OPERATING MANUAL

HD29 series

Air speed, temperature and relative humidity transmitters

EN

V1.0

senseca

Contents

1 Introduction

HD29… series transmitters measure air speed and, optionally depending on model, temperature and relative humidity (RH).

The air speed sensor is thin film.

The probe stem is in stainless steel, allowing it to be used in harsh environments.

The probe is available in different versions:

- Fixed duct horizontal probe (HD29...**TOx**)
- Probe with M16 connector and cable (HD29...**TCxx**)

Available outputs, depending on the model:

- **4…20 mA** active current analog output (HD29**A**…)
- **0…10 V** voltage analog output (HD29**V**…)
- **RS485** digital output with Modbus-RTU or ASCII proprietary protocol (HD29**S**…)

The instruments are factory calibrated and ready for use.

Models

HD29

Cable length (*only …TC models*)
02 = 2 m
05 = 5 m
10 = 10 m

Type of probe and stem length (*)
TC1 = probe with cable, short stem
TC2 = probe with cable, medium stem
TC3 = probe with cable, long stem
TO1 = horizontal fixed probe, short stem
TO2 = horizontal fixed probe, medium stem
TO3 = horizontal fixed probe, long stem

Measured quantities
300 = air speed
370 = air speed and temperature
371 = air speed, temperature and relative humidity

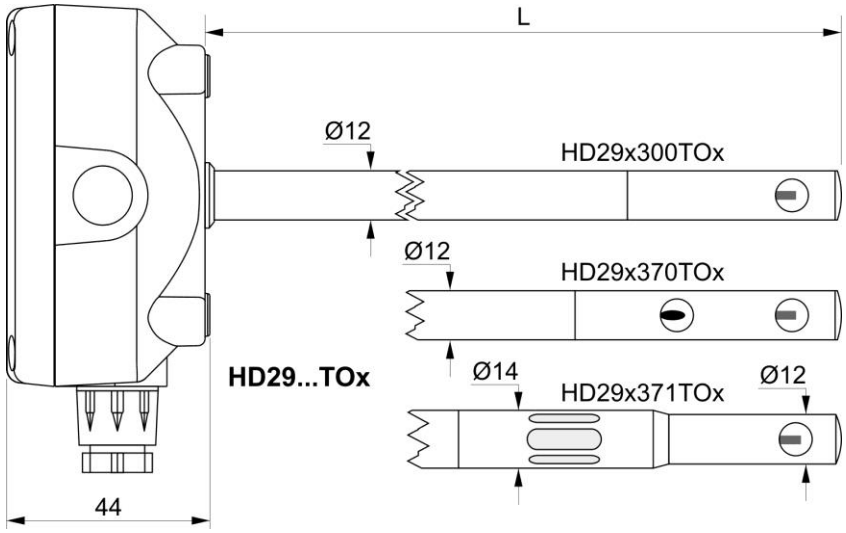
Type of output
A = active 4…20 mA analog output
V = 0…10 V analog output
S = RS485 digital output

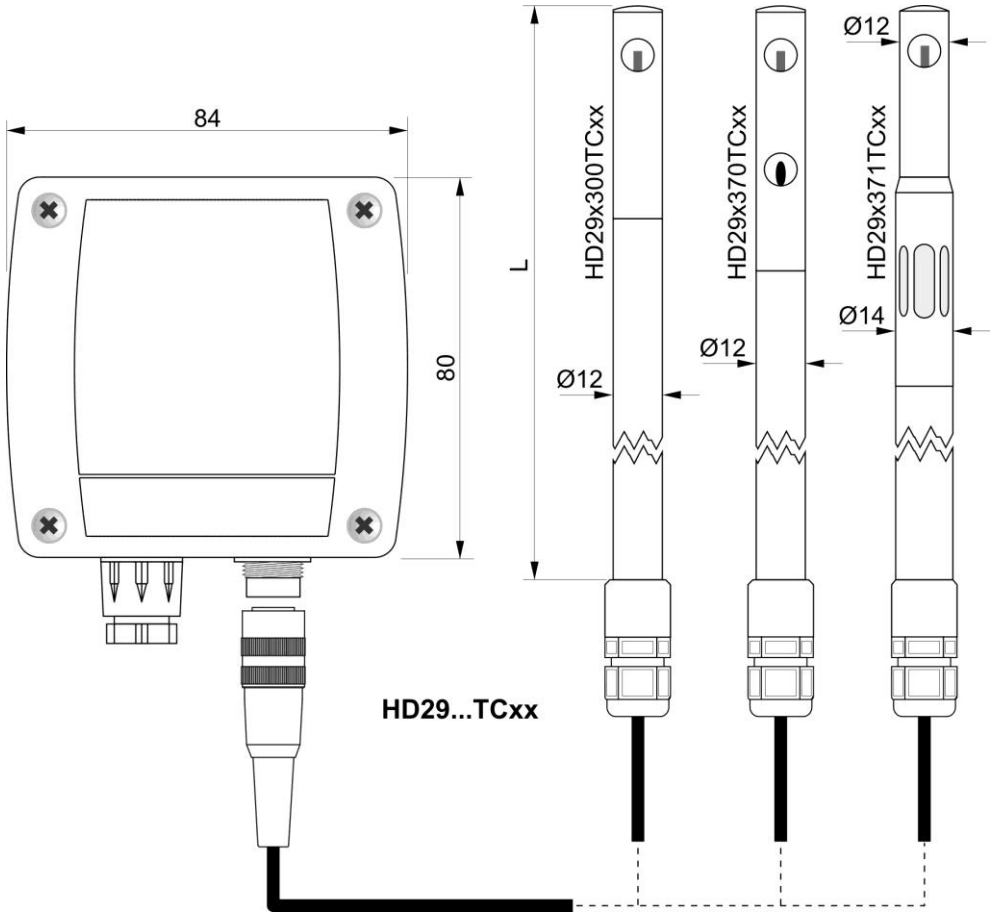
(*) The stem length depends on the measured quantities and the type of probe. For the actual stem length, see the table on page 5.

2 Technical specifications

Sensor	Speed	Thermal
	Temperature	NTC
	RH	Capacitive
Measuring range	Speed	Configurable in HD29**A**… and HD29**V**… models: Range 1: 0.05…1 m/s Range 2: 0.1…2 m/s Range 3: 0.2…10 m/s Range 4: 0.2…20 m/s 0.05…20 m/s in HD29**S**… models
	Temperature	-10…+60 °C
	RH	0…100%
Accuracy	Speed @ 50% RH @ 1013 hPa	HD29**A**… and HD29**V**… models: Range 1: ±(0.1 + 3% of measure) m/s Range 2: ±(0.15 + 3% of measure) m/s Range 3: ±(0.5 + 3% of measure) m/s Range 4: ±(0.7 + 3% of measure) m/s HD29**S**… models: ±(0.1 + 3% of measure) m/s @ $V \leq 1$ m/s ±(0.15 + 3% of measure) m/s @ 1 m/s < $V \leq 2$ m/s ±(0.5 + 3% of measure) m/s @ 2 m/s < $V \leq 10$ m/s ±(0.7 + 3% of measure) m/s @ 10 m/s < $V \leq 20$ m/s
	Temperature	±0.3 °C
	RH	±1.5% (10…90%) / ±2% (remaining range) @ T=15…35 °C (1.5 + 1.5% of measure)% @ T=remaining range
Resolution (**HD29S…**)	Speed	0.01 m/s
	Temperature	0.1 °C
	RH	0.1%
Air temperature compensation for speed measurement		0…+80 °C
Output		Active 4…20 mA (HD29**A**…) 0…10 Vdc (HD29**V**…) RS485 Modbus-RTU or ASCII proprietary protocol (HD29**S**…)
Power supply		24 Vac ± 10% or 18…40 Vdc (HD29**A**... e HD29**V**...) 18...30 Vdc (HD29**S**...)
Power consumption		< 100 mA (+ current of outputs in HD29**A**… models)
Electrical connections		Screw terminal block, max 1.5 mm^2 , PG9 cable gland
Operating conditions		-10…+60 °C (transmitter housing) / -30…+100 °C (probe) Speed sensor: clean air, RH<80%
Storage temperature		-10…+70 °C
Materials		Housing: ABS Front labels: polycarbonate Probe stem: stainless steel
Protection degree		IP65

Dimensions (mm)



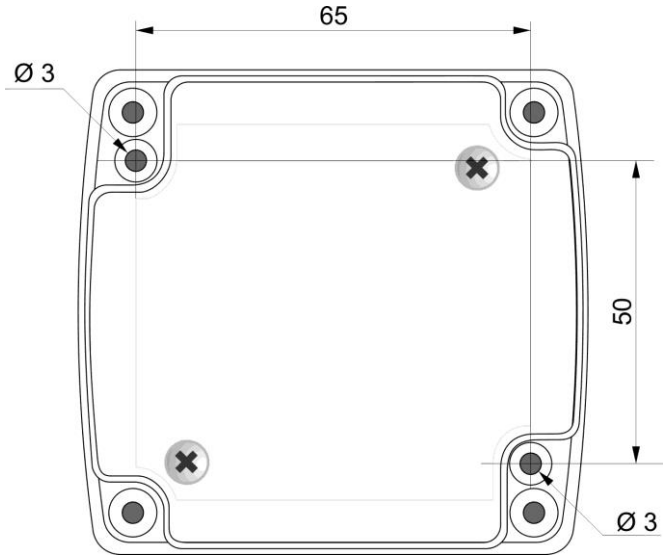


Nominal stem length **L** as a function of model (*tolerance ±1% approx.*):

	TC1	**TC2**	**TC3**	**TO1**	**TO2**	**TO3**
HD29x300…	145	245	345	150	250	350
HD29x370…	175	275	375	180	280	380
HD29x371…	215	415	565	215	415	565

3 Installation

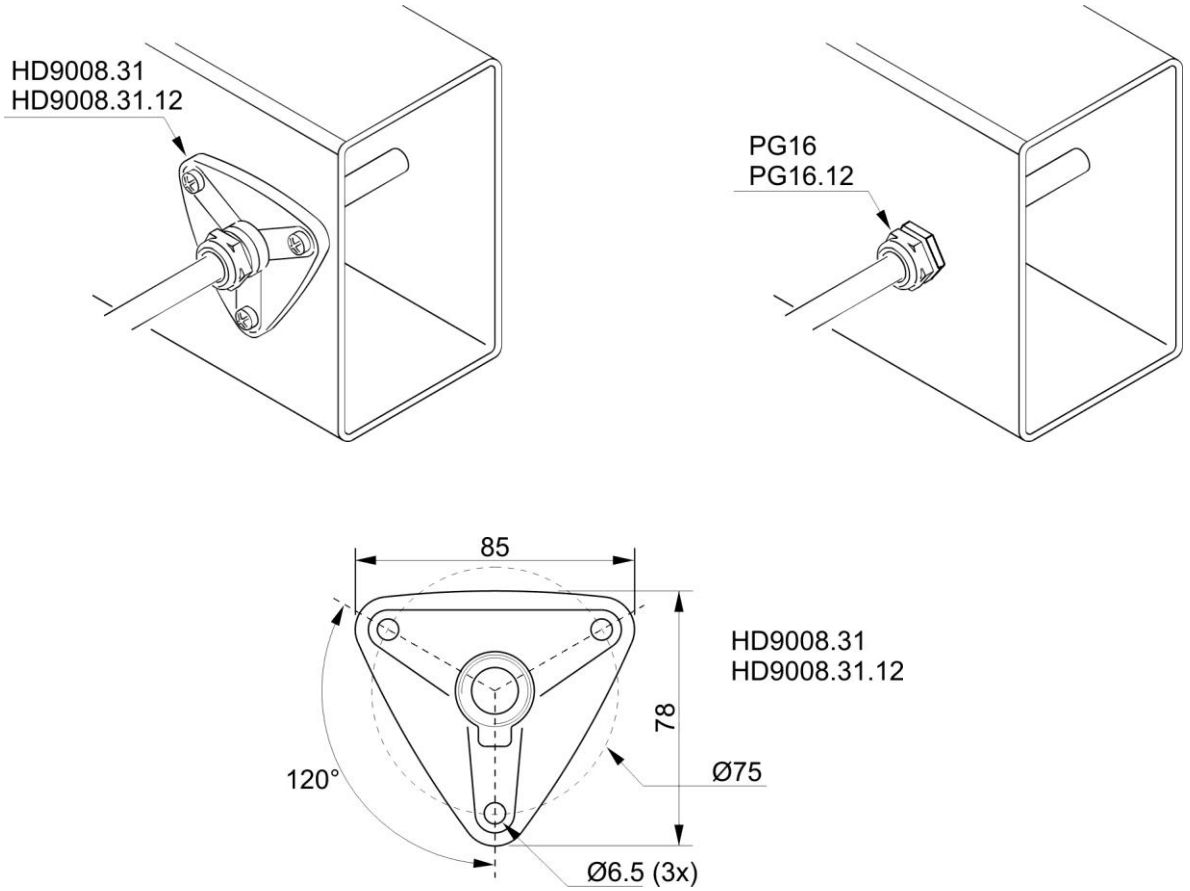
The transmitter is wall mounted using the two ∅3 mm holes on the back (open the cover to access the holes and the terminal header for electrical connections).



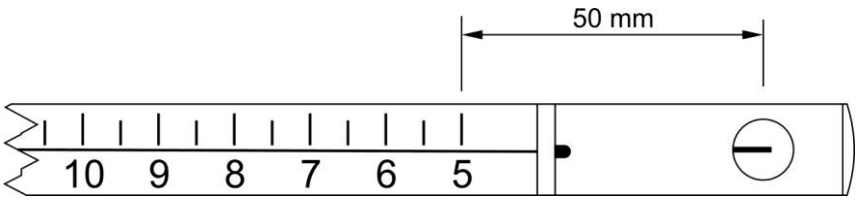
The ∅12 mm probes can be fixed to a duct by using the **HD9008.31.12** flange or the **PG16.12** metal cable gland.

The ∅14 mm probes can be fixed to a duct by using the **HD9008.31** flange or the **PG16** metal cable gland.

PG16 and PG16.12 have G ½", L=8 mm thread on duct side.



To facilitate proper placement of the probe inside a duct, a graduated scale engraved along the stem indicates the depth of introduction of the speed sensor inside the duct.



The air sensor window must be oriented in the direction of airflow. To properly orient the speed sensor with respect to the flow, once it is introduced into the duct, the sensor window and the line at the base of the graduated scale are on the same axis.

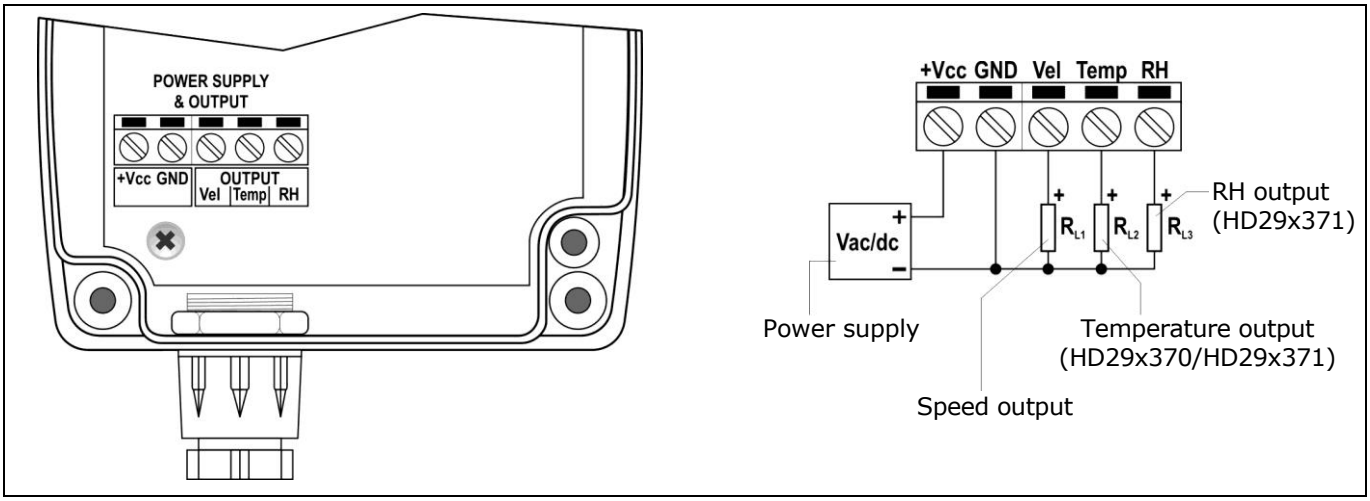
The graduated scale must face the direction from which the air flow comes (the sensor is not bidirectional).

The probe with the same serial number as the transmitter (if ordered together) must be connected to the **TC** version transmitters. Replacement of the probe requires recalibration of the transmitter in line with the new probe.

3.1 Electrical connections

Internally there is the terminal header for connecting power supply and output.

HD29A... and HD29V... models

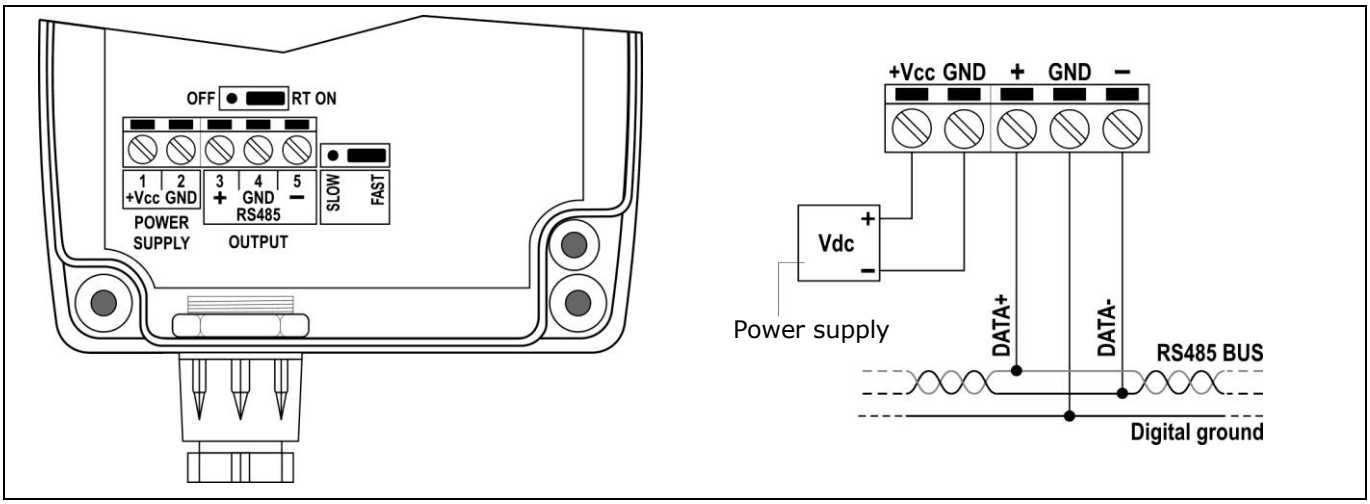


The load resistance R_L varies according to the type of analog output:

Analog output	Load resistance
0…10 V	> 10 kΩ
4…20 mA active	< 500 Ω

In the event of an anomaly in the measurement (detected measurement outside the measuring range), the output goes to a value 10% higher than the full scale: 11 V if the output is 0...10 V, 22 mA if the output is 4…20 mA.

HD29S... models

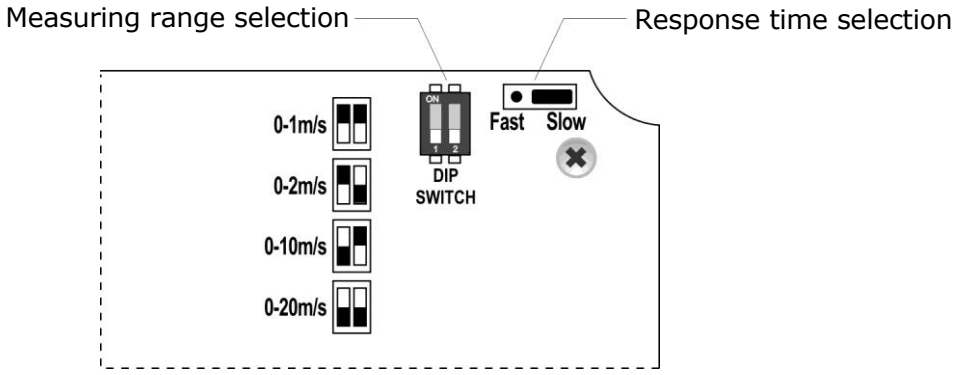


Before connecting the transmitter to the RS485 network, set the address and the communication parameters, if different from the factory preset (see "Configuration" chapter). The output is not isolated.

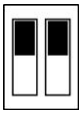
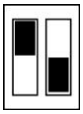
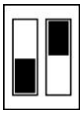
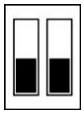
3.2 Setting of dip switches and jumpers

HD29A... and HD29V... models

On the board there are two "dip switches" and a jumper.

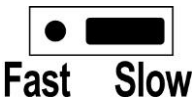


The dip switches allow the configuration of different speed ranges to be associated with the analog output:

	Range 1 **0…1 m/s**	Range 2 **0…2 m/s**	Range 3 **0…10 m/s**	Range 4 **0…20 m/s**
Dip switches setting				

Note: The speed range associated with the analog output always starts from 0 m/s, even if the valid measurement range starts from a threshold value greater than zero (see the measurement ranges given in the technical specifications).

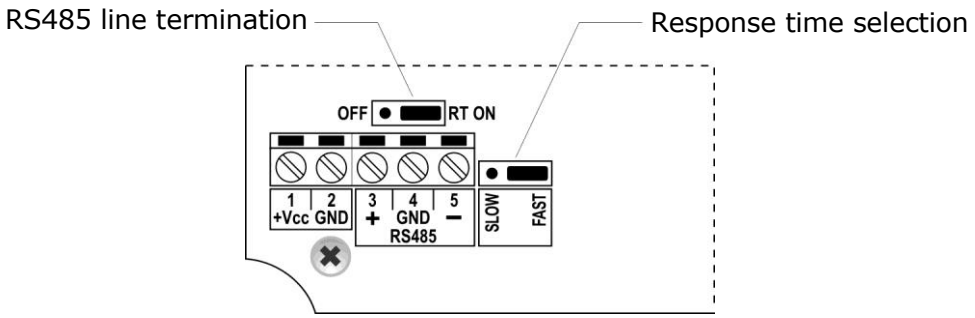
The "Fast/Slow" short jumper allows the configuration of the speed measurement response (integration) time:

	Slow **2 s**	Fast **0,2 s**
"Fast/Slow" short jumper setting		

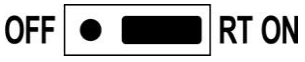
It is advisable to set the slow response time if there is turbulence in the airflow.

HD29S... models

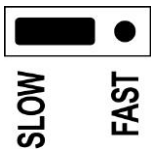
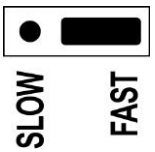
On the board there are two jumpers.



The "RT" short jumper allows inserting an RS485 line termination built into the transmitter.

	Termination connected	Termination disconnected
RT short jumper setting		

The "FAST/SLOW" short jumper allows configuring the filtering factor "N" for calculating the speed measurement (see par. 4.1):

	Slow response time **N=25**	Fast response time **N=0**
"Fast/Slow" short jumper setting		

It is advisable to set the slow response time if there is turbulence in the airflow.

Attention!

The "FAST/SLOW" short jumper setting is ignored if the JSS0 command of the ASCII proprietary protocol is sent or if 0 is set in the Holding Register with address 7 of the Modbus-RTU protocol (see the chapters on protocols).

4 Configuration and measurement in HD29S... models

The configuration of the transmitter and the reading of the measurements can be done via the RS485 serial output, both with the proprietary protocol and with the Modbus-RTU protocol.

In the first 10 seconds after the transmitter power on, it is always active the proprietary protocol. After 10 seconds from power on, the operating protocol is activated, which by default is the Modbus-RTU protocol.

It is possible to keep the proprietary protocol active even after 10 seconds from power on by sending, before the 10 seconds expire, the command **@** of the proprietary protocol. The proprietary protocol can be set as operating protocol by means of the DP0 command.

The commands of the proprietary protocol and the registers of the Modbus-RTU protocol are described in detail in the following chapters.

4.1 Air speed measurement filtering factor

In HD29S models... the speed measurement $\mathbf{V_n}$ provided is calculated according to the following formula:

$$\mathbf{V_n = [(K - N) * V_i] + (N * V_{n-1})] / K}$$

Where:
K = 30 (fixed value)
N = filtering factor (integer number between 0 and 29)
V_i = current instantaneous speed detected (without any filtering applied)
V_{n-1} = previous speed (calculated with filtering factor)

The higher the filter value N, the longer the response time of the speed measurement. If N=0, the speed provided is the instantaneous speed.

The filtering factor can be set in multiple ways:

- with the "FAST/SLOW" short jumper;
- with the FSS command of the ASCII proprietary protocol;
- with the Holding Register with address 6 of the Modbus-RTU protocol.

By default, the setting of the "FAST/SLOW" short jumper is used.

By sending the JSS0 command of the ASCII proprietary protocol or setting 0 in the Holding Register with address 7 of the Modbus-RTU protocol, the "FAST/SLOW" short jumper setting is ignored and instead the value N set with the FSS command of the ASCII proprietary protocol or with the Holding Register with address 6 of the Modbus-RTU protocol is considered.

5 ASCII proprietary protocol (HD29S...)

To use the ASCII proprietary protocol, it is necessary to connect the transmitter to the PC via a RS485/USB or RS485/RS232 converter and use a standard serial communication program. In the serial communication program, set the COM port number to which the transmitter is connected and the communication parameters as follows:

- If the Modbus-RTU protocol is set as the operating protocol in the transmitter (default), set the Baud Rate 57600 and the parameters 8N2 in the serial communication program, then power cycle the transmitter and send the command **@** within 10 seconds from the transmitter power on.
- If the proprietary protocol is already set as the operating protocol in the transmitter, it is possible to operate with Baud Rate 57600 and parameters 8N2 by sending the command **@** within 10 seconds from the transmitter power on, or you can let the 10 seconds pass without sending the command **@** and operate with the communication parameters set in the transmitter (default 19200, 8E1).

To change the transmitter configuration, the serial command **CAL USER ON** must be sent first (the transmitter replies with USER CAL MODE ON). The command CAL USER ON is automatically disabled after a few minutes of inactivity. If the settings should be only read, the command CAL USER ON is not required.

Below is the list of the serial commands.

Transmitter information:

Command	Reply	Description
G0	*Model*	Transmitter model
G1	Hard.Rev=*Revision*|	Transmitter hardware revision
G2	SN=nnnnnnnn	Transmitter serial number
G3	Firm.Ver.=x.y	Transmitter firmware revision
G4	Firm.Date=yyyy/mm/dd	Date of firmware revision

Protocol:

Command	Reply	Description
@	&|	Keeps the proprietary protocol operational even after 10 seconds from transmitter power on. It must be sent within 10 seconds from transmitter power on.
DPn	&|	Sets the operating protocol: ▪ Proprietary if n=0 ▪ Modbus-RTU if n=1 (default)
GP	& n|	Reads the operating protocol set in the transmitter.
SM	&|	Activates the Modbus-RTU protocol immediately.
CMAn	&|	Sets the Modbus-RTU address (1…247, default=1) to n.
RMA	& n|	Reads the Modbus-RTU address.

Warning: after sending the DP1 command, the transmitter remains with the proprietary protocol. Send the command SM to activate the Modbus-RTU protocol immediately, or power cycle the transmitter.

RS485 communication parameters:

Command	Reply	Description
CMBn	&|	Sets the Baud Rate: ▪ 1200 if n=0 ▪ 2400 if n=1 ▪ 4800 if n=2 ▪ 9600 if n=3 ▪ 19200 if n=4 (default) ▪ 38400 if n=5 ▪ 57600 if n=6 ▪ 115200 if n=7
RMB	& n|	Reads Baud Rate setting
CMPn	&|	Sets parity and stop bits (data bits = 8 fixed): ▪ 8N1 if n=0 ▪ 8N2 if n=1 ▪ 8E1 if n=2 (default) ▪ 8E1 if n=3 ▪ 8O1 if n=4 ▪ 8O2 if n=5
RMP	& n|	Reads the setting of parity and stop bits.
CMWn	&|	Sets waiting time after transmission with Modbus-RTU protocol: ▪ Immediate reception if n=0 (violates protocol) ▪ Waiting 3.5 characters if n=1 (respects protocol) Default=Immediate reception (n=0)
RMW	& n|	Reads the setting of waiting time after transmission with Modbus-RTU protocol.

Measurements reading:

Command	Reply	Description
S0	&|	Disables the sending of the measurements enabled with S1.
S1	&|	Enables the sending of the measurements at regular intervals. To set the sending interval, use the command MT.
S2	& *Measurements*	Prints the measurements in the following sequence: ▪ Air speed ▪ Temperature ▪ Relative humidity ▪ Dew Point (*calculated from T/RH*) ▪ Absolute humidity (*calculated from T/RH*) ▪ Wet bulb temperature (*calculated from T/RH*) ▪ Error status (*value to be converted into binary*): Bit 0=1 ⇒ Air speed measurement error Bit 1=1 ⇒ Temperature measurement error Bit 2=1 ⇒ Relative humidity measurement error The measurements are expressed in the set meas. units.
MTn	&|	Sets the measurement sending interval to n multiples of 0.125 seconds (measurement frequency 8 Hz). Default=8 (equivalent to 1 s). Can be set from 1 to 32.
NT	& n|	Reads the measurements sending interval.

Air speed measurement filtering factor:

Command	Reply	Description
JSSn	&|	Selects which filtering factor to use for calculating air speed measurement: ▪ If n=0, use the filtering factor set with the FSS command ▪ If n=1, use the filtering factor set with "FAST/SLOW" short jumper (default)
JSG	& n|	Reads which filtering factor is used for calculating air speed measurement (the one set with the short jumper or the one set with the command).
JSR	& n|	Reads the setting of the "FAST/SLOW" short jumper: • n=0 ⇒ SLOW • n=1 ⇒ FAST
FSSn	&|	Sets the filtering factor to n (0…29, default=0) for calculating air speed measurement. **Warning**: the filtering factor set with this command is only used after the JSS0 command is sent.
FSG	& n|	Reads the filtering factor set with the command FSS.

Units of measurement:

Command	Reply	Description
TSn	&|	Sets the air speed unit of measurement of index n: ▪ m/s if n=0 (default) ▪ km/h if n=1 ▪ ft/s if n=2 ▪ mph if n=3
HS	& n|	Reads the air speed unit of measurement.
TTn	&|	Sets the temperature unit of measurement of index n: ▪ °C if n=0 (default) ▪ °F if n=1
HT	& n|	Reads the temperature unit of measurement.

Restoring the factory configuration:

Command	Reply	Description
DFLT	&|	Restores the factory configuration.

Date/time:

The setting of the date and time is necessary in case a relative humidity user calibration is performed, as the transmitter stores the date of the user calibration.

Date and time must be set before performing a user calibration.

Date and time are not retained in case of power failure.

Command	Reply	Description
DA*date time*	&|	Sets the transmitter date and time Date and time format = yyyy/mm/dd hh:mm:ss (e.g., DA2024/07/12 09:25:00)
GA	*Date and time*	Reads current date/time

Relative humidity calibration:

In the models with T/RH probe, a 2-point user RH calibration can be performed with the HA and HB commands.

User calibration must be enabled by sending the CAL USER ON command, and the calibration type in use must be set to "user" (CC1 command).

Before performing calibration, check that the date set in the transmitter is correct. In case the date is not set, the transmitter will not allow calibration.

Command	Reply	Description
CCn	&|	Sets the type of RH calibration to be used: ▪ Factory calibration if n=0 (default) ▪ User calibration if n=1
GC	(*)	Reads the date of factory calibration, the date of user calibration and the type of RH calibration in use.
HAnnn	&|	Calibrates the higher RH point to the value nnn in tenths of %RH (e.g., 75.0% ⇒ nnn=750).
HBnnn	&|	Calibrates the lower RH point to the value nnn in tenths of %RH (e.g., 33.0% ⇒ nnn=330).

(*) Reply to GC command:
Fact.Calib.Date=yyyy/mm/dd User.Calib.Date=yyyy/mm/dd Cal.Mode=Factory or User

6 Modbus-RTU protocol (HD29S...)

By default, the instrument has MODBUS address **1** and communication parameters 19200, 8E1. The address and the communication parameters can be changed by using the appropriate serial commands of the proprietary protocol or, alternatively, directly with MODBUS commands by changing the value of the Coils and Holding Registers described later.

The MODBUS-RTU protocol, if set as the operating protocol (default), is active after 10 seconds from the instrument power on.

In order to change the instrument configuration using the MODBUS-RTU protocol, the value 1 must be written first in the *Coil* with address 1.

Below is the list of registers.

Input Registers:

Address	Description	Format
0	Air speed in the set unit of measurement [x100]	16-bit Integer
1	Temperature in the set unit of measurement [x10]	16-bit Integer
2	Relative humidity in % [x10]	16-bit Integer
3	Dew Point (calculated from T/RH) in the set unit of measurement [x10]	16-bit Integer
4	Absolute humidity (calculated from T/RH) in g/m^3 [x10]	16-bit Integer
5	Wet bulb temperature (calculated from T/RH) in the set unit of measurement [x10]	16-bit Integer
6	Error register: Bit 0 = 1 ⇒ Air speed measurement error Bit 1 = 1 ⇒ Temperature measurement error Bit 2 = 1 ⇒ Relative humidity measurement error	16-bit Integer
7	Instrument firmware revision The most significant byte indicates the major revision; the least significant byte indicates the minor revision	16-bit Integer
8	Number of Modbus communication errors	16-bit Integer
9	Current setting of "FAST/SLOW" short jumper: **0**=SLOW, **1**=FAST The short jumper setting is only significant if the use of the jumper is enabled (see Holding Register with address 7).	16-bit Integer

Coils:

Address	Description	Format
0	Set 1 to restore the factory configuration. Bit zeroing is automatic.	Bit
1	Enable configuration change: **0**=no (default), **1**=yes The changes to *Coils* and *Holding Registers* will be accepted only if this register is set to 1.	Bit
2	Sets waiting time after transmission with Modbus protocol: **0**=immediate reception (default), **1**=waiting 3.5 characters.	Bit

Holding Registers:

Address	Description	Format
0	RS485 Baud Rate: **0**=1200, **1**=2400, **2**=4800, **3**=9600, **4**=19200 (default) **5**=38400, **6**=57600, **7**=115200	16-bit Integer
1	RS485 parity and stop bits: **0**=8N1, **1**=8N2, **2**=8E1 (default), **3**=8E2, **4**=8O1, **5**=8O2 (N=no parity, E=even parity, O=odd parity)	16-bit Integer
2	Instrument address for the Modbus protocol (1…247, default=1).	16-bit Integer
3	Temperature unit of measurement: **0**=°C (default), **1**=°F	16-bit Integer
4	Air speed unit of measurement: **0**=m/s (default), **1**=km/h, **2**=ft/s, **3**=mph	16-bit Integer
5	Setting of the type of RH calibration to be used: **0**=user calibration, **1**=factory calibration (default)	16-bit Integer
6	Filtering factor "N" (0…29, default=0) for calculating air speed measurement. **Warning**: the filtering factor set in this register is only used if the Holding Register with address 7 is set to 0.	16-bit Integer
7	Selection of which filtering factor to use for calculating air speed measurement: **0**=use the filtering factor set with Holding Register with address 6. **1**=use the filtering factor set with "FAST/SLOW" short jumper (default).	16-bit Integer

7 Maintenance

In models measuring relative humidity, in order to grant measurements high accuracy, it is necessary to clean the filter periodically if impurities are present in the airflow.

Do not use aggressive cleaning agents or incompatible with the materials indicated in the technical specifications. For cleaning the housing, use a soft dry cloth or slightly dampened with clean water.

8 Safety instructions

The transmitter proper operation and operating safety can be ensured only in the climatic conditions specified in this manual and if all standard safety measures as well as the specific measures described in this manual are followed.

Do not use the instrument in places where there are:

- Corrosive or flammable gases.
- Direct vibrations or shocks to the instrument.
- High-intensity electromagnetic fields, static electricity.

User obligations

The transmitter operator shall follow the directives and regulations below that refer to the treatment of dangerous materials:

- EU directives on workplace safety.
- National law regulations on workplace safety.
- Accident prevention regulations.

9 Accessories ordering codes

Fixing accessories must be ordered separately.

Fixing accessories

HD9008.31	Wall flange with cable gland to fix Ø 14 mm probes.
HD9008.31.12	Wall flange with cable gland to fix Ø 12 mm probes.
PG16	AISI304 cable gland to fix Ø 14 mm probes. G ½", L=8 mm thread.
PG16.12	AISI304 cable gland to fix Ø 12 mm probes. G ½", L=8 mm thread.

PC connecting cable

RS48	PC connecting cable for the configuration of the transmitter. With built-in RS485/USB converter. 3 open wires on transmitter side and A-type USB connector on PC side. **For HD29S... models.**

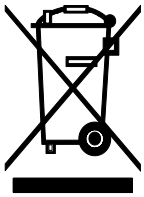
WARRANTY

The manufacturer is required to respond to the "factory warranty" only in those cases provided by Legislative Decree 6 September 2005 - n. 206. Each instrument is sold after rigorous inspections; if any manufacturing defect is found, it is necessary to contact the distributor where the instrument was purchased from. During the warranty period (24 months from the date of invoice) any manufacturing defects found will be repaired free of charge. Misuse, wear, neglect, lack or inefficient maintenance as well as theft and damage during transport are excluded. Warranty does not apply if changes, tampering or unauthorized repairs are made on the product. Solutions, probes, electrodes and microphones are not guaranteed as the improper use, even for a few minutes, may cause irreparable damages.
The manufacturer repairs the products that show defects of construction in accordance with the terms and conditions of warranty included in the manual of the product. For any dispute, the competent court is the Court of Padua. The Italian law and the "Convention on Contracts for the International Sales of Goods" apply.

TECHNICAL INFORMATION

The quality level of our instruments is the result of the continuous product development. This may lead to differences between the information reported in the manual and the instrument you have purchased.
We reserve the right to change technical specifications and dimensions to fit the product requirements without prior notice.

DISPOSAL INFORMATION



Electrical and electronic equipment marked with specific symbol in compliance with 2012/19/EU Directive must be disposed of separately from household waste. European users can hand them over to the dealer or to the manufacturer when purchasing a new electrical and electronic equipment, or to a WEEE collection point designated by local authorities. Illegal disposal is punished by law.

Disposing of electrical and electronic equipment separately from normal waste helps to preserve natural resources and allows materials to be recycled in an environmentally friendly way without risks to human health.

CE RoHS

senseca.com

Senseca Italy S.r.l.
Via Marconi, 5
35030 Selvazzano Dentro (PD)
ITALY
info@senseca.com