

ANGLE vs. DIGITAL OUTPUT



OBJECTIVE

This document gives information relating to the digital outputs of the SCA61T, SCA100T, SCA103T, and SCA1X5T- series inclinometers. The document gives the formulas for transferring the digital output to angle, and for transferring the angle to corresponding output signals.

SCA61T, SCA100T, SCA103T, AND SCA1X5T DIGITAL OUTPUT

Transfer equations from angle to digital output and digital output to angle are presented. Also a transfer table from angle to analogue and digital signals is presented.

Transfer function from angle to digital output can be presented as

$$D_{out} [\text{counts}] = \sin(\alpha) \cdot Sens [\text{counts/g}] + D_{out@0^\circ} [\text{counts}], \tag{1}$$

and from digital output to angle as

$$\alpha = \arcsin\left(\frac{D_{out} [\text{counts}] - D_{out@0^\circ} [\text{counts}]}{Sens [\text{counts/g}]}\right), \tag{2}$$

where D_{out} is the digital output, $D_{out@0^\circ}$ is the digital offset value, α is the angle and $Sens$ is the sensitivity of the device. Digital offset value ($D_{out@0^\circ}$) used in calculations is:

- 1024 for SCA61T , SCA100T, and SCA1X5T -series
- 0 for SCA103T series

Transfer table from angle to analog and digital output is presented in Table 1.
Resolution (LSB) between angles 0° to 1° is:

- ~0.070° for 90° (2V/g) device,
- ~0.035° for 30° (4V/g) device,
- ~0.017° for 30° (8V/g) device (differential SCA103T signal),
- ~0.009° for 15° (16V/g) device (differential SCA103T signal)



Table 1. Transfer table from angle to digital and analog output.

Angle [°]	Acceleration [g]	For SCA61T, 100T, 125T- D06				For SCA61T, 100T,115T- D03, 125T-D08		For SCA103T only		For SCA103T only	
		Analog [V/g]	Digital counts / g	Analog [V/g]	Digital counts / g	Differential output		Differential output			
		2	819	4	1638	Out1-Out2 [V/g]	RDAX-RDAY counts / g	Out1-Out2 [V/g]	RDAX-RDAY counts / g		
-90	-1,000	0,500	205	0,000	0	-5,000	-2047	-5,000	-2047		
-80	-0,985	0,530	217	0,000	0	-5,000	-2047	-5,000	-2047		
-70	-0,940	0,621	254	0,000	0	-5,000	-2047	-5,000	-2047		
-60	-0,866	0,768	315	0,000	0	-5,000	-2047	-5,000	-2047		
-50	-0,766	0,968	396	0,000	0	-5,000	-2047	-5,000	-2047		
-40	-0,643	1,214	497	0,000	0	-5,000	-2047	-5,000	-2047		
-30	-0,500	1,500	614	0,500	205	-4,000	-1638	-5,000	-2047		
-25	-0,423	1,655	678	0,810	332	-3,381	-1385	-5,000	-2047		
-20	-0,342	1,816	744	1,132	464	-2,736	-1121	-5,000	-2047		
-15	-0,259	1,982	812	1,465	600	-2,071	-848	-4,141	-1696		
-10	-0,174	2,153	882	1,805	739	-1,389	-569	-2,778	-1138		
-9	-0,156	2,187	896	1,874	768	-1,251	-513	-2,503	-1025		
-8	-0,139	2,222	910	1,943	796	-1,113	-456	-2,227	-912		
-7	-0,122	2,256	924	2,013	824	-0,975	-399	-1,950	-799		
-6	-0,105	2,291	938	2,082	853	-0,836	-343	-1,672	-685		
-5	-0,087	2,326	953	2,151	881	-0,697	-286	-1,394	-571		
-4	-0,070	2,360	967	2,221	910	-0,558	-229	-1,116	-457		
-3	-0,052	2,395	981	2,291	938	-0,419	-171	-0,837	-343		
-2	-0,035	2,430	995	2,360	967	-0,279	-114	-0,558	-229		
-1	-0,017	2,465	1010	2,430	995	-0,140	-57	-0,279	-114		
0	0,000	2,500	1024	2,500	1024	0,000	0	0,000	0		
1	0,017	2,535	1038	2,570	1053	0,140	57	0,279	114		
2	0,035	2,570	1053	2,640	1081	0,279	114	0,558	229		
3	0,052	2,605	1067	2,709	1110	0,419	171	0,837	343		
4	0,070	2,640	1081	2,779	1138	0,558	229	1,116	457		
5	0,087	2,674	1095	2,849	1167	0,697	286	1,394	571		
6	0,105	2,709	1110	2,918	1195	0,836	343	1,672	685		
7	0,122	2,744	1124	2,987	1224	0,975	399	1,950	799		
8	0,139	2,778	1138	3,057	1252	1,113	456	2,227	912		
9	0,156	2,813	1152	3,126	1280	1,251	513	2,503	1025		
10	0,174	2,847	1166	3,195	1309	1,389	569	2,778	1138		
15	0,259	3,018	1236	3,535	1448	2,071	848	4,141	1696		
20	0,342	3,184	1304	3,868	1584	2,736	1121	5,000	2047		
25	0,423	3,345	1370	4,190	1716	3,381	1385	5,000	2047		
30	0,500	3,500	1434	4,500	1843	4,000	1638	5,000	2047		
40	0,643	3,786	1551	5,000	2047	5,000	2047	5,000	2047		
50	0,766	4,032	1652	5,000	2047	5,000	2047	5,000	2047		
60	0,866	4,232	1733	5,000	2047	5,000	2047	5,000	2047		
70	0,940	4,379	1794	5,000	2047	5,000	2047	5,000	2047		
80	0,985	4,470	1831	5,000	2047	5,000	2047	5,000	2047		
90	1,000	4,500	1843	5,000	2047	5,000	2047	5,000	2047		

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VTI Technologies Oy
Myllynkivenkuja 6
P.O.Box 27
FIN-01621 Vantaa
Finland
Tel. +358 9 8791 81
Fax. +358 9 8791 8791
sales@vti.fi

VTI Technologies Oy
Frankfurt Branch
Rennbahnstr. 72-74
D-60528 Frankfurt am Main
Germany
Tel. +49 69 6786 880
Fax +49 69 6786 8829
sales.de@vti.fi

VTI Technologies, Inc.
One Park Lane Blvd.
Suite 804 - East Tower
Dearborn, MI 48126
USA
Tel. (313) 425 0850
Fax (313) 425 0860
sales@vitechnologies.com

