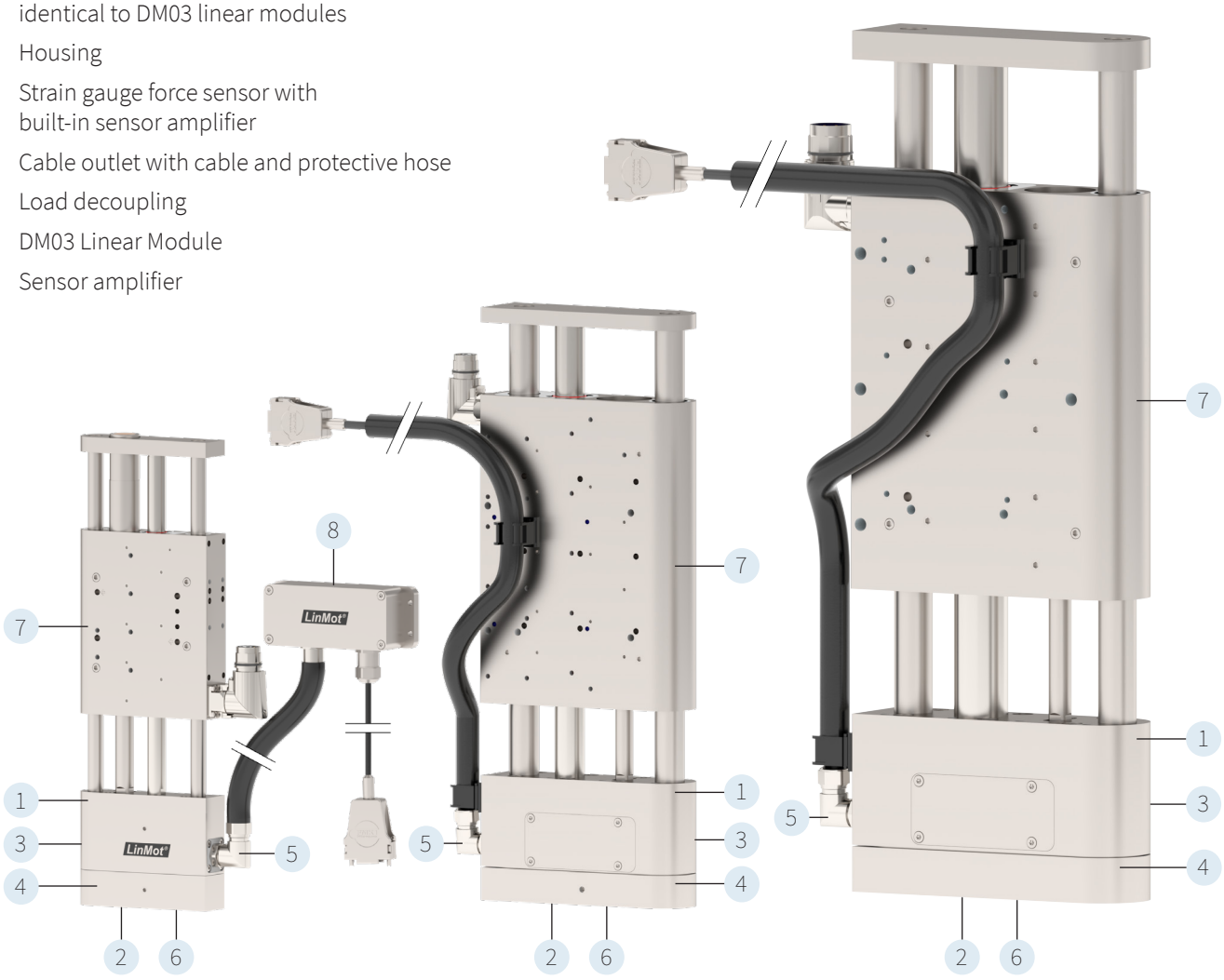
FORCE SENSOR MODULES
DM03-23-FS / DM03-37-FS / DM03-48-FS

- Front flange with force sensor for direct mounting on DM03 modules
- Realization of force-controlled applications such as joining or pressing
- Implementation of process controls based on force profiles
- Decoupled force measurement in the direction of movement independent of the force application point
- Arbitrary mounting of grippers or tools without measurement influence
- High measuring accuracy with simultaneous high overload resistance

FORCE SENSOR MODULES DM03-23-FS / DM03-37-FS / DM03-48-FS

1. Base plate for direct mounting on the linear modules of the DM03 series
2. Fixing points for the load (gripper, tools, etc.) identical to DM03 linear modules
3. Housing
4. Strain gauge force sensor with built-in sensor amplifier
5. Cable outlet with cable and protective hose
6. Load decoupling
7. DM03 Linear Module
8. Sensor amplifier



DM03-23-FS **DM03-37-FS** **DM03-48-FS**

Force Sensor Modules

The force sensor modules of the DM03 series can be flanged directly to the DM03 linear modules and thus enable the measurement of the forces occurring in the direction of movement of the modules. Together with the C1250 drives, which can also be calibrated, it is thus possible to either execute a process in a force-controlled manner or to implement process monitoring based on the forces that occur.

The technology of the force measurement modules is based on the proven use of strain gauges (DMS sensors) as used in classic load cells. Such force sensors have already been used successfully with LinMot linear motors and the dedicated technology function "force control". However, with conventional load cells it is important to note that the force must be applied centrally and precisely in the axial direction. In addition, no lateral forces may occur, which also makes it largely impossible to attach grippers or tools on the side of the force application. From the user's point of view, this severely restricts the possible applications or requires a undesirable design effort. With the newly developed force sensor modules from LinMot, these restrictions no longer apply. The actual force sensor technology was integrated into the force sensor module in such a way that lateral loads are absorbed and unfavorable force application is largely compensated for. The great advantage for the user is that fixtures or grippers can be mounted without affecting the force measurement. A classic +/- 10V signal is generated as the output signal for the LinMot Drives or also for a PLC. The amplifier and evaluation circuitry required for this is built into the force sensor module in a protected manner. This makes the installation of the module as well as its recalibration very simple.

Designation Code Linear Modules DM03 with Force Sensor FS

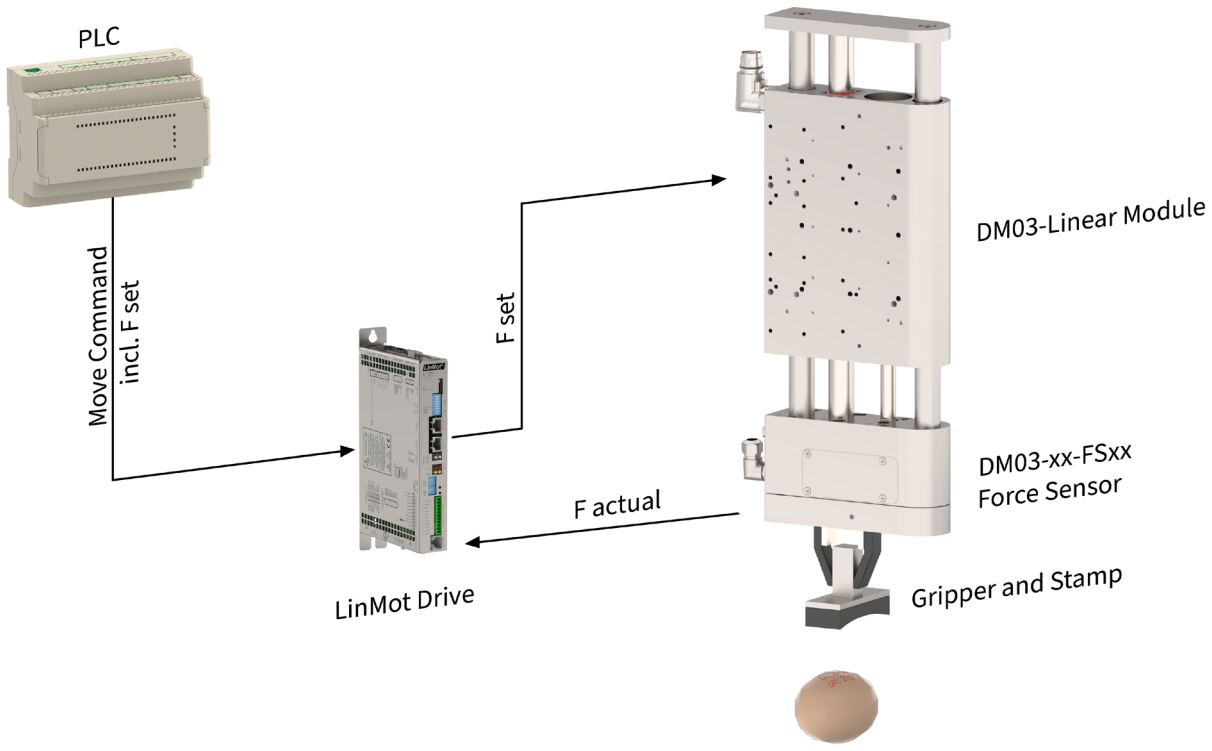
DM03 - 37 - FS21 - SL01

- SL01 – IP Protection class
- FS21 – Measuring range
- 37 – Motor type
- DM03 – Linear module

The force sensor modules differ in a number of ways. For each size of DM03 linear module there is a corresponding sensor module. In addition, the customer can choose between different measuring ranges for the force sensors. These are divided into 50 N, 100 N, 250 N and 500 N. LinMot also offers different protection classes for the sensors. This ensures that the sensors can also be used in demanding environments.

Applications

Typical applications include force-controlled assembly of parts or components. For this purpose, dedicated force control software ("technology function") is installed on the LinMot drives of the C1250 series, which can be used to switch dynamically between position control and force control. This allows parts to be positioned and then assembled with defined pressure. The second group of applications covers the topic of process monitoring. For this purpose, the corresponding force values are continuously recorded and then compared with the target values. Any deviations are used to detect errors or, in the sense of creeping process changes, to detect them at an early stage. Typically, the "Process Monitoring" application software is installed on the LinMot C1250 Drive. It enables easy monitoring of measured variables by means of freely definable monitoring windows. The following figure shows an example of a closed force control loop. A characteristic feature is the high measuring accuracy despite axially offset force application and external weight influence (gripper and punch), which acts on the output side of the force sensor.



TECHNICAL DATA

			DM03-23-FS23-SL01
Supply Voltage		VDC	24
Measuring Range		N (lbf)	50 (11.24)
Measuring Direction			Zug & Druck
Boundary Frequency -3dB Measuring Amplifier		kHz	4.4
Output Signal [1]		VDC	±10
Current Consumption		mA	<100
Zero Offset		mV	<100
Mechanical Overload	Compression Direction	% FS [2]	300
	Tension Direction	% FS [2]	300
Resolution (C1250 Drive)		Bit	12
Linearity & Hysteresis		% FS [2]	<1
Nominal Measuring Distance		mm (in)	0.02 (0.0008)
Maximum Shear Force		N	60
IP Code			IP 40
Operating Temperature	Nominal	°C	5…45
	Reduced Accuracy	°C	0…80
Weight *		g (lb)	390 / 890 (0.86 / 1.96)

* Moving Mass / Total Weight

			DM03-37-FS21-SL01	DM03-37-FS22-SL01
Supply Voltage		VDC	24	24
Measuring Range		N (lbf)	100 (22.5)	250 (56.2)
Measuring Direction			Zug & Druck	Zug & Druck
Boundary Frequency -3dB Measuring Amplifier		kHz	4.4	4.4
Output Signal [1]		VDC	±10	±10
Current Consumption		mA	<100	<100
Zero Offset		mV	<100	<100
Mechanical Overload	Compression Direction	% FS [2]	800	400
	Tension Direction	% FS [2]	400	200
Resolution (C1250 Drive)		Bit	12	12
Linearity & Hysteresis		% FS [2]	<1	<1
Nominal Measuring Distance		mm (in)	0.02 (0.0008)	0.02 (0.0008)
Maximum Shear Force		N	400	400
IP Code			IP 40	IP 40
Operating Temperature	Nominal	°C	5…45	5…45
	Reduced Accuracy	°C	0…80	0…80
Weight		g (lb)	1375 (3.03)	1375 (3.03)

			DM03-48-FS22-SL01	DM03-48-FS25-SL01
Supply Voltage		VDC	24	24
Measuring Range		N (lbf)	250 (56.2)	500 (112.4)
Measuring Direction			Zug & Druck	Zug & Druck
Boundary Frequency -3dB Measuring Amplifier		kHz	4.4	4.4
Output Signal [1]		VDC	±10	±10
Current Consumption		mA	<100	<100
Zero Offset		mV	<100	<100
Mechanical Overload	Compression Direction	% FS [2]	800	500
	Tension Direction	% FS [2]	300	200
Resolution (C1250 Drive)		Bit	12	12
Linearity & Hysteresis		% FS [2]	<1	<1
Nominal Measuring Distance		mm (in)	0.02 (0.0008)	0.02 (0.0008)
Maximum Shear Force		N	300	300
IP Code			IP 40	IP 40
Operating Temperature	Nominal	°C	5…45	5…45
	Reduced Accuracy	°C	0…80	0…80
Weight		g (lb)	1660 (3.66)	1740 (3.84)

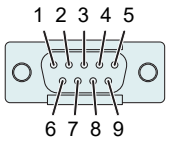
1) The sign of the output signal of the force sensor is defined analogue to the default position movement direction of the DM01 module, see assembly instructions.
2) FS = Full Scale

CONNECTOR

Connector Wiring	Force Sensor DSub-9	Wire Color Sensor Cable
Supply GND	1	white
Do not connect	2	n/a
AGND	3	pink
Do not connect	4	n/a
Force +	5	grey
Supply 24V	6	brown
Do not connect	7	n/a
Motlink P	8	green
Force -	9	yellow
Connector Housing	Shield	n/a

PIN 9 (Force -) and PIN 1 (Supply ground) are internally galvanically isolated and must not be connected to each other.

DSub-9 Female



The force sensor has a 2 m cable outlet with a DSub-9 connector at the end of the cable.

ACCURACY AND CALIBRATION

The force sensors are delivered with a factory calibration certificate valid for two years. After initial commissioning, it is recommended that the sensors are calibrated annually by LinMot (see the 'Recalibration' section).
The following table lists the respective accuracies and factory calibrations of the individual sensor types, along with their corresponding item numbers. The accuracy and calibration refer to a centric load on the force sensor. In the case of eccentric loading, a small gain error is to be expected depending on the lever length (see chapter ‘Permissible eccentric load’). However, the repeatability of the measurements is still guaranteed.

Force Sensor Type	Factory Calibration Full Range, 1%	Factory Calibration Full Range, 0.5%
DM03-23-FS23-SL01	0150-6588-00	N/A
DM03-37-FS21-SL01	0150-6240-00	0150-6240-03
DM03-37-FS22-SL01	0150-6241-00	0150-6241-03
DM03-48-FS22-SL01	0150-6242-00	0150-6242-03
DM03-48-FS25-SL01	0150-6243-00	0150-6243-03

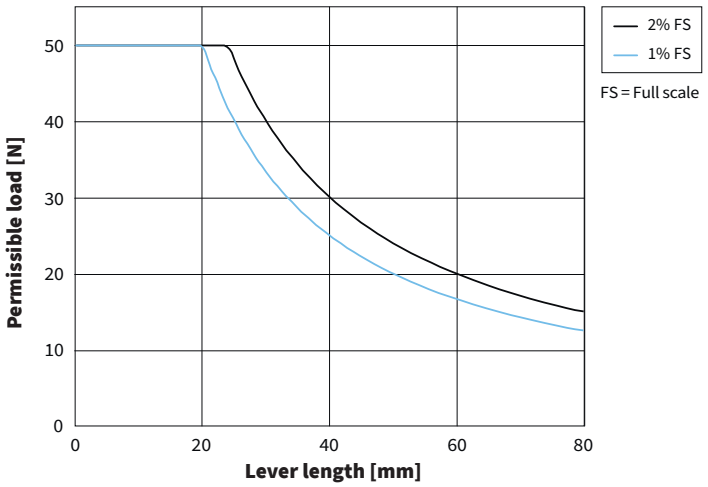
RECALIBRATION

Annual recalibration is recommended for normal operating conditions. This cycle may need to be adjusted depending on customer requirements and the application in question.
The same calibration items apply to all sensor types (DM03-23, DM03-37 and DM03-48). The only difference is in accuracy. The following table provides an overview.

Force Sensor Type	Recalibration Full Range, 1%	Recalibration Full Range, 0.5%
DM03-23-FS23-SL01	0120-6050	N/A
DM03-37-FS21-SL01	0120-6050	0120-6051
DM03-37-FS22-SL01	0120-6050	0120-6051
DM03-48-FS22-SL01	0120-6050	0120-6051
DM03-48-FS25-SL01	0120-6050	0120-6051

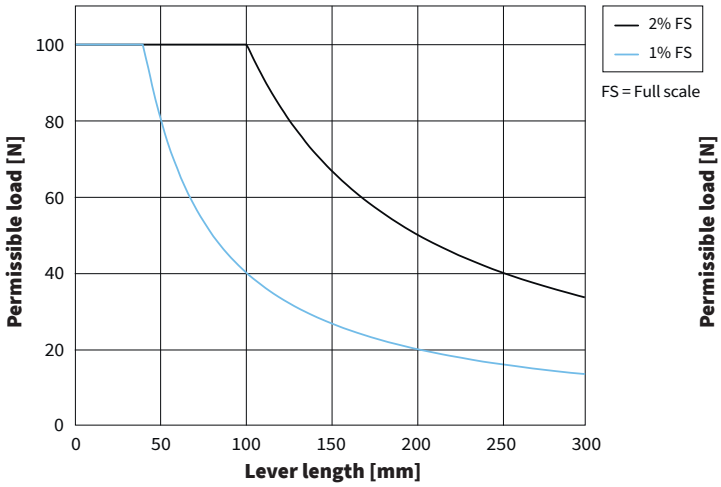
PERMISSIBLE ECCENTRIC LOAD

DM03-23-FS23-SL01

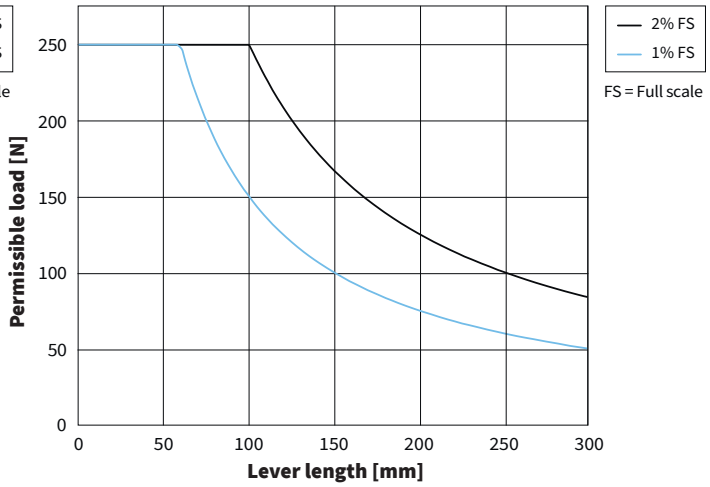


The sensor can absorb eccentric loads up to a defined limit. As the lever arm increases (the distance between the point at which force is applied and the centre of the sensor), both the permissible load and the measuring accuracy decrease. The dependence of these parameters on eccentricity and lever arm is illustrated in the following diagrams.

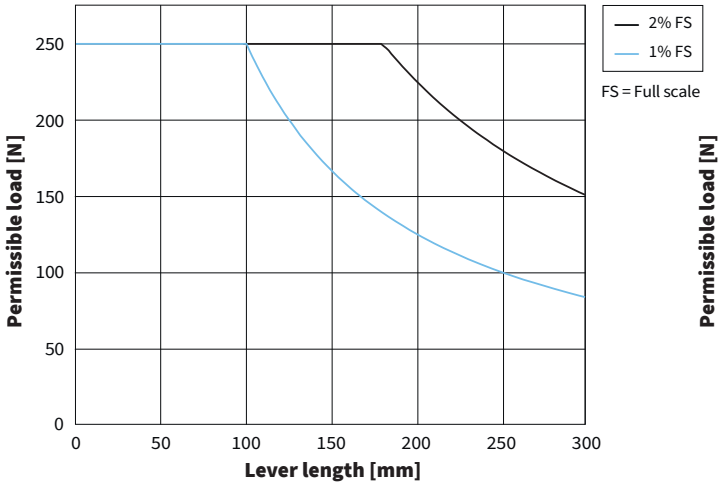
DM03-37-FS21-SL01



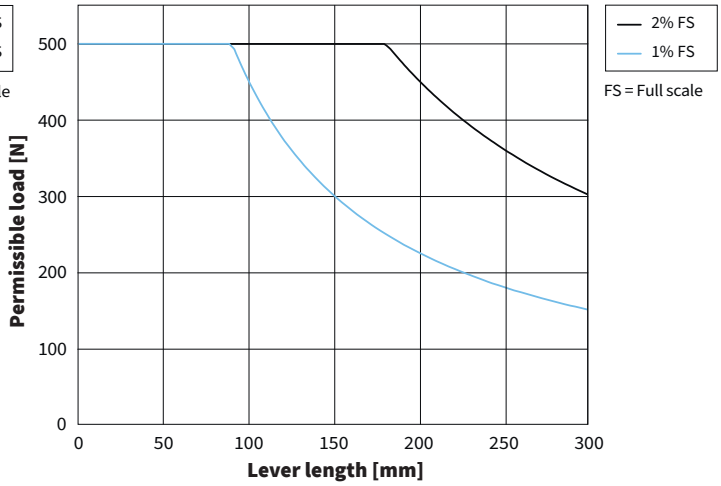
DM03-37-FS22-SL01



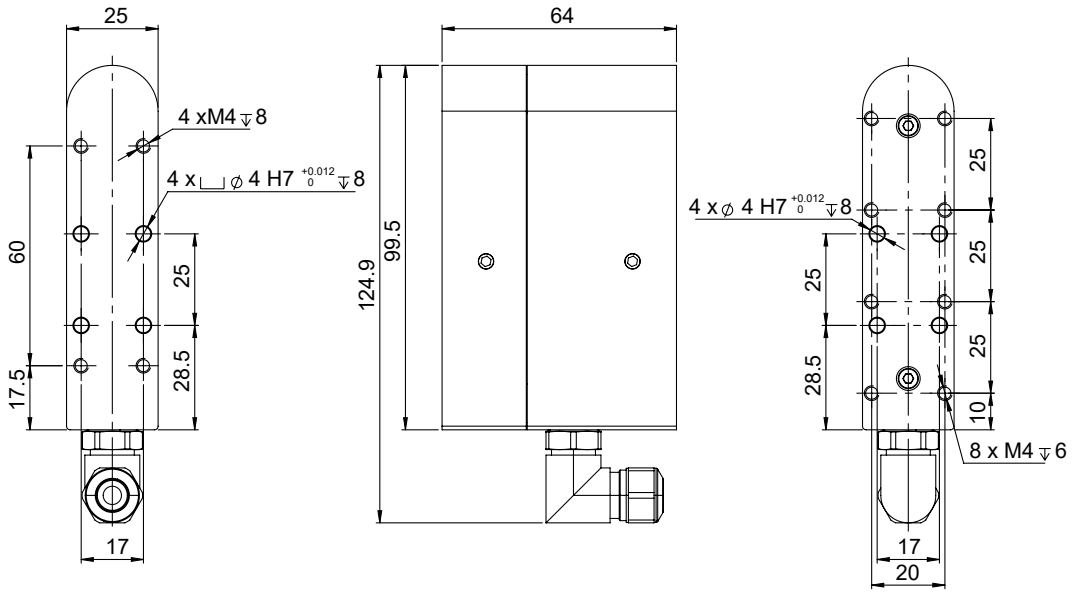
DM03-48-FS22-SL01

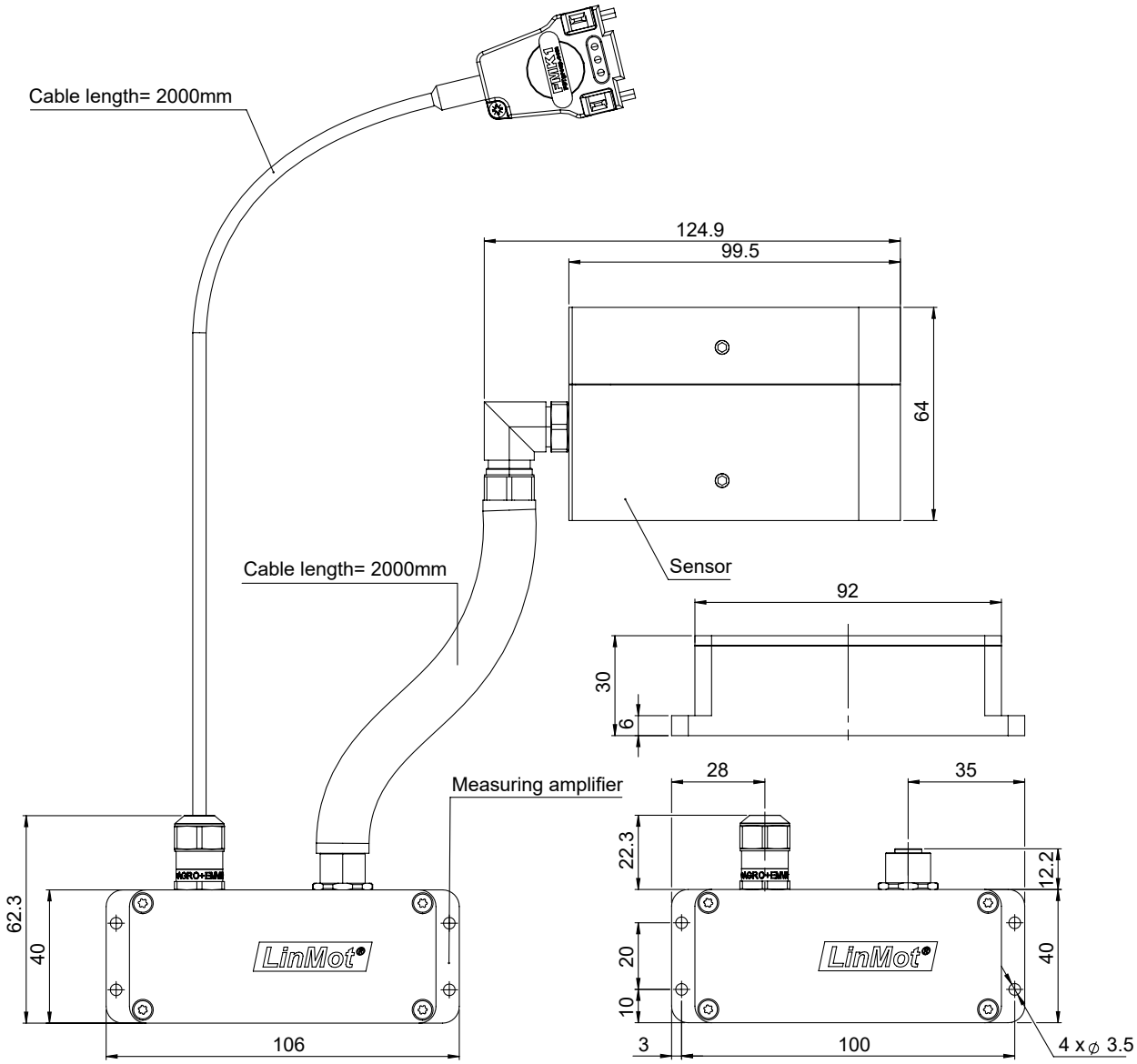


DM03-48-FS25-SL01



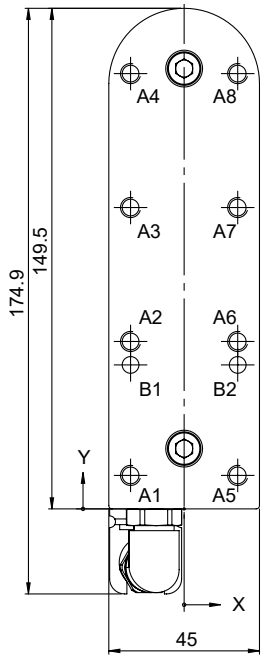
DIMENSIONS DM03-23-FS

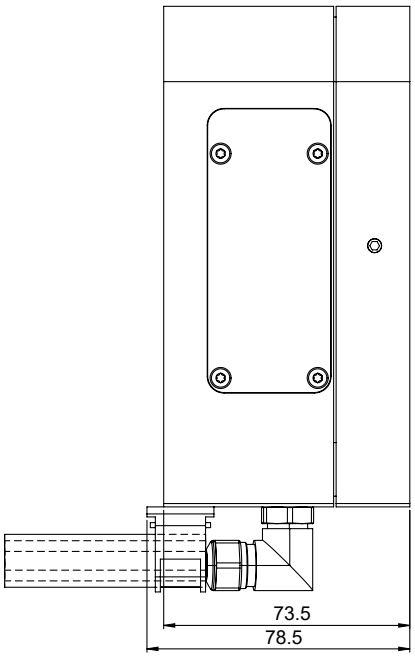


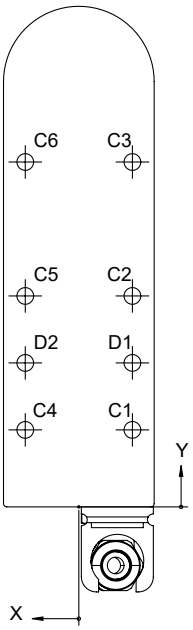


Dimensions mm

DIMENSIONS DM03-37-FS

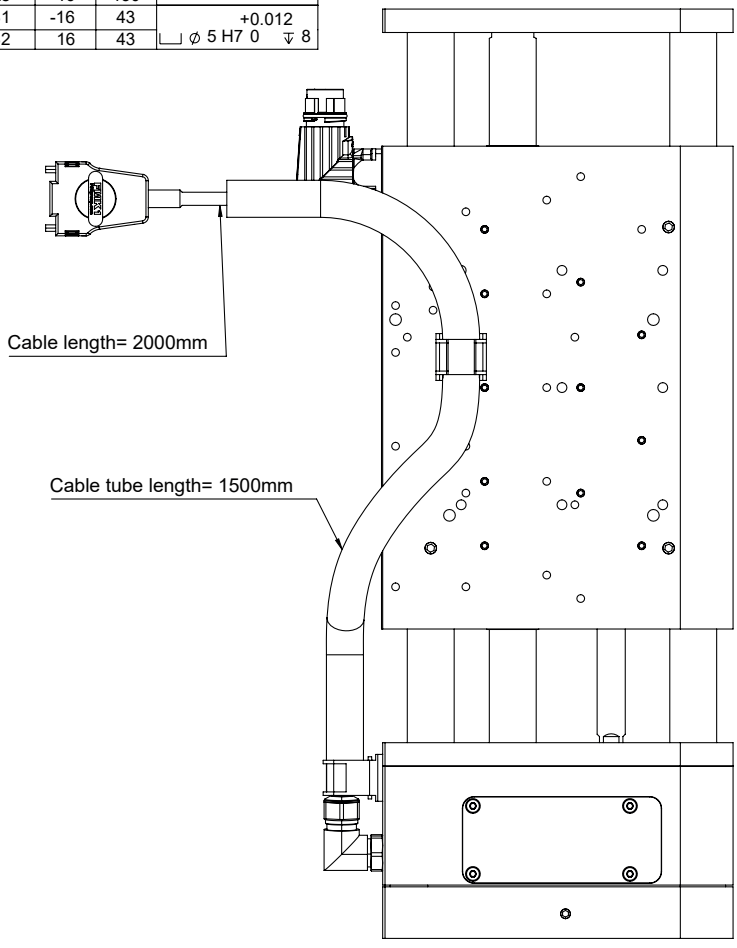






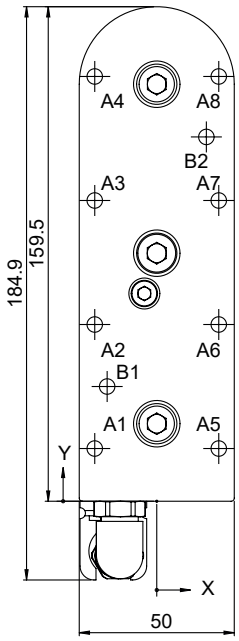
	X-POS.	Y-POS.	
A1	-16	10	M6 ↧ 10
A2	-16	50	
A3	-16	90	
A4	-16	130	
A5	16	10	
A6	16	50	
A7	16	90	
A8	16	130	
B1	-16	43	+0.012 ⌴ ⌀ 5 H7 0 ↧ 8
B2	16	43	

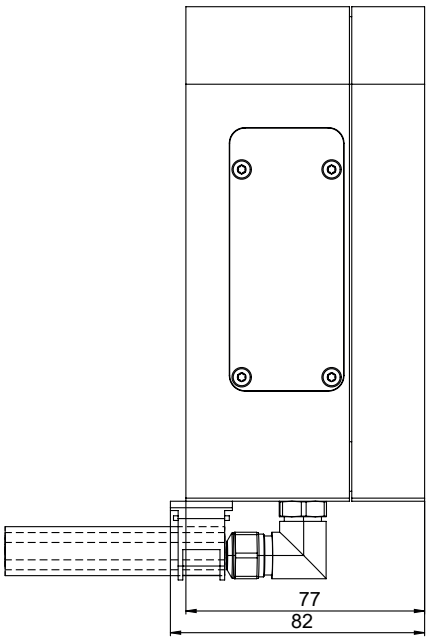
	X-POS.	Y-POS.	
C1	-16	23	M6 ↧ 10
C2	-16	63	
C3	-16	103	
C4	16	23	
C5	16	63	
C6	16	103	
D1	-16	43	+0.012
D2	16	43	⌴ ⌀ 5 H7 0 ↧ 8

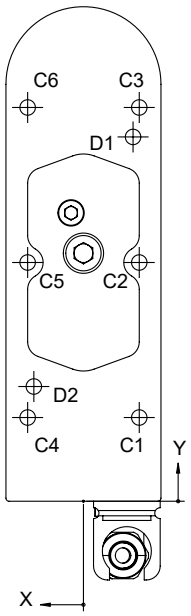


Dimensions mm

DIMENSIONS DM03-48-FS

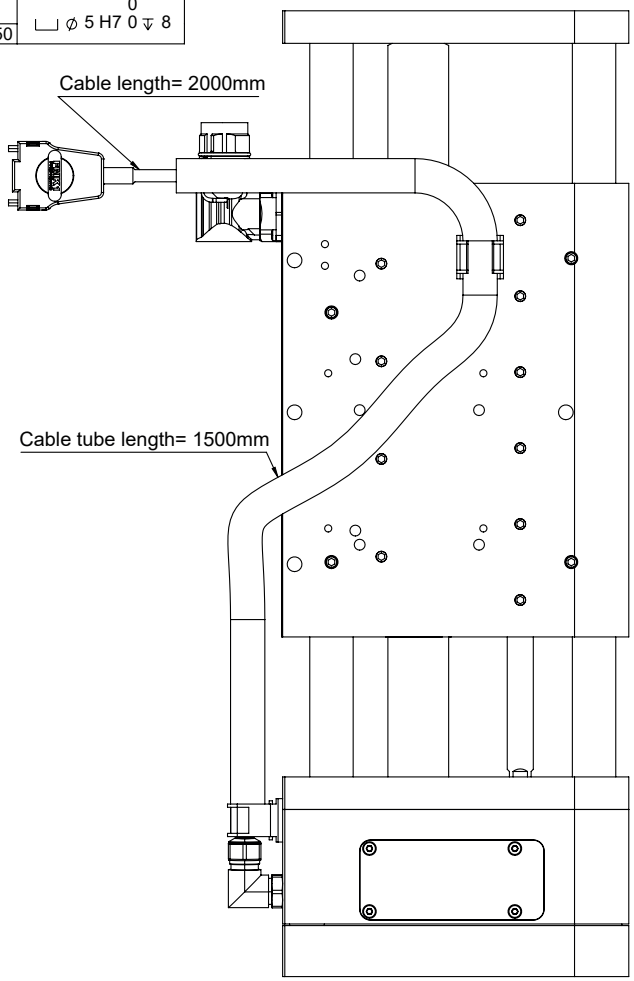






	X-POS	Y-POS	
A1	-20	17	M6 ↧10
A2	-20	57	
A3	-20	97	
A4	-20	137	
A5	20	17	
A6	20	57	
A7	20	97	
A8	20	137	
B1	-16	37	⌴ ⌀ 5 H7 +0.012 0 ↧ 8
B2	16	117.50	

	X-POS	Y-POS	
C1	-18	27	M6 ↧10
C2	-18	77	
C3	-18	127	
C4	18	27	
C5	18	77	
C6	18	127	
D1	-16	117.50	⌴ ⌀ 5 H7 +0.012 0 ↧ 8
D2	16	37	



Dimensions mm

ORDERING INFORMATION

Item	Description	Item-No.
DM03-23-FS23-SL01	Force Sensor Kit, +-50 N, Cal. Class A, IP40, Factory Calibration 1%	0150-6588-00
DM03-37-FS21-SL01	Force Sensor Kit, +-100 N, Cal. Class B, IP40, Factory Calibration 1%	0150-6240-00
DM03-37-FS21-SL01	Force Sensor Kit, +-100 N, Cal. Class B, IP40, Factory Calibration 0.5%	0150-6240-03
DM03-37-FS22-SL01	Force Sensor kit, +-250 N, Cal. Class B, IP40, Factory Calibration 1%	0150-6241-00
DM03-37-FS22-SL01	Force Sensor Kit, +-250 N, Cal. Class B, IP40, Factory Calibration 0.5%	0150-6241-03
DM03-48-FS22-SL01	Force Sensor Kit, +-250 N, Cal. Class B, IP40, Factory Calibration 1%	0150-6242-00
DM03-48-FS22-SL01	Force Sensor Kit, +-250 N, Cal. Class B, IP40, Factory Calibration 0.5%	0150-6242-03
DM03-48-FS25-SL01	Force Sensor Kit, +-500 N, Cal. Class B, IP40, Factory Calibration 1%	0150-6243-00
DM03-48-FS25-SL01	Force Sensor Kit, +-500 N, Cal. Class B, IP40, Factory Calibration 0.5%	0150-6243-03
KSS014-06-./D	Extension Cable for Connection to C11x0 and C12xx Servo Drives	0150-5359
KSS014-06-./D	Extension Cable for Connection to Servo Drive C1252	0150-6016

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