Instruction for Use

021578/12/08

Baro Transmitter

3.1157.10.0xx

Safety Instructions, Environment, Documentation

Operating Instructions

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- We can accept no liability whatsoever for any losses arising from the information contained in this document.

- Subject to modification in terms of content.

- The device should not be passed on without the/these operating instructions.

Safety Instructions

- Read through the operating instructions before using the device for the first time.

- The device may only be fitted and connected by a qualified technician who is familar with and observes the engineering regulations, provisions and standards applicable in each case.

- The device may only be fitted and connected when de-energised.

- **Adolf Thies GmbH & Co KG** guarantees proper functioning of the device provided that no modifications have been made to the mechanics, electronics or software and that the following points are observed.

- All information, warnings and instructions for use included in these operating instructions must be taken into account and observed as this is essential to ensure troublefree operation and a safe condition of the measuring system.

- The device is only designed for a specific application as described in these operating instructions.

- They device should only be operated with the accessories and consumables supplied and/or recommended by **Adolf Thies GmbH & Co KG**.

- Repairs may only be carried out by trained staff or **Adolf Thies GmbH & Co KG**. Only components and spare parts supplied and/or recommended by **Adolf Thies GmbH & Co KG** should be used for repairs.

- Opening the device may expose live parts possibly posing a lethal hazard if touched. It should only be opened for the purpose of repair by trained staff.

- When using the device, it must be ensured that it is not subjected to a service condition which might bring about damage to objects or present a risk to persons.

- All users must be constantly instructed about handling and safety of the device.

- Adjustment and maintenance performed while the opened device is energised may only be carried out by qualified technicians who are aware of the associated risk.

- The device may only be operated by trained technicians whose qualifications enable them to comply with the safety measures necessary during use of the device.

- In the event of any malfunction the device should no longer be used.

- The measuring results do not only depend on correct usage, installation and functioning of the device, but are also influenced by other factors. It is therefore necessary to check the results supplied by the measuring system for plausibility before taking action on the basis of such measuring results.

Environment

- As a longstanding manufacturer of sensors Adolf Thies GmbH & Co KG is committed to the objectives of environmental protection and is therefore willing to take back all supplied products governed by the provisions of "*ElektroG*" (German Electrical and Electronic Equipment Act) and to perform environmentally compatible disposal and recycling. We are prepared to take back all Thies products concerned free of charge if returned to Thies by our customers carriage-paid.

- Make sure you retain packaging for storage or transport of products. Should packaging however no longer be required, arrange for recycling as the packaging materials are designed to be recycled.

Contents

Tables

Figures

1   Models available

Description	Order-No.	Electrical Output	Meas. Range	Operating voltage
Baro Transmitter	3.1157.10.000	Digital: 1 x RS485 1 x 300...1100 Hz	300...1100 hPa	5…24 V DC
		Analogue: 1 x 0...5 V set: 800...1060 hPa	scalable: 300...1100 hPa	8...24 V DC
Baro Transmitter	3.1157.10.040	Digital: 1 x RS485 1 x 300...1100 Hz	300...1100 hPa	5…24 V DC
		Analogue: 1 x 0...20 mA set: 600...1060 hPa	scalable: 300...1100 hPa	12…24 V DC
Baro Transmitter	3.1157.10.041	Digital: 1 x RS485 1 x 300...1100 Hz	300...1100 hPa	5…24 V DC
		Analogue: 1 x 4... 20 mA set: 600...1060 hPa	scalable: 300...1100 hPa	12...24 V DC
Baro Transmitter	3.1157.10.061	Digital: 1 x RS485 1 x 300...1100 Hz	300...1100 hPa	5…24 V DC
		Analogue: 1 x 0...10 V set: 600...1060 hPa	scalable: 300...1100 hPa	12...24 V DC

2   Application / Construction / Mode of operation

The baro transmitter measures the „absolute air pressure" of the atmosphere at the location.

It is designed for application in the field of environmental protection, where high accuracy, quick responding behaviour, long-term sturdiness and reliability are required.
The instrument is suited for indoor- and outdoor application.

In the baro transmitter a tempered, piezo-ceramic absolute-pressure-sensor is used, that features excellent thermal and mechanical sturdiness.

The electrical connection is carried out via an 8-pole terminal strip, and a special screwed cable gland with linear smoothing function for air pressure.

The following outputs are available:

1 x voltage-/ power output

1 x frequency output

1 x serial interface

The frequency output is an open collector output. A pull-up resistance can be connected to the output via a soldered bridge.

3 Mechanical Mounting

The baro transmitter can be operated in air (non-condensing) and in non-conductive gases.

Attention:
> **On application in liquids or aggressive gases the instrument can be destructed!**

The special screwed cable gland with linear smoothing function for air pressure should indicate downward.

Attention:
> **At the location of the baro transmitter as well as on application in a housing a pressure compensation to the atmospheric air pressure must be possible.**

The housing of the baro transmitter is suited for wall mounting or installation on other plane surfaces. For mounting, please remove the cover. The housing lower part can be mounted by appropriate screws through the now visible and accessible fixing borings ($\varnothing$ 4 mm).

Attention:
> **The electronics is situated in the cover of the baro transmitter.
> The instrument has to be opened only in dry ambience.
> The exposed electronics must not be damaged.**

4 Electrical Mounting

8-pole terminal strip		
No.	Description	Function
1	SHUTDOWN	Shutdown of baro transmitter
2	SUPPLY	5-24 VDC supply (+)
3	GND*	Supply, ground (-)
4	FREQUENCY	Frequency output
5	AGND*	Analogue signal, ground (-)
6	V_{OUT} / I_{OUT}	Analogue output
7	B	RS485 (Data+)
8	A	RS485 (Data-)
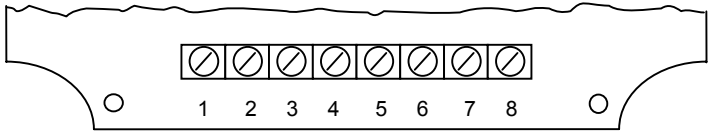
Table 1: Pin Assignment of Terminal Strip

* The pins AGND and GND are connected to the same electrical potential

The different outputs are usable at the same time. With the analogue output the analogue ground (AGND) has to be applied. For the frequency output AGND or GND is allowable. The baro transmitter is protected against polarity reversal.

5 Operating Mode

The baro transmitter can be used alternatively in two operating modes:

Active *mode* or *shutdown mode*.

In the **active mode** the baro transmitter outputs continuously measuring values after connection of power supply.

In the *shutdown mode* the baro transmitter can be turned on and off via an external trigger signal.

0V   = Baro transmitter off

5 ... 24V = Baro transmitter on

Remark:

The baro transmitter is delivered with factory-setting „active mode".

The respective operating mode is selected by means of the jumper P1 (see chapter 7).

6 Settings

The baro transmitter can be configured by means of jumpers and soldered bridges. The following figures show the position of the bridges and the coding table.
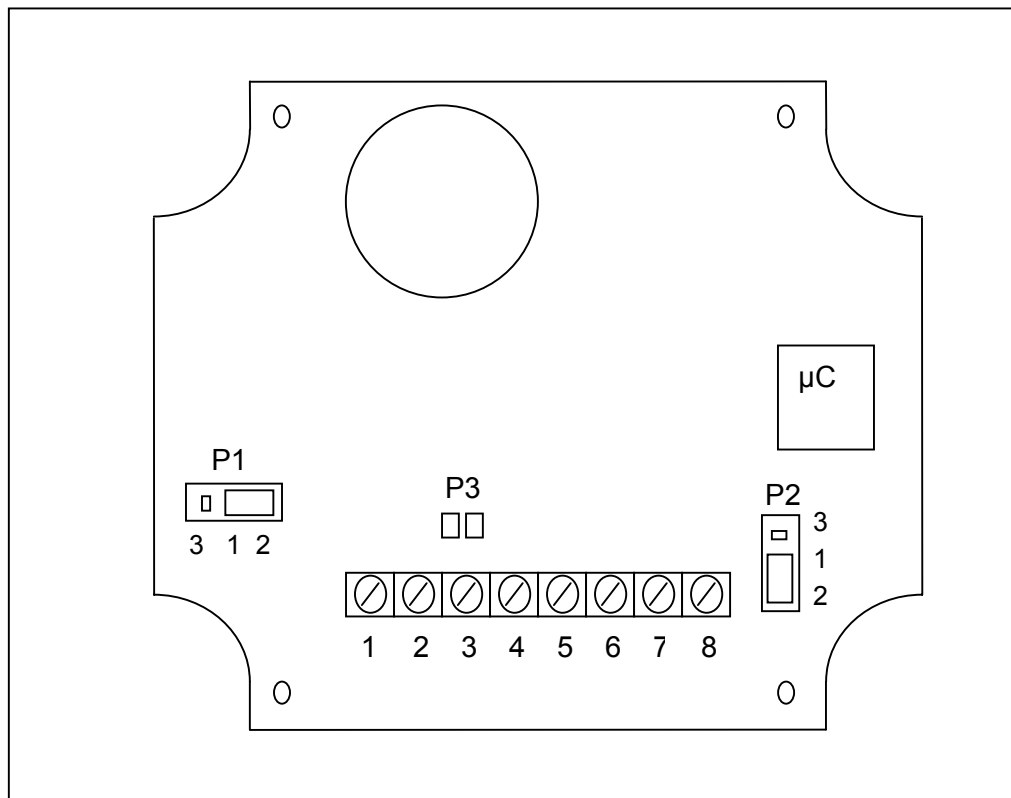
Figure 1:Position Jumper

Jumper / Soldered bridge			
Function	**P1**	**P2**	**P3**
SHUTDOWN Off *	1-2		
SHUTDOWN On	1-3		
RS485 termination off *		1-2	
RS485 termination on (120Ohm)		1-3	
Pull-up- resistance inactive *			O
Pull-up- resistance active (5,6kOhm)**			X

Table 2: Coding jumper / soldered bridge

O: open

X: closed

*: factory-setting

**: resistance at the frequency output (open collector output)

7 Analysis

Mathematical correlation between output variable and air pressure:

Output	Formula
Voltage output: 0...5V @ 800...1060hPa	$p = 800hPa + \dfrac{260hPa}{5V} \cdot U\,[\,V\,]$
Voltage output: 0...10V @ 600...1060hPa	$p = 600hPa + \dfrac{460hPa}{10V} \cdot U\,[\,V\,]$
Voltage output: 0...20mA @ 600...1060hPa	$p = 600hPa + \dfrac{460hPa}{20mA} \cdot I\,[\,mA\,]$
Voltage output: 4...20mA @ 600...1060hPa	$p = 600hPa + \dfrac{460hPa}{16mA} \cdot (\,I\,[\,mA\,] - 4mA\,)$
Frequency output: 300...1100Hz @ 300...1100hPa	$p = 1\dfrac{hPa}{Hz} \cdot f\,[Hz]$

8 Serial Communication

An RS485 interface is available for serial communication. It can be operated in half duplex mode at different baud rates.

A terminating resistor (120 Ω) can be hardware-connected by the jumper P2 (see chapter 7).

Software version number and bus-ID are output on starting the baro transmitter. Output with the selected baud rate.

Example:
THIES Baro comp.
v0.03-07
ID02

Factory-setting: ID = 0, baud rate = 9600, frame = 8N1

Bus operation

Thanks to the concept of the ID-based communication an operation in bus assembly is possible. Prerequisites are as follows:

- Different IDs of the individual bus parties
- Master- Slave structure, i.e. there is one instrument in the bus that queries cyclically the data of the individual instruments.

8.1 Data Telegram

The data output is carried out on query of the command TR.

The detailed construction is given in the following:

Data telegram:
<(STX)><pressure>;<temperature>;<status>*<check sum><CR><LF><ETX>

Character No.	Function
1	STX (HEX 02)
2	10^3 Air pressure in hPa
3	10^2 Air pressure in hPa
4	10^1 Air pressure in hPa
5	10^0 Air pressure in hPa
6	. Decimal point (HEX 2E)
7	10^{-1} Air pressure in hPa
8	10^{-2} Air pressure in hPa
9	Semicolon (HEX 3B)
10	Sign temperature (,+' or ,-')
11	10^1 Sensor temperature in °C
12	10^0 Sensor temperature in °C
13	. Decimal point (HEX 2E)
14	10^{-1} Sensor temperature in °C
15	Semicolon (HEX 3B)
16	High nibble status byte in HEX
17	Low nibble status byte in HEX
18	* (HEX 2A) check sum identification
19	High nibble check sum in HEX
20	Low nibble check sum in HEX
21	CR (HEX 0D) Carriage Return
22	LF (HEX 0A) line feed
23	ETX (HEX 03)

Control character:

CR – Carriage Return (13_{dec}; 0x0D)
LF – Line Feed (10_{dec}; 0x0A)
STX – Start of Text (2_{dec}; 0x02)
ETX – End of Text (3_{dec}; 0x03)

Separation character:

Separation character between the individual measuring values in the string is the semicolon ';'. The check sum separation character is the multiplication sign '*'.

Check sum:

The check sum is the XOR relation of all characters between <STX> and the byte <*>. The star serves as separation character of the check sum, and is not factored any more in the check sum.

Status:

In the baro transmitter there is a status byte available that outputs information on the status of the sensor.

Bit-Number	Function	Description
Bit 0	General malfunction	In case the internal pressure sensor is not correctly identified, bit 0 is set. Thus, all measured values of the telegram are invalid.
Bit 1	Heating control	Is one in case the heating control is active and the temperature is <49°C or >51°C. That way, this bit indicates if the standard deviation of temperature controller is within the range of +-1°C.
Bit 2	Heating on	Is one when the heating is active
Bit 3	Excess temperature	Is one if the temperature at the sensor is higher than 60°C.
Bit 4... Bit 7	Unused	These bits are presently not used and are always 0.

8.2 General Construction on Sending a Command

The baro transmitter has a command interpreter that can change the behaviour of the instrument. That way, for ex. the baud rate, the instrument ID can be modified:
Generally, a command is constructed as follows:

<id><command><CR>   or
<id><command><parameter><CR>

id: Baro transmitter – ID. It is always binary and in the range 00... 99

Command :   see list of commands

Parameter: A **five-digit** value for setting a new parameter value.

<CR>:   Carriage Return (13_{dec}; 0x0D)

In the baro transmitter a verification of the command-syntax is carried out. IF a correct command has been received, this is acknowledged by an „echo telegram".

Example: 00BR00005<CR>   transmission command

              !00BR00005<CR>   Echo telegram

If a command is sent to the instrument without the parameter value, that value is transmitted which was currently set.

Example: 00BR<CR>   transmission command

              !00BR00005<CR>   Echo telegram

In order to avoid an unintentional changing of parameter some commands (see list of commands) are saved by a "key". This „key" has to be transmitted before the actual command.

Example: Changing of Baud Rate

00KY00234<CR>   Key-saved command released

00BR00006<CR>   Baud rate set to 19200

> **Attention:**
>
> **The key-saved commands are released as long as the supply voltage is connected, or the command 00KY00000<CR> is transmitted.**

8.3 List of Commands

	Command	Description	KEY
Command AY	<id>AY<para>	Minimum value of the analogue output	yes
Command AZ	<id>AZ<para>	Maximum value of the analogue output	yes
Command BR	<id>BR<para>	Selecting the baud rate	yes
Command DP	<id>DP<para>	Time for mean value calculation	yes
Command HT	<id>HT<para>	Mode of heating control	yes
Command ID	<id>ID<para>	Instrument- ID	yes
Command KY	<id>KY<para>	Set key/pass word	no
Command PP	<id>PP<para>	Output of calibration value	no
Command PS	<id>PS<para>	Energy saving mode	yes
Command TR	<id>TR<para>	Telegram query	no

8.4 Commands and Description

Command AY

<id>AY<parameter><CR>	Scales the minimum value of the analogue output
Echo of command	!xxAYxxxxx<CR>
Access:	read / write
Description:	By the command AY the pressure value for the lower analogue output value is stated.
Value range:	300...1000
Initial value:	600 with 3.1157.10.040/041/061
	800 with 3.1157.10.000

Command AZ

<id>AZ<parameter><CR>	Scales the maximum value of the analogue output
Echo of command	!xxAZxxxxx<CR>
Access:	read / write
Description :	The required baud rate is set by the BR-command and the parameter 0000x..
Value range:	400...1100
Initial value:	1060

Command BR

<id>BR<parameter><CR>	Setting the baud rate
<id>BR<CR>	Query of the current BR-parameter
Echo of command	!xxBRxxxxx<CR>
Access:	read / write
Description:	The required baud rate is set by the BR-command and the parameter 0000x.

Parameter description:

Parameter	Description
00003	2400 baud (8n1)
00004	4800 baud (8n1)
00005	9600 baud (8n1)
00006	19200 baud (8n1)
00007	38400 baud (8n1)
00008	57600 baud (8n1)

Value range:	3 to 8
Initial value:	5

Command DP

<id>DP<parameter><CR>	mean value time
<id>DP<CR>	Query of the current DP-Parameter
Echo of command	!xxDPxxxxx<CR>
Access:	read / write

Description:	By command „DP" is set the time for the gliding mean value calculation of the pressure value.
Parameter description:	0: 1 second
	1: 2 seconds
	2: 4 seconds
	3: 8 seconds
	4: 16 seconds
Value range:	0...4
Initial value:	4

Command HT

<id>HT<parameter><CR>	Mode of the heating control
<id>HT<CR>	Query of the current HT-parameter
Echo of command	!xxHTxxxxx<CR>
Access:	read / write
Description:	The command „HT" is setting the mode of the heating control. Adjusting of sensor temperature to 50°C.
Parameter description:	0: heating off
	1: heating on
Value range:	0...1
Initial value:	1

Command ID

<id>ID<parameter><CR>	Setting the identification number
<id>ID<CR>	Query of current ID-parameter
Echo of command	!xxIDxxxxx<CR>
Access:	read / write
Description:	This command is setting the identification number. The ‚id' is used in every telegram of the measurement transducer. After the ‚id' has been changed the instrument replies immediately with the new ‚id'.
Value range:	0 to 99
Initial value:	0

Command KY

<id>KY<parameter><CR>	Key
Echo of command	!xxKYxxxxx<CR>
Access:	read / write
Description:	The value for the key (password) is set by the command „KY". A change of parameters is possible only when this value is set to „234".
Value range:	0 / 234
Initial value:	0

Command PP

<id>PP<CR>	Query of the current calibration parameters
Echo of command	--
Access:	read
Description:	The calibration parameters of the pressure sensor are output by the command „PP".
Response telegram:	< AC1=10459; // Parameter AC1
	< AC2=64447;// Parameter AC2
	< AC3=51002;// Parameter AC3
	< AC4=32770;// Parameter AC4
	< AC5=26335;// Parameter AC5
	< AC6=23458;// Parameter AC6
	< B1= 06348; // Parameter B1
	< B2= 00059; // Parameter B2
	< MB= 32768; // Parameter MB
	< MC= 54561; // Parameter MC
	< MD= 02400; // Parameter MD
Value range:	--
Initial value:	--

Command PS

<id>PS<parameter><CR>	Power Save
<id>PS<CR>	Query of the current PS parameter
Echo of command	!xxPSxxxxx<CR>
Access:	read / write
Description:	Energy saving mode is set by the command „PS".
Parameter description:	0: all outputs active

1: only RS485 active

2: only analogue output active

3: only frequency output active

4: only analogue- and frequency output active

5: only RS485 and analogue output active

6: only RS485 and frequency output active

7: only RS485 Receiver active (start-up via receipt of a sign)

8: all deactivated (start-up only via power-on-reset)

PS- mode	Power consumption in mA
0	10
1	9
2	7,0
3	6
4	7
5	10
6	9
7	3
8	0,25
Shutdown=0	1µA

Value range: 0...8

Initial value: 0

Command TR

<id>TR<00001><CR>   Query of measuring value

Echo of command   --

Access: read

Description: The command triggers a single transmission of the current measuring value.

Response telegram: <(STX)><pressure>;<temperature>;<status>*<check sum><CR><LF><ETX>

Value range: 1

Initial value: --

9 Maintenance

With proper mounting the instrument operates maintenance-free.

The measuring results are effective at the moment of factory-calibration. The user is responsible for repeat of calibration and determination of the date.

For the storing of the baro transmitter a dry, dust-free room with temperatures between –30...+70° is required. We recommend to store the instrument in a paperboard.

10 Technical Data

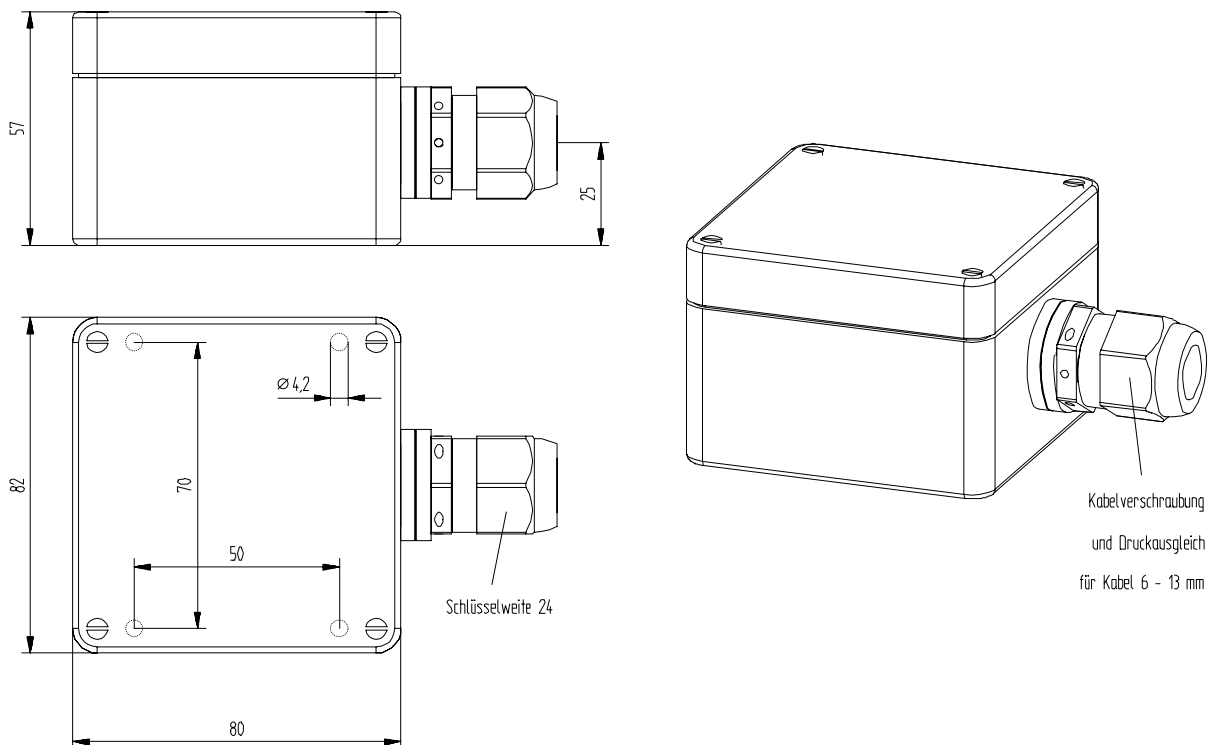| Pressure sensor		
	Type	Piezo resistive
Barometr. Air pressure	Measuring range	300...1100 hPa
	Resolution	0,01 hPa
	Accuracy with sensor heating @ -40.. 65°C	± 0,25 hPa
	Accuracy w/o sensor heating @ -20... 65°C	Typical ± 1 hPa
	Long-term stability	± 0,1 hPa / Jahr
Pressure sensor heating	Control temperature	50°C ±1°K
Serial Interface		
	Type	RS485
	Mode of operation	Half-duplex mode
	Data format	8N1
	Baud rate	2400, 4800, **9600**, 19200, 38400, 57600 115200
Frequency output		
	Measuring range	300 ...1100 hPa
	Frequency	300... 1100 Hz
Definition	Open collector, sink	$U_{max} \leq 30$ V, $I_{max} \leq 20mA$
	Pull-up-resistance active	U_{low} = 0V, U_{high} = 3V
Analogue output		
	Measuring range scalable factory-setting	300...1100 hPa 800...1060 hPa with 3.1157.10.000 600...1060 hPa with 3.1157.10.040/041/061
Voltage	Output (3.1157.10.000)	0...5V @ $U_B \geq$ 8V DC
	Output (3.1157.10.061)	0...10V @ $U_B \geq$ 12V DC
	R (load)	>50kΩ (output 0.. 10V), > 1kΩ (output 0... 5V)
Current	Output (3.1157.10.040)	0...20 mA,
	Output (3.1157.10.041)	4...20 mA,
	R_L(load)	$\leq$ 400Ω @ $U_B \geq$ 12V DC

General		
Operating voltage		(8)12...24 VDC
	On using digital outputs	5...24 VDC
	Power consumption at @ 12 V DC	10mA (max. 115mA with heating) 9mA (only RS485 active) 7mA (only analogue output active) 6mA (only frequency output active) 7mA (only analogue- and frequency-output active) 10mA (only RS485 and analogue-output active) 9mA (only RS485 and frequency output active) 3mA (only RS485 Receiver active) 1µA (in shutdown mode)
External Control	Shutdown mode	0 V = Baro transmitter off 5... 24 V = Baro transmitter on
Gliding mean value		1, 2, 4, 8, 16 sec
Ambient conditions	Temperature range	-40... +65 °C
	Humidity range	Non-condensing
Housing	Material	Polycarbonat
	Dimensions	Siehe Maßbild
	Weight	Ca. 015 Kg
	Protection	IP65
	Connection	Screwed cable gland and 8-pole terminal strip

11 Dimensional Drawing [in mm]

Kabelverschraubung

und Druckausgleich

für Kabel 6 - 13 mm

Schlüsselweite 24

12 EC-Declaration of Conformity

Document-No.: **000113**   Month: 12   Year: 08

Manufacturer: **A D O L F   T H I E S   G m b H   &   C o. K G**

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Description of Product: **Digital Baro Transmitter**

Article No.   **3.1157.10.000**   **3.1157.10.040**   **3.1157.10.041**   **3.1157.10.061**

specified technical data in the document: **021577/12/08**

The indicated products correspond to the essential requirement of the following European Directives and Regulations:

2004/108/EC   DIRECTIVE 2004/108/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 15 December 2004   on the approximation of the laws of the Member States relating to
electromagnetic compatibility and repealing Directive 89/336/EEC

2006/95/EC   DIRECTIVE 2006/95/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical
equipment designed for use within certain voltage limits

552/2004/EC   Regulation (EC) No 552/2004 of the European Parliament and the Council of 10 March 2004
on the interoperability of the European Air Traffic Management network
(the interoperability Regulation)

The indicated products comply with the regulations of the directives. This is proved by the compliance with the following standards:
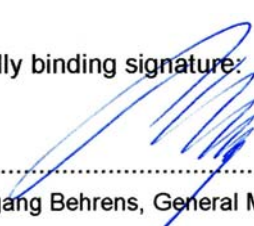
Reference number	Specification
IEC 61000-6-2: 2005	Electromagnetic compatibility Immunity for industrial environment
IEC 61000-6-3: 2006	Electromagnetic compatibility Emission standard for residential, commercial and light industrial environments
IEC 61010-1: 2001	Safety requirements for electrical equipment for measurement, control and laboratory use. Part 1: General requirements

Place: Göttingen   Date: 05.12.2008

Legally binding signature: issuer:

....
Wolfgang Behrens, General Manager   Joachim Beinhorn, Development Manager

This declaration certificates the compliance with the mentioned directives, however does not include any warranty of characteristics.
Please pay attention to the security advises of the provided instructions for use.

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