

Analog to SDI-12 Converter

(Stand-alone version)



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ECOMATIK dendrometers and temperature sensors (e.g. LAT-B3) are originally equipped with an analog output. The analog-to-SDI-12 converter converts their signal into digital form and transmits the data via the SDI-12 protocol.

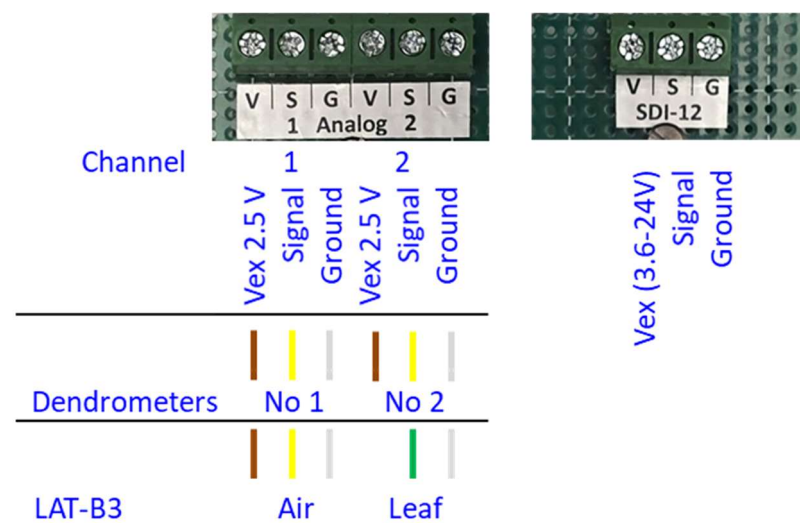
The stand-alone version of the SDI-12 converter is equipped with a terminal block. This allows customer to connect ECOMATIK dendrometers or ECOMATIK temperature sensors, or sensors from third parties that operate with a 2.5 V excitation voltage.

1. Scope of delivery

The SDI-12 converter The converter is supplied in a connection box with 2 cable glands.



2. Connection



3. Measurement functions

Two measurement formulas are implemented in the converter:

- 1) A linear function for dendrometer measurements
- 2) A Steinhart-Hart function for ECOMATIK temperature sensors.

Conversion function for dendrometers

$$y = a + b * \frac{V_{out}}{V_{ex}}$$

y: Dendrometer output in μm

V_{ex}=2.5 V: Excitation Voltage

V_{out}: Sensor output in V

a=0 by default

b=1 by default. b value depends on dendrometer types:

b=11000

for dendrometer models: DD-S1, DD-S2, DD-S2W, DD-L1, DD-L1W, DR1, DR1W, DR3, DR3W, DR7, DF1, DF5, DC1, DD-RO, DV

b=25400

for dendrometer models: DD-S3, DD-L2, DR2, DR6, DF2, DF6, DC3

b=50800

for dendrometer models: DD-L3, DF3, DC4

b=150000

for dendrometer model: DF4

Steinhart-Hart function conversion function for ECOMATIK temperature sensors

$$y = \frac{1}{a + b * x + c * x^3} + d$$

$$x = \ln\left(\frac{V_{ex}}{V_{out}} - 1\right) * e$$

y: Temperature in °C

V_{ex}: Excitation Voltage 2.5 V

V_{out}: Sensor output in V

a=8.4906823733471 E-04

b=2.6092929546095 E-04

c=1.3016564067 E-07

d=-273.15

e=20000

Both channels can be programmed individually either for connecting a dendrometer or a temperature sensor.

4. Programming

For programming extended SDI-12 commands are available:

For Dendrometer Measurements	
Commando/Response	Meaning
C: 0XCOEF[0,0]=1! R: 0XACK	Channel 1 is defined for dendrometer measurement Response: 0XACK
C: 0XCOEF[0,1]=0! R: 0XACK	Channel 1: coefficient a=0 Response: 0XACK
C: 0XCOEF[0,2]=11000! R: 0XACK	Channel 1: coefficient b=11000 Response: 0XACK
C: 0XCOEF[1,0]=1! R: 0XACK	Channel 2 is defined for dendrometer measurement Response: 0XACK
C: 0XCOEF[1,1]=0! R: 0XACK	Channel 2: coefficient a=0 Response: 0XACK
C: 0XCOEF[1,2]=11000! R: 0XACK	Channel 2: coefficient b=11000 Response: 0XACK

For Temperature Measurement with NTC Thermistor	
Commando/Response	Meaning
C: 0XCOEF[0,0]=2! R: 0XACK	Channel 1 is defined for temperature measurement Response: 0XACK
C: 0XCOEF[0,1]=8.4906823733471E-04! R: 0XACK	Channel 1: a=8.4906823733471E-04 Response: 0XACK
C: 0XCOEF[0,2]=2.6092929546095E-04! R: 0XACK	Channel 1: b=2.6092929546095E-04 Response: 0XACK
C: 0XCOEF[0,3]=1.3016564067E-07! R: 0XACK	Channel 1: c=1.3016564067E-07 Response: 0XACK
C: 0XCOEF[0,4]=-273.15! R: 0XACK	Channel 1: d=-273.15 Response: 0XACK
C: 0XCOEF[0,5]=20000! R: 0XACK	Channel 1: e=20000 Response: 0XACK
C: 0XCOEF[1,0]=2! R: 0XACK	Channel 2 is defined for temperature measurement Response: 0XACK
C: 0XCOEF[1,1]=8.4906823733471E-04! R: 0XACK	Channel 2: a=8.4906823733471E-04 Response: 0XACK
C: 0XCOEF[1,2]=2.6092929546095E-04! R: 0XACK	Channel 2: b=2.6092929546095E-04 Response: 0XACK
C: 0XCOEF[1,3]=1.3016564067E-07! R: 0XACK	Channel 2: c=1.3016564067E-07 Response: 0XACK
C: 0XCOEF[1,4]=-273.15! R: 0XACK	Channel 2: d=-273.15 Response: 0XACK
C: 0XCOEF[1,5]=20000! R: 0XACK	Channel 2: e=20000 Response: 0XACK

5. SDI-12 Commandos

The converter is fully compliant with SDI-12 standard version 1.3, and supports SDI-12 commandos: aM!, aMC!, aC!, aCC!, aD0!, aI!, aV!, ?!, aAb! (a = current Address, b = new Address) and extended SDI commands (cf. section 'Programming')

Example 1: 2x Dendrometer Commando/Response	Example 2: 1x LAT-B3 Commando/Response	Description
?! 0	?! 0	C: Request the single sensor address R: Address 0
0A1! 1	0A1! 1	C: Change Address from 0 to 1 R: Address 1
1M! 10033	1M! 10033	C: Start the measurement R: Address 1, Measuring duration 3 Sec. return 3 data
1D0! 1+5497.401855+3358.326431+2.499996 The meaning of the data 1: address 5497.401855: channel 1, dendrometer value in μm 3358.326431: channel 2, dendrometer value in μm 2.499996: Excitation voltage in V	1D0! 1+23.945461+21.895641+2.499995 The meaning of the data 1: address 23.945461: air temperature in $^{\circ}\text{C}$ 21.895641: Leaf temperature in $^{\circ}\text{C}$ 2.499995: Excitation voltage in V	C: Display data R: Address+ data1+ data2+data3

6. Technical specification

Sensor protocol	SDI-12 Version 1.3
Power supply voltage	3.6 V to 24 V DC
Warming up duration	700 mSec
Power consumption	Sleep: 0.13 mA/ 5V Measurement: 4.8 mA (3 Sec.) /5 V
Noise free resolution	17 bits
Channels	2
Sensor Input type	Single ended
Supported SDI-12 commands	aM!, aMC!, aC!, aCC!, aD0!, a!, aV!, ?!, aAb! (a = current adress, b = new address) and extended SDI commands for programming
Cable assignment	Brown: Excitation 3.6-24 V DC (Vex) White: Power/Signal Ground (GND) Green: SDI-12 Signal
Protection	IP 66
Size/Weight	B 65 mm, H: 115 mm, T: 56 mm, Weight: 167 g