

## **Product sheet**

# **CMS Bolt Load Sensor**

**Phone** [+31 \(0\)24 6 790 797](tel:+31246790797) | **E-mail** [info@boltsafe.com](mailto:info@boltsafe.com)

**Website** [www.boltsafe.com](http://www.boltsafe.com) | **Address** Platinawerf 8, 6641 TL Beuningen, The Netherlands



### ***How does the CMS bolt load sensor work?***

The BoltSafe bolt load cell is a specially designed load cell (load sensor) that monitors the (residual) bolt load in bolted joints. CMS stands for Continuous Monitoring System, which allows for continuous monitoring of the bolt load from one connection point. Several load sensors can be interconnected within a network.

Using a BoltSafe load cell eliminates any uncertainties about the bolt load. This results in enhanced safety, dependable joints and better control over the structure. Besides those safety benefits, the costs during installation and throughout the joint's service life are reduced.



### ***How is the CMS bolt load cell used?***

The load cell is shaped and used as a regular washer and is available in sizes M10 to M100 and 7/8" to 4". Sensors for smaller bolt sizes smaller are available upon request. The BoltSafe bolt load cell is installed on the non-driven side of a bolted connection, preferably under a nut. While tightening the bolt, force is being applied to the load washer, which results in minor deformations of the stainless steel washer. The sensor constantly measures changes in electrical resistance caused by these deformations. This data is used to determine the (residual) bolt load at any moment.



Because of the rugged design of the load cells, they are able to withstand harsh conditions, such as heavy industrial environments. The load sensors can be used in contact with oil, rain, seawater, ice and temperatures up to 80 degrees Celsius (176°F). We do not recommend using the washers in conditions where the temperature is above 80 or below -40 degrees Celsius. Each sensor utilizes an ASIC (Application Specific Integrated Circuit), which performs all signal conditioning and digital communication. Because of this, each BoltSafe load sensor has a unique serial number for individual identification and traceability. The digital monitoring system not only measures the residual bolt load, but can also monitor the sensor temperature.

The calibration of the sensor is done once by BoltSafe. After that, the sensor is plug-and-play and there is no need to recalibrate when different readout methods are used. There is also no need for recalibrating the load cell during its service life, provided that it is used according to its specifications and requirements. Another application of the load cells is in temporary construction. In this case the sensors are used as washers to check the load in the construction to make sure that the temporary construction does not collapse.



### ***Benefits of a continuous monitoring bolt load sensor***

With continuous monitoring, it is a lot easier to determine the bolt load while the load cell is mounted, at any time. In addition to checking the bolt load at any given time, it is also possible to view historical data. This helps to determine when and where a problem with the bolt load might have occurred. The CMS sensor is usually slightly smaller than the PMS sensor. Another benefit of the CMS load cell is that it can be linked with other CMS load cells in a network, where data from all sensors can be monitored at once. The live data from the bolt load cells can be checked remotely with different readout methods.



### ***Readout methods that are compatible with the CMS sensor***

The CMS load cell data can be read by various readout systems. The first option is our handheld reader, the SM-200. The second method is Network with PDI (CM-1000 box with PDI). The next method is Network with PDI-NT (CM-1000 box with PDI-NT). Another method is the RS-232 and Analog Converter. The last possible readout method is our newest innovation, the IoT-node.



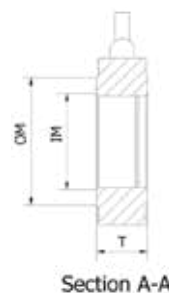
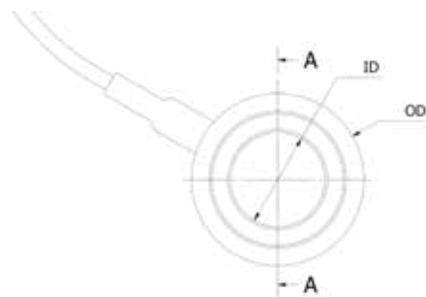
Sizes	To fit bolt sizes from M100 to M72 (7/8" to 4")
Cable lengths	Standard: 1 meter (3.3 feet) (5 or 10 m optional)
Full Scale Load (FS)	From 166 kN to 2500 kN (37318 lbf to 562022 lbf) depending on sensor size
Maximum Load at ambient temperature	FS range x 1.3 (without affecting the validity of the calibration)
Temperature range	-40°C to 80°C (-40°F to 176°F)
Storage Temperature	-40°C to 80°C (-40°F to 176°F)
Minimum Load	10% FS
Total accuracy at ambient temperature (rms)	<1% FS (machined parallel surfaces in bolt-nut assembly)
Linearity	<1.5% FS
Hysteresis	<0.9% FS
Creep	<0.1% FS
Repeatability	<0.5% FS
Typical Temperature effects	< ± 0.08% FS/°C
Sealing	IP66
Material	Stainless Steel 17-4 PH, Condition H1025
Sensor Output	Serial digital signal
Power Supply	Powered through electronic interface
Connection	M12 connector male 5 pole
Intrinsic Safe Code	II 2 G, EEx ib IIC T4 (upon special request)

We also produce CMS bolt load sensors that are able to withstand and measure 15% higher loads, the dimensions of these sensors stay the same (see next page for dimensions). Contact us for more information about these sensors through [info@boltsafe.com](mailto:info@boltsafe.com) or by phone +31 24 6790797.



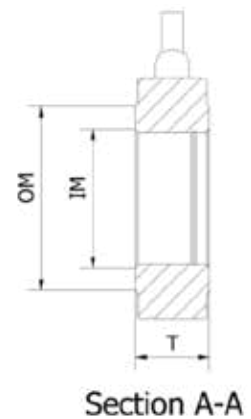
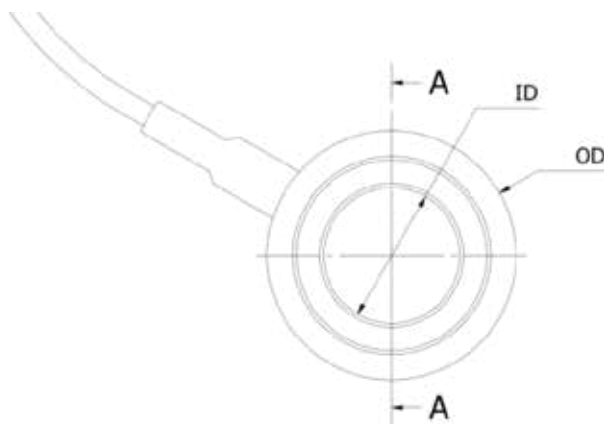
**Dimensions of the bolt load sensor (metric)**

Bolt Size	Clearance Hole ID		Outside Diameter OD		Overall Thickness T		Steel Weight		Max. Load		Measuring Surface IM		Measuring Surface OM	
	mm	inch	mm	inch	mm	inch	gr	oz	kN	lbf	mm	inch	mm	inch
<b>M20</b>	20,4	0,80	37,0	1,46	14	0,55	72	2,54	164	36869	22,0	0,87	27,7	1,09
<b>M22</b>	22,4	0,88	40,0	1,57	14	0,55	83	2,94	222	49908	24,2	0,95	31,4	1,24
<b>M24</b>	24,4	0,96	44,0	1,73	14	0,55	103	3,65	240	53954	26,4	1,04	33,3	1,31
<b>M27</b>	27,4	1,08	50,0	1,97	14	0,55	137	4,82	318	71490	29,7	1,17	38,0	1,50
<b>M30</b>	30,6	1,20	56,0	2,20	17	0,67	211	7,44	405	91048	33,0	1,30	42,8	1,69
<b>M33</b>	33,6	1,32	58,0	2,28	17	0,67	213	7,51	480	107909	36,3	1,43	46,6	1,83
<b>M36</b>	36,6	1,44	66,0	2,60	17	0,67	292	10,30	580	130390	39,6	1,56	51,1	2,01
<b>M39</b>	39,6	1,56	68,0	2,68	17	0,67	294	10,38	710	159615	42,9	1,69	55,9	2,20
<b>M42</b>	42,6	1,68	75,0	2,95	20	0,79	436	15,38	810	182096	46,2	1,82	60,0	2,36
<b>M45</b>	45,6	1,80	80,0	3,15	20	0,79	496	17,50	950	213570	49,5	1,95	64,7	2,55
<b>M48</b>	48,6	1,91	86,0	3,39	20	0,79	581	20,48	1.120	251787	52,8	2,08	69,5	2,74
<b>M52</b>	52,6	2,07	92,0	3,62	20	0,79	659	23,24	1.260	283261	57,2	2,25	74,2	2,92
<b>M56</b>	56,6	2,23	100,0	3,94	20	0,79	790	27,87	1.395	313610	61,6	2,43	78,7	3,10
<b>M60</b>	60,8	2,39	108,0	4,25	23	0,91	1.070	37,73	1.515	340587	66,0	2,60	83,4	3,28
<b>M64</b>	64,8	2,55	114,0	4,49	23	0,91	1.183	41,72	1.680	377681	70,4	2,77	88,2	3,47
<b>M64HV</b>	68,4	2,69	116,0	4,57	23	0,91	1.178	41,54	1.880	422643	73,5	2,89	93,0	3,66
<b>M68</b>	68,8	2,71	121,0	4,76	23	0,91	1.335	47,10	1.860	418147	74,9	2,95	92,9	3,66
<b>M72</b>	72,8	2,87	128,0	5,04	23	0,91	1.497	52,80	2.120	476597	79,4	3,13	97,7	3,85
<b>M72HV</b>	72,8	2,87	130,0	5,12	23	0,91	1.565	55,22	2.940	660941	78,4	3,09	110,0	4,33
<b>M76</b>	76,8	3,02	135,0	5,31	23	0,91	1.668	58,83	2.300	517063	83,7	3,30	102,4	4,03
<b>M80</b>	80,8	3,18	142,0	5,59	23	0,91	1.848	65,18	2.500	562025	88,1	3,47	107,2	4,22
<b>M85</b>	85,8	3,38	151,0	5,94	23	0,91	2.096	73,94	2.825	635088	96,6	3,80	113,9	4,48
<b>M90</b>	90,8	3,57	160,0	6,30	23	0,91	2.360	83,25	3.210	721640	99,1	3,90	121,1	4,77
<b>M100</b>	100,8	3,97	177,0	6,97	23	0,91	2.885	101,77	4.040	908232	110,2	4,34	135,4	5,33



**Dimensions of the bolt load sensor (imperial)**

Bolt Size	Clearance Hole ID		Outside Diameter OD		Overall Thickness T		Steel Weight		Max. Load		Measuring Surface IM		Measuring Surface OM	
	mm	inch	mm	inch	mm	inch	gr	oz	kN	lbf	mm	inch	mm	inch
<b>7/8"</b>	22,6	0,89	47,0	1,85	14	0,55	134	4,72	282	63396	25,8	1,02	32,9	1,30
<b>1"</b>	25,8	1,02	52,0	2,05	14	0,55	162	5,70	348	78234	29,0	1,14	37,1	1,46
<b>1-1/8"</b>	29,0	1,14	57,1	2,25	14	0,55	193	6,79	415	93296	32,2	1,27	41,4	1,63
<b>1-1/4"</b>	32,3	1,27	63,0	2,48	17	0,67	285	10,04	490	110157	35,5	1,40	45,7	1,80
<b>1-3/8"</b>	35,5	1,40	69,0	2,72	17	0,67	342	12,08	570	128142	38,7	1,52	50,0	1,97
<b>1-1/2"</b>	38,7	1,52	78,0	3,07	17	0,67	453	15,97	665	149499	41,9	1,65	54,3	2,14
<b>1-5/8"</b>	41,9	1,65	80,0	3,15	17	0,67	457	16,12	770	173104	45,4	1,79	58,6	2,31
<b>1-3/4"</b>	45,1	1,78	85,0	3,35	20	0,79	602	21,24	910	204577	48,9	1,93	63,6	2,50
<b>1-7/8"</b>	48,2	1,90	91,0	3,58	20	0,79	693	24,45	1.050	236051	52,4	2,06	67,9	2,67
<b>2"</b>	51,4	2,02	98,0	3,86	20	0,79	813	28,68	1.180	265276	55,9	2,20	72,2	2,84
<b>2-1/4"</b>	57,8	2,28	108,8	4,28	23	0,91	1.145	40,38	1.530	343959	62,9	2,48	81,8	3,22
<b>2-1/2"</b>	64,3	2,53	116,6	4,59	23	0,91	1.275	44,97	1.860	418147	69,9	2,75	90,6	3,57
<b>2-3/4"</b>	70,8	2,79	124,0	4,88	23	0,91	1.396	49,26	2.220	499078	76,4	3,01	99,0	3,90
<b>3"</b>	77,0	3,03	135,0	5,31	23	0,91	1.662	58,61	2.700	606987	83,5	3,29	109,2	4,30
<b>3-1/4"</b>	83,3	3,28	147,0	5,79	23	0,91	1.989	70,14	3.150	708152	90,4	3,56	118,3	4,66
<b>3-1/2"</b>	89,7	3,53	158,0	6,22	23	0,91	2.298	81,05	3.640	818308	97,4	3,83	127,4	5,02
<b>3-3/4"</b>	96,1	3,78	169,0	6,65	23	0,91	2.629	92,75	4.200	944202	104,3	4,11	136,5	5,37
<b>4"</b>	102,4	4,03	180,0	7,09	23	0,91	2.986	105,33	4.800	1079088	111,3	4,38	145,6	5,73





**Bolt Safe**

MEMBER OF



Phone +31 (0)24 6 790 797 | E-mail [info@boltsafe.com](mailto:info@boltsafe.com)  
Address Platinawerf 8, 6641 TL Beuningen, The Netherlands  
Website [www.boltsafe.com](http://www.boltsafe.com)