (maximum) 09 - Input "0" displays the **Hold** value 10 - Input "0" displays the **Peak to Peak** value 11 - Input "0" displays the **Valley** value (minimum) 12 - Input "0" disables the buttons 13 - Input "0" stores the **actual weight** (**Hold** value) 14 - Input "0" tares the displays and deletes all other values 15 - Input "0" **turn off display** 16 **-** Input "0" displays the **Mass Flow** of LIW (firmware type 2) 17 - Input "0" **Start/Stop** function for LIW (firmware type 2) 18 - Input "0" **Freeze/Run** function for LIW (firmware type 2)
	6.1		**Logic Input "1"** (command AI'n' – n=1)
		6.1.x	**Functions** (x = choose one from 00 to 18 with 'up'/'down' buttons) 00 - Input "1" has no function 01 - Input "1" acts as **Zero** button 02 - Input "1" acts as **Tare** button 03 - Input "1" acts as **Up arrow** button 04 - Input "1" acts as **Down arrow** button 05 - Input "1" starts the **Trigger** function 06 - Input "1" displays the **Average** value 07 - Input "1" displays the **Peak** value (maximum) 08 - Input "1" deletes the **Peak** value (maximum) 09 - Input "1" displays the **Hold** value 10 - Input "1" displays the **Peak to Peak** value 11 - Input "1" displays the **Valley** value (minimum) 12 - Input "1" disables the buttons 13 - Input "1" stores the **actual weight** (**Hold** value) 14 - Input "1" tares the displays and deletes all other values 15 - Input "1" **turn off display** 16 **-** Input "1" displays the **Mass Flow** of LIW (firmware type 2) 17 - Input "1" **Start/Stop** function for LIW (firmware type 2) 18 - Input "1" **Freeze/Run** function for LIW (firmware type 2)

Note for menu 6.0 or 6.1.: **LIW** means a "Loss in Weight" application

7.9. Menu 7 – Logic Outputs

Remark: Activate a new setup with 1x Power OFF & ON !

7			**Logic output setup** (Menu 7.0 to 7.2)
	7.0		**Logic Output "0"**
		7.0.1	**Setpoint "0"**
			7.0.1.1 Setup of the Setpoint value (command S'n' – n=0) Permitted values +/- 999 999
			7.0.1.2 Setup the Polarity (switch logic) **ON** or **OFF** (command P'n' – n=0) Use the UP/DOWN buttons for "on" / "oFF"
		7.0.2	**Hysterisis value "0" (± 'n')** (command H'n' – n=0) Permitted values +/- 9 999
		7.0.3	**Base for Setpoint "0"** (command A'n' – n=0) GroS - **Gross** value nEt- **Net** value PEA - **Peak** value (Maximum) AUEr - **Average** value HoLd - **Hold** value PP - **Peak to Peak** value UALL - **Valley** value (Minimum) Error - **Error 4** or **5** FLo - **Mass Flow** value (firmware type 2, *reserved*) bA - ***Batch*** *Loss in Weight (firmware type 2, reserved)* LIC - ***Bit 0...2*** *from LIW control via PLC (firmware type 2, reserved)* Ard - ***Average ready*** *(check weigher, firmware type 0, reserved)*
		7.0.4	**Test logic output "0"** (Use the UP/DOWN buttons) Open/Close contacts using the keyboard 7.0.4.0 Output is **OFF** 7.0.4.1 Output is **ON**
	7.1		**Logic Output "1"** (commands S'n', P'n', H'n', A'n' – n=1) As per section 7.0 - but for logic output "1"
	7.2		**Logic Output "2"** (commands S'n', P'n', H'n', A'n' – n=2) As per section 7.0 - but for logic output "1"
	7.3		**Hold Time for <u>all</u> the Logic Outputs 0, 1 and 2** (command HT) Permitted value range is from 0 to 65 535 ms The signal has to exceed the setpoint limit continuously at least for this time period before a switch event will be initiated.

7.10. Menu 8 – Data Communication

Remark: Activate a new setup with 1x Power OFF & ON !

8			**Data Communication setup** (Menu 8.1 to 8.9)
	8.1		**Baud Rate for COM Port RS 422/485** (use the UP/DOWN buttons) (command BR)
			9600 Baud 19200 Baud 38400 Baud 57600 Baud 115200 Baud
	8.2		**Select RS 422 or RS 485** (use the UP/DOWN buttons)
			422 = RS 422 Interface for single DAD 141.1 application 485 = RS 485 Interface for multiple DAD 141.1 application in a bus
	8.3		**Set Device Address COM Port (RS 422/485)** (command AD)
			- Set device address for multi-drop to 001 … 255 - Set device address for single point to point applications to 000 - Factory Default: 000
	8.4		**Select Auto-transmit mode** (use the UP/DOWN buttons)
			gros - **Gross** value (command SG) net - **Net** value (command SN) AUEr - A**verage** value (command SA) SAP - **ADC value** ALL - Data string with **Gross, Net and Status** (command SW) PEA - **Peak** value (Maximum) (command SM) HoLd - H**old** value (command SH) UALL - **Valley** value (Minimum) (command SV) PP - **Peak to Peak** value (command SO) oFF - set output "1" **OFF**
	8.5		**Transmission delay Tx @ COM Port** (required for some PLCs) (command TD)
			- Transmission delay from 000 … 255 milliseconds
	8.6		**IP-Address of Ethernet Interface** (command NA)
			- in decimal notation per 3 characters - Factory default: **192.168.0.100**
		8.6.x	**Example for factory default - AAA.BBB.CCC.DDD**
		8.6.1	AAA 000**192**
		8.6.2	BBB 000**168**
		8.6.3	CCC 000**000**
		8.6.4	DDD 000**100**

Menu 8 – Data Communication / Continuation

Remark: Activate a new setup with 1x Power OFF & ON !

8			**Data Communication setup** (Menu 8.1 to 8.9)
	8.7		**Parity Check Modbus RTU** only (use the UP/DOWN buttons) **No** – no parity **o** – odd parity **e** – even parity
	8.8		**Protocol Selection Serial Port** (use the UP/DOWN buttons) **SER** – ASCII protocol **RTU** – binary data protocol Remark: After changing the protocol, you have to re-start the DAD 141
	8.9		**Save or Restore user setup** (use the UP/DOWN buttons) (commands SU / RU) **STORE** – Store setup in EEPROM **RECALL** – Restore setup from EEPROM Remark: After **RECALL**, for activation you have to re-start the DAD 141.

7.11. Factory Default via Front Panel

While Power ON the DAD 141, press the both buttons UP & DOWN simultaneously for 2 or 3 seconds for setting the device to factory default.

Note: All settings will be deleted proceeding a factory default!

7.12. Error Codes - shown in the Display

	Zero key is not enabled (chapter 7.3, menu 1.1)
	Out of zero range. (You are trying to set a zero which is greater than ± 2% of the upper display limit)
	N/A
	Input exceeded ± 3.3mV/V
	Load cell connection fail
	Requested value out of range
	Display overload – see menu 3.1o
	Display underload – see menu 3.1u
	The Zero or Tare motion limit has been exceeded. Set Zero or Tare function disallowed. Review Zero and Tare motion limits set in menu 4.4.

8. Examples

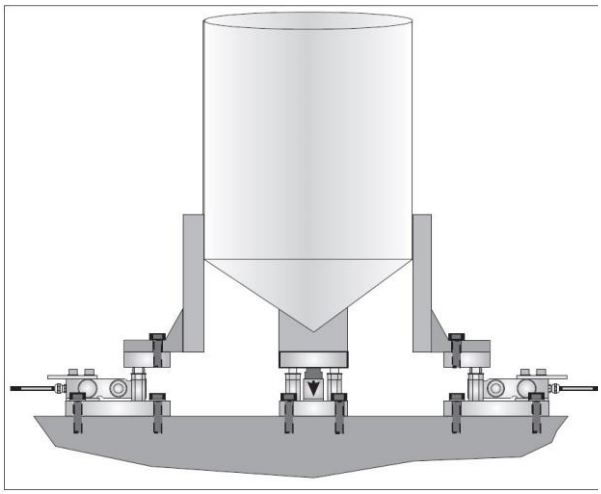
8.1. Example 1 – Calibration procedure using weights

3 Leg tank or silo fitted with 3 load cells of 1000kg; load cell signal @ 1000kg = 2 mV/V.

Dead load of tank / silo is 600kg.
Live range is 1 500kg, step size is 0.5kg.

It is assumed that the load cell system is connected to the DAD 141.1 and the power is on. The maximum and minimum display values, display increment size and decimal point position should be defined prior to carrying out the calibration (See chapter 7.5 menu 3).

For this example the display maximum is defined as 1600.0kg, the display minimum is -200.0kg, the Display step size is 0.5kg.



Remember that all parameters of the menues 1.1 - 1.3, 2.1 - 2.3 and 3.1 - 3.3 can only be accessed or changed after remove the jumper on the seal switch pins (28).

a A scale calibration by using weight(s) can **only** be performed in the scale status '**no motion**'. This requires in any case to check the settings of menu 4.

Recommendations for setup as follows:
- Menu 4.1: set cut off frequency to 4.1.7 = 0.5Hz
- Menu 4.2: choose IIR filter
- Menu 4.4.1: set no motion range e.g. to 2, which means for this example 0.2kg
- Menu 4.4.2: set no motion time to 1000, which means 1000ms or 1s

In case of outdoor application or indoor with a lot of mechanical noise from the floor/ground, may be you have to change the 'no motion' settings.

b Go to Menu 3.2 (display step size) by using the **UP/DOWN** and **ZERO** keys. The display shows the actual step size, e.g. 1. Now you can change step size by using the **UP/DOWN** keys and set to 5. Press the **ZERO** key to store & leave menu point. This procedure defines the step size to 5, which leads with the setup of decimal point to 0.5kg steps.

c Go to Menu 3.3 (decimal point position) by using the **UP/DOWN** and **ZERO** keys. The display shows the actual decimal point, e.g. 0.0. Now you could change decimal point position by using the **UP/DOWN** keys, but in this example we keep the setup. Press the **ZERO** key to store & leave menu point. This procedure defines the decimal point position to 0.0, which leads to weight readings of e.g. 498.5kg.

d Go to Menu 1.2 by using the **UP/DOWN** and **ZERO** keys. The display shows the actual mV/V value, e.g. 0.4107. Make sure that the tank/silo is empty or at the point where you want the display to read zero. Press the **ZERO** key to set the display to read 0000.0kg. This procedure defines the actual zero calibration point. Leave this menu point with **ZERO** key.

e Go to Menu 2.1 by using the **UP/DOWN** and **ZERO** keys. Set the display to read the span value of the calibration weight(s) applied. For this example, if the calibration applied load is 750kg, set the display to read 750.0. By using the **UP/DOWN** and **TARE** keys you have to setup each number of the 6 digit display to 00750.0. Press now **ZERO** key for storage. This procedure defines the span calibration value. Leave this menu point with **ZERO** key.

f Go to Menu 2.2. by using the **UP/DOWN** and **ZERO** keys. Apply the calibration weight(s) to the weighing system. The display will show the actual input signal in mV/V, e.g. 0.9087. Press the **ZERO** key to set the display to read 750.0kg. The gravimetric calibration is done. Leave this menu point with **ZERO** key.

g The last point for this example are the settings of over/under range.
Go to Menu 3.1 (over/under range) by using the **UP/DOWN** and **ZERO** keys.
Press **ZERO** key again for setup over range (3.1.o) or additional with **UP** key under range (3.1.U).
The display shows in both cases 099999.9. By using the **UP/DOWN** and **TARE** keys you have to setup each number of the 6 digit display to 01600.0 for over range and 00200.0 for under range. As default, the under range value is always negative, shown trough the '-' LED in the display (left lower corner).
Leave each menu point with the **ZERO** key.
This procedure defines the over range to 1600.0, which leads @ weight readings of >1600.0kg to all upper LEDs of the 6 display numbers.
This procedure defines the under range to -200.0, which leads @ weight readings of <-200.0kg to all lower LEDs of the 6 display numbers.

Press the **TARE** key two or three times and the DAD 141.1 will be back in weighing mode.

Calibration is now completed and stored. Please switch 1x OFF/ON for new TAC value.

Remark

After calibration procedure you can adjust the filter settings back to your application.
As rule of thumb you can calculate the weight/force true value of nearly100% as 1/cut off frequency.
Examples:

- fcut = 0.5 Hz means it takes about 2 seconds for the true value – the value will increase while these 2 seconds to the true value.
- fcut = 8 Hz means it takes about 0.125 seconds for the true value – the value increase take only 125 milliseconds.

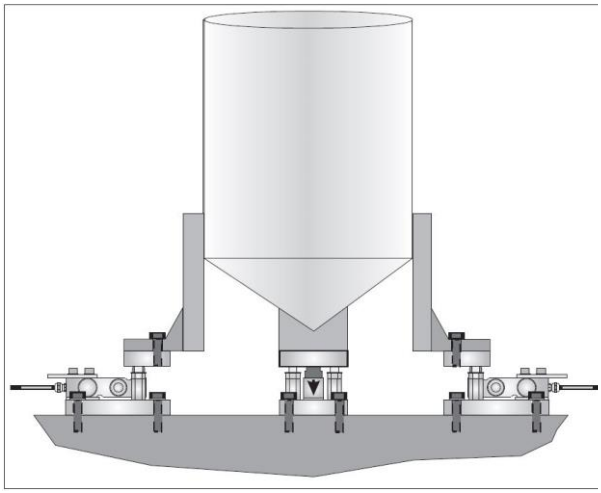
8.2. Example 2 – Calibration procedure using load cell's mV/V sensitivity

3 Leg tank or silo fitted with 3 load cells of 1000kg; load cell signal @ 1000kg = 2 mV/V.

Dead load of tank / silo is 600kg.
Live range is 1500 kg, step size is 0.5kg.

It is assumed that the load cell system is connected to the DAD 141.1 and the power is on. The maximum and minimum display values, display increment size and decimal point position should be defined prior to carrying out the calibration (See chapter 7.5 menu 3).

For this example the display maximum is defined as 1600.0kg, the display minimum is -200.0kg, the Display step size is 0.5kg.



Remember that all parameters of the menues 1.1 - 1.3, 2.1 - 2.3 and 3.1 - 3.3 can only be accessed or changed after remove the jumper on the seal switch pins (28).

a A scale calibration by using weight(s) can **only** be performed in the scale status '**no motion**'. This requires in any case to check the settings of menu 4.

Recommendations for setup as follows:
- Menu 4.1: set cut off frequency to 4.1.7 = 0.5Hz
- Menu 4.2: choose IIR filter
- Menu 4.4.1: set no motion range e.g. to 2, which means for this example 0.2kg
- Menu 4.4.2: set no motion time to 1000, which means 1000ms or 1s

In case of outdoor application or indoor with a lot of mechanical noise from the floor/ground, may be you have to change the 'no motion' settings.

b Go to Menu 3.2 (display step size) by using the **UP/DOWN** and **ZERO** keys. The display shows the actual step size, e.g. 1. Now you can change step size by using the **UP/DOWN** keys and set to 5. Press the **ZERO** key to store & leave menu point. This procedure defines the step size to 5, which leads with the setup of decimal point to 0.5kg steps.

c Go to Menu 3.3 (decimal point position) by using the **UP/DOWN** and **ZERO** keys. The display shows the actual decimal point, e.g. 0.0. Now you could change decimal point position by using the **UP/DOWN** keys, but in this example we keep the setup. Press the **ZERO** key to store & leave menu point. This procedure defines the decimal point position to 0.0, which leads to weight readings of e.g. 498.5kg.

d Go to Menu 1.3 (cal. zero in mV/V) by using the **UP/DOWN** and **ZERO** keys. The display shows the actual mV/V value, e.g. 0.4107. Make sure that the tank/silo is empty or at the point where you want the display to read zero. Press the **ZERO** key to set the display reading to 0000.0kg. This procedure defines the actual zero calibration point. Leave this menu point with **ZERO** key.

In case you want to setup absolute zero to 00.0000mV/V, you can do this via **ZERO** key and using **UP/DOWN** and **TARE** keys etc.

e Go to Menu 2.1 by using the **UP/DOWN** and **ZERO** keys. Set the display to read the span value @ summary of load cell capacity. For this example, we use 3 load cells with 1000kg capacity each, set the display to read 3000.0. By using the **UP/DOWN** and **TARE** keys you have to setup each number of the 6 digit display to 03000.0. Press now **ZERO** key for storage. This procedure defines the span calibration value. Leave this menu point with **ZERO** key.

f Go to Menu 2.3. by using the **UP/DOWN** and **ZERO** keys. The display shows 00.000mV/V. The load cells signal @ 3000kg is e.g. 2.0123mV/V ((signal #1 + signal #2 + signal #3) / 3). By using the **UP/DOWN** and **TARE** keys you have to setup each number of the 6 digit display to 02.0123. Press the **ZERO** key to set the display to read 3000.0kg. The electronic span calibration is done.
Leave this menu point with **ZERO** key.

The mV/V setting conform to our example with 1500kg live range means, we would have to setup only 01.0062 – which is 50% of mV/V @ 3000kg.

g The last point for this example are the settings of over/under range.
Go to chapter 7.4 menu 3.1 (over/under range) by using the **UP/DOWN** and **ZERO** keys.
Press **ZERO** key again for setup over range (3.1.o) or additional with **UP** key under range (3.1.U).
The display shows in both cases 099999.9. By using the **UP/DOWN** and **TARE** keys you have to setup each number of the 6 digit display to 01600.0 for over range and 00200.0 for under range. As default, the under range value is always negative, shown trough the '-' LED in the display (left lower corner).
Leave each menu point with the **ZERO** key.
This procedure defines the over range to 1600.0, which leads @ weight readings of >1600.0kg to all upper LEDs of the 6 display numbers.
This procedure defines the under range to -200.0, which leads @ weight readings of <-200.0kg to all lower LEDs of the 6 display numbers.

Press the **TARE** key two or three times and the DAD 141.1 will be back in weighing mode.

Calibration is now completed and stored. Please switch 1x OFF/ON for new TAC value.

Remark

After calibration procedure you can adjust the filter settings back to your application.
As rule of thumb you can calculate the weight/force true value of nearly100% as 1/cut off frequency.
Examples:

- fcut = 0.5 Hz means it takes about 2 seconds for the true value – the value will increase while these 2 seconds to the true value.
- fcut = 8 Hz means it takes about 0.125 seconds for the true value – the value increase take only 125 milliseconds.

Practicle Hint

A mix between gravimetric & electronic calibration is possible, too. For silos or tanks can a complete gravimetric calibration lead to a problem when you have to apply e.g. 50 tons. In such a case we recommend to calibrate zero gravimetrically (dead load of silo / tank) and span electronically (average mV/V values of load cells).

9. Setup via PC / PLC - Command Overview -

Command	Short description	Parameter value	Page
AA	Get/set analog output action (base)	0 through 8	50
AD	Communication: Device Address	0...255	49
AG	Absolute gain calibration	± 33000	35
AH	Get/set analog high	-999999 to 999999	50
AI'n'	Assign Input 'n' to 1 out of 15 different functions/base	0 to 15	45
AL	Get/set analog low	-999999 to 999999	50
AM	Analog Output Mode Current / Voltage	0 to 5	50
A'n'	Action for Setpoint 'n': choose 0 of 8 different base for setpoint 'n'	0 to 8	47
AS	Save analog output parameters	none	51
AZ	Absolute zero point calibration	± 33000	35
BR	Communication: Baud Rate	9600…115200 baud	49
CE	Calibration: Open Calibration Sequence; Read TAC Counter	0...65535	32
CG	Calibration: Set Calibration Gain (Span) at Load > Zero	1...999999	34
CI	Calibration: Minimum Output Value	–999999...0	33
CL	Communication: Close Device	None	49
CM n	Calibration: Set Maximum Output Value (n = 1, 2 or 3)	1...999999	32
CS	Save the Calibration Data (CM, CI, DS, DP, etc.) to the EEPROM	None	35, 51
CZ	Calibration: Set Calibration Zero Point – Scale Without Load	None	33
DP	Calibration: Set Decimal Point Position	0...5	33
DS	Calibration: Set Display Step Size	1, 2, 5, 10, …, 500	33
DX	Communication: Set full-duplex (1) or half duplex (0)	0 or 1	49
FD	Factory default settings: Write Data to the EEPROM (TAC protected)	None	34
FM	Read / modify filter mode: IIR (0) or FIR (1)	0 or 1	38
FL	Digital low pass filter: Filter Cut-off Frequency	0...8	38
FT	Firmware type, check weighing, weighing filler, dose out, loss in weight	0...3	36
GA	Output: Get Triggered Average Value	None	43, 52
GG	Output: Get Gross Value	None	42
GH	Get Hold Value	None	43
GI	Retrieves an image file from the DAD141.1's EEPROM	None	51
GN	Output: Get Net Value	None	42
GM	Get Peak (Maximum) Value	None	43
GO	Get Peak tp Peak Value	None	43
GS	Output: Get ADC Sample Value	None	42
GT	Output: Get Tare Value	None	42
GV	Get Valley Value	None	43
GW	Output: Get Data String "Net/Gros/Status"	None	42
H'n'	Hysteresis for Setpoint H0 (S0) or H1 (S1) or H2 (S2)	-9999...+9999	47
HT	Trigger function: Hold time for Violation of Setpoint Limit	0...65535 ms	48
ID	Device information: Identify Device	None	31
IH	Hardware version	None	31
IN	Logic input: for each Input Status 0 or 1	0000…0011	45
IO	Logic output: for each Output Status 0 or 1	0000…0111	46
IS	Device information: Identify Device Status	None	31
IV	Device information: Identify Firmware Version	None	31
MR	Calibration: Define Multi-interval (0) or Multi-range (1)	0 or 1	**33**
MT	Trigger function: Measuring Time for Averaging	0...3000 ms	52
NA	Network Address <aaa.bbb.ccc.ddd>	e.g. 192.168.0.100	49
NR	Motion detection: No-motion Range	0...65535 d	37
NT	Motion detection: No-motion Time Period	0...65535 ms	37

Command	Short description	Parameter value	Page
OM	Output Mask – to control hy host	0000…0111	46
ON	Open Net weight of device ‘n’	0…255	42
OP	Open Device	0…255	49
PI	Download a saved image file to the DAD 141.1’s EEPROM	Image data string	51
P’n’	Polarity of Setpoint ‘n’, n= 0, 1 or 2: On / Off	0 or 1	48
RM	Reset Peak (Maximum) Value	None	43
RS	Device information: Read serial number	None	32
RT	Scale function: Reset Tare and Switch to Gross Indication	None	40
RZ	Scale function: Reset Zero Point	None	40
SA	Auto-transmit: Send Triggered Average Value automatically	None	44, 53
SD	Trigger function: Start Delay	0... 500 ms	52
SG	Auto-transmit: Send Gross Value continuously	None	44
SH	Auto-transmit: Send Hold Value	None	44
SM	Auto-transmit: Send Peak (Maximum) Value	None	44
SN	Auto-transmit: Send Net Value continuously	None	44
S’n‘	Setup of Setpoints S0, S1 and S2	-999999...+999999	47
SO	Auto-transmit: Send Peak to Peak Value	None	44
SR	Reset Firmware (Warm Start)	None	32
SS	Save the Setpoint Data (S’n’, H’n’, P’n’, A’n’) to the EEPROM	None	51
ST	Scale function: Set Tare and Switch to Net Indication	None	40
SV	Auto-transmit: Send Valley Value	None	44
SW	Auto-transmit: Send Data String „Net/Gross/Status“ continuously	None	44
SZ	Scale function: System Zero Point	None	40
TD	Communication: Transmission delay	0…255 ms	49
TE	Trigger function: Trigger on Rising Edge (1) or Falling Edge (0)	0 or 1	52
TH	Trigger Hold (save the actual weight/reading)		43
TI	Trigger function: Averaging Time for Automatic Taring	0...65535 ms	41
TL	Trigger function: Trigger Level	0...999999	53
TN	Non Volatile Tare value ON/OFF @ power OFF	0 or 1	41
TR	Trigger function: Software Trigger	None	52
TW	Trigger function: Window for Automatic Taring	0...65535	41
UR	Update Rate (average of 2 exp. ‘n’ values – 2 exp 7 = 128)	0...7	39
WP	Save the Setup Data (FL, NR, NT, AD, BR, DX) to the EEPROM	None	51
ZI	Initial Zero Setting ON/OFF	0 or 1	35
ZN	Non Volatile Zero Value ON/OFF @ power OFF	0 or 1	40
ZR	Calibration: Zero Range	0...999999	34
ZT	Zero Tracking – disable (0), enable (1 – legal for trade) or 2 …255	0…255	34
	Commands: Store / Restore of USER-Setup		
SU	Store User Setup incl. calibration non-volatile in EEPROM	None	35
RU	Restore User Setup to DAD 141.1	None	36

9.1. Special Commands of DAD14x.y – Overview

Command	Short description	Parameter value
	Special Commands for experts / IT specialists	
NM	Ethernet Address Mask – Factory default 192.168.0.100 Get or set the Ethernet Address Mask.	AAA.BBB.CCC.DDD
NG	Ethernet Standard Gateway – e.g.192.168.0.1 Get or set the Ethernet Standard Gateway.	AAA.BBB.CCC.DDD
PF	Pre-filter, get or set. **Note**: Special command for internal use of manufacturer or for specialists only.	pl. ask Hauch & Bach or your supplier
EP	Ethernet Port, get or set, for change the standard ports. **Note**: In case a predefined port is needed, e.g. for Telnet. Special command for use of user, IT specialist help required.	pl. ask Hauch & Bach or your supplier
LE	Last Error, returns the most recent error occurred, code values 000 ... 024. Detailed information see error table chapter 9.1.2.	
AT	Auto Transmit data after Power ON of the DAD14x. Detailed information see Auto Transmit table chapter 9.1.1.	0 ... 10
OF	Controls the Output Format for the commands GG, GN and GW.	
TM	Tare Mode: If TM = 0, then taring of negative values is allowed. If TM = 1, then only positive values can be tared – use in approved applications. **Note**: Command TM is TAC protected.	0 or 1
ZM	Zero Mode: If ZM = 0, then the automatic “zeroing” defined by commands TW and TI will tare the scale. If ZM = 1, then the scale will be zeroed instead – in approved applications. Note: Command ZM is TAC protected.	0 or 1
PW	Pulse Width, setting the pulse duration time of an OUTPUT. Note: In case the process / PLC needs a pulse for a special time, the user / specialist can use this command.	pl. ask Hauch & Bach or your supplier
SE	Web Server Enable, enables the internal Web Server: SE 0<CR> Disable SE 1<CR> Enable **Note**: Firmware version 1.45 or higher	0 or 1

Continuation Special Commands of DAD14x.y

Command	Short description	Parameter value
	Commands For Application "Dosing & Loss In Weight"	
	These commands are part of the manual "Dosing & Loss in Weight" and can be used when firmware type 2 is set.	
LS	Control mass flow (start, stop, freeze)	For detailed information/description see separate manual
LI	Mass flow status	
SL	Save the parameters PL1 to PL12	
GF	Mass flow (actual)	
GR	Mass flow trend	
PL1 to PL10	Parameters for dosing / mass flow	
GD	Output PID controller	
VF	Set analog output to value X (in %)	
	Commands For Application Filling (In / Out)	
	These commands are part of the manual "Dose In" & "Dose Out" and can be used for: firmware type 1 (dose in) or firmware type 3 (dose out).	
DI	Dose Info	For detailed information/description see separate manuals
SC	Start cycle	
AC	Abort cycle	
DT	Dose tare (only firmware type 1)	
PD1 to PD22	Parameters for filling in (PD1 to 22) / filling out (PD1 to 18)	
GD	Get dosed value	
SD	Save the filling parameters	

9.1.1. Auto Transmit

The AT command parameters have the following meaning in the DAD 14x:

0: IDLE (OFF, Factory default)
1: GROSS
2: NET
3: AVERAGE
4: SAMPLE
5: LONG WEIGHT VALUE
6: PEAK
7: HOLD
8: VALLEY
9: PEAK TO PEAK
10: HBM AED

Note: AT 10 will transmit the **net weight** in a format used by some devices of HBM. The format is:

- If the net weight is negative, then a '-' (minus) will be sent, else a ' ' (space) will be sent.
- The numerical value of the net weight will be sent as seven digits with leading zeros.
- If the parameter DP is set to zero then no decimal point will be sent. If DP is different from zero a decimal point will be inserted in the digit string but it will remain seven characters long.
- The transmission will be terminated with a CR/LF sequence (0x0D and 0x0A).

9.1.2. DAD 14x - Error List

Code	Name	Description
000	NO ERROR	no error
001	NOT_IMPLEMENTED	The command is unknown to the device.
002	NOT_READY	The device cannot execute the command now.
003	ERR_BAUD	The device does not support the requested baud rate.
004	CAL_NOT_OPEN	The command cannot be executed because the TAC protection is ON.
005	BAD_CAL_ID	The requested Calibration parameter field is not present in the device.
006	BAD_CAL_VALUE	The value for the Calibration parameter field is outside the allowed range.
007	TIMEOUT	The command was terminated because the weight was unstable for too long.
008	NOT_STABLE	The command was rejected because the weight was not stable.
009	BAD_FILL_PARAM_ID	The requested Filling parameter field is not present in the device.
010	BAD_FILL_PARAM_VALUE	The value for the Filling parameter field is outside the allowed range.
011	BAD_GEN_VALUE_ID	The requested General parameter field is not present in the device.
012	BAD_GEN_PARAM_VALUE	The value for the General parameter field is outside the allowed range.
013	BAD_TRIG_VALUE_ID	The requested Trigger parameter field is not present in the device.
014	BAD_TRIG_PARAM_VALUE	The value for the Trigger parameter field is outside the allowed range.
015	BAD_TARE_RANGE	The requested Tare value is outside the allowed range.
016	BAD_FILL_SLOPE	The filling slope can neither be determined nor monitored.
017	BAD_FLOW_VALUE_ID	The requested Loss-In-Weight / Flow parameter field is not present in the device.
018	BAD_FLOW_PARAM_VALUE	The value for the Loss-In-Weight / Flow parameter field is outside the allowed range.
019	ZEROING_DISABLED	The Zeroing function has been disabled in this device.
020	OUT_OF_ZERO_RANGE	Zeroing this weight is not permitted.
021	NOT_ENOUGH_RESOLUTION	
022	INPUT_RANGE_EXCEEDED	The electrical weight input is outside the specifications for the device.
023	LOAD_CELL_CONNECTION_ERROR	The loadcell electrical inputs is not making sense.
024	COMMAND_NOT_ALLOWED	If you try to e.g. "Set Zero" while device is doing an average measurement.

10. Setup via PC / PLC - Command Descriptions

For better clarity, all commands are divided into groups as described on the following pages. Each command has to be completed with a CR (Enter), which is shown in the following tables as "↵ ".

For each command, the Modbus Index is displayed in brakets [Index 0xNNNN] and explained in the separate manual 'Modbus Communication'. In case of no index mentioned, the command is not available for Modbus RTU or TCP.

10.1. System Diagnosis Commands – ID, IH, IV, IS, SR, RS

Use these commands you get the DAD 141.1 type, firmware version or device status. These commands are sent without parameters.

10.1.1. ID Get Device Identity [Index 0x202C]

Master (PC / SPS) sends	Slave (DAD 141.1) responds
ID↵	**D:1410**

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

Note: The ID 1410 is valid for firmware type 0. All other ID's / Firmware-Types see command FT (p. 39) or see the description in the application manuals.

10.1.2. IH Get Hardware Version

Master (PC / SPS) sends	Slave (DAD 141.1) responds
IH↵	**H:14100101FFFFFFFFFFFFF…**

10.1.3. IV Get Firmware Version [Index 0x202E]

Master (PC / SPS) sends	Slave (DAD 141.1) responds
IV↵	**V:0104**

The response to this request gives the firmware version, here 1.47, of the active device.

10.1.4. IS Get Device Status [Index 0x2030]

Master (PC / SPS) sends	Slave (DAD 141.1) responds
IS↵	**S:067000** (example)

The response to this request comprises of two 3-digit decimal values (001 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	(not used)	8	(not used)
16	Average data ready	16	(not used)
32	(Setpoint-) output 0 active	32	(not used)
64	(Setpoint-) output 1 active	64	(not used)
128	(Setpoint-) output 2 active	128	(not used)

The example decodes the result S: 067000 (binary 01000011) as follows:

- Signal stable (no motion) [2^0 = 1, LSB]
- Zeroing action performed [2^1 = 2]
- Tare not active [= 0]
- Output 0 active [= 0]
- Output 1 active [2^6 = 64]
- Output 2 not active [= 0]

Note: Not used bits are set to zero at the DAD 141.1.

10.1.5. SR Reset DAD 141.1 Firmware

Master (PC / SPS) sends	Slave (DAD 141.1) responds
SR↵	**OK**

This command will respond with 'OK' and after maximum 400 ms perform a complete reset of the DAD 141.1. It has the same functionality as power OFF and ON again.

10.1.6. RS Read Serial Number [Index 0x2034]

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

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
RS↵	**S+00147301**	Serial Number: 0147301

10.2. Calibration Commands – CE, CM 'n', CI, MR, DS, DP, CZ, CG, ZT, FD, ZR, ZI, AZ, AG, CS, SU, RU, FT

10.2.1. CE Read TAC* Counter / Open Calibration Sequence [Index 0x2204]

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 (DAD 141.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active

This command must be issued PRIOR to any attempt to set the calibration parameters AG, AZ, CM, CI, DS, DP, CZ, CG, ZT, ZR, FD or CS. In legal for trade applications the TAC counter can be used to check if critical parameters have been changed without re-verification. After each calibration the TAC counter increases by 1.

10.2.2. CM 'n' Set Maximum Output Value [Index CM1: 0x220C]

[Index CM2: 0x221A] [Index CM3: 0x221C]

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 1 to 999 999.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
CM↵	**M+050000**	Request: CM = 50000 d
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
CM 30000↵	**OK**	Setup: CM = 30000 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...999 999	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...999 999	
Triple range or triple interval Teilungen (→ Befehl **MR**)	CM 1 = 1...MAX 1	CM 2 = MAX 1...MAX 2	CM 3 = MAX 2...999 999

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

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. But for none legal for trade applications you can change the behaviour with the settings of ZT (see 10.2.8) and/or ZR (see 10.2.10).

Factory default: CM1 = 999 999, CM 2 = 0, CM 3 = 0

10.2.3. CI Set Minimum Output Value [Index 0x220E]

This command is used to set up the minimum output value. Permitted values are from – 999 999 to 0.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
CI↵	**I–010009**	Request: CI = –10009 d
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
CI –100↵	**OK**	Setup: CI = –100 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 = –010009

10.2.4. MR Set Multi-range / Multi-interval [Index 0x2218]

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

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
MR↵	**M+00000**	Request: MR = 0 (Multi-interval)
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
MR 1↵	**OK**	Setup: MR = 1 (Multi-range)

Note: Single range applications ignore this parameter.

10.2.5. DS Set Display Step Size [Index 0x2216]

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 (DAD 141.1) responds	Meaning
DS↵	**S+00002**	Request: Step size 2
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
DS 50↵	**OK**	Setup: Step size 50

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

Factory default: DS = 00001

10.2.6. DP Set Decimal Point Position [Index 0x2214]

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

Factory default: DP = 00000

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
DP↵	**P+00003**	Request: Position of decimal point 3
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
DP 0↵	**OK**	Setup: no decimal point

10.2.7. CZ Set Calibration Zero Point [Index 0x2212]

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 (DAD 141.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
CZ 0↵	**OK**	Zero point saved

10.2.8. CG Set Calibration Gain (Span) [Index 0x2206]

This is the reference point for calibration with load, and is subject to TAC control.
Permitted values are from 1 to 999 999.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
CG↵	**G+010000**	Request: Calibration weight = 10000 d
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
CG 15000↵	**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 DAD 141.1 will respond with an error message ("ERR").

Factory default: 10000 = 2.000 mV/V input signal

10.2.9. ZT Zero Tracking [Index 0x2122]

This command enables / disables the zero tracking function. ZT = 0 disables the zero tracking, ZT = 1 or higher enables the zero tracking, independent of decimal point setting. Issuing the command without any parameter returns the current ZT value. Permitted values are 0 to 255.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
ZT↵	**Z:001**	Request: ZT status
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
ZT 0↵	**OK**	Setup: ZT = Disabled

ZT = enabled - performed only on results less than ±ZT range at a rate of 0.4d/sec.

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

Factory default: ZT = 1 [Enabled]

10.2.10. FD Reset to Factory Default Settings [Index 0x2066]

This command puts the DAD 141.1 back to a known state. The factory default settings data will be written to the EEPROM and the TAC will be incremented by +1.

Note: All calibration and setup settings will be lost by issuing this command!
The user setup - stored via command SU – will be not overwritten and remains untouched.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
FD↵	**OK**	Factory default setting

10.2.11. ZR Zero Range [Index 0x2220]

Sets the zero range manually – this is the range in divisions within which the weighing scale can be zeroed.
Issuing the ZR command without any parameter will return the current value.
Permitted values are 0 to 999 999.
A value of zero 0 disables the zeroing of the scale.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
ZR↵	**R+002000**	Request: ZR = 2000 d
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
ZR 100↵	**OK**	Setup: Zero range = 100 d

Factory default: ZR = 0

10.2.12. ZI Initial Zero ON / OFF [Index 0x221E]

Can proceed an initial zero @ power ON.
Permitted values are 0 (OFF) or 1 (ON).

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
ZI↵	**Z:001**	Request: ZI = 1 (ON)
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
ZI 0↵	**OK**	Setup: Initial Zero is OFF

Factory default: ZI = 0

10.2.13. AZ Absolute zero point calibration (eCal) [Index 0x2202]

The command AZ is used as reference point for all weight calculations and will setup in mV/V.
Permitted values are ± 33 000 (= ± 3.3000 mV/V).

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AZ↵	**Z+0.2796**	Request: Zero point @ 0.2796 mV/V
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
AZ_00500↵	**OK**	New: Zero point @ 0.0500 mV/V

Factory default: 00000d @ 0.0000mV/V input signal.

10.2.14. AG Absolute gain calibration (eCal) [Index 0x2200]

The command AG is used as absolute gain (or measuring range) for all weight calculations and will setup in mV/V. Permitted values are ± 33 000 (= ± 3.3000 mV/V).

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AG↵	**G+0.1868**	Request: gain 10 000d @ 0.1868 mV/V
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
AG_+011200_+005000↵	**OK**	New: gain 5 000d @ 1.12 mV/V

Factory default: 10 000d @ 2.0000mV/V input signal.

10.2.15. CS Save the Calibration Data [Index 0x2066]

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 (DAD 141.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
CS↵	**OK**	Calibration values saved

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

10.2.16. SU Save User Setup in EEPROM

This command saves all the setup data including calibration non-volatile in EEPROM. In delivery status the user setup contains the factory default settings (as FD command).

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Store sequence active
SU↵	**OK**	User setup stored in EEPROM

10.2.17. RU Restore User Setup to DAD 141.1

This command restores the user setup including the calibration from the EEPROM, the TAC counter is increased by +1.To activate, the SR command (warm start) must be performed or just re-start the DAD 141.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Restore sequence active
RU↵	**OK**	Restore from EEPROM
SR↵	**OK**	Activate restored user setup

10.2.18. FT Firmware Type

The DAD 141.1 with firmware version 141.181.v.1.45 or higher can be used to run different applications. The respective firmware type can be freely selected with the FT command.

The different firmware types of FT are:

FT = 0 is the basic version with checkweigher functions, content of this manual.
The device ID for this firmware type is **1410**.

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 **1414**.

FT = 2 is the version for dosing / loss in weight with a PID controlled analog output for e.g. the vibration feeder.
The device ID for this firmware type is **1415**.

FT = 3 is the version for ‘DOSE OUT‘ materials, e.g. into a keg or bag with coarse and fine feed.
The device ID for this firmware type is **1416**.

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. Then the FT setting must be saved with the command "CS".

10.3. 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.

10.3.1. NR Set ‘No-motion’ Range [Index 0x2112]

This is the range within which the weighing signal is allowed to fluctuate and still be considered as “stable”.
Permitted values are from 1 to 65535.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
NR↵	**R+00010**	Request: NR = 10 d
NR 2↵	**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]

10.3.2. NT Set ‘No-motion’ Time Period [Index 0x2114]

This is the time period (in milliseconds) over which the weight signal is checked to see if it is “stable” or has “no-motion“. The weight signal has to vary by less than NR divisions over the time period NT to be considered ‘stable’.
Permitted values are from 1 to 65535.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
NT↵	**T+01000**	Request: NT = 1000 ms
NT 500↵	**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]

10.4. 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.

10.4.1. FM Filter Mode [Index 0x2110]

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 (DAD 141.1) responds	Meaning
FM↵	**M+00000**	Request: FM = 0 (IIR filter)
FM 0↵	**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: FM = 0 (IIR filter)

10.4.2. FL Filter Settings [Index 0x2106]

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

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
FL↵	**F+00003**	Request: FL = 3 (4 Hz)
FL 7↵	**OK**	Setup: FL = 7 (0.5 Hz)
WP↵	**OK**	Setup saved

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

Factory default: FL = 3.

Mode 0 (IIR filter) Settings / Characteristic

FL	Settling time to 0.1% (ms)	3dB Cut-off frequency (Hz)	Damping @300Hz (dB)	Output-rate* (samples/s)
0	-	- **		600
1	55	18	57	600
2	122	8	78	600
3	242	4	96	600
4	322	3	104	600
5	482	2	114	600
6	963	1	132	600
7	1923	0.5	149	600
8	3847	0.25	164	600

***** Output-rate = $600/2^{UR}$ samples/s ** Antialiasing filter 18 Hz @ 60 dB/dec

Mode 1 (FIR filter) Settings / Characteristic

FL	Settling time to 0.1% (ms)	3 dB Cut-off frequency (Hz)	20 dB damping at frequency (Hz)	40 dB damping at frequency (Hz)	Damping in the stopband (dB)	Stopband (Hz)	Output rate max. (samples/s)
0	-	**					600
1	47	19.7	48	64	>90	>80	600
2	93	9.8	24	32	>90	>40	300
3	140	6.5	16	21	>90	>26	200
4	187	4.9	12	16	>90	>20	150
5	233	3.9	10	13	>90	>16	120
6	280	3.2	8	11	>90	>13	100
7	327	2.8	7	9	>90	>11	85.7
8	373	2.5	6	8	>90	>10	75

** Antialiasing filter 18 Hz @ 60 dB/decade

Attention: In mode 1 the output rate is dependant on the selected filter level (FL) and will be automatically adjusted by the DAD 141.1.

10.4.3. UR Update Rate and Averaging [Index 0x2120]

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 will always be calculated from 2^{UR} measurement values.

DAD 141.1 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 (DAD 141.1) responds	Meaning
UR↵	**U+00003**	Request: Averaging of 8 values
UR 7↵	**OK**	Setup: Averaging of 128 values
WP↵	**OK**	Setup saved

Factory default: 0 (no averaging, means 600 samples/sec)

Remark to Mode 1

Dependency Output Rate - averaging UR - Filter FL

UR	Output Rate samples/s								
	FL0	FL1 19.7 Hz	FL2 9.8 Hz	FL3 6.5 Hz	FL4 4.9 Hz	FL5 3.9 Hz	FL6 3.2 Hz	FL7 2.8 Hz	FL8 2.5 Hz
0	600	600	300	200	150	120	100	85.7	75
1	300	300	150	100	75	60	50	42.85	37.5
2	150	150	75	50	37,5	30	25	21.42	18.75
3	75	75	37.5	25	18.75	15	12.5	10.71	9.38
4	37.5	37.5	18.75	12.5	9.38	7.5	6.25	5.36	4.69
5	18.75	18.75	9.38	6.25	4.69	3.75	3.13	2.68	2.34
6	9.38	9.38	4.69	3.13	2.34	1.88	1.56	1.34	1.17
7	4.69	4.69	2.34	1.56	1.17	0.94	0.78	0.67	0.59

10.5. Taring and Zeroing Commands – SZ, RZ, ZN, ST, RT, TN, RW, TI

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.
See chapter 11 - Use in "Approved" applications.

10.5.1. SZ Set System Zero [Index 0x2061]

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 (DAD 141.1) responds	Meaning
SZ↵	**OK**	Set zero performed

The SZ command will fail (DAD 141.1 responds with ERR) if the new "current zero" is outside the active +/- zero range set with the ZR command. 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 DAD 141.1 will respond with ERR (error).

10.5.2. RZ Reset Zero [Index 0x2061]

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 (DAD 141.1) responds	Meaning
RZ↵	**OK**	Zero point CZ active

The DAD 141.1 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".

10.5.3. ZN Store Zero Value [Index 0x2226]

This command allows to store the zero value non volatile @ power off of the DAD 141.1.
Permitted values are 0 (off) and 1 (on).

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
ZN↵	**Z:000**	Zero @ power off: OFF
ZN_1	**OK**	Setup: Zero @ power off: ON

10.5.4. ST Set Tare [Index 0x2061]

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 (DAD 141.1) 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 DAD 141.1 will respond with ERR (error).

10.5.5. RT Reset Tare [Index 0x2061]

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

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
RT↵	**OK**	Tare de-activated / Gross operation

The DAD 141.1 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".

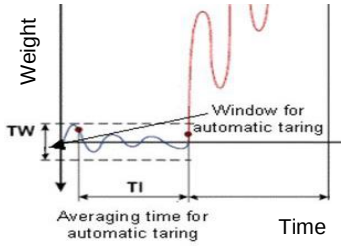
10.5.6. TN Store Tare Value [Index 0x2224]

This command allows to store the tare value non volatile @ power off of the DAD 141.1.
Permitted values are 0 (off) and 1 (on).

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
TN↵	**T:000**	Tare @ power off: OFF
TN_1	**OK**	Setup: Tare @ power off: ON

10.5.7. TW Window for Automatic Taring [Index 0x240A]

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.



Permitted values are from 0 to 65535.

Default setting: TW = 0 [= automatic taring disabled]

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
TW↵	**W+00000**	Request: TW = 0 d
TW 100↵	**OK**	Setup: TW = 100 d

10.5.8. TI Averaging Time for Automatic Taring [Index 0x240C]

This command defines the averaging time for the automatic taring. Within this time period the system calculates an averaged tare value.

Permitted values are from 0 to 65535.

Default setting: TI = 0 ms [= automatic taring disabled]

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
TI↵	**T+00000**	Request: TI = 0 ms
TI 200↵	**OK**	Setup: TI = 200 ms

Remark to TW / TI:
The dynamic automatic taring (virtually) will be proceeded only in case both commands are setup with permitted values. In the case, one of both is set to “0”, the automatic taring is switched off.

10.6. Output Commands – GG, GN, ON, GT, GS, GW, GA, GH, GM, RM, GO, GV

The following commands "Get's" the gross, net, tare, ADC sample values etc. from the DAD 141.1.

10.6.1. GG Get Gross Value [Index 0x2000 or 0x2020]

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
GG↵	**G+001.100**	Gross value: 1.100 d

10.6.2. GN Get Net Value [Index 0x2002 or 0x2022]

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
GN↵	**N+001.000**	Net value: 1.000 d

10.6.3. ON Get Net Value of device 'n'

This command can be used for having quick access to all net values of some DAD 141.1 in a RS 485 network without using any other commands like Open (OP) or Close (CL)

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
ON3↵	**N+001.000**	Net value of # 3: 1.000 d

10.6.4. GT Get Tare Value [Index 0x2118]

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
GT↵	**T+000.100**	Tare value: 100 d

10.6.5. GS Get ADC Sample Value [Index 0x202A]

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 (DAD 141.1) 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.

10.6.6. GW Get Data String "Net, Gross and Status" [Index 0x3300 or 0x3500]

Issuing the GW command, which has no parameters, will return the net weight, the gross weight, the status and the checksum values, all combined into one single string in the format **W+000100+00110001 0F**. The first two sections of the return string comprise the net weight and gross weight results, followed by two hexadecimal characters, which represent two bitmapped status indicators. The last two hexadecimal characters represent the checksum, which is the inverse of the sum of all the ASCII values of the string, not including the checksum characters.

W	**+000100**	**+001100**	**0**	**1**	**0F**
Leading character signifies the GW	Net weight excluding decimal point	Gross weight excluding decimal point	First bitmapped binary value	Second bitmapped binary value	Checksum

The bitmapped characters are:

First bitmapped value	description	Second bitmapped value	description
1	Not used	1	No motion
2	Output 0 active	2	Zero action performed
4	Output 1 active	4	Tare active
8	Output 2 active	8	Not used

The checksum is derived as follows:

a. Add the ASCII values (in hex) of all the 15 characters in the string
b. Invert the hexadecimal value
c. Add one to the value
d. Use only the last two digits
e. Convert the hexadecimal value to characters

10.6.7. GA Get Triggered Average Value [Index 0x2008 or 0x2028]

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 10.13.

Master (PC / SPS) sends	Slave (DAD 141.1) 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 99999 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.

10.6.8. GH Get Hold Value [Index 0x2084 or 0x2086]

Get the actual weight value, activated by the logic inputs.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
GH↵	**H+001.800**	Hold value: 1800 d

10.6.9. TH Trigger Hold Value [Index 0x2061]

Saves the weight value of the last GH reading.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
TH↵	**OK**	Save actual weight value

10.6.10. GM Get Peak Value [Index 0x2080 or 0x2082]

The peak value is the maximum input value while your measurement.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
GM↵	**M+051.100**	Peak value: 51100 d

10.6.11. RM Reset Peak Value [Index 0x2061]

Resets the peak value.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
RM↵	**OK**	Reset Peak value

10.6.12. GO Get Peak To Peak Value [Index 0x208C or 0x208E]

The peak to peak value is the difference value between the maximum and minimum input values while your measurement.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
GO↵	**O+091.100**	Peak to Peak value: 91100 d

10.6.13. GV Get Valley Value [Index 0x2088 or 0x208A]

The valley value is the minimum input value while your measurement.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
GV↵	**V+000.100**	Valley value: 100 d

10.7. Auto-Transmit Commands – SG, SN, SW, SA, SH, SM, SO, SV

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 DAD 141.1. The data output rate will depend on the baud rate being used e.g. with a baud rate of 115200 approximately 1000 values per second can be transmitted. The output rate of DAD 141.1 is max. 600 measurement values per second.

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

10.7.1. SG Send Gross Value continuously

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SG↵	**G+001.100**	Gross value: 1,100 d

10.7.2. SN Send Net Value continuously

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SN↵	**N+001.000**	Net value: 1,000 d

10.7.3. SW Send Data String "Net, Gross and Status" continuously

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+001100010F**.

For more detailed information of the data string see command GW (chapter 10.6.6).

10.7.4. SA Send Triggered Average Value automatically

Master (PC / SPS) sends	Slave (DAD 141.1) 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 chapter 10.13.

10.7.5. SH Send Hold Value continuously

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SH↵	**H+001.100**	Hold value: 1,100 d

10.7.6. SM Send Peak Value continuously

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SM↵	**M+001.100**	Peak value: 1,100 d

10.7.7. SO Send Peak To Peak Value continuously

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SO↵	**O+001.100**	Peak to Peak value: 1,100 d

10.7.8. SV Send Valley Value continuously

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SV↵	**V+000.100**	Valley value: 100 d

10.8. Logic Input Functions & Status – AI'n', IN

10.8.1. AI Assign input 'n' [Index 0x2074 and 0x2076]

This command reads / setup the function of the logical inputs. The values for 'n' are 0 or 1.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AI_1↵	**I1:+00000**	Reading Input 1: no function
AI_1_10↵	**OK**	Setup accepted
AI_1↵	**I1:+00010**	Input 1: display set to 'Peak to Peak' value

The 2 logic inputs 'n' can be used for the different functions:

00 - Input "n" has **no function**
01 - Input "n" acts as **Zero** button
02 - Input "n" acts as **Tare** button
03 - Input "n" acts as **Up arrow** button
04 - Input "n" acts as **Down arrow** button
05 - Input "n" starts the **Trigger** function
06 - Input "n" displays the **Average** value
07 - Input "n" displays the **Peak** value (maximum)
08 - Input "n" deletes the **Peak** value (maximum)
09 - Input "n" displays the **Hold** value
10 - Input "n" displays the **Peak to Peak** value
11 - Input "n" displays the **Valley** value (minimum)
12 - Input "n" disables the **buttons**
13 - Input "n" stores the **actual weight** (**Hold** value)
14 - Input "n" **tares the displays** and deletes all other values
15 - Input "n" **turn off display**
16 – Input "n" displays the **mass flow** (loss in weight)
17 – Input "n" Loss in Weight **Start/Stop** function
18 – Input "n" Loss in Weight **Freeze/Run** function

10.8.2. IN Read status of the logic inputs [Index 0x210C]

This command reads the status of the digital inputs.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
IN↵	**I:0000**	Reading: Input 0 or 1 inactive
IN↵	**I:0001**	Reading: Input 0 active
IN↵	**I:0010**	Reading: Input 1 active
IN↵	**I:0011**	Reading: Input 0 and 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 corresponding to Input 0.

10.9. Logic Output Commands - IO, OM, S'n', H'n', P'n', A'n', HT

The definitions for this section may be changed due to the fact that the definitions of the logic outputs for the DAD 141.1, where the status depends on the weight value (setpoint) are to be defined. Each logic output can be assigned an independent setpoint value (S'n') with a corresponding hysteresis/polarity action (H'n', P'n') and allocation (A'n' – switch on the gross, net, peak, average etc. weight).

10.9.1. IO Read / Modify the Status of the logic Outputs [Index 0x210A]

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 MOSFETs), the least significant bit corresponding to Output 0 etc.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
IO↵	**IO:0001**	Output 0 is high
IO↵	**IO:0101**	Outputs 0 and 2 are high
IO↵	**IO:0111**	Outputs 0, 1 and 2 are high

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 (DAD 141.1) responds	Meaning
IO_010↵	**OK**	Setup output 1 is high
IO_011↵	**OK**	Setup outputs 0 and 1 are high
IO_111↵	**OK**	Setup outputs 0, 1 and 2 are high

However, the OM command can be used to allow the status of the logic outputs to be set via the IO command or set their status directly by the host application.

Factory default: IO=0000

10.9.2. OM Control of the logic outputs by the host application [Index 0x2116]

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 (DAD 141.1) responds	Meaning
OM↵	**OM:0001**	Enable Output 0
OM↵	**OM:0101**	Enable Outputs 0 and 2
OM↵	**OM:0111**	Enable Outputs 0, 1 and 2

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 141.1) responds	Meaning
OM_010↵	**OK**	Enables output 1
OM_ 011↵	**OK**	Enables outputs 0 and 1
OM_111↵	**OK**	Enables outputs 0, 1 and 2

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.

Factory default: OM=0000

10.9.3. A'n' Assign action for setpoint 'n' [Index 0x2068]

This command is used to release the external control of the logic outputs: read or setup

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
A1↵	**A1:+00000**	Output 1 based to gross value
A2↵	**A2:+00002**	Output 2 based to peak value
A1_1↵	**OK**	Output 1 set to base net value
A1↵	**A1:+00001**	Output 1 based to net value

Choose the source for the output 'n' like follows:

00 - **Gross** value
01 - **Net** value
02 - **Peak** value (Maximum)
03 - **Average** value (check weigher)
04 - **Hold** value
05 - **Peak to Peak** value
06 - **Valley** value (Minimum)
07 - **Error 4** or **5**
08 - **Mass Flow** value (firmware type 2 only)
09 - ***Batch** Loss in Weight (reserved)*
10 - ***Bit 0...2** from LIW control via PLC (reserved)*
11 - ***Average ready** (check weigher, reserved)*

10.9.4. S'n' Setpoint Value [Index 0x206C]

This command is used to read or setup the 3 setpoints S0, S1 and S2. Permitted value range is +/- 999 999.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
S1↵	**S1:+001500**	Request: Setpoint S1 = 1500 d
S1 3000↵	**OK**	Setup: Setpoint S1 = 3000 d

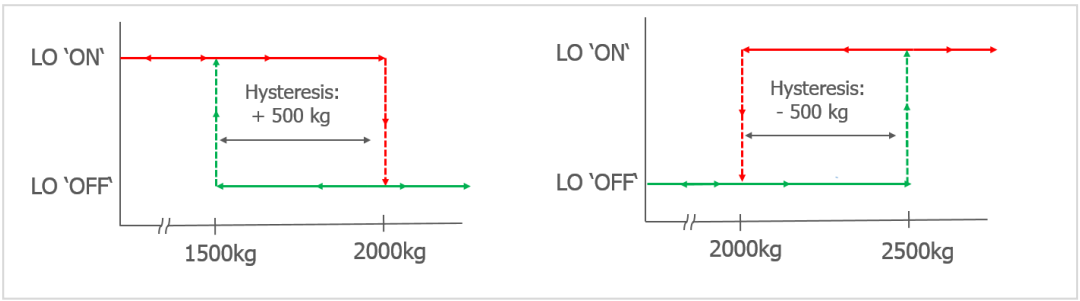
Factory defaults: S'0' = 1000 d , S'1' = 5000 d, S'2' = 9999 d

10.9.5. H'n' Setpoint Hysteresis and Switching Action [Index 0x206A]

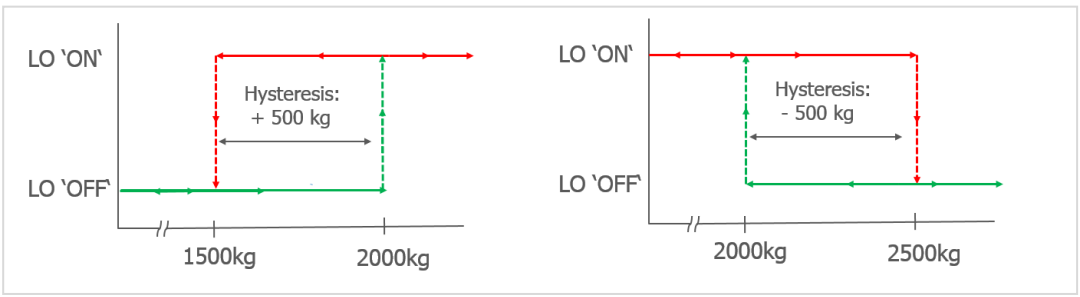
The switching logic will be defined by the numeric value of hysteresis and the polarity.
The outputs can operate as "normally closed" or "normally open", depending of the settings H'n' and P'n'.

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

Polarity = 0 [OFF]:



Polarity = 1 [ON]:



Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
H1↵	**H1:+00000**	Request: hysteresis setpoint S1
H1_100↵	**OK**	Setup: hysteresis setpoint S1 to 100 d

Allowed hysteresis values are within the range from –9 999 to +9 999 at a step size of 1.

10.9.6. P'n' Polarity of Setpoint [Index 0x2070]

This command is used to setup the switch characteristic of the 3 setpoints S0, S1 and S2.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
P0↵	**P0:+00000**	Request: Polarity of setpoint S0 is OFF
P0_1↵	**OK**	Setup: Polarity of setpoint S0 is ON
P1_1↵	**OK**	Setup: Polarity of setpoint S1 is ON
P1↵	**P:+00001**	Request: Polarity of setpoint S1 is ON

Permitted values are 0 [OFF] and 1 [ON]

For further informations or better understanding, see the examples in chapter 10.9.5, too.

Note: All changes to the setpoint settings have to be stored in the EEPROM using the SS command. See chapter 10.12.

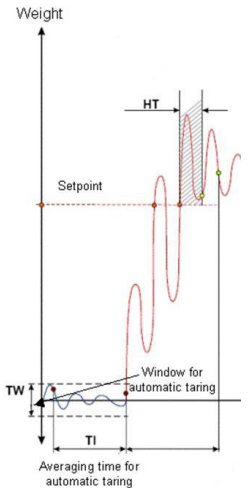
10.9.7. HT Hold time for all Setpoints [Index 0x2408]

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.

Note: This setup is valid for **all** 3 Logic Outputs.

Permitted value range is 0 to 65 535 ms.

Default setting: HT = 0 ms.



Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
HT↵	**H+00000**	Request: HT = 0 ms
HT 200↵	**OK**	Setup: HT = 200 ms

10.10. Communication Setup Commands – AD, NA, BR, DX, OP, CL, TD

10.10.1. AD Device Address

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

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AD↵	**A:000**	Request: Address 0 (= factory default)
AD_49↵	**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.

10.10.2. NA Network Address [Index 0x300C]

This command displays or sets the network address of DAD 141.1 Ethernet port.

Factory default of TCP/IP address: 192.168.0.100.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
NA↵	**A:192.168.000.100**	Request: Actual TCP/IP address
NA192.168.11.90↵	**OK**	Setup: Set the address to 192.168.11.90

Note: A change will take effect after a reset, e.g. power off / on.

10.10.3. BR Baud Rate

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

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
BR↵	**B 115200**	Request: 115200 Baud (= factory default)
BR_9600↵	**OK**	Setup: 9600 Baud

Factory setup: 115200 baud

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

10.10.4. DX Operation Mode Half-/Full-Duplex

The DAD 141.1 can operate in half or full duplex mode.

Master (PC / SPS) sends	Slave (DAD 141.1) resp.	Meaning
DX↵	**X:001**	Request: DX = 1 (full duplex, factory default))
DX 0↵	**OK**	Setup: DX = 0 (half duplex)

10.10.5. OP Open Device

This command, if sent without parameters, requests the address or device number of the device active on the bus. If sent with parameters, this enables the device defined by the parameters.

Master (PC / SPS) sends	Slave (DAD 141.1) resp.	Meaning
OP↵	**O:003**	Request: Device #3 open
OP_14↵	**OK**	Setup: Open Device #14

10.10.6. CL Close Devices

This command will close DAD 141.1 device in a bus.

Master (PC / SPS) sends	Slave (DAD 141.1) resp.	Meaning
CL↵	**OK**	Setup: All devices closed

10.10.7. TD Transmission Delay

In some half duplex applications using a PLC system, a delay of the data transmission (up to 255 milliseconds) can be helpful due to the very quick answers of the DAD 141.1. Permitted values are 0 to 255 ms.

Master (PC / SPS) sends	Slave (DAD 141.1) resp.	Meaning
TD↵	**T+00000**	Request: 0 d – no delay
TD_200↵	**OK**	Setup: 200 d – 200 ms delay

10.11. Analog Output – AA, AH, AL, AM

The following commands must be saved in EEPROM by command AS.

10.11.1. AA Analog Output Base [Index 0x2100]

This command can setup the analog output base. Permitted values are 0 … 9.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AA↵	**A+00001**	Request: base is gross value
AA_2↵	**OK**	Setup: base is Peak value

You can choose one out of the following analog output base:

0 - analog output follows **Gross** value (GroS)
1 - analog output follows **Net** value (nEt)
2 - analog output follows **Peak** value (PEA)
3 - analog output follows **Average** value (AUEr)
4 - analog output follows **Hold** value (HoLd)
5 - analog output follows **Peak - Peak** value (PP)
6 - analog output follows **Valley** value (UALL)
7 - analog output follows **Display** value (dISP)
8 - analog output is switched **OFF** (oFF)
9 - analog output follows **Mass flow** value (FLo - firmware type 2 only)

10.11.2. AH Set Analog High Level [Index 0x2102]

Request / Set up high level for analog output. Permitted values are -999 999 … +999 999d.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AH↵	**H+010000**	Request: setting 10 000 d
AH_30000↵	**OK**	Setup: 30 000 d

10.11.3. AL Set Analog Low Level [Index 0x2104]

Request / Setup low level for analog output. Permitted values are -999 999 … +999 999d.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AL↵	**L+000000**	Request: setting 0 d
AL_600↵	**OK**	Setup: 600 d

10.11.4. AM Set Analog Output Mode [Index 0x2128]

Request / Setup mode for analog output. Permitted values are 0 … 5.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AM↵	**M:000**	Request: setting 4 to 20mA
AM_3↵	**OK**	Setup: 0 to +10V

You can choose one out of the following analog output modes:

0	4 to 20mA
1	0 to 20mA
2	0 to +5V
3	0 to +10V
4	-5 to +5V
5	-10V to +10V

10.12. Save Calibration and Setup – CS, WP, SS, AS, GI, PI

The calibration and setup parameters can be divided in 4 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:** S1, S2, S3, H1, H2, H3, A1, A2, A3 - saved by command **SS**
- **Analog outputs:** AA, AH, AL, AM - if available - saved by command **AS**

Note: Calibration data can only be saved if the TAC code is known and preceding the CS command. See the commands **CE** and **CS** in chapter 10.2.

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

10.12.1. CS Save the Calibration Data [Index 0x2066]

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 (DAD 141.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
CS↵	**OK**	Calibration values saved

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

10.12.2. WP Save the Setup Parameters [Index 0x2066]

With this command the settings of the “Filter” (FL, FM), the “No-motion” (NR, NT), the “Inputs” (AI0, AI1) and the communication (AD, BR, DX) will be saved in the EEPROM.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
WP↵	**OK**	Setup data saved
WP↵	**ERR**	Error

10.12.3. SS Save Setpoint Parameters [Index 0x2066]

With this command the setpoints (S0, S1, S2), the setpoint hysteresis (H0, H1, H2) and the setpoint allocation (A0, A1, A2) will be saved in the EEPROM.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SS↵	**OK**	Setpoint parameters saved
SS↵	**ERR**	Error

10.12.4. AS Save Analog Output Parameters [Index 0x2066]

With this command the action (AA), the analog low (AL), the analog high (AH) and the output mode (AM) will be saved in the EEPROM.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
AS↵	**OK**	Analog output parameters saved
AS↵	**ERR**	Error

10.12.5. GI Get an Image File from the EEPROM

Retrieves a HEX-INTEL formatted EEPROM image file from the EEPROM of the source DAD 141.1. The image file contains all stored information except the calibration data. This image file can be downloaded to any DAD 141.1 with the same firmware type and revision no. as the source DAD 141.1.

10.12.6. PI Download an Image File to the EEPROM

Downloads a HEX-INTEL formatted EEPROM image file to the target DAD 141.1 EEPROM. The image file contains all stored information except the calibration data.

Attention: The target DAD 141.1 must have same firmware type and revision no. as the source DAD 141.1.

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

When using these commands, e.g. a checkweigher can be realized. The triggering of the measurement can be done by measuring signal, or by command TR or via a digital input. The time diagram of a typical checkweighing with explanations see next page.

Note: All changes to the trigger commands have to be stored in the EEPROM using the WP command. See chapter 10.12.

10.13.1. SD Start Delay Time [Index 0x211A or 0x2412]

This command defines a time delay between the trigger and the start of the measurement.
Setting range: 0 ms to 500 ms.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SD↵	**S+00100**	Request: SD = 100 ms
SD 200↵	**OK**	Setup: SD = 200 ms

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

10.13.2. MT Measuring Time [Index 0x210E or 0x2410]

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

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
MT↵	**M+00100**	Request: MT = 100 ms
MT 500↵	**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

10.13.3. GA Get Triggered Average Value [Index 0x2008 or 0x2028]

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 (DAD 141.1) 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 99999 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.

10.13.4. TE Trigger Edge [Index 0x2402 or 0x211C]

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 (DAD 141.1) responds	Meaning
TE↵	**E:001**	Request: TE = 1 (rising edge)
TE 0↵	**OK**	Setup: TE = 0 (falling edge)

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

10.13.5. TR Software Trigger [Index 0x2062]

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 (DAD 141.1) responds	Meaning
TR↵	**OK**	Trigger event

10.13.6. TL Trigger Level [Index 0x211E or 0x2400]

This command defines a level for a rising edge trigger on the measurement signal. Setting range: 0 to 99999.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
TL↵	**T+99999**	Request: TL = 99999
TL 1000↵	**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 = 99999 [= 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 = 99999). This setting disables the trigger level.

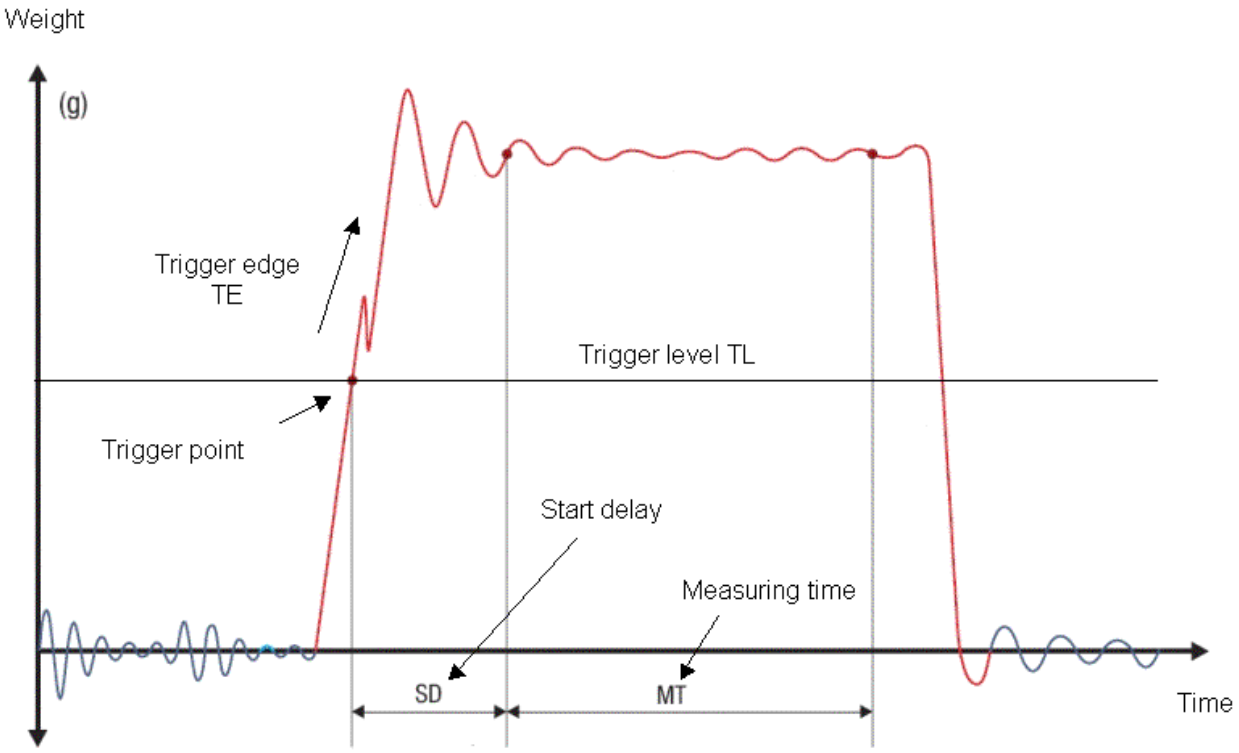


Figure: Time plot of a typical checkweigher cycle

10.13.7. SA Send Triggered Average Value automatically

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
SA↵	**OK**	Auto-Transmit: triggered average value

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

11. Legal For Trade Applications

The weighing indicators of the DAD 14x.y series have type approvals for Class III with 10000 parts according to OIML R76 for NSW (non-automatic weighing instruments) - DK 0199.422 revision 2, according to the Directive 2014/31/EU. The minimum verification interval value is 0.2µV per increment.
With the type approval DK 0199.422 Revision 2, a device of the DAD14x.y series can be used as a legal for trade weighing indicator for single-range and multi-interval scales. For further information please refer to the type approval.

For the weighing indicators series DAD 14x.y an evaluation certificate for class III with 10000 parts for NSW (non-automatic weighing instruments) exists additional - DK 0199-17.01, in accordance with OIML R76:2006, EN45501:2015, WELMEC Guide 2.1:2001 and WELMEC Guide 8.8:2008. The minimum verification interval value is 0.2µV per increment.
With the evaluation certificate DK 0199-17.01 a device of the series DAD14x.y can be used for multi-range and multi-interval scales. For further information please refer to the evaluation certificate.

For legal for trade applications, the choosen certificate used must be marked on the housing, see section 5.1 on page 10.

11.1. Access to metrological data and weighing range adjustment

The access to the configuration and the adjustment function is made by means of a traceable code (TAC = Traceable Access Code), which is automatically increased as a non-volatile number by 1, each time the adjustment function is ended. The proof can be viewed by means of the command CE, which is answered with the status CExxxxx. The code is limited up to max. 65535.

11.2. Protection of the metrological data and the scale calibration

Access to the configuration and adjustment function is protected by a code (TAC).

Setup or adjustments can only be made with the switch open (terminals 28). In case of changes, the value of the TAC counter is increased by 1 accordingly.
For legal-for-trade use, the two contacts must be jumpered and sealed. A damaged seal indicates an unauthorized modification of the adjustment.

12. Calibration and Calibration Sequence

The calibration of DAD 141.1 is only possible after starting a calibration sequence (compare with chapter 10.2).

- Command CE: Calibration enable – returns the current TAC value
- Command CM: Calibrate maximum display – sets the max. allowable display value
- Command CI: Calibrate minimum – sets the minimum allowable display value
- Command DS: Display step size – sets the output incremental step size
- Command DP: Decimal point – sets the position of the output decimal point
- Command CZ: Calibrate zero – sets the system zero point
- Command CG: Calibrate gain – sets the system gain
- Command ZT: Zero track enable / disable
- Command ZR: If applicable: Zero Range – sets the zero range manually
- Command ZI: If applicable: Initial Zero Range
- Command FD : If applicable: Reset to factory default settings
- Command CS : Save calibration data (TAC counter automatically incremented by 1)

Preparing the calibration:

- Check, if the max value of the display is set sufficiently high (see chapter 10.2, command CM)
- Check, if the no motion conditions are defined reasonable (chapter 10.3, e.g. NR = 1, NT = 1000)
- Set the IIR filter frequency to 0.5 Hz (see chapter 10.4, FM = 0, FL = 7)

Example: Setup of zero point, system gain and decimal point

The chosen calibration weight has the value 5000 (increments). That could be 500 g, 5 kg or 5000 kg. We calibrate with 500 g. The decimal point is set up by command DPx (x = 1, 2 or 3), here 1 figure after the decimal point. A measured weight of 500 g is displayed as 500.0.

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
CE↵	**E+000017 (example)**	Request: TAC counter CE17
Adjust zero: The scale has to be empty. No load!		
CE 17↵	**OK**	Calibration sequence active
CZ↵	**OK**	System zero point saved
Adjust gain: First put the calibration weight on the scale (here 500 g)!		
CE 17↵	**OK**	Calibration sequence active
CG 5000↵	**OK**	Setting span
CG↵	**G+05000**	Request: span 5000 d
CE 17↵	**OK**	Calibration sequence active
DP 1↵	**OK**	Setting: decimal point 0000.0
CE 17↵	**OK**	Calibration sequence active
CS↵	**OK**	Save calibration data in EEPROM

Zero point, gain and decimal point position were saved in the EEPROM; the calibration counter (TAC) is increased automatically by 1.

13. Updates – Firmware Download

For a firmware update the DAD 141.1 has to be connected either via the Serial port or via the Ethernet port to a Windows PC.

A download is accomplished with help of the software "**DAD141_Programmer1.6**" (or higher).

Firmware update for DAD 141.1:

First all necessary files (DAD141_Programmer1.6 and firmware) have to be stored in same directory. The firmware for DAD 141.1 is stored in a file e.g. "141.181.v.1.45.hex".

- Switch on DAD 141.1
- Start program "DAD141_Programmer1.6".
- Press button "Load" and choose the file "141.181.v.1.45.hex".
- Press button "Program".
- Download proceeds. – The end will be indicated with "Programming OK ".
- Switch off DAD 141.1.
- Now use a terminal program or DOP 4 software for running a factory reset of the DAD 141.1 by using the command FD

Note: The command FD is TAC protected. You must issue the CE command with relevant TAC code prior to the FD command else the FD command will fail.

FD Reset to Factory Default Settings

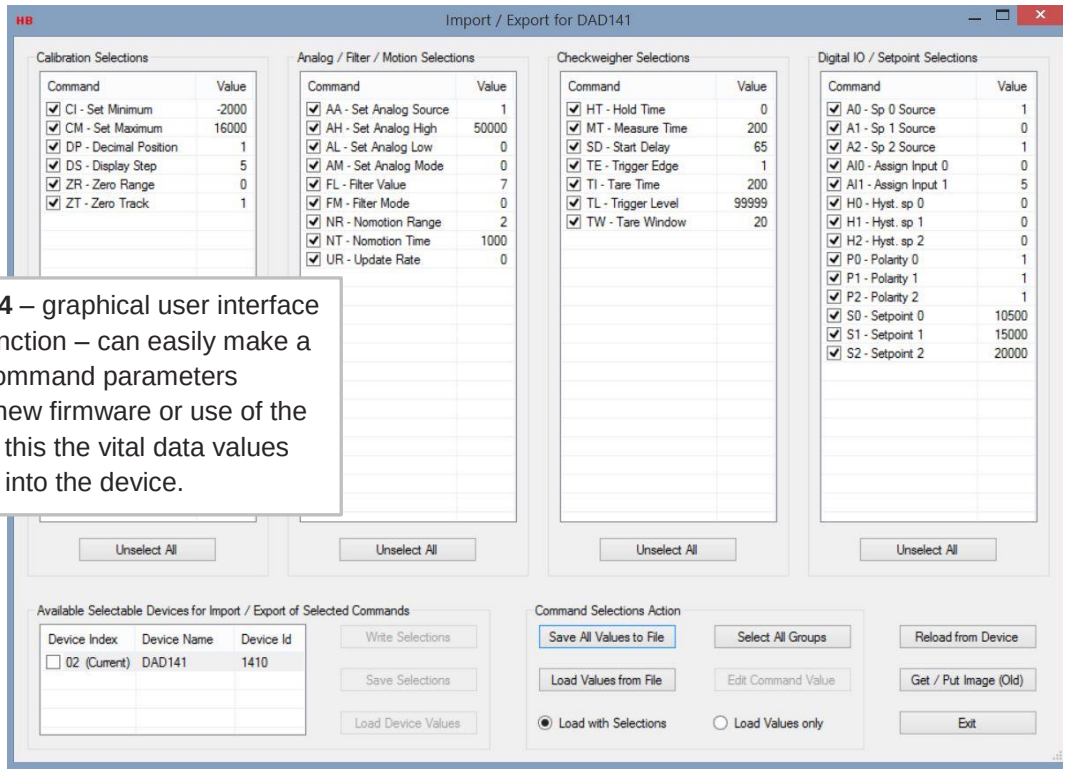
This command puts the DAD 141.1 back to a known state. The data will be written to the EEPROM and the TAC will be incremented by 1.

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

Master (PC / SPS) sends	Slave (DAD 141.1) responds	Meaning
CE↵	**E+00017 (example)**	Request: TAC counter CE17
CE 17↵	**OK**	Calibration sequence active
FD 0↵	**OK**	Factory default setting

Practicle Hint

The Software **DOP4** – graphical user interface with oscilloscope function – can easily make a backup of all vital command parameters before download a new firmware or use of the FD command. After this the vital data values can be loaded back into the device.



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