Lodam
BY BITZER GROUP

Dual Differential Pressure tranducer

Technical manual

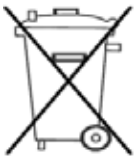
Version 3.0

DUAL DPT

Contents

1. Read this first

The contents of this manual are subject to change without notice. Lodam electronics holds the copyright to this user's manual. The user shall follow any instructions given in this user manual entirely and not only partly. Any non-following of this user manual result in exclusion of all warranties, guarantees, and liabilities.



Disposing of the parts of the controller:

INFORMATION FOR USERS ON THE CORRECT HANDLING OF WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

In reference to European Union directive 2012/19/EU and the related national legislation, please note that:

1. WEEE cannot be disposed of as municipal waste and such waste must be collected and disposed of separately;
2. The public or private waste collection systems defined by local legislation must be used. In addition, the equipment can be returned to the distributor at the end of its working life when buying new equipment;
3. The equipment may contain hazardous substances: the improper use or incorrect disposal of such may have negative effects on human health and on the environment;
4. The symbol (crossed-out wheeled bin) shown on the product or on the packaging and on the instruction sheet indicates that the equipment has been introduced onto the market after 13 August 2005 and that it must be disposed of separately;
5. In the event of illegal disposal of electrical and electronic waste, the penalties are specified by local waste disposal legislation.

1.1. Reading instructions

The following symbols are used to draw the reader's attention to different warning levels.

Important information.

Danger!! General danger.

1.2. User manual

Before installation the user should be thoroughly familiarized with this user manual, especially with purposes, installation and operation.

Special care should be taken when installing and connecting external equipment (air hoses and MODBUS communication cables) and handling the modules correctly according to protection against ESD.

Installation of the DUAL – DPT must be performed by authorized personnel only. All warranties are excluded in case installation is performed by unauthorized personnel or in case the DUAL – DPT has not been correctly installed.

2. General

The DUAL – DPT (Differential Pressure Transducer) is a general purpose differential pressure transducer for measuring air pressure. The DUAL – DPT has two integrated pressure sensor elements.

Application areas could be ventilation systems for monitoring filter status and this way tell the actual pollution level of the filter. Another area could be to measure pressure levels to obtain maximum efficiency and reliability of fans.

The DUAL – DPT has also an internal temperature sensor and connection for two external NTC temperature sensors – allowing measurement of the temperatures where the pressures are measured.

With one DUAL – DPT two pressures and two temperatures can be measured with just one unit. This ensures a simple installation and reduces the space needed. All connections are from one side.

Communication with the DUAL – DPT is via MODBUS (RTU) over RS485.

3. Definitions

Product range

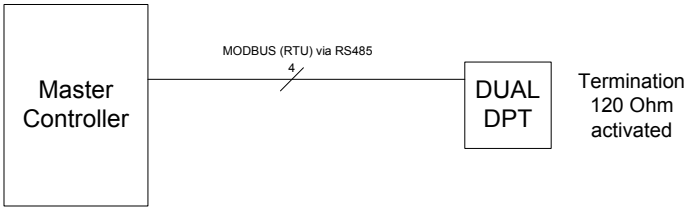
Definitions	
ESD	Electro Static Discharge
HW	Hardware/electronics
MODBUS	Application-layer messaging protocol - http://www.modbus.org/specs.php
NTC	Negative Temperature Coefficient
RS485	Hardware communication standard

4. How to...

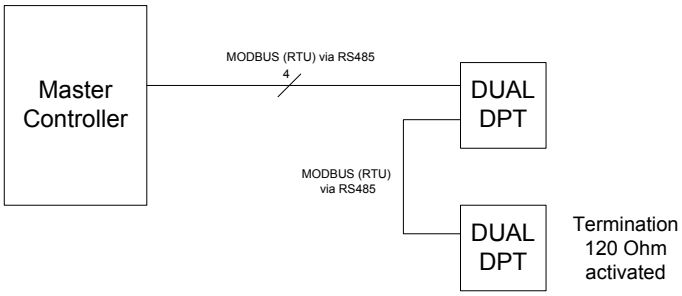
Connection samples
The DUAL – DPT is connected using a 4 wired connector (RS485).

There is 1 RS485 port but it is with two connections so the MODBUS signal can be looped on to the next device without having to use double wires in the terminals.

One master controller and one DUAL – DPT.



One master controller and two DUAL – DPT.

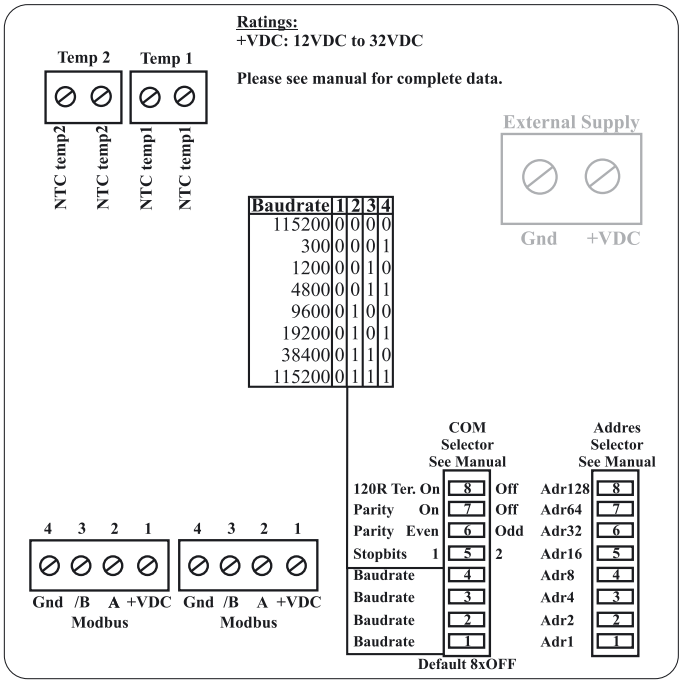


To ensure proper operation of the MODBUS communication both ends of the communication link must be terminated with a 120 Ohm resistor. The last DUAL – DPT on the bus must therefore be terminated with the on-board 120 Ohm termination resistor using DIP switch number 8 on the COM DIP switch.

Power for the DUAL - DPT is taken from the RS485 connection.

5. Connections

Connections on the module. Label inside the Dual – DPT module:

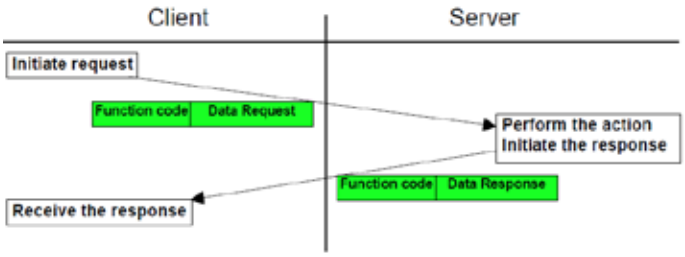


Note: The External Supply is a future option.

Terminal	Description
+VDC	Future option. External power supply, +12 VDC ~ +32 VDC
Gnd	Future option. Neutral
Temp1	NTC element 1 – two wires
Temp2	NTC element 2 – two wires
Modbus	2 connections - same port. Used for wiring/looping to the next DUAL – DPT unit.
Gnd	Neutral
/B	Data-; inverted signal
A	Data+; signal
+VDC	Power supply via RS485; +12 VDC ~ +32 VDC
COM selector	8-bit Dip switch for setting communication settings and Baud rate
Address selector	Setting the Modbus address in the range 1 – 254

6. Function

Communication with the DUAL – DPT is via MODBUS (RTU). Configuration and reading of pressures and temperatures from the DUAL – DPT is described in the following sections.



MODBUS configuration – register layout. Specification of the protocol:

Protocol:
Modbus (RTU mode).
Please see: http://www.modbus.org/specs.php

Modbus address:
DUAL – DPT-1250Pa uses default address 24.
DUAL – DPT-250Pa uses default address 25.

Baud rate:
Default 115200, but 9600 and 19200 are selectable

Number of data bits:
8

Number of stop bits:
Default 1, but 2 is selectable

Parity:
Default Even, but None and Odd are selectable

6.1. Overview of Modbus functions

Name	Address	Possible Values	Register type	Default	Description
Reserved	0x0000	-	Input register	-	Unused
Operation	0x0001	Bitmask field. 0x0001: Stopped 0x0002: Started 0x0008: Error 0x0080: Restarting	Input register		Stopped: Device stops performing its regulation. Started: Device is performing its regulation.
ErrCode	0x0002	0x0000-0xFFFF 0x0085 Wrong Opsignal	Input register	0x0000	Application error codes. Reflects a previous Opsignal command.
Pressure1	0x0003	0 to 1250	Input register	-	Pressure reading, transducer 1. Pa (signed short integer)
Pressure2	0x0004	0 to 1250	Input register	-	Pressure reading, transducer 2. Pa (signed short integer)
TempIn-ternal	0x0005	-10000 to 20000 (Scale 100)	Input register	-	Onboard temperature sensor. ºC (signed short integer)
TempEx-ternal1	0x0006	-10000 to 20000 (Scale 100)	Input register	-	External NTC sensor input 1. ºC (signed short integer) -7000 = not connected 15000 = short circuit
TempEx-ternal2	0x0007	-10000 to 20000 (Scale 100)	Input register	-	External NTC sensor input 2. ºC (signed short integer) -7000 = not connected 15000 = short circuit
DIPCOM	0x0013	0 to 127	Input register		Dip switch Com reading
DIPADDR	0x0014	0 to 255	Input register		Dip switch Com reading
AppStatus	0x0015	0: If nothing changed 1: If FilterC1 of FilterC2 is changed and not stored yet.	Input register	0	Dirty flag for FilterC1/ FilterC2
AppCm-dReply	0x0016	0: Ready 3: Load filter constant done 4: Store filter constant done 131: Load filter constant error 132: Store filter constant error	Input register		Application command reply
OpSignal	0x0800	Write 0x0000: Ready 0x0001: Stop 0x0002: Start 0x0008: Reset Error 0x0080: Restart	Holding register	0x0000	Ready – Commands can be issued (the sensor is always running) Stop – regulation Start – regulation Reset – operation error message Restart – reboot (after 3 seconds).
Calibrate	0x0801	Calibrate pressure sensors Writing 0x01 calibrates pressure sensor Read: (signed short int) -1: Failed 0: Calibration success 1: Calibrate 2: Using calibration value from eeprom 3: Not calibrated	Holding register		
FilterC1	0x0802	0 to 50	Holding register	0	Filter constant in seconds Use AppCmd to store setting
FilterC2	0x0803	0 to 50	Holding register	0	Filter constant in seconds Use AppCmd to store setting
AppCmd	0x0805	Application Commands 0: Ready 1: Clear 4: Load filter constant 5: Store filter constant	Holding register	0x0000	Application Commands See AppCmdReply for reply to AppCmd. 1: Clear AppCmdReply 4: Reload filter constants 5: Update and store filter constants
Sensor Type	0x0806	4: 1250 Pa Dual 5: 250 Pa Dual 6: 1250 Pa Single 7: 250 Pa Single	Holding register		Internal value, don't change

Name	Address	Possible Values	Register type	Default	Description
AppType	0xFF00	0x0000: Bootstrapper 0x0001: Bootloader 0x0002: Application	Input register	0x0002	Application type
AppID	0xFF01	0x0018 DPT1250 Dual 0x0019 DPT 250 Dual 0x0022 DPT1250 Single 0x0023 DPT 250 Single	Input register	0x0000	Application ID
SWRe-lease	0xFF02	0x0000 – 0xFFFF	Input register	-	SW release number
SWVersion	0xFF03	0x0000 – 0xFFFF	Input register	-	SW version number
SWLevel	0xFF04	0x0000 – 0xFFFF	Input register	-	SW level number
SWPatch	0xFF05	0x0000 – 0xFFFF	Input register	-	SW patch number

6.2. Pressure sensor calibration

To ensure a better accuracy, the DPT transducers can be calibrated. Calibration is initiated by writing 0x01 to the Calibrate register.

It is possible to calibrate the sensor if the pressure is within resting position: +300 Pa for the DPT-1250; +150 Pa for the DPT-250.

When calibrated the Calibrate register is reset to 0. If the calibration is rejected the value of Calibrate is set to -1.

6.3. Pressure readings

Read the following two input registers – regardless if it is a Dual - DPT 250 or a Dual - DPT 1250.

Name	Address	Possible Values	Register type	De-fault	Description
Pressure1	0x0003	0 to 1250	Input register	-	Pressure reading, transducer 1. Pa (signed short integer)
Pressure2	0x0004	0 to 1250	Input register	-	Pressure reading, transducer 2. Pa (signed short integer)

6.4. Temperature readings

Read the following input registers – regardless if it is a Dual - DPT 250 or a Dual - DPT 1250.

Name	Address	Possible Values	Register type	Default	Description
TempInternal	0x0005	-10000 to 20000 (Scale 100)	Input register	-	Onboard temperature sensor. °C (signed short integer)
TempExter-nal1	0x0006	-10000 to 20000 (Scale 100)	Input register	-	External NTC sensor input 1. °C (signed short integer) -7000 = not connected 15000 = short circuit
TempExter-nal2	0x0007	-10000 to 20000 (Scale 100)	Input register	-	External NTC sensor input 1. °C (signed short integer) -7000 = not connected 15000 = short circuit

6.5. Hardware information

Name	Address	Possible Values	Register type	Default	Description
HWType	0xFF06	0x0020 DPT1250 Dual 0x0021 DPT 250 Dual 0x0027 DPT1250 Single 0x0028 DPT 250 Single	Input register	0x001C	-
CmdReply	0xFF07	0x00 : Nothing 0x02 : Programming Done 0x82 : Programming Error 0x03 : Going to Application mode 0x83 : Cannot go to application mode 0x04 : Going to Bootloader mode 0x84 : Cannot go to bootloader mode 0x8F : Function not supported	Input register	0x0000	Reply to a command in Cmd register
Status	0xFF08	0: Cfg Not dirty 1: Cfg Dirty	Input register	0x0000	If any register from 0xFF80 upwards has changed this field reflects the dirty status.
Cmd	0xFF80	0 : Nothing / Clear 1 : Clear (CmdReply = 0) 2 : Program Configuration 3 : Set Application mode and reboot (wait 3 sec) 4 : Set Bootloader mode and reboot (wait 3 sec) 5 : Reset communication to factory settings	Holding register	0x0000	Cmd returns to 0 when a command has been executed.
Address	0xFF81	0x00XX	Holding register	0x0012	Read only 1
Baudrate	0xFF82	0x0001 : 9600 0x0002 : 19200 0x0003 : 115200	Holding register	0x0003 : 115200	Read only1
Stopbits	0xFF83	1, 2	Holding register	1	Read only1
Parity	0xFF84	0 : None 1 : Even 2 : Odd	Holding register	1 : Even	Read only1

Note 1: Selected using DIP switches.

6.6. Reading the serial number of the module

Serial number is exchanged using Modbus files. To support the Modbus files layout a device must implement Modbus function: 0x14 (read) and 0x15 (write).

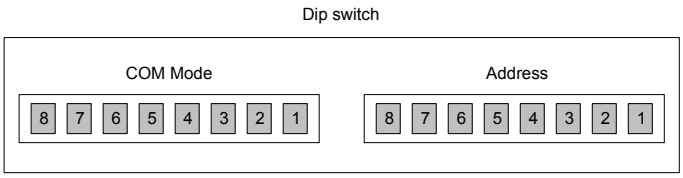
Read only files (RO) are identified in the range from 0xFF00 to 0xFF7F and Read/Write files (RW) are identified in the range from 0xFF80 to 0xFFFF.

Standard Modbus files				
File number	Record number	Payload From – To Byte	Description	Default
0xFF80	0x0000	0-31	PCBA S/N	-
0xFF80	0x0001	0-31	Module S/N	-

6.7. Dipswitches

There are two DIP switches on the pcb; one for MODBUS Address and one for Com mode (baud rate etc).

The DIP switches are only read during start-up and the values for Com mode and address are used. Any changes on any DIP switch after start-up will have no influence on the running system!



Numbers are those printed on the DIP switch. A DIP switch is on (1) if it is in the ON position.

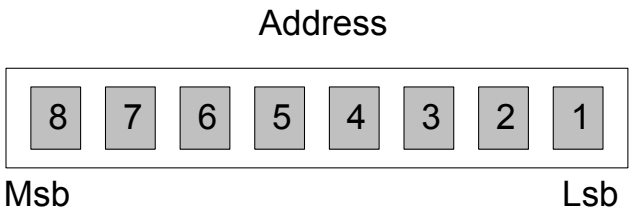
Switch	Description	Value=0	Value=1
8	RS485 Termination	Off	On
7	Parity on – off	On	Off
6	Parity even – odd	Even	Odd
5	Stopbits	1	2
4-Jan	Baudrate		

Baudrate	Value	Bit pattern switch 4-1
115200	0	0
300	1	1
1200	2	10
4800	3	11
9600	4	100
19200	5	101
38400	6	110
115200	7	111

6.8. MODBUS address setting

Modbus address is selected using the 8 bit dipswitch labelled adr on the pcb.

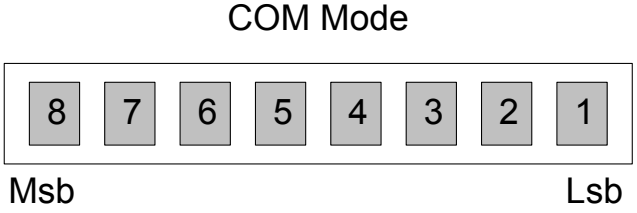
Address 0 can not be selected since it is the broadcast address, and it will be defaulted to address 23 for the DPT1250 and address 24 for DPT250.



6.9. Communication modes

Communication speed, parity, stop bits is selected using the dipswitch labelled COM on the pcb.

Se also the label in section 5. Connections on the module.



If no COM mode is selected it is defaulted to 115200 baud, 1 stop bit and even parity

6.10. Status information

The following input registers hold status for the module

Name	Address	Possible Values	Reg Type	Default	Description
Operation	0x0001	Bitmask field. 0x0001: Stopped 0x0002: Started 0x0008: Error 0x0080: Restarting	Input register		Stopped: Device stops performing its regulation. Started: Device is performing its regulation.
ErrCode	0x0002	0x0000-0xFFFF 0x0085 Wrong Opsignal	Input register	0x0000	Application error codes. Reflects a previous Opsignal command.

6.11. MODBUS sample communication

Note: The following sample is a general MODBUS communication sample and is not for the DUAL – DPT!

Request:
- 0b041000000e75a4

Response:
- 0b041cffff0000095008b0e4a80014000b000108e-108f1ffff000f

- 0002fff39f8e

Request (Input register)		
0x0b	Slave address	1 byte
0x04	Function code	1 byte
0x1000	Start addr	2 bytes
0x000e	Quantity	2 bytes
0x75a4	CRC	2 bytes

Response		
0x0b	Address	1 byte
0x04	Function code	1 byte
0x1c	NB bytes of data	1 byte
0xffff	Value1	2 bytes
0x0000	Value2	2 bytes
0x0950	Value3	2 bytes
0x08b0	Value4	2 bytes
0xe4a8	Value5	2 bytes
0x0014	Value6	2 bytes
0x000b	Value7	2 bytes
0x0001	Value8	2 bytes
0x08e1	Value9	2 bytes
0x08f1	Value10	2 bytes
0xffff	Value11	2 bytes
0x000f	Value12	2 bytes
0x0002	Value13	2 bytes
0xfff3	Value14	2 bytes
0x9f8e	CRC	2 bytes

Request:
- 0b03200000018f60

Response:
- 0b030200002045

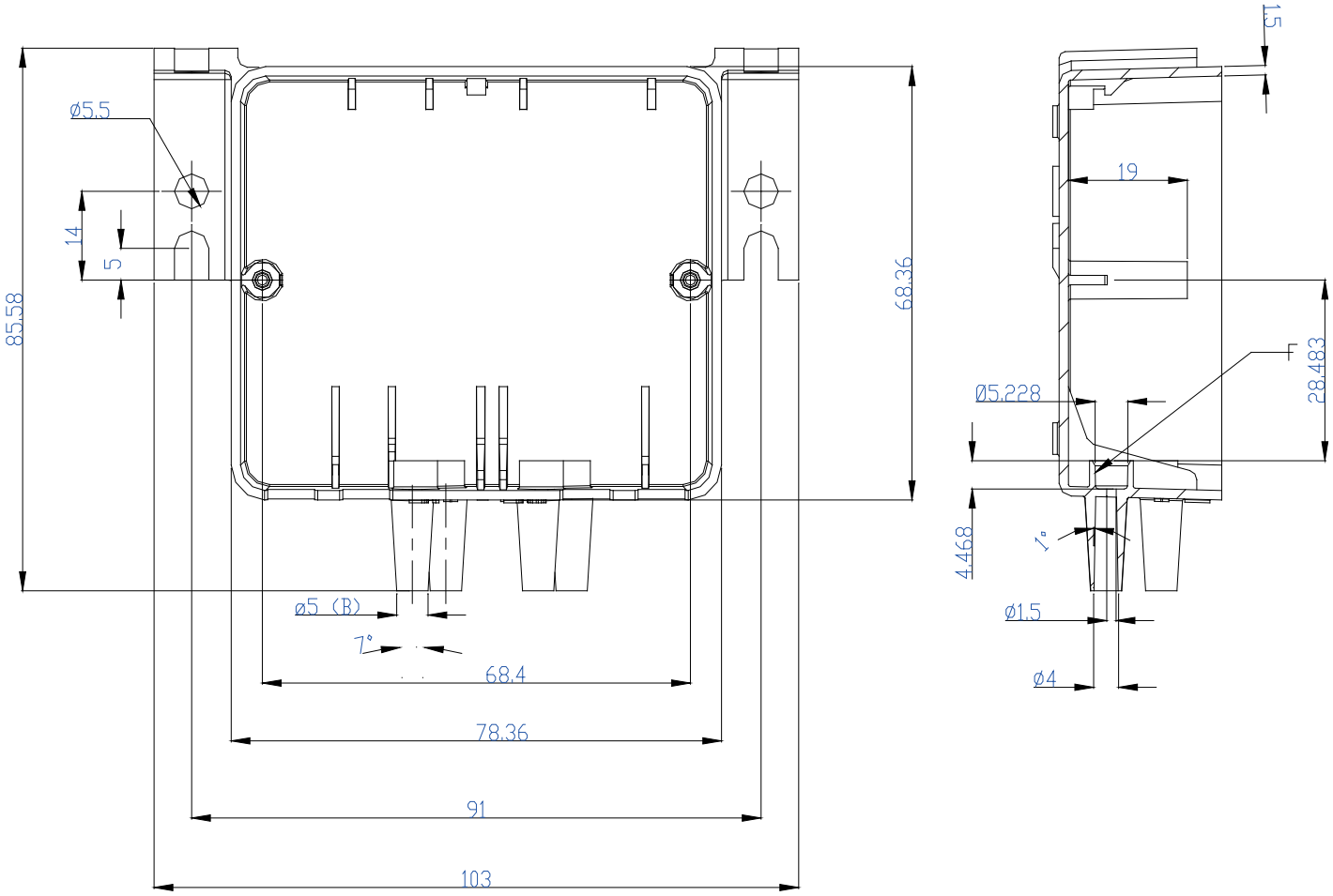
Request (Holding register)		
0x0b	Slave address	1 byte
0x03	Function code	1 byte
0x2000	Address	2 bytes
0x0001	Quantity	2 bytes
0x8f60	CRC	2 bytes

Response		
0x0b	Slave address	1 byte
0x03	Function code	1 byte
0x02	Quantity	1 byte
0x0000	Value1	2 bytes
0x2045	CRC	2 bytes

7. Technical data

Technical specification, DUAL DPT	
Power supply	12 VDC to 32 VDC Via RS485 port.
Temperature range	-25°C ~ +85°C
Relative humidity	Max. 95%RH, non-condensing
Cabinet protection	IP54
Differential pressure transducer	2; 0 – 250 Pa / 0 – 1250 Pa
Pressure measurement	Air only
Air connection	Tube – inner diameter of air hose: 5 mm
Overpressure	Max. 8 kPa
Accuracy	0 – 250 Pa: 2,25% fullscale ~ ± 6 Pa 0 – 1250 Pa: 1,5% fullscale ~ ± 19 Pa (incl. aging, temperature drift and conversion)
Resolution	1 Pa
Onboard temperature sensor	1; -30°C ~ +70°C
Accuracy	± 1°C
Resolution	1°C
External temperature sensors	Option of 2; NTC; Signal and Gnd
Temperature range	-50°C ~ + 99°C
Accuracy	± 3°C in the range -50°C ~ -36°C ± 1°C in the range -35°C ~ +49°C ± 3°C in the range +50°C ~ +99°C
Resolution	<= 1,0°C in the range < -35°C <= 0,2°C in the range -35°C ~ +39°C <= 1,0°C in the range +40°C ~ +85°C <= 1,5°C in the range > +85°C
Communication	1 RS485 port; dual connection Half duplex, max 115 kB Receiver Rin >= 12 kOhm
Weight	80g
Dimensions	103,0 mm (w) * 85,6 mm (d) * 33 mm (h)
Mounting	With two screws
Housing material	PC Lexan, transparent

8. Drawings


ø5.5
14
5
85.58
68.36
ø5 (B)
7°
68.4
78.36
91
103
1.5
19
28.483
Ø5.228
4.468
1°
Ø1.5
ø4

9. Standards

The product is manufactured according to the following standards.

- RoHS 2011/65/EC
- Low voltage 2006/95/EU
- EMC 2004/108/EC
- 61000-6-x Generic EMC

The following standards have been used:
EN 61010-1
Safety requirement for electrical equipment for measurement and control.

EN 61000-6-2
Immunity standard for industrial environments.

EN 61000-6-3
Emission standard for residential, commercial and light-industrialenvironments.

CE approved.

10. Trouble shooting

- Check if there is power to the DUAL – DPT, range 12 VDC to 32 VDC.
- Check if the communication address setting matches the selected. Note: Address 0 should not be used!
- Check if the communication speed matches the selected.
- Check if communication is running: The green LED is flashing regularly at start up and when no communication is active. It flashes irregularly together with the normal flash frequency when communication is active.

11. NTC temperature/ resistance table

The DUAL – DPT temperature inputs are for a NTC temperature sensor. The curve for a standard Lodam NTC temperature sensor is used.

The table below shows the relation between temperature and measured resistance in the NTC sensor and can be used to measure if the read temperature matches the measured resistance.

Resistance is in Ohm and temperature is in ºC. The right columns lists the resistance at a temperature of the left most column plus the temperature in the heading of the right column, i.e. 0ºC; +2ºC; +4ºC etc.

ºC	+ 0ºC	+ 2ºC	+ 4ºC	+ 6ºC	+ 8ºC
-50	667828	579718	504230	439445	383712
-40	335671	294193	258307	227196	200184
-30	176683	156199	138322	122687	108991
-20	96974	86415	77121	68927	61693
-10	55298	49663	44610	40150	36183
0	32651	29500	26688	24173	21922
10	19904	18093	16465	15001	13683
20	12494	11420	10450	9572	8777
30	8056	7402	6807	6266	5774
40	5325	4916	4542	4200	3887
50	3601	3339	3098	2877	2674
60	2487	2315	2157	2011	1876
70	1752	1637	1530	1432	1341
80	1256	1178	1105	1037	975
90	916	862	811	768	720
100	679	640	604	571	540
110	510	483	457	433	401
120	389	369	350	332	315

12. Index

13. Notes

Innovative and energy saving **climate control**

When it comes to climate control Lodam is one of the most experienced you can turn to. For more than four decades we have developed, produced and implemented electronic solutions dedicated to optimising applications like:

- Compressors
- Condensing units
- Heat pumps
- Air conditioning
- Refrigerated truck and trailer
- Reefer containers

We know the importance of reliable, energy-efficient operation – and constantly push technological boundaries to bring you the most innovative and forward-thinking solutions.

As part of the BITZER Group we are backed by one of the world's leading players in the refrigeration and air conditioning industry. This alliance provides us with extensive network and application knowhow and allows us to stay at the forefront of climate control innovation. And to help ensure comfortable surroundings for humans and reliable protection of valuable goods anywhere in the world.

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