DMS Digitalinterface
DI301 DP

Operating instructions

A.S.T. Angewandte SYSTEM-TECHNIK GmbH Dresden
Marschnerstraße 26 D-01307 Dresden
Phone (03 51) 44 55 30 Fax (03 51) 44 55 555
www.ast.de astmr@ast.de

Table of Contents

1. General instructions

1.1. Preface

These operating instructions contain the most important information for the successful use of the digital sensor interface DI301 DP and describe briefly its function, the commissioning and configuration as well as the installation. If you have any further questions concerning the sensor interface DI301 DP, please get in touch with the sales representative who is in charge of you.

You will find the relevant addresses, phone and fax numbers on the cover of this manual.

2. System description (specification)

2.1. Overview over the system

The digital Profibus interface DI301 DP has been developed for force measurements and industrial weighing procedures with the output of the measured value being transmitted to field-bus systems, such as the Profibus DP or the special RS485 bus systems. It meets the highest demands as regards the measuring accuracy, measuring speed and flexibility.

A board with digital inputs and relay outputs allows simple control functions and incremental distance measurements that can be evaluated together with the force measurement. The DI301 DP includes and provides all important functions, such as zeroing, zero position at start-up, taring as well as a resolution of the scaled measured value up to 100 000 parts that are necessary for the use as weighing indicator.

A rugged die-cast aluminum housing with a degree of protection IP65 will allow the installation outside switching cabinets in the immediate vicinity of the load transducers, even in external areas. Standardized field bus interfaces will make it possible to network up to 125 DI301 DP devices in one BUS.

2.2. DI301 DP variants

The DI301 DP is available as single or two-channel device. The table below provides an overview over the available variants as regards the input configuration. Only the two-channel version facilitates the use of the digital inputs and outputs.

type code	input signal	
	channel 1	channel 2
DI301 DP.11	mV/V	
DI301 DP.21	mV/V	mV/V
DI301 DP.22	mV/V	0 ... ±10V
DI301 DP.23	mV/V	4 ... 20mA
DI301 DP.24	0 ... ±10V	0 ... ±10V
DI301 DP.25	4 ... 20mA	4 ... 20mA

Table 1 - DI301 DP variants

2.3. Scope of supply

DI301 DP in the relevant die-cast aluminum housing.

Accessories

	type code	description
software	**XKS 265**	service program DI301 DP (test and parameterization program)
documentation		documentation on CD (manual, specification for the Profibus user, GSD file)

Options

	type code	description
cable	**XKC 267**	connecting cable Profibus (5-pin cable connector B-coded and 9-pin SUB-D plug), 5 m
cable	**XKC 269**	parameterization cable RS232C

2.4. Overview over the functions

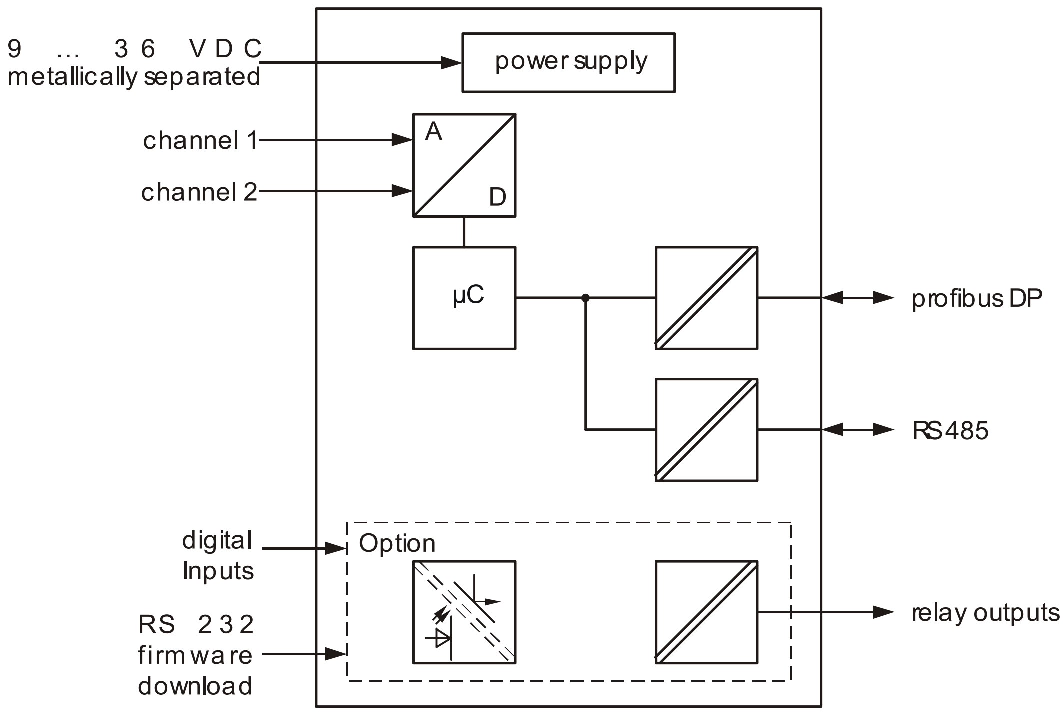

Fig. 1 - Wiring diagram

The DI301 DP has a 2-channel 24-bit AD-Converter, a micro-controller for the internal processing of the measured values and communication purposes as well as a special controller for the Profibus interface. Possible input signals of the DI301 DP are strain gauge bridge voltages as well as standard signals of 0 ... 10 V or 4 ... 20 mA. The input signal will be amplified, filtered, digitalized, processed by the micro-controller and transmitted to the field bus interface. Apart from the Profibus DP, a proprietary multi-point protocol via RS485 is also available as a field bus protocol.

The configuration and calibration is done with a test and service program XKS265 via an RS232 parameterization interface. All set values including the calibration data can be stored in a file and re-loaded.

2.4.1. Power supply strategy

The power is supplied as direct current between +9 V…+36 V. The metallic separation of the main assemblies throughout will ensure the highest possible immunity to interference.

3. Installation and commissioning

3.1. Ambient conditions

The DI301 DP satisfies the requirements for the degree of protection IP 65. Please refer to the Technical Data Sheet for further details about the ambient conditions.

3.2. Connecting equipment

The measuring signals and the operating voltage will be connected via screw-type terminals, while the connection with the Profibus or field bus is established via standardized B-coded M12 plug-in connectors. The wires must only be connected when the equipment has been de-energized.

Elements and components located in the terminal area must not be mechanically destroyed, while connecting the wires. The use of shielded cables is mandatory, in order to exclude fault signals. The individual wire ends shall be as short as possible and equipped with connector sleeves, so as to avoid EMC problems. The shielding of all cables leading into the equipment shall be contacted with the cable glands, for which purpose approx. 0.5 cm are removed from the external sheathing.

3.3. Power supply

The DI301 DP requires a non-stabilized direct voltage of +9 … +36 VDC with a residual ripple of < 3 %. The average power input at 24 VDC amounts to approx. 200 mA. The feeder line is equipped on the input side with reserve voltage protection.

In addition to that, the DI301 DP is also available as variant DI301DP.xx-230VAC with a 230-V supply connection. Table 1 applies to the individual input variants. The wiring diagram can be taken from **Fig. 5**.

3.4. Profibus installation

The relevant guidelines of the Profibus User Organization (PNO) apply to the connection of the DI301 DP with the Profibus and for the integration of the assembly into the Profibus architecture.

3.5. Configuration of the interfaces

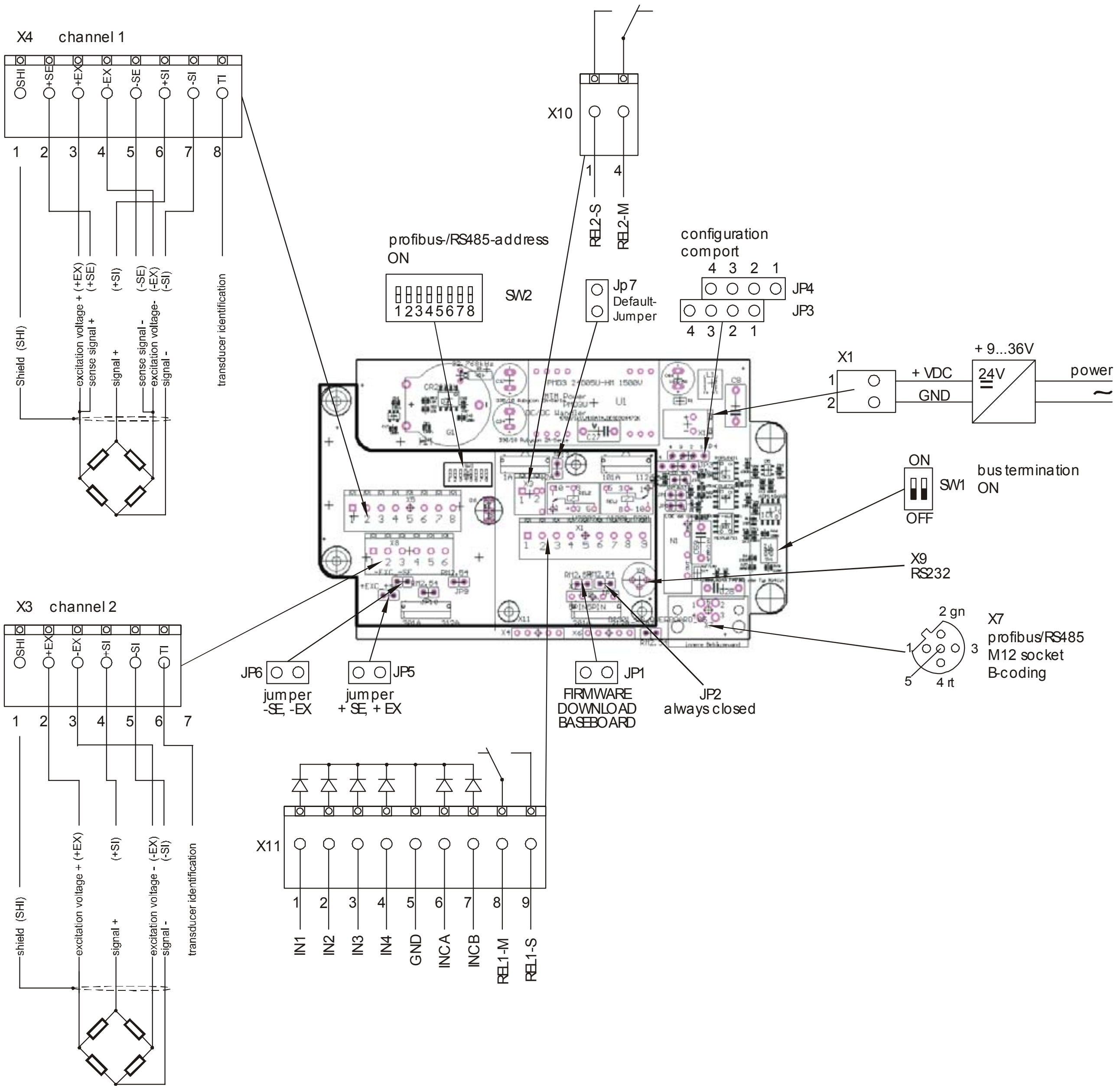

Fig. 2 - Terminal / Jumper overview

3.5.1. Terminal/Jumper configuration of the DI301 DP

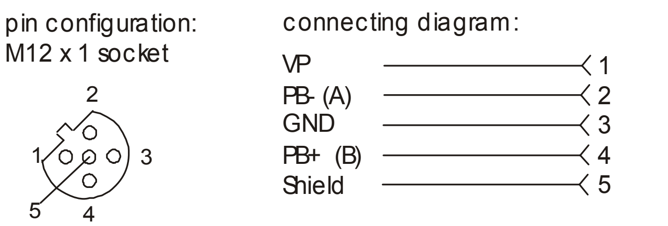

Fig. 3 – Pin configuration of the **X7** Profibus M12 socket

PIN	signal	description
X1-1	+VDC	+9..36V DC
X1-2	GND	GND

Table 2 – Configuration X1 operating voltage (see **Fig. 2)**

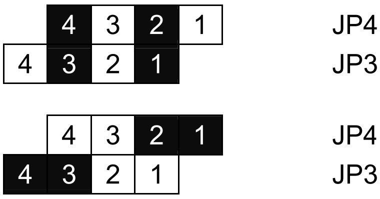

Fig. 4 – Interface configuration via JP3, JP4

jumpers - Fig. 4	connection between	remarks
JP4/4 - JP3/3 Fig. 1 JP4/2 - JP3/1	serial communication via X9 (RS232)	communication, firmware and parameter download via RS232
JP4/2 - JP4/1 Fig. 2 JP3/4 - JP3/3	serial communication via X7 (RS485)	communication via RS485, RS232 (X9) cannot be used! **WARNING!** Cannot be used with the standard variant of DI301 DP.

Table 3 – Explanation of **Fig. 4**

1	2	3	4	5	6	7	8	address
ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	1
OFF	ON	OFF	OFF	OFF	OFF	OFF	OFF	2
ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	3
.	.	.	.	.	.	.	OFF	.
OFF	ON	ON	ON	ON	ON	ON	OFF	126
ON	ON	ON	ON	ON	ON	ON	OFF	127
OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	address as setup parameter

Table 4 – Setting the Profibus address with **SW2** (**Fig. 2**)

PIN	signal	description
X4-1	SHI	SHIELD
X4-2	+SE	sensing line (+)
X4-3	+EX	bridge supply voltage (+) channel 1
X4-4	-EX	bridge supply voltage (-) channel 1
X4-5	-SE	sensing line (-)
X4-6	+SI 1	measuring signal (+) channel 1
X4-7	-SI 1	measuring signal (-) channel 1
X4-8	TI1	transducer identification / sensor identification channel 1

Table 5 – Configuration of terminal **X4** load-cell connection channel 1 (**Fig. 2**)

PIN	signal	description
X3-1	SHI	SHIELD
X3-2	+EX	bridge supply voltage (+) channel 2
X3-3	-EX	bridge supply voltage (-) channel 2
X3-4	+SI 1	measuring signal (+) channel 2
X3-5	-SI 1	measuring signal (-) channel 2
X3-6	TI1	transducer Identification / sensor identification channel 2

Table 6 – Configuration of terminal **X3** load-cell connection channel 2 (**Fig. 2**)

PIN	signal	description
X10-1	REL 2-M	relay contact M/ relay 2
X10-2	REL 2-M	relay contact S/ relay 2

Table 7 – Configuration of terminal **X10** (**Fig. 2**)

PIN	signal	description
X11-1	IN 1	optoinput 1
X11-2	IN 2	optoinput 2
X11-3	IN 3	optoinput 3
X11-4	IN 4	optoinput 4
X11-5	GND	GND
X11-6	INCA	incremental counter input A
X11-7	INCB	incremental counter input B (direction)
X11-8	REL 1-M	relay contact M/ relay 1
X11-9	REL 2-S	relay contact S/ relay 1

Table 8 – Configuration of terminal **X11** (**Fig. 2**)

PIN	signal	description
JP1	normal: open	download controller (basic board)
JP2	normal: always closed	download controller (extension board)
JP5	bridge -SE with –EX	4-conductor operations for channel 1 closed
JP6	bridge +SE with +EX	4-conductor operations for channel 1 closed
JP7	Default jumper	when closed, the default setup will be loaded **calibration data will get lost!**

Table 9 – Jumper configuration (**Fig. 2**)

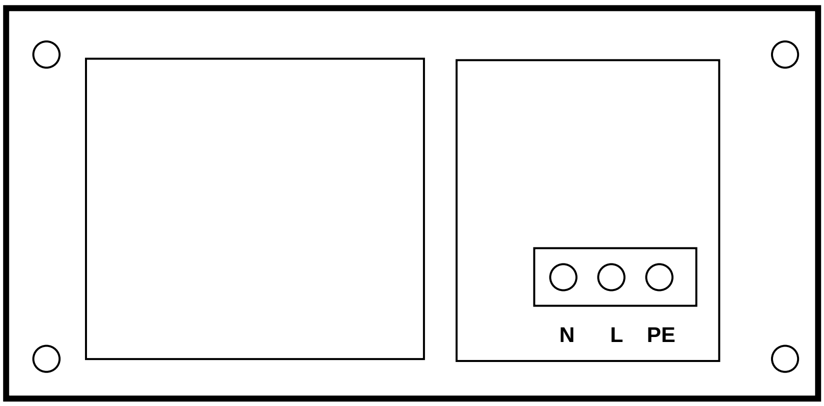

Fig. 5 – Wiring diagram of the supply connection of the DI301DP.xx-230VAC

3.6. Hardware configurations

The hardware configuration is largely limited to the following settings, if the manufacturer's default settings do not correspond to the intended application:

equipment address:	SW2 according to **Table 4**	initial setting is address 7
line termination:	SW1 according to **Fig. 2**	initial setting „open"
field bus protocol:	JP3, JP4, according to **Table 3**	initial setting: RS232 + Profibus DP

3.7. Scaling and parameterization

3.7.1. Factory calibration

The DI301 DP will always be calibrated by the manufacturer and supplied in this condition. This means that the transmission behavior of the analog signal processing will be standardized accordingly. In order to do so, the values Offset & Gain which determine the transmission behavior of the AD channels will be set in such a way that the digital output value 0 can be realized for the input value 0 mV/V and the digital decimal output value 2 000 000 for the input value 2 mV/V. These correction values are stored in the non-volatile memories of the channel-specific registers and will thus ensure their efficient exchange in the event of a repair.

3.7.2. Settings and sensitivity calibration

Opening the menu: Extras > Comport

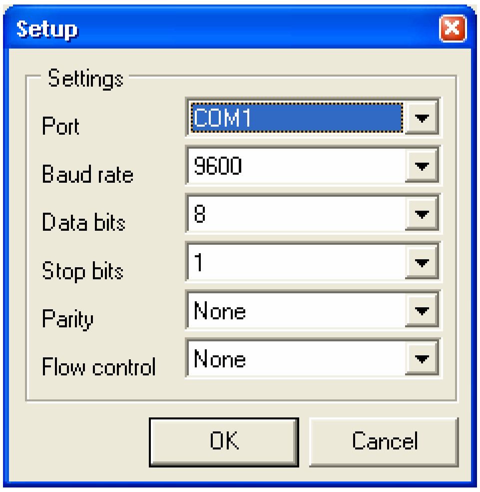

Fig. 6 - Setting the comport parameter (default)

Since the standard version of the DI301 DP has neither a keyboard nor a display, all settings can only be made on a PC via its interfaces. The same applies to data which is to be indicated. A special cable for the RS232 parameterization interface will be made available as accessory.

All standard settings for the commissioning and calibration can be carried out via a user interface (**Fig. 7**). Modified parameters will not become active, before they have not been transmitted to the DI301 DP by pressing the button "Write setup to device".

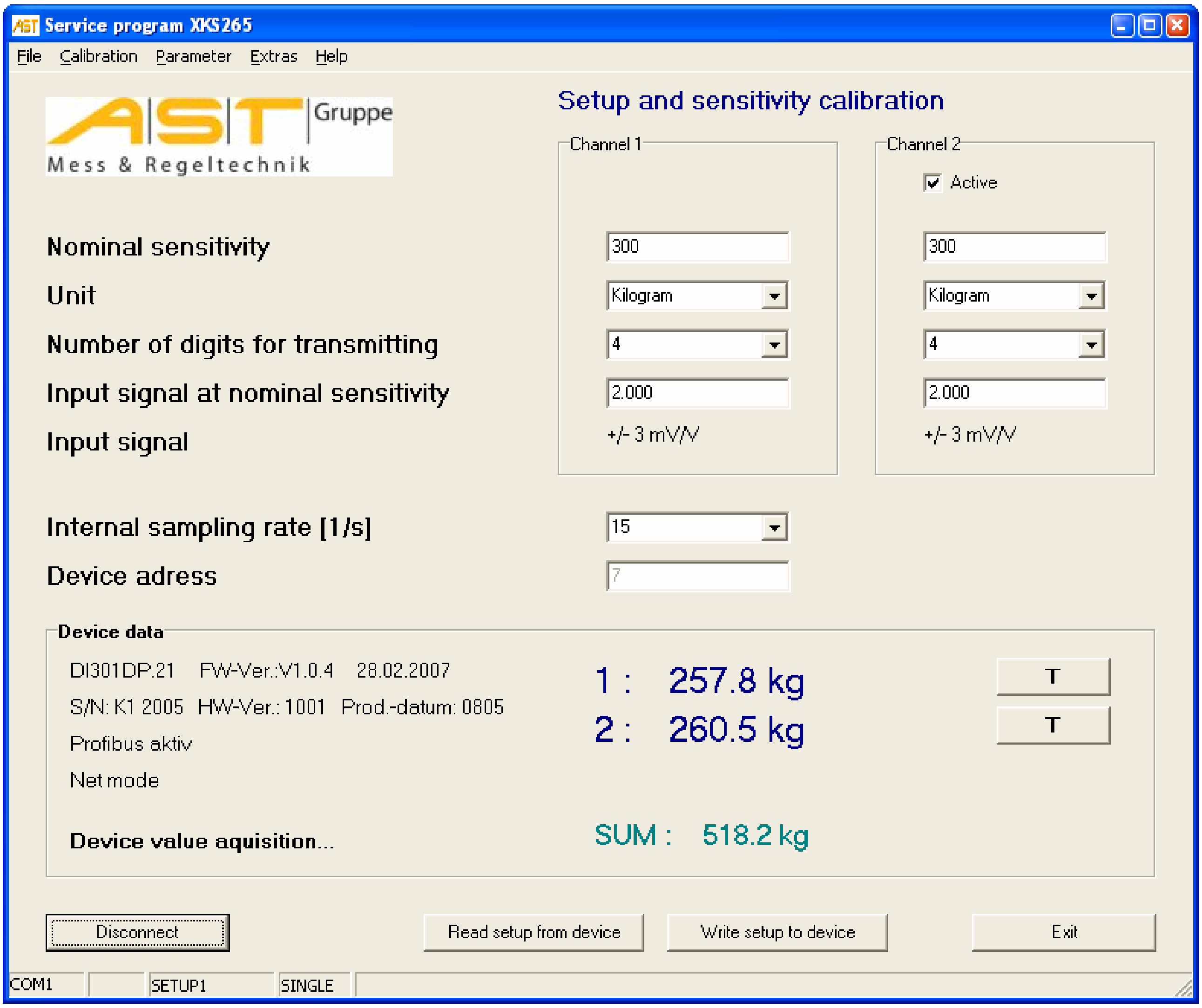

Fig. 7 – Configuration mask for settings and sensitivity calibration

3.7.2.1. Handling the user interface

Button "Connect/Disconnect"

The "Connect" button will start the communication with the DI301 DP. Device data (such as the serial No., the firmware version and further equipment data as well as Profibus active/inactive) will be read from the device and displayed. The current measured value will also be inquired periodically and displayed, once the DI301 DP has been calibrated.

The connection with the DI301 DP will be interrupted by pressing the "Disconnect" button.

Button "Read setup from device"

The entire parameter set of the DI301 DP will be read out and the relevant parameters and displays be entered into the input mask. The entire parameter set can be saved on the PC as a file via "File > Save", after it has been successfully read out.

Button "Write setup to device"

The entire parameter set of the DI301 DP will be transmitted to the device and become effective hereafter. All modifications in the input fields will become effective, too.
The "old" calibration data will be overwritten, if modifications have been made in the input fields.

A stored parameter file can be imported from a data memory of the PC via "File > Open" and subsequently be transmitted to the DI301 DP.

Buttons" >0<" / "T"
Taring or Zeroing can be selected via the menu: “Extras > Button function”. The indicated measured value will be zeroed or tared.

In addition to that, the sum channel can be activated in the 2-channel mode via „Parameter > Weighing related parameter > Misc. parameters > Sum channel active“. The value for the sum channel will be displayed in addition to the values for channels 1and 2 in the main window. The sum channel can only be activated, when identical measuring units have been selected and activated for channels 1 and 2.

3.7.2.2. Calibration

Referring to Fig. 8 the sensitivity calibration (also theoretical calibration) will scale the equipment with the parameters of the load-cell. The calibration will always refer to zero. The equipment can be speedily calibrated by entering the nominal load of the load-cell and the input voltage ratio. However, the calibration with a known load will not be accurate, since tolerances of the assemblies influence the result. Partial load ranges cannot be entered. The sensitivity calibration will become effective on pressing the button "Write setup to device".

Input field "Nominal sensitivity"
The nominal force of the load-cell will be entered in this field, which accepts up to five digits.

Input field "Unit"
Input field for the measuring unit to be used. It corresponds to the nominal force of the load-cell.
Values: N/ kN/ g/ kg/ t/ lb/ oz

Input field "Number of digits for transmitting"
The number of digits for transmitting measured values will be entered in this field. The number of digits must be ≥ the number of digits for the nominal force.

Input field "Input signal of the nominal sensitivity [mV/V]"
The nominal sensitivity of the load-cell at the nominal force will be entered here, values: -3.000...+3.000 mV/V, factory setting: 2.000 mV/V

Display Input signal
These values will be imported from the DI301 DP on pressing the button "Read setup from device". This configuration is fixed for each equipment version and cannot be modified.

Input field "Internal sampling rate [1/s]"
The sampling rate of the DI301 DP will be determined in this input field. Possible set values are:
1-channel operation: 25/50/100/200/400 Hz, factory setting: 400
1-channel operation with log function: 25/50/100/200/400/800/1600 Hz, factory setting: 400
2-channel operation: 3/5/8/12/15/20 Hz, factory setting: 15

There is a difference, whether the analog-digital converter (ADC) operates in the continuous mode (DI301 DP in 1-channel operation) or in the single mode (DI301 DP in 2-channel operation). The sampling rate set for 1-channel operations (continuous mode of the ADC) corresponds directly to the number of measured values/sec available, in which case sampling rates of >800 can only be stored in the internal RAM, since data quantities of that kind cannot be transmitted immediately via the serial interface.

In 2-channel operations (single mode of the ADC), the sampling rate available will be lower, since the ADC always carries out one conversion only, so that the channel must be switched over subsequently.

Higher sampling rates are available in the log storage mode, which can be activated via menu “Extras > Logfunction active”. The log storage mode records the sampling values as 16-bit source data values in the internal log memory with its capacity of 12.000 values, from where they can be read out.

sampling rate [1/s] – normal operation (1-channel operation)	sampling rate [1/s] – log operation (1-channel operation)	sampling rate [1/s] – normal operation (2-channel operation)
25	25	3
50	50	5
100	100	8
200	200	12
400	400	15
	800	20
	1600	

Table 10 – Sampling rates available

Input field "Device address"

The Profibus address will be set via the DIL switch SW2. The address indicated here is for information only and cannot be modified via the software. When SW2, switch 8 is ON (refering to **Tab. 4)**, address is software selectable.
Values: 1…125

Display Channel 1/Channel 2

Column 2 is concealed, when channel 2 is inactive. When "Active" is ticked, the 2nd channel will be activated.

3.7.3. Calibration under load

The user interface "Calibration under load" allows a 2-point calibration with a known load or force in the DI301 DP. This menu is activated via “Calibration > Load calibration – channel x”.
The 2-point calibration facilitates the independent recording of zero of the load-cell under load and of any point along the characteristic curve, in order to establish the slope.

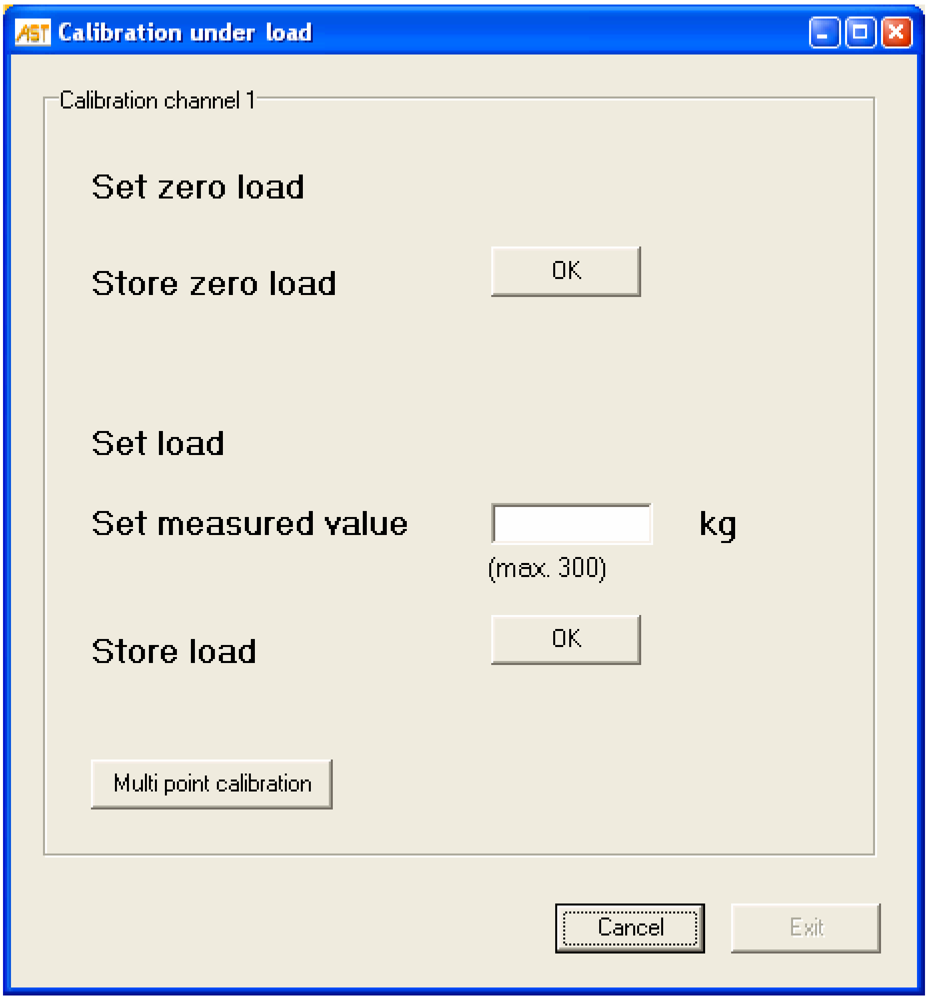

Fig. 8 – Configuration mask of the calibration under load

Button "Store zero load"
This function records the input voltage ratio established by the load-cell at this moment as zero load. If the sensitivity of the DI301 DP has been calibrated in advance, the function can be used to correct the zero value. The characteristic curve will be shifted parallel and the slope of the sensitivity calibration be retained.

Input field "Set measured value"
The measuring unit and the maximum measuring range (max. xxx) can be taken from the relevant parameters of the DI301 DP. They can be modified with the help of the user interface "Settings and sensitivity calibration" and thus be adapted to the actual measuring job.

In order to calibrate the end value, the known weight acting onto the load-cell will be entered first. The value must not exceed the value indicated below the input field, nor should it drop below 20 % of the maximum value, in order to ensure sufficient calibration accuracy.

Button "Store load"
On pressing this button, the DI301 DP starts a measuring process and allocates the measured value entered to the current input voltage ratio. Before this function is activated, the load corresponding to the measured value entered must act on the load-cell and satisfy the required standstill condition.

Button "Multi-point calibration"
Up to 6 additional points can be calibrated on pressing this button by stating the load.

3.8. Weighing parameters

This menu is activated via “Parameter > Weighing related parameters”.

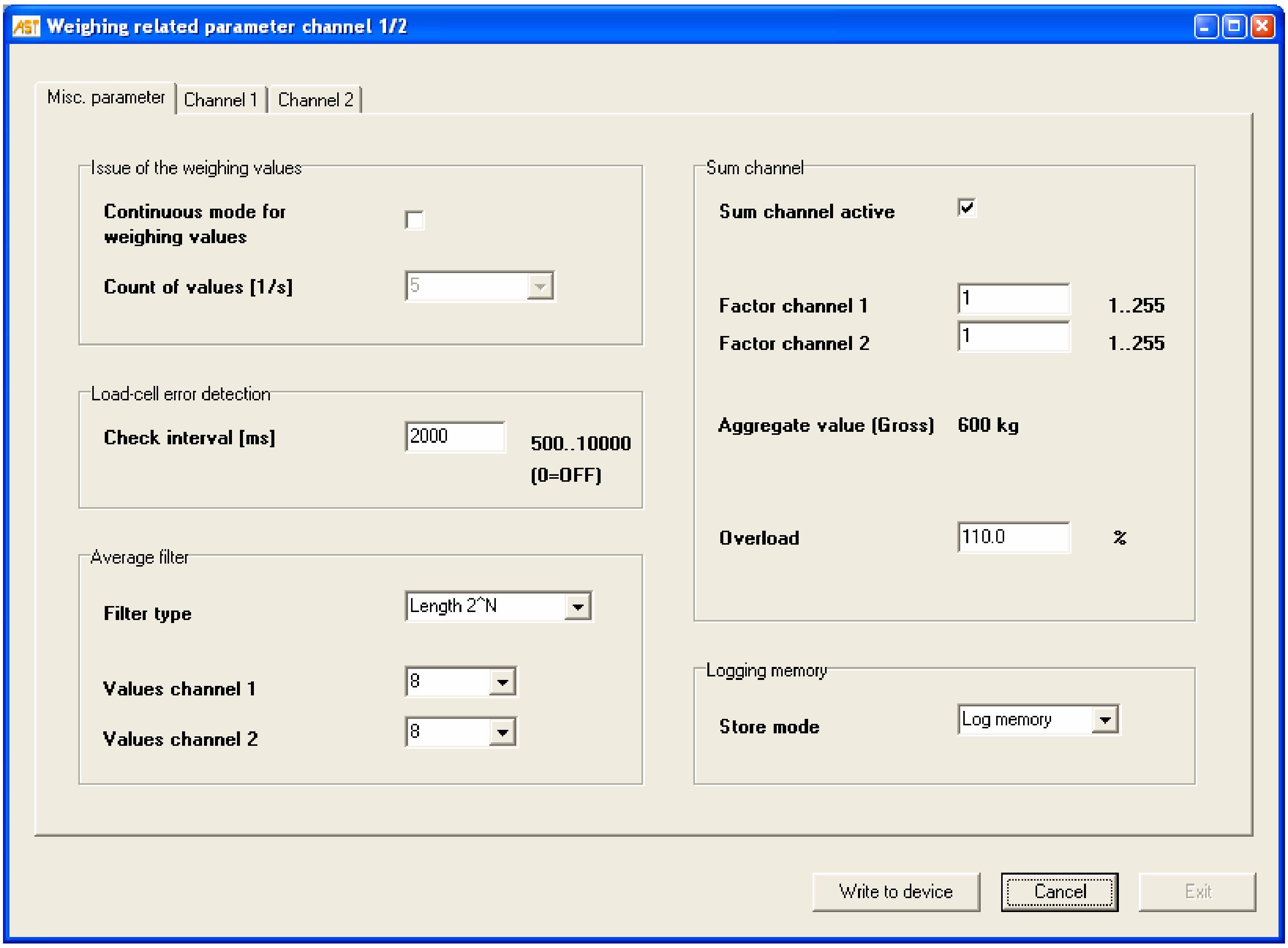

Fig. 9 – Setting weighing parameters, misc. parameters

Issue of weighing values
It is possible to configure the continuous issue of the values or of a certain number of values per second. The values (channel, gross, net, tare) will be issued to the serial interface as string.

Load-cell error detection
The interval of the bridge error detection can be set or, alternatively, the bridge error detection can be deactivated. During two-channel operations the time for the bridge error detection is reduced to half the value per channel.

Average filter
Two variants for the average filter and the values of the average value filter for the individual channels can be set.

Sum channel
Activation / Deactivation of the sum channel. Prerequisite for activating the sum channel is that the 2nd channel has been activated and identical measuring units for the setup have been fixed (see **Fig. 7**).

Each channel can be scaled via separate factor settings. Limits for the sum channel's overload can be set here.

Logging memory

The log memory mode can be additionally set for 1-channel operations. The storage mode of the internal log memory can be fixed. It is possible to set the log memory mode for up to 12.000 16-bit values or the ring memory mode for more than 12.000 16-bit values.

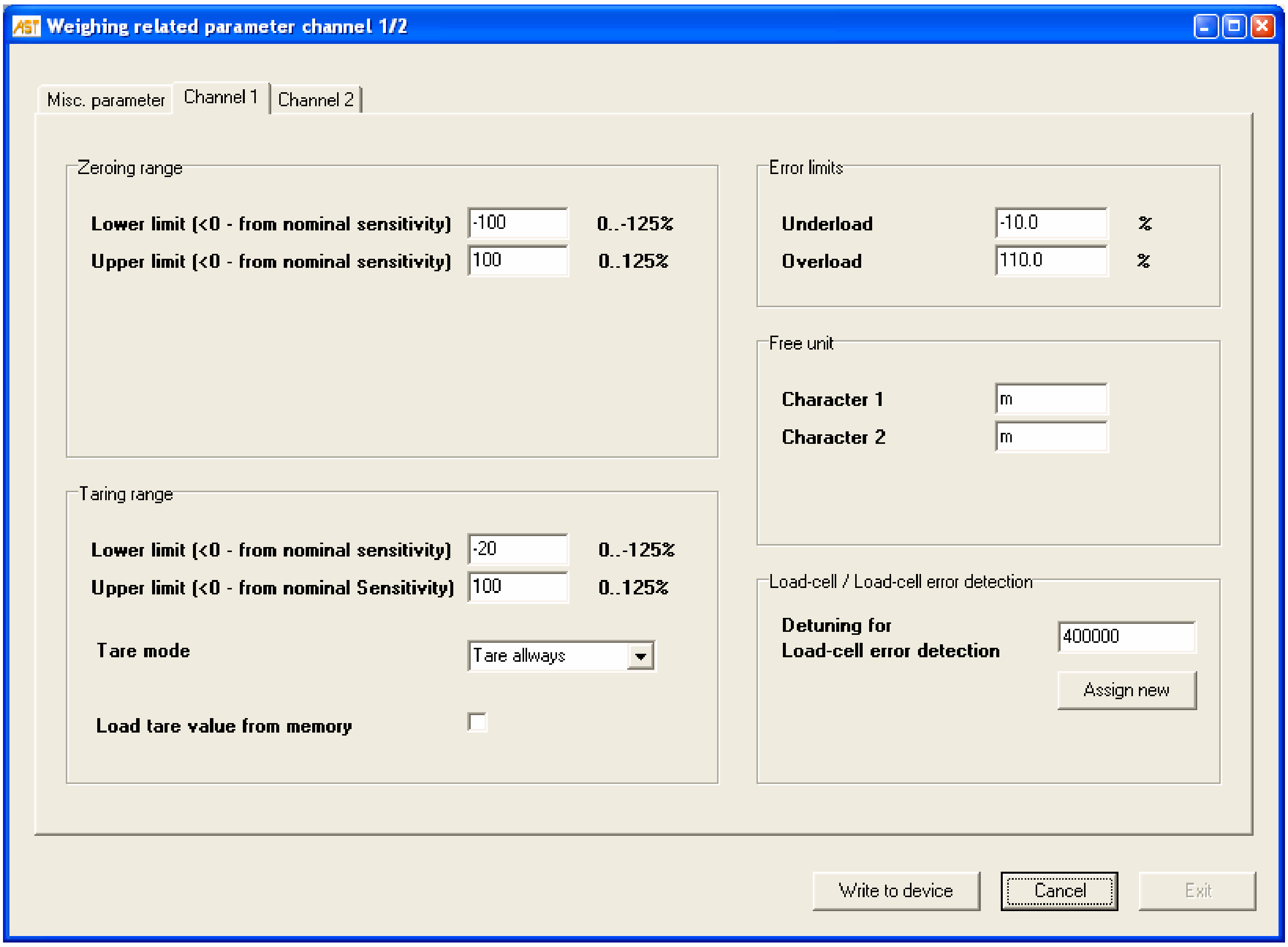

Fig. 10– Setting weighing parameters, channels 1/2

The weighing parameters can be set separately for each channel (channel 1/2).

Zeroing range

The limits for the zero range can be set above and below the zero value; which will be indicated as percentage of the nominal sensitivity (see **Fig. 7**).

Taring range

The limits of the tare range and the mode of taring can be set here. In addition to that, it can be determined, whether the tare value stored most recently is to be loaded automatically, when the DI301 is started. The value is indicated as a percentage of the nominal sensitivity (see **Fig. 7**).

Error limits

Error limits for the underload and overload can be set here. The value(s) will be indicated as a percentage of the nominal sensitivity (see **Fig. 7**).

Free measuring unit

Two freely definable signs can be entered for the free measuring unit.

Load-cell / Load-cell error detection

The real detuning value for the load-cell error detection of the connected load-cell can be determined by pressing the button „Assign new“ and saved accordingly.

3.9. Inputs and outputs

The extension board will make available 4 opto-inputs, 1 input for the incremental position encoder with an identification device for the direction of rotation and 2 relay outputs. The configuration of connecting the individual terminals has been described in **section 3.5** above.
This menu is activated via “Parameter > Digital inputs + Incremental position encoder”.

3.9.1. Opto-inputs and input for the incremental position encoder

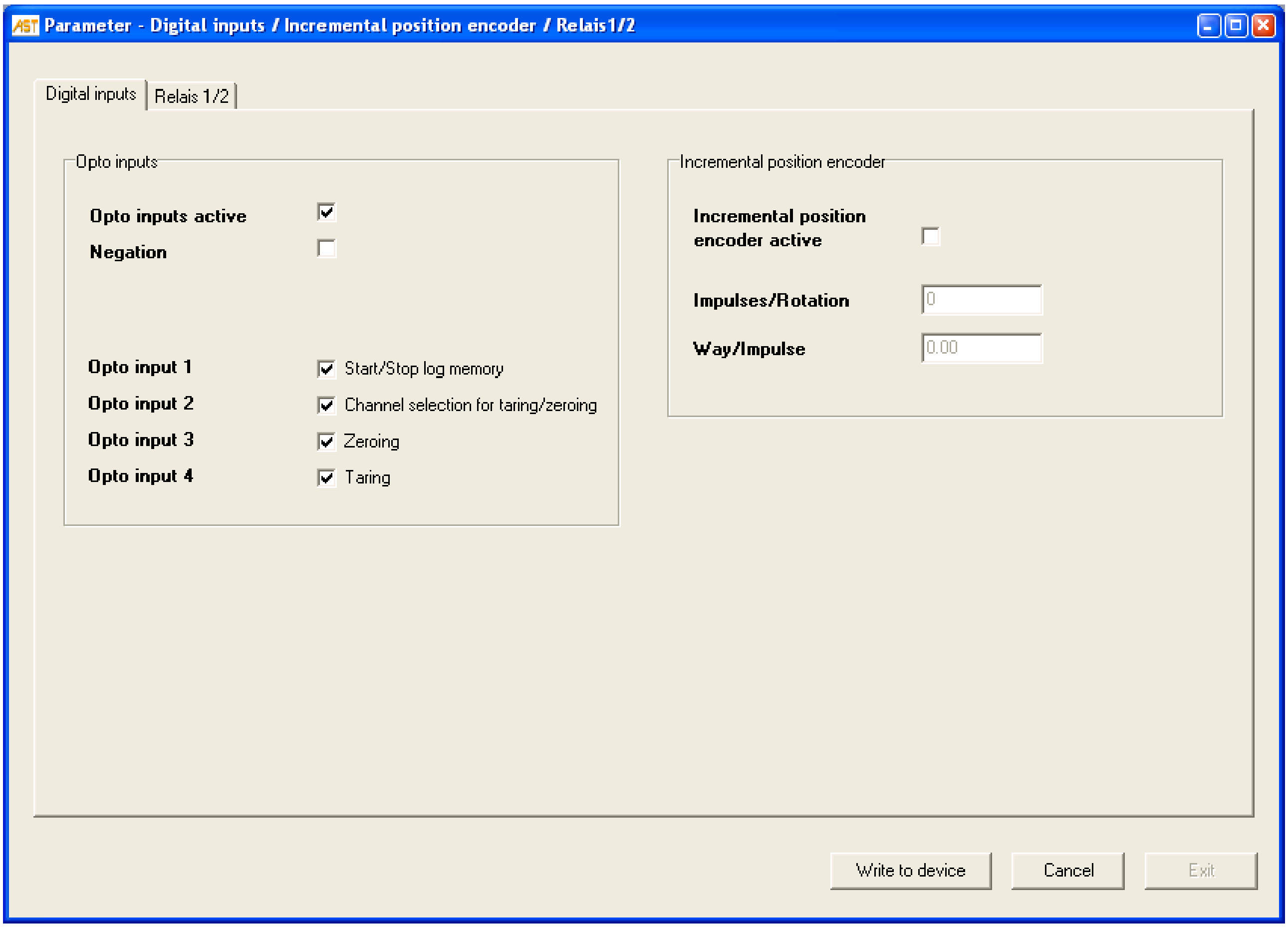

Fig. 11 – Setting opto-inputs and input for the incremental position encoder

Opto inputs

The opto-inputs can be activated/deactivated. In addition to that, the DI301 may carry out a logic negation. The opto-inputs can be assigned standard functions via this menu.

Opto input 1 -> Start/Stop of the log memory
Opto input 2 -> Channel selection for taring/zeroing
Opto input 3 -> Zeroing
Opto input 4 -> Taring

Incremental position encoder

The input for the incremental position coder can be activated/deactivated. In addition to that, the source data values of the counter can be scaled with values via the setup parameters (impulse/rotation and way/impulse).

3.9.2. Relay outputs

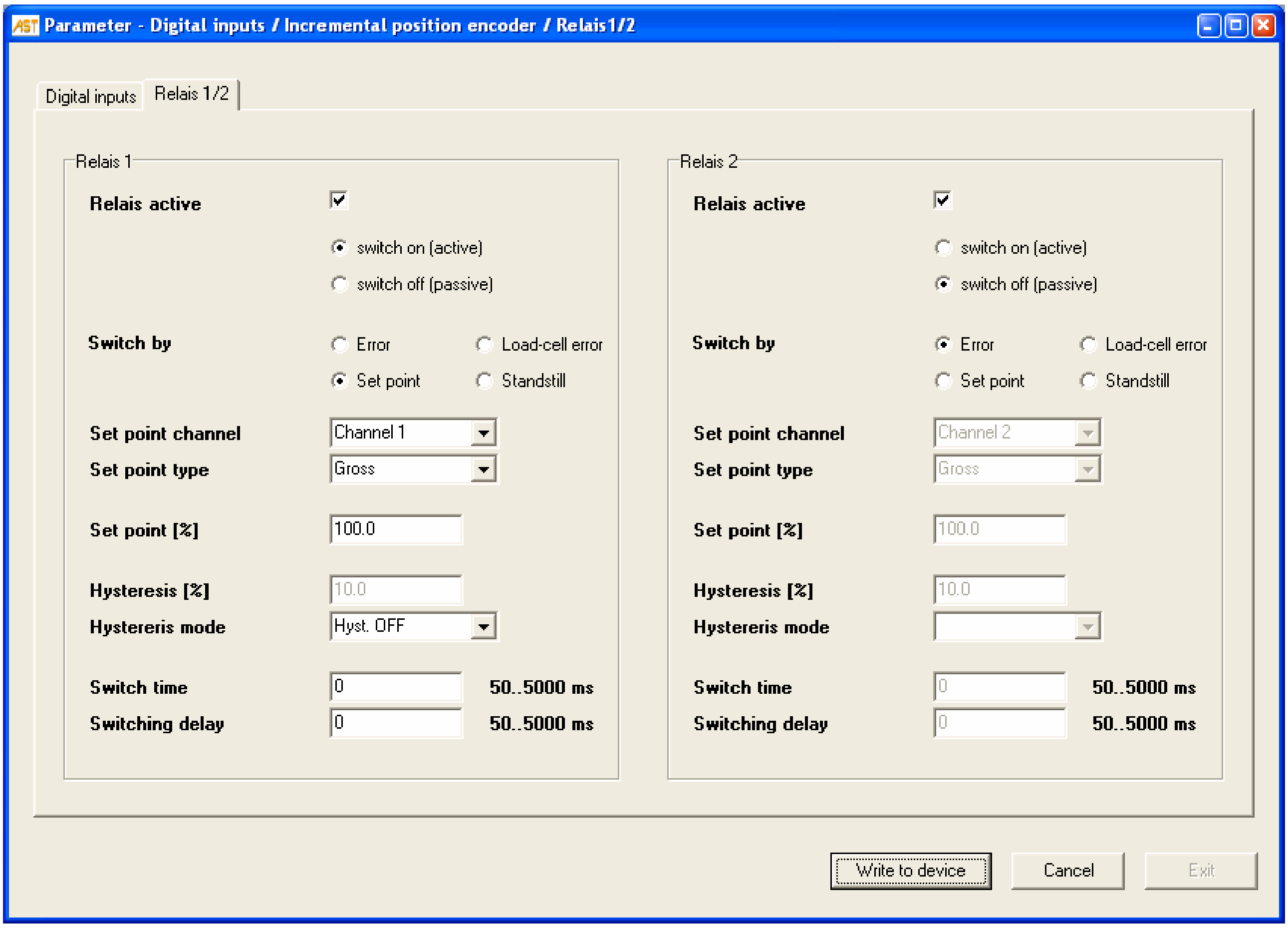

Fig. 12 – Setting relay outputs

It is basically possible to activate/deactivate the relays and to set a logic negation thru the software (break & make contacts). The relays 1/2 can be set freely in the channels for certain functions.

Error
Should an error occur in the DI301 DP, the relay will be switched.

Load-cell error
Should a bridge error occur in the DI301 DP, the relay will be switched.

Set point
The following switching parameters can be set at certain limits.

Set point channel	→ channels 1/2, channel 1 or 2, sum channel
Set point type	→ gross/net of the relevant channel (channels 1/2, gross only for the sum channel)
Set point [%]	→ set point in per cent
Hysteresis [%]	→ hysteresis value for the set point
Hysteresis mode	→ the hysteresis can be set symmetrically, above or below the limit, or to OFF

Standstill
In the event of a standstill of the channel selected (channel 1/2, channel 1 or 2 or sum channel), the relay will be switched.

Additional parameter

Switching time	→ settable switching time for the relay (50...5000 ms / 0 = permanently on)
Switching delay	→ settable switching delay (50...5000 ms / 0 = no delay)

3.10. Error rectification

3.10.1. Error display

The selected error (overload, underload, bridge error) will be directly displayed in the main window of the program.

3.10.2. Handling of the default setup

In the event of an error, the default setup (factory setting) can be loaded in two different ways. During ongoing operations, a default setup will be loaded after the default jumper has been plugged in (see **Fig. 2**) and the DI301 DP has been re-started. The old setup settings as well as the calibration data will be retained.

Once the DI301 DP has been disconnected from the power supply, the default jumper been plugged in and the DI301 DP been re-started, a default setup will be loaded and imported into the internal setup memory. In this case, all settings and calibration data will be lost!

3.10.3. Connecting problems

No.	cause	solution
1	cable connection interrupted	check the cable
2	DI301 DP without operating voltage	check the cable
3	COM port at the PC not open	deactivate the software that is assigned to the COM port and re-start the computer, if necessary
4	communication setting incorrectly set	set the software correctly, see section 3.7.2, above, check the COM port
5	firmware error in the DI301 DP	default-setup in the DI301 DP variant 1: open the DI301 DP, set jumper JP2 (see Fig. 2), interrupt power supply briefly (reset), re-connect the power supply, wait until status-LED flashes red, remove JP2 and wait, until DI301 DP re-starts after approx. 8...10 sec variant 2: write a default-setup in the DI301 DP with the help of the service program XKS265 -> menu > extras > default-setup
6	USB / RS 232 converter	This equipment does not normally work reliably

Table 11 – Error help

3.11. Status LED

The two-color LED on the lid of the housing indicates the following statuses:

indication	status
yellow	Controller OK, Profibus not connected
green	Controller OK, Profibus link OK
yellow - red- yellow -red > intermitting	ERROR, Profibus not connected
green flashing	ERROR, Profibus link OK

Table 12 – Status LED of the DI301 DP

4. Functions of the interfaces

4.1. Description of the transfer protocol RS232/RS485 for the DI301 DP

4.1.1. Host command

Start	ADR	LEN	CMD	RSV	ST	data/ parameters	BCC1	BCC2	End
STX	xx	xx	xx	xx	status bit-coded	xx	xx	xx	ETX

STX/ETX : start and end coding of the telegram
ADR : maximum: 0 x 7D (125); 0 x 7E (126) broadcast -> similar to PB
LEN : number of bytes CMD, RSV, ST, data/parameters
CMD : binary command code
RSV : reserve
ST : binary status byte
data/parameters : 2-byte error code, parameters, measured values, maximum: 128 bytes useful data
BCC1/2 : 16-bit check sum via ADR until end of data (sum of all bytes and 1er compl.)

4.1.2. DI301 DP response telegram

Start	ADR	LEN	CMD	RSV	ST	data/ parameters	BCC1	BCC2	End
STX	xx	xx	0x8X	xx	status bit-coded	xx	xx	xx	ETX

Identical with the Host telegram, but:
- bit .7 set at CMD specifies response telegram

4.1.3. DI301 DP response -> error acknowledgement

Start	ADR	LEN	CMD	RSV	ST	data/ parameters	BCC1	BCC2	End
STX	xx	xx	0xFF	0xFF	status bit-coded	2-byte error code bit-coded	xx	xx	ETX

Identical with the Host telegram, but:

- bit .7 set at CMD specifies response telegram
- for communication as error acknowledgement only
- CMD/RSV are 0 x FF

The DI301 DP will send an error acknowledgement under the following conditions:

1. incorrect check sum (BCC) during the transmission
2. unknown command (distinction in the error code)

4.1.4. Overview over the commands of the RS232/RS485 interface

name	code decimal	code hexadecimal	function	remarks
commands for adjustment functions (calibration)				
CALNU	1	01	calibration (ADC internal)	
CALEN	2	02	end point calibration (ADC internal / 2000000 parts)	
CALNC	3	03	external calibration zero	
CALEC	4	04	external calibration end point	
CALZU	5	05	external calibration additional point	
CALCL	6	06	change calibration set/conversion rate	
CALTN	7	07	theoretical calibration zero (mV/V)	internal
CALTE	8	08	theoretical calibration end point (mV/V)	internal
CALVL	9	09	values for external calibration	internal
CALZE	10	0A	delete additional calibration points	
commands for measuring functions				
RTARA	16	10	taring (set tare memory)	
SADWU	17	11	send filtered ADC value 1x	
SCONT	18	12	send measured value continuously on/off	
SNBTN	19	13	send BTN continuously on/off	not in use
RMMON	20	14	maximum and minimum value measurement on/off	
SMNRM	21	15	current standardized value in per cent of the nominal load	
SMMWE	22	16	maximum and minimum value measurement (send maximum and minimum value)	
SMWMV	23	17	send current measured value [mV]	
ADMOD	24	18	change-over to ADC mode	
ADOGI	25	19	initiate ADC with Offset = 0 and Gain = 1	
RCHAN	26	1A	change-over into measuring channel (cont. mode)	
RNULL	27	1B	weighing equipment functions -> zeroing	
RTARS	28	1C	taring (set tare memory) with weight value	
DIMOD	30	1E	read out current ADC mode	
ADCST	31	1F	establish ADC status	internal
ADCRG	32	20	save in log memory (on/off), fetch values	
CALST	33	21	number of control points (external calibration) in ADC channel 0/1	
commands for RTC				
SDATI	36	24	write/set time of the day / date in DI301	
RDATI	37	25	read date and time of the day from DI301	
other commands for weight strings				
DIBNT	40	28	send gross/net/tare	
commands form extension board				
EXBVL	45	2D	read the values for the extension board	
EXBST	46	2E	write the values for the extension board	
setup commands				
SETRD	60	3C	read setup	
SETWR	61	3D	write setup	
SETVL	62	3E	set setup valid/invalid	not in use
SETCS	63	3F	read setup check sum (active setup)	
SETTS	64	40	setup test (active setup)	
SETDF	65	41	load default values from code	

SETEE	66	42	running time setup from EEPROM (active setup)	
SETDE	67	43	default values -> EEPROM	
SETRE	68	44	runtime values -> EEPROM	
SETCN	69	45	change active setup	
SETER	70	46	erase the complete setup (0 x FF)	internal
STRDE	71	47	erase the setup from the external EEPROM	internal
DIVER	72	48	read various DI301 information	
error commands				
ERRCD	80	50	read/erase error bytes	
broadcast command				
BRCST	100	64	broadcast command	
ADC commands				
RADUR	110	6E	write ADC register	internal
SADUR	111	6F	read ADC register	internal
ADCIR	112	70	ADC interrupt on/off	internal
ADCRS	113	71	ADC reset	internal
debug and test commands				
LZDBG	122	7A	debug command (running time variables of scale)	not in use
DIWCL	123	7B	various factory settings	not in use
DIDIG	124	7C	diag commands	not in use
DIMSC	125	7D	various commands	internal
DIDBG	126	7E	debug commands	not in use
DITST	127	7F	test commands	not in use
other commands				
RREST	51	33	DI301 RESET	

Table 13 - Commands of the PC-interface/CMD

The above commands are the complete set of DI301 DP commands. Selected commands will be described in section 4.2.2. below in connection with the relevant parameters, while section 4.3.4 will describe selected commands with parameters to be used in the Profibus.

4.1.5. Description of the status bytes

status byte ST - meaning of the bits

bit 1:	00000001	status -> error bit
bit 2:	00000010	reserve
bit 3:	00000100	status -> underload (bridge 1 or 2)
bit 4:	00001000	status -> overload (bridge 1 or 2)
bit 5:	00010000	status -> strain gauge bridge error (bridge 1 or 2)
bit 6:	00100000	reserve
bit 7:	01000000	status -> extension board exists
bit 8:	10000000	status -> default setup

4.1.6. Description of the error bytes

The DI301 DP 2 sends error bytes (global errors) with each response telegram. Special error bytes can be requested for each command for a more detailed and precise error diagnose.

4.1.6.1. Global errors

byte 1 - meaning of the bits

bit 1:	00000001	initialization error
bit 2:	00000010	setup error
bit 3:	00000100	interface error (RS232/485)
bit 4:	00001000	ADC error
bit 5:	00010000	strain gauge bridge error
bit 6:	00100000	hardware error (general)
bit 7:	01000000	reserve
bit 8:	10000000	Profibus error

byte 2 - meaning of the bits

bit 1…bit 8		reserve

4.1.6.2. Special errors

byte 1 - initialization error :

bit 1:	00000001	initialization error
bit 2…bit 8		reserve

byte 2 – setup error :

bit 1:	00000001	setup FAIL
bit 2:	00000010	setup CSUM
bit 3:	00000100	setup VALID
bit 4:	00001000	setup WRITE
bit 5:	00010000	setup READ
bit 6:	00100000	setup DEFAULT
bit 7:	01000000	setup BLOCK
bit 8:	10000000	reserve

byte 3 – COM error :

bit 1:	00000001	CSUM error
bit 2:	00000010	CMD error
bit 3:	00000100	TIMEOUT
bit 4:	00001000	BUF-FAIL
bit 5:	00010000	SEND-BLOCK error
bit 6… bit 8		reserve

byte 4 – ADC error :

bit 1:	00000001	initialization error
bit 2:	00000010	general error
bit 3:	00000100	error ADC measured value buffer channel 1
bit 4:	00001000	error ADC measured value buffer channel 2
bit 5… bit 8		reserve

byte 5 - strain gauge bridge error :

bit 1:	00000001	supply interruption SE, EXC
bit 2:	00000010	error bridge 1
bit 3:	00000100	error bridge 2
bit 4:	00001000	error bridge 1 - overload
bit 5:	00010000	error bridge 2 - overload
bit 6:	00001000	error bridge 1 - underload
bit 7:	00010000	error bridge 2 - underload
bit 8:	10000000	error sum channel - overload

byte 6 – hardware error (general):

bit 1:	00000001	RAM error
bit 2:	00000010	LCD error
bit 3:	00000100	RTC error
bit 4:	00001000	EEPROM error
bit 5:	00010000	error on the extension board
bit 7:	01000000	address error (HW-Adr)
bit 8		reserve

byte 7 – Profibus error :

bit 1:	00000001	error SPC3
bit 2:	00000010	error PRM
bit 3:	00000100	error CFG
bit 4… bit 8		reserve

4.2. Description for users of the RS232/RS485

4.2.1. General notes on the protocol used

The DI301 DP communicates with higher-level equipment (master) via polling and response telegrams. The user can influence the data exchange via RS232/RS485 in the desired data format (string, measured ADC value as long number) by different polling telegrams. The DI301 DP will be addressed in an RS485 bus via its set address. A connection via RS232 does not require a specific address, since address 1 will be used.

4.2.2. DI301 DP polling and response telegrams

The bytes in the following descriptions will be represented as hexadecimal numbers! When stating the examples in the ASCII version, the hexadecimal numbers will be represented as <xx>, the plain ASCII text as string.

The check sum (BCC1/2) will be calculated as a 16-bit check sum from ADR until the end of the data/parameters as addition to the individual bytes and subsequent one's complement of this sum and added to the telegram.

Here is a code example for C.

```
unsigned short calc_csum(unsigned char * data, unsigned int len)
{
 unsigned int i, end_adr;
 unsigned long csum = 0;

 // add data bytewise
 for(i = 0; i < len; i++)
 csum = csum + (unsigned long) data[i];

 // one's complement of the sum
 csum = ~csum;

 return (unsigned short)csum;
}
```

Commands for adjustment functions (calibration)

Important note!

For using the adjustment function, set one-channel operations with the command ADMOD and a conversion rate of 25 Hz in the 2-channel mode of the DI301 DP and set the associated channel as desired with the command RCHAN!

CALNC load calibration zero

call from the master:
CMD byte (command): 0x03 / 3 (decimal)

example (hexadecimal): 02 01 03 03 00 00 FF F8 03

response from the slave:
response telegram (confirmation) after a waiting period (of approx. 6-8 sec)

example (hexadecimal): 02 01 03 83 00 00 FF 78 03

CALEC — load calibration end point with the weight being stated

call from the master:

CMD byte (command):	0x04 / 4 (decimal)	
parameter byte 1:	01	weight data as string
parameter byte 2-n:	xxx	string

example (hexadecimal): 02 01 07 04 00 00 01 34 30 30 FF 5E 03

example (ASCII): <02><01><07><04><00><00><01>400<FF><5E><03>

calibration with a load of 400 (kg).

response from the slave:
response telegram (confirmation) after a waiting time (approx.6-8s).

example (hexadecimal): 02 01 03 84 00 00 FF 77 03

CALZU — load calibration additional point

call from the master:

CMD byte (command):	0x05 / 5 (decimal)	
parameter byte 1:	01	weight data as string
parameter byte 2-n:	xxx	string

Up to 6 additional points can be calibrated, which will be sorted in automatically by the firmware of the DI301 DP.

example (hexadecimal): 02 01 07 05 00 00 01 32 35 30 FF 5A 03

example (ASCII): <02><01><07><05><00><00><01>250<FF><5A><03>

calibration of a control point with a load of 250 (kg).

response from the slave:
response telegram (confirmation) after a waiting time (of approx.6-8 sec).

example (hexadecimal): 02 01 03 85 00 00 FF 76 03

CALST — inquire the number of calibrated control points

call from the master:

CMD byte (command):	0x21 / 33 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2

A total of 8 control points can be calibrated. This includes zero and the end point, i.e. 6 additional control points can be calibrated.

example (hexadecimal): 02 01 04 21 00 00 01 FF D8 03

response from the slave:
response telegram contains one byte (number of calibrated additional points).

example (hexadecimal): 02 01 04 A1 00 00 03 FF 56 03

The calibration includes 3 control points (zero, end point and 1 additional control value).

commands for setting the mode and the measuring channel of the DI301 DP

ADMOD — setting the mode of the DI301 DP

The DI301 DP can only be operated in one-channel operations with measuring channel 1!

call from the master:

CMD byte (command):	0x18 / 24 (decimal)	
parameter byte 1:	00	one-channel operations
	01	two-channel operations
parameter byte 2:		internal sampling rate [1/s]
		one-channel operations / two-channel operations
	00	25 / 3
	01	50 / 5
	02	100 / 8
	03	200 / 12
	04	400 / 15
	05	800 / 20
	06	1600 / 20

example 1 (hexadecimal): 02 01 05 18 00 00 00 04 FF DD 03

Switching on one-channel operations with a sampling rate of 400 1/s.

example 2 (hexadecimal): 02 01 05 18 00 00 01 04 FF DC 03

Switching on two-channel operations with an internal sampling rate of 15 1/s.

response from the slave:
response telegram (confirmation).

example 1 (hexadecimal): 02 01 03 98 00 00 FF 63 03

example 2 (hexadecimal): 02 01 03 98 00 00 FF 63 03

RCHAN — setting the measuring channel of the DI301 DP

call from the master:

CMD byte (command):	0x1A / 26 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2

example (hexadecimal): 02 01 04 1A 00 00 01 FF DF 03

Switching on measuring channel 1.

response from the slave:
response telegram (confirmation).

example (hexadecimal): 02 01 03 9A 00 00 FF 61 03

commands for measuring functions

DIBNT — inquiring gross/net/tare

call from the master:

CMD byte (command):	0x28 / 40 (decimal)	
parameter byte 1:	00	gross/net/tare (channel 1/2)
	01	gross (channel 1/2)
	02	net (channel 1/2)
	03	tare (channel 1/2)
	14	gross/net/tare (sum channel)
	15	gross (sum channel)
	16	net (sum channel)
	17	tare (sum channel)
parameter byte 2:	01	measuring channel 1
	02	measuring channel 2

example (hexadecimal): 02 01 05 28 00 00 01 01 FF D0 03

inquiring gross/net/tare for measuring channel 1.

response from the slave:

response byte 1:	Cx	channel identifier (x=1/2/S)
response byte 2:	:	separator
response byte 3-n:	xxx	weight string with measuring unit (incl. seperator)

example (hexadecimal): 02 01 23 A8 00 00 3E 43 31 3A 42 32 39 39 2E 35 20 6B 67 3A 4E 32 39 39 2E 35 20 6B 67 3A 54 30 2E 30 20 6B 67 3C F7 41 03

example (ASCII): <02><01><23><A8><00><00>C1:B299.5 kg:N299.5 kg:T0.0 kg<<F7><41><03>

The response of the slave includes the identification and data of measuring channel 1 (C1) and the identifications and data for gross (B299.5 kg), net (N299.5 kg) and tare (T0.0 kg). The response string will be marked with > and < on both ends, the individual values separated from each other by a colon „:".

RTARA — weighing function - taring (setting the tare memory)

call from the master:

CMD byte (command):	0x10 / 16 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2
parameter byte 2:	00	tare value not saved
	01	tare value saved

example (hexadecimal): 02 01 05 10 00 00 01 FF E8 03

response from the slave:
response telegram (confirmation).

example (hexadecimal): 02 01 03 90 00 00 FF 6B 03

RTARS — weighing function – taring with weight data

call from the master:

CMD byte (command):	0x1C / 28 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2
parameter byte 2:	01	weight data as string
parameter byte3-n:	xxx	taring weight as string without measuring unit

example (hexadecimal): 02 01 09 1C 00 00 01 32 35 30 2E 30 FE E3 03

example (ASCII): <02><01><09><1C><00><00><01>250.0<FE><E3><03>

taring with 250.0 kg being stated at a final weight of 300.0 kg

response from the slave:
response telegram (confirmation).

example (hexadecimal): 02 01 03 9C 00 00 FF 60 03

RNULL — weighing function - zeroing

call from the master:

CMD byte (command):	0x1B / 27 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2

example (hexadecimal): 02 01 04 1B 00 00 01 FF DE 03

response from the slave:
response telegram (confirmation).

example (hexadecimal): 02 01 03 9B 00 00 FF 60 03

SADWU — inquire filtered ADC value (average value)

call from the master:

CMD byte (command):	0x11 / 17 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2
parameter byte 2:	00	
parameter byte 3:	00	

example (hexadecimal): 02 01 06 11 00 00 01 00 00 FF E6 03

response from the slave:
The response telegram contains the current filtered ADC value (long value). The 4 bytes of the long value will be transmitted, an input value of 2 mV/V corresponds to a value of 2.000.000 (2 million, as an example).

example (hexadecimal): 02 01 08 91 00 00 01 00 1E 78 2A FE A4 03

SMNRM — inquire standardized value

The response contains the standardized value of the measuring channel in per cent as far as the scaling is concerned.

call from the master:

CMD byte:	0x15 / 21 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2

example (hexadecimal): 02 01 04 15 00 00 01 FF E4 03

response from the slave:
The response telegram contains the current standardized value of the measuring channel as a float number, i.e. the 4 bytes of the float value will be transmitted.

example (hexadecimal): 02 01 07 95 00 00 BB AE F5 06 FC FE 03

SMWMV — inquire the current measured value in mV/V

call from the master:

CMD byte:	0x17 / 23 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2
parameter byte 2:	01	

example (hexadecimal): 02 01 05 17 00 00 01 01 FF E0 03

response from the slave:
The response telegram contains the current standardized value of the measuring channel as float number, i.e. the 4 bytes of the float value will be transmitted.

example (hexadecimal): 02 01 0C 97 00 00 31 31 2E 39 39 36 35 30 36 FD 88 03

SCONT — send the ADC/weight values continuously (current measuring channel)

The function „Send weight values continuously" may also be activated via "Setup/Parameters", which will initiate the continuous transmission of the values after the equipment has been started.

call from the master:

CMD byte:	0x12 / 18 (decimal)	
parameter byte 1:	00	stop
	01	start
parameter byte 2:	00	ADC values
	01	weight values

example1 (hexadecimal): 02 01 05 12 00 00 01 01 FF E5 03

switching on the continuous transmission of the weight values

example2 (hexadecimal): 02 01 05 12 00 00 00 01 FF E6 03

switching off the continuous transmission of the weight values; no response from the device!

example3 (hexadecimal): 02 01 05 12 00 00 01 00 FF E6 03

switching on the continuous transmission of the ADC values

example4 (hexadecimal): 02 01 05 12 00 00 00 00 FF E6 03

switching off the continuous transmission of the ADC values

Please note: When activating the continuous issue of the ADC values, the ADC source values will be transmitted directly and without standardization/scaling to the interface, i.e. the 4 bytes of the ADC value (long value) will be transmitted. An input value of 2 mV/V corresponds to a value of 2.000.000 (2 million, as an example). This is only possible with the 1st ADC channel and requires the deactivation of the 2nd channel!

response from the slave:
response telegram (confirmation). Start of the continuous transmission of the measured values, which will be sent directly without protocol overhead in the form of command DIBNT (see above).

example1 (hexadecimal): 3E 43 31 3A 42 31 38 32 2E 38 20 6B 67 3A 4E 31 38 32 3E 38 20 6B 67 3A 54 30 2E 30 20 6B 673C

example1 (ASCII): >C1:B182.8 kg:N182.8 kg:T0.0 kg<

Please note: The ADC values will be transmitted in a frame with <STX><4 byte long values><ETX>.

Additional functions

RMMON measurement of the minimum/maximum values (ADC value) on/off

call from the slave:

CMD byte:	0x14 / 20 (decimal)	
parameter byte 1:	00	off
	01	on

example1 (hexadecimal): 02 01 04 14 00 00 01 FF E5 03

switching on the measurement of the minimum/maximum values.

example2 (hexadecimal): 02 01 04 14 00 00 00 FF E6 03

switching off the measurement of the minimum/maximum values.

response from the slave:
response telegram (confirmation).

example 1 (hexadecimal): 02 01 03 94 00 00 FF 67 03

example 2 (hexadecimal): 02 01 03 94 00 00 FF 67 03

SMMWE inquire the minimum/maximum values

call from the slave:

CMD byte:	0x16 / 22 (decimal)	
parameter byte 1:	01	measuring channel 1
	02	measuring channel 2
parameter byte 2:	00	minimum value
	01	maximum value
parameter byte 3:	00	ADC value (long value)
	01	weight value (string)

example1 (hexadecimal): 02 01 06 16 00 00 01 00 00 FF E1 03

minimum value (ADC-value) of measuring channel 1

example2 (hexadecimal): 02 01 06 16 00 01 01 00 00 FF E1 03

maximum value (ADC value) of measuring channel 1

response from the slave:
The response telegram with the ADC value (depending on parameter 1) in the form of a long value (4 bytes) corresponds an input value of 2 mV/V with a value of 2.000.000 (2 million, as an example).

example 1 (hexadecimal): 02 01 07 96 00 00 00 0C B1 E9 FD BB 03

minimum value (ADC value) of measuring channel 1 (831977).

example 2 (hexadecimal): 02 01 07 96 00 00 00 1E 72 76 FE 5B 03

maximum value (ADC value) of measuring channel 1 (1995382).

Other commands

ERRCD — inquire/reset error byte(s)

call from the slave:
CMD byte (command): 0x50 / 80 (decimal)

parameter byte 1:	01	read
	02	write (reset error byte(s))
parameter byte 2:	00	error byte 1 and error byte 2
	01	error byte Init
	02	error byte setup
	04	error byte Com
	08	error byte ADC
	10	error byte weighing cell
	20	error byte hardware
	80	error byte Profibus

example1 (hexadecimal): 02 01 05 00 00 01 00 FF A8 03

inquire error bytes 1 and 2.

example2 (hexadecimal): 02 01 04 50 00 00 02 FF A8 03

erase/reset of error bytes 1 and 2 – NO response from the DI301 DP!

response from the slave:
response telegram depending on the parameter byte(s); the meaning of the status byte and of the individual error bits are described in section 4.1.5./4.1.6. above.

example1 (hexadecimal): 02 01 05 D0 00 09 10 00 FF 10 03

The response telegram in example 1 illustrates that the status byte has set bit 0 (error) and bit 3 (underload) and the error byte 1 bit 4 (strain gauge bridge error).

RREST — Reset DI301

call from the slave:
CMD byte (command): 0x1B / 27 (decimal)

parameter byte 1:	00	hard reset
	01	soft reset

example (hexadecimal): 02 01 04 33 00 00 00 FF C7 03

response from the slave:
response telegram (confirmation), reset and re-start of the DI301.

example (hexadecimal): 02 01 03 B3 00 00 FF 48 03

Please note: The commands for the setup are encapsulated via the settings of the DI301 DP service program XKS265.

4.3. Description for users of the DI301 DP Profibus

The standard Profibus DP and its standardization according to IEC61158 are widely used in the industry and its application becomes more and more popular. It is for this reason that we have adapted our new digital sensor interface to this field bus. As an alternative to the Profibus DP, the RS232/RS485 interface with an A.S.T.- specific BUS protocol will continue to be available also in the future (see chapter 4.2 above).

4.3.1. Profibus-DP interface DI301 DP

transmission protocol:	Profibus-DPV0 - slave according to IEC61158
transmission rates:	9.6 KBit/s … 12 MBit/s
electrical isolation:	interface metallically separated with opto-couplers insulation voltage U > 500V
termination resistance:	via DIL switch (see Fig. 2) cable type A: (390Ω - 220Ω - 390Ω)
field bus connection:	M12 socket, B-coded (see Fig. 2)
operating modes:	sync and freeze mode will not be supported
addressing:	ADR up to 125 subscribers via DIL-switch or setup parameters settable (see **Fig. 2**)
Ident No.:	0x0939 (2361)
parameterization data:	via the RS232 parameterization interface only
diagnosis information:	6-byte system diagnosis according to the standard 12-byte equipment-specific diagnosis
data exchange buffer:	4-byte OUT / 16-byte IN
GSD file:	AST_0939.gsd

4.3.2. General notes on the protocol used

The DI301 DP communicates with higher-level equipment (master) via polling and response telegrams. Only a limited number of the commands, otherwise available from the DI301 DP, can be used for the communication via the Profibus DP. The master will have to take into account that the DI301 DP slave may have maximum response times. A polling telegram without response will be acknowledged with ACK (0x06), an invalid telegram with NAK (0x15).

The Profibus will only transmit operating commands, while the DI301 DP is generally parameterized and scaled via the RS232 parameterization interface with a special parameterization cable.

4.3.3. DI301 DP data format

The user can influence the data exchange via the Profibus in the desired data format (string, measured ADC value as long number) by different polling telegrams. The desired data format requires different transmission settings that are pre-determined by the GSD-file.

Command telegrams to the slave will be transmitted with 4 bytes, response telegrams from slave with a length of 16 bytes. 0 (0x00) will be transmitted for unused bytes. The first byte transmitted in a response telegram is the status byte. The meaning of the individual bits has been described in section 4.1.5. above.

4.3.4. DI301 DP Profibus polling and response telegrams

The bytes in the following descriptions and tables will be represented as hexadecimal numbers!

DIBNT Sending gross/net/tare

call from the master:

byte 1: command 0x28 40 (decimal)
byte 2: parameters: 01 gross (channel 1/2)
02 net (channel 1/2)
03 tare (channel 1/2)
15 gross (sum channel)
byte 3: parameters: 01 measuring channel 1
02 measuring channel 2
byte 4: parameters: 00 no concurrent transmission of data via RS232
01 concurrent transmission of data via RS232

response from the slave (16 byte Profibus):

byte 1: S status byte
byte 2: C channel identifier (1 = channel 1; 2 = channel 2; S = sum channel)
byte 3: : separator (0x3A)
byte 4...byte 15 weight string:
6 digits before the decimal point (B) + 1 digit for the decimal point + 3 digits after the decimal point (A) + 2 digits for the measuring unit; the string is right-aligned (U)
byte 16: toggle byte (0x01/0x00)

→ weight string:
byte 4: B1 digit 1 before the decimal point
byte 5: B2 digit 2 before the decimal point
byte 6: B3 digit 3 before the decimal point
byte 7: B4 digit 4 before the decimal point
byte 8: B5 digit 5 before the decimal point
byte 9: B6 digit 6 before the decimal point
byte 10: . decimal point (0x2E)
byte 11: A1 digit 1 after the decimal point
byte 12: A2 digit 2 after the decimal point
byte 13: A3 digit 3 after the decimal point
byte 14: U1 measuring unit
byte 15: U2 measuring unit

byte No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
call	28	XX	XX	XX												
response	S	C	3A	B1	B2	B3	B4	B5	B6	2E	A1	A2	A3	U1	U2	Toggle

example (hexadecimal): 31 3A 30 30 30 32 39 39 2E 39 30 30 6B 67 01

example (ASCII): 1:000299.900kg<01>

The response is a weight string of 299.900 kg for measuring channel 1; the toggle byte is set (0x01).

RTARA weighing function - taring (tare memory set)

call from the slave:

byte 1: command 0x10 16 (decimal)
byte 2: parameters 01 measuring channel 1
02 measuring channel 2
byte 3: parameters 00 no saving of tare values
01 saving the tare values
byte 4: 00

byte No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
call	10	00	00	00												
response	S	06	00	00	00	00	00	00	00	00	00	00	00	00	00	00

RNULL weighing function - zeroing

call from the slave:

byte 1: command 0x1B 27 (decimal)
byte 2: parameters 01 measuring channel 1
02 measuring channel 2
byte 3: 00
byte 4: 00

byte No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
call	1B	00	00	00												
response	S	06	00	00	00	00	00	00	00	00	00	00	00	00	00	00

SADWU sending ADC value filtered

The response covers the value range 0...2000000d or 0…1E8480h (2 million)

call from the slave:

byte 1: command 0x11 17 (decimal)
byte 2: parameters: 01 measuring channel 1
02 measuring channel 2
byte 3: parameters: 01 sending also via RS232
00 no transmission via RS232
byte 4: parameters: 00 4 byte average value (long value)
01 string (0...2 million)

example: measured value 2.000.000 (2 million) parts – response: 16 bytes as string

byte No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
call	11	00	00	00												
response	S	32	30	30	30	30	30	30	00	00	00	00	00	00	00	00

ERRCD inquire/reset error byte(s)

call from the slave:

byte 1: command	0x50	80 (decimal)
byte 2: parameters	01	read
	02	write/erase
byte 3: parameters	00	error byte 1 and error byte 2
	01	error byte Init
	02	error byte setup
	04	error byte Com
	08	error byte ADC
	10	error byte weighing cell
	20	error byte hardware
	80	error byte Profibus
byte 4: 00		

example: inquire error bytes 1 and 2

byte No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
call	50	01	00	00												
response	S	E1	E2	00	00	00	00	00	00	00	00	00	00	00	00	00

unknown command to slave

the slave will acknowledge an unknown command with NAK (0x15)

byte No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
call	XX	00	00	00												
response	S	15	00	00	00	00	00	00	00	00	00	00	00	00	00	00

4.3.5. Extended diagnosis data

The DI301 DP makes 12 bytes as extended diagnosis data available, which have the following meaning:

byte 1 :	status byte
byte 2,3:	global error byte
byte 4 ... 10:	special error bytes
byte 11,12:	reserve

The meaning of the bit positions of the status bytes and of the individual error bytes has been explained in sections 4.1.5 and 4.1.6. above.

Subject to technical alterations. 03/2007
A.S.T. Angewandte SYSTEM-TECHNIK GmbH Dresden

5. Technical data

input strain gauge		one-channel operations	two-channel operations
connecting equipment		6 conductors	channel 1: 6-conductor system channel 2: 4-conductor system
admissible bridge resistance	Ω	87...2000	
input signal (S)	mV/V	-3...3	
supply voltage for the strain gauge bridge	VDC	±2.5	
standard input signal			
standard signal		0 (+4)...+20 mA or 0... ±10 V	
output			
- Profibus		Profibus DP V0 … 12 Mbit/s, IEC 61158	
- asynchronous protocol RS 485		bus-compatible, maximum: 16 subscribers, 9600 Baud	
measuring characteristics			
external measured-value output rate	Hz	up to 400	up to 15 per channel
internal conversion rate	Hz	Max. 1600	
internal resolution	bit	24	
power supply			
voltage range	VDC	9 ... 36	
power consumption at 24V (w/o load transducer)	mA	approx. 60	
ambient conditions			
operating temperature range	°C	- 20...+ 60	
storage temperature range	°C	- 25...+ 85	
error at S = 2 mV/V			
error for strain gauge-bridge	%S	0,01	
linearity	%S	0,0015	
noise-limited resolution of measured value at 2mV/V	bit	14 … 19 (depending on the measuring rate)	
input sensitivity for 1 LSB	nV	5	
zero drift	nV/K	20	
design details		die-cast aluminum housing	
weight	Kg	0,4	
dimensions (W x H x D)	mm	125 x 80 x 57	
protection class pursuant to EN 60529		IP 65	
internal terminal strips		0,14 ... 1mm²	
internal parameterization interface		RS232	

5.1. Transmission speed

The transmission speed of the measured values via the serial interface depends on the internal parameterization and on the interface conditions of the DI301. By taking the response times of the DI301 DP (maximum 50 ms) and of the host (approx. 25 ms) into account, the following situation may arise under the most unfavorable conditions:

transmission rate Bd	**RS232/RS485**	**RS232/RS485**
	polling mode (sampling values [1/s])	continuous mode (sampling values [1/s])
	(filtered measured values or weight values related to measuring units)	unfiltered AD conversion values
19200	15	400

RS232/RS485	Profibus
log memory [measured value/s]	DP slave cycle [measured value/s]
25/50/100/200/400/800/1600	approx. 15
measured values cannot be transmitted in real time	with a DP cycle time of 1ms response time DI301 DP: 50ms response time host: 25ms

6. Dimensioned drawings