HighLine

MEASURING LENGTHS UP TO 50 M, RUGGED DESIGN - THE HEAVY-DUTY WIRE DRAW ENCODER

Wire draw encoders

SICK
Sensor Intelligence.

MEASURING LENGTHS UP TO 50 M, RUGGED DESIGN - THE HEAVY-DUTY WIRE DRAW ENCODER

Product description

With wire draw lengths from 2 to 50 m, the HighLine series of wire draw encoders have enormous range. Thanks to guide rollers, the HighLine series enables flexible measurement paths - even around obstacles. Their rugged housing and dirt-resistant brush assemblies allow the encoder to be used in the toughest of environments, including dust, shock and vibration, which ensure a long service lifetime.

At a glance

- Measuring lengths: 2 m … 50 m
- Modular measuring system with a wide selection of interfaces/measuring lengths
- Very rugged system (dirt scraper, integrated brushes)
- High-quality winding mechanism and wire input
- High enclosure rating
- High shock and vibration resistance
- Extremely high resolution possible
- Expandable using external accessories

Your benefits

- Reliable solution for use in harsh ambient conditions
- Long service life due to rugged industrial housing
- Quick and easy installation without the need for precise linear guidance
- Low integration and maintenance costs
- Customization option reduces storage costs
- Analog interface speeds up commissioning and cost-effective interface card can be used

CE

Additional information

➜ www.sick.com/HighLine

For more information, simply enter the link or scan the QR code and get direct access to technical data, CAD design models, operating instructions, software, application examples, and much more.

Fields of application

- Positioning of rack operation equipment
- Positioning grippers and trolleys with cranes
- Automated guided systems

- Elevators
- Lifting platforms
- Presses

Detailed technical data

Performance

BTF

Measurement range	0 m … 2 m 0 m … 3 m 0 m … 5 m 0 m … 10 m 0 m … 20 m 0 m … 30 m 0 m … 50 m 0 m … 15 m
Encoder	Absolute encoders
Resolution (wire draw + encoder)	Example calculation based on the BTF08 with PROFINET: 200 mm (wire draw length per revolution - see Mechanical data): 262,144 (number of steps per revolution) = 0.001 mm (resolution of wire draw + encoder combination).
Repeatability	≤ 1 mm [1] ≤ 1.5 mm [1] ≤ 2 mm [1] ≤ 5 mm [1]
Linearity	≤ ± 2 mm [1]
Hysteresis	≤ 2 mm [1] ≤ 3 mm [1] ≤ 5 mm [1] ≤ 10 mm [1]

[1] Value applies to wire draw mechanism.

PRF

Measurement range	0 m … 2 m 0 m … 3 m 0 m … 5 m 0 m … 10 m 0 m … 20 m 0 m … 30 m 0 m … 50 m
Encoder	Incremental encoders
Resolution (wire draw + encoder)	Example calculation based on the PRF08 with HTL Push Pull: 200 mm (wire draw length per revolution - see Mechanical data): 2,000 (pulses per revolution) = 0.1 mm (resolution of wire draw + encoder combination).
Repeatability	≤ 1 mm [1] ≤ 1.5 mm [1] ≤ 2 mm [1] ≤ 5 mm [1]
Linearity	≤ ± 2 mm [1]
Hysteresis	≤ 2 mm [1] ≤ 3 mm [1] ≤ 5 mm [1] ≤ 10 mm [1]

[1] Value applies to wire draw mechanism.

Interfaces

BTF

Communication interface	IO-Link / V1.1 / COM3 (230,4 kBaud) CANopen SSI PROFINET EtherCAT® EtherNet/IP™ PROFIBUS DP DeviceNet™ Analog / Current / 4...20 mA Analog / Voltage / 0...10 V
Programmable/configurable	✔

PRF

Communication interface	Incremental / TTL / RS-422 Incremental / TTL / Push pull Incremental / TTL / HTL
Programmable/configurable	✔ –

Electrical data

BTF

Connection type	
AHM36 IO-Link Basic	Male connector, M12, 4-pin, universal
AHM36 IO-Link Advanced	Male connector, M12, 4-pin, universal
AHM36 CANopen	Male connector, M12, 5-pin, universal
AHM36 SSI	Male connector, M12, 8-pin, universal Cable, 8-wire, universal, 5 m
AFM60 PROFINET	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial
AFM60 EtherCAT®	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial
AFM60 EtherNet/IP	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial
ATM60 SSI	Male connector, M23, 12-pin, radial
ATM60 PROFIBUS	Connection adapter for PROFIBUS [1]
ATM60 DeviceNet	Connection adapter for DeviceNet [1]
ATM60 CANopen	Connection adapter for CANopen [1]
A3M60 PROFIBUS	Male connector, 2 x M12, 5-pin, axial Female connector, 1 x M12, 5-pin, axial
ACM60	Male connector, M12, 5-pin, radial
Supply voltage	
AHM36 IO-Link Basic	18 V ... 30 V
AHM36 IO-Link Advanced	18 V ... 30 V
AHM36 CANopen	10 V ... 30 V
AHM36 SSI	4.5 V DC ... 32 V DC
AFM60 PROFINET	10 V DC ... 30 V DC

[1] Please order the bus adaptor seperately.

[2] This product is a standard product and does not constitute a safety component as defined in the Machinery Directive. Calculation based on nominal load of components, average ambient temperature 40°C, frequency of use 8760 h/a. All electronic failures are considered hazardous. For more information, see document no. 8015532.

AFM60 EtherCAT®	10 V DC ... 30 V DC
AFM60 EtherNet/IP	10 V DC ... 30 V DC
ATM60 SSI	10 V ... 32 V
ATM60 PROFIBUS	10 V ... 32 V
ATM60 DeviceNet	10 V ... 32 V
ATM60 CANopen	10 V ... 32 V
A3M60 PROFIBUS	10 V ... 32 V
ACM60	18 V DC ... 33 V DC
Operating current	≤ 80 mA (without load)
Power consumption	
AHM36 IO-Link Basic	≤ 1.5 W (without load)
AHM36 IO-Link Advanced	≤ 1.5 W (without load)
AHM36 CANopen	≤ 1.5 W (without load)
AHM36 SSI	≤ 1.5 W (without load)
AFM60 PROFINET	≤ 3 W (without load)
AFM60 EtherCAT®	≤ 3 W (without load)
AFM60 EtherNet/IP	≤ 3 W (without load)
ATM60 SSI	≤ 0.8 W (without load)
ATM60 PROFIBUS	≤ 2 W (without load)
ATM60 DeviceNet	≤ 2 W (without load)
ATM60 CANopen	≤ 2 W (without load)
A3M60 PROFIBUS	≤ 1.5 W (without load)
MTTFd: mean time to dangerous failure	
AHM36 IO-Link Basic	240 years (EN ISO 13849-1) [2]
AHM36 IO-Link Advanced	240 years (EN ISO 13849-1) [2]
AHM36 CANopen	270 years (EN ISO 13849-1) [2]
AHM36 SSI	230 years (EN ISO 13849-1) [2]
AFM60 PROFINET	80 years (EN ISO 13849-1) [2]
AFM60 EtherCAT®	80 years (EN ISO 13849-1) [2]
AFM60 EtherNet/IP	80 years (EN ISO 13849-1) [2]
ATM60 SSI	150 years (EN ISO 13849-1) [2]
ATM60 PROFIBUS	150 years (EN ISO 13849-1) [2]
ATM60 DeviceNet	150 years (EN ISO 13849-1) [2]
ATM60 CANopen	150 years (EN ISO 13849-1) [2]
A3M60 PROFIBUS	60 years (EN ISO 13849-1) [2]
ACM60	600 years (EN ISO 13849-1) [2]

[1] Please order the bus adaptor seperately.

[2] This product is a standard product and does not constitute a safety component as defined in the Machinery Directive. Calculation based on nominal load of components, average ambient temperature 40°C, frequency of use 8760 h/a. All electronic failures are considered hazardous. For more information, see document no. 8015532.

PRF

Connection type	Male connector, M23, 12-pin, radial Male connector, M12, 8-pin, radial Cable, 8-wire, universal, 5 m Cable, 8-wire, universal, 1.5 m
Supply voltage	4.5 V ... 5.5 V 10 V ... 32 V 4.5 V ... 32 V
Power consumption	≤ 0.7 W (without load) ≤ 0.5 W (without load)
MTTFd: mean time to dangerous failure	300 years (EN ISO 13849-1) [1]

[1] This product is a standard product and does not constitute a safety component as defined in the Machinery Directive. Calculation based on nominal load of components, average ambient temperature 40°C, frequency of use 8760 h/a. All electronic failures are considered hazardous. For more information, see document no. 8015532.

Mechanical data

BTF

	0 m ... 2 m	0 m ... 3 m	0 m ... 5 m	0 m ... 10 m	0 m ... 20 m	0 m ... 30 m	0 m ... 50 m	0 m ... 15 m
Measuring wire material	Highly flexible stranded steel 1,4401 stainless steel V4A							
Weight (measuring wire)	7.1 g/m				2.6 g/m		7.1 g/m	
Housing material, wire draw mechanism	Aluminum (anodized), zinc die cast	Aluminum (anodised), plastic					Aluminum (anodized), zinc die cast	Aluminum (anodised), plastic
Spring return force	6 N ... 14 N [1]		15 N ... 20 N [1]	10 N ... 20 N [1]			18 N ... 37 N [1]	10 N ... 20 N [1]
Length of wire pulled out per revolution	200 mm		334.1 mm	332.4 mm 327.7 mm	332.4 mm		491.5 mm	327.7 mm
Life of wire draw mechanism	Typ. 1,000,000 cycles [2] [3]							
Actual wire draw length	2.2 m	3.2 m	5.2 m	10.2 m 15.2 m	20.2 m	30.2 m	50.2 m	15.2 m
Wire acceleration	40 m/s²		70 m/s²	40 m/s²	30 m/s²	15 m/s²	18 m/s²	–
Operating speed	8 m/s			8 m/s 4 m/s	6 m/s		4 m/s	
Mounted encoder	AHM36 IO-Link Basic AHM36 IO-Link Advanced AHM36 CANopen AHM36 SSI AFM60 PROFINET AFM60 EtherCAT® AFM60 EtherNet/IP ATM60 SSI ATM60 PROFIBUS ATM60 DeviceNet ATM60 CANopen A3M60 PROFIBUS ACM60					AHM36 IO-Link Basic AHM36 IO-Link Advanced AHM36 CANopen AHM36 SSI AFM60 PROFINET AFM60 EtherCAT® AFM60 EtherNet/IP ATM60 SSI ATM60 PROFIBUS ATM60 DeviceNet ATM60 CANopen A3M60 PROFIBUS		AFM60 EtherCAT® AFM60 EtherNet/IP

[1] These values were measred at an ambient temperature of 25 °C. There may be variations at other temperatures.

[2] Average values, which depend on the application.

[3] The service life depends on the type of load. This is influenced by environmental conditions, the installation location, the measuring range in use, the traversing speed, and acceleration.

	0 m … 2 m	0 m … 3 m	0 m … 5 m	0 m … 10 m	0 m … 20 m	0 m … 30 m	0 m … 50 m	0 m … 15 m
Mounted mechanic	MRA-F080-102D2, 6028625	MRA-F080-103D2, 6030125	MRA-F130-105D2, 6028626	MRA-F130-110D2, 6028627 MRA-F130-115D2, 6072738	MRA-F130-120D1, 6028628	MRA-F130-130D1, 6028629	MRA-F190-150D2, 6028630	MRA-F130-115D2, 6072738

[1] These values were measred at an ambient temperature of 25 °C. There may be variations at other temperatures.

[2] Average values, which depend on the application.

[3] The service life depends on the type of load. This is influenced by environmental conditions, the installation location, the measuring range in use, the traversing speed, and acceleration.

PRF

	0 m … 2 m	0 m … 3 m	0 m … 5 m	0 m … 10 m	0 m … 20 m	0 m … 30 m	0 m … 50 m
Measuring wire material	Highly flexible stranded steel 1,4401 stainless steel V4A						
Weight (measuring wire)	7.1 g/m				2.6 g/m		7.1 g/m
Housing material, wire draw mechanism	Aluminum (anodized), zinc die cast		Aluminum (anodised), plastic				Aluminum (anodized), zinc die cast
Spring return force	6 N … 14 N [1]		15 N … 20 N [1]	10 N … 20 N [1]			18 N … 37 N [1]
Length of wire pulled out per revolution	200 mm		334.1 mm	332.4 mm			491.5 mm
Life of wire draw mechanism	Typ. 1,000,000 cycles [2] [3]						
Actual wire draw length	2.2 m	3.2 m	5.2 m	10.2 m	20.2 m	30.2 m	50.2 m
Wire acceleration	40 m/s²		70 m/s²	40 m/s²	30 m/s²	15 m/s²	18 m/s²
Operating speed	8 m/s				6 m/s		4 m/s
Mounted encoder	DFS60						
Mounted mechanic	MRA-F080-102D2, 6028625	MRA-F080-103D2, 6030125	MRA-F130-105D2, 6028626	MRA-F130-110D2, 6028627	MRA-F130-120D1, 6028628	MRA-F130-130D1, 6028629	MRA-F190-150D2, 6028630

[1] These values were measred at an ambient temperature of 25 °C. There may be variations at other temperatures.

[2] Average values, which depend on the application.

[3] The service life depends on the type of load. This is influenced by environmental conditions, the installation location, the measuring range in use, the traversing speed, and acceleration.

Ambient data

BTF

EMC	
AHM36 IO-Link Basic	According to EN 61000-6-2, EN 61000-6-3 and EN 61131-9
AHM36 IO-Link Advanced	According to EN 61000-6-2, EN 61000-6-3 and EN 61131-9
AHM36 CANopen	According to EN 61000-6-2 and EN 61000-6-3
AHM36 SSI	According to EN 61000-6-2 and EN 61000-6-3
AFM60 PROFINET	According to EN 61000-6-2 and EN 61000-6-3 [1]
AFM60 EtherCAT®	According to EN 61000-6-2 and EN 61000-6-3 [1]
AFM60 EtherNet/IP	According to EN 61000-6-2 and EN 61000-6-3 [2]
ATM60 SSI	According to EN 61000-6-2 and EN 61000-6-3
ATM60 PROFIBUS	According to EN 61000-6-2 and EN 61000-6-3
ATM60 DeviceNet	According to EN 61000-6-2 and EN 61000-6-3

[1] The EMC according to the standards quoted is achieved if screened cables are used.

[2] EMC according to the standards quoted is achieved if shielded cables are used.

ATM60 CANopen	According to EN 61000-6-2 and EN 61000-6-3
A3M60 PROFIBUS	According to EN 61000-6-2 and EN 61000-6-3
ACM60	According to EN 61000-6-2 and EN 61000-6-4
Enclosure rating	IP64
	IP31
Operating temperature range	
AHM36 IO-Link Basic	–20 °C … +70 °C
AHM36 IO-Link Advanced	–20 °C … +70 °C
AHM36 CANopen	–30 °C … +70 °C
AHM36 SSI	–30 °C … +70 °C
AFM60 PROFINET	–30 °C … +70 °C
AFM60 EtherCAT®	–30 °C … +70 °C
AFM60 EtherNet/IP	–30 °C … +70 °C
ATM60 SSI	–20 °C … +70 °C
ATM60 PROFIBUS	–20 °C … +70 °C
ATM60 DeviceNet	–20 °C … +70 °C
ATM60 CANopen	–20 °C … +70 °C
A3M60 PROFIBUS	–10 °C … +70 °C
ACM60	–30 °C … +70 °C

[1] The EMC according to the standards quoted is achieved if screened cables are used.

[2] EMC according to the standards quoted is achieved if shielded cables are used.

PRF

EMC	According to EN 61000-6-2 and EN 61000-6-3
Enclosure rating	IP64
	IP31
Operating temperature range	–30 °C … +70 °C
	0 °C … +70 °C

Type code

Absolute

Construction size

0	8	80 mm [1]
1	3	130 mm [2]
1	9	190 mm [3]

Communication interface

A	SSI
C	CANopen [4]
D	DeviceNet [4]
E	EtherCAT®
H	HIPERFACE® (on request)
I	EtherNet/IP
K	SSI + SinCos (on request)
L	SSI + Incremental HTL (on request)
N	PROFINET
P	PROFIBUS
Q	IO-Link
R	SSI + Incremental programmable (on request)
S	SSI + SinCos programmable (on request)
T	SSI + Incremental TTL (on request)

Connection type

A	Male connector, M23, 12-pin, radial [5]
B	Male connector, 3 x M12, axial [6]
C	Male connector, M12, 8-polig, radial [5]
H	Male connector for field bus adapter [4] [7]
K	Cable, 8-wire, universal, 1.5 m (on request)
L	Cable, 8-wire, universal, 3.0 m (on request)
M	Cable, 8-wire, universal, 5.0 m (on request)
N	Male connector, M12, 8-pin, universal [5]
Q	Male connector, M12, 5-pin, universal [8]
R	Male connector, M12, 4-pin, universal [9]

Measuring length

0	2	2 meters
0	3	3 meters
0	5	5 meters
1	0	10 meters
1	5	15 meters
2	0	20 meters
2	5	25 meters
3	0	30 meters
5	0	50 meters
6	0	60 meters

resolution coefficient

4	0	A = SSI with connection type A / measuring 2 m, 3 m
2	0	A = SSI with connection type A / measuring length 5 m, 10 m, 20 m, 30 m
1	0	A = SSI with connection type A / measuring length 50 m
4	1	A = SSI with connection type N / measuring length 2 m, 3 m
2	4	A = SSI with connection type N / measuring length 5 m, 10 m
2	5	A = SSI with connection type N / measuring length 20 m, 30 m
1	7	A = SSI with connection type N / measuring length 50 m
4	1	C = CANopen with connection type H ; D = DeviceNet; P = PROFIBUS / measuring length 2 m, 3 m
2	5	C = CANopen with connection type H; D = DeviceNet; P = PROFIBUS / measuring length 5 m, 10 m, 20 m, 30 m
1	7	C = CANopen with connection type H; D = DeviceNet; P = PROFIBUS / measuring length 50 m
8	2	C = CANopen with connection type Q; D = DeviceNet; P = PROFIBUS / measuring length 2 m, 3 m
4	9	C = CANopen with connection type Q; D = DeviceNet; P = PROFIBUS / measuring length 5 m, 10 m, 20 m, 30 m
3	3	C = CANopen with connection type Q; D = DeviceNet; P = PROFIBUS / measuring length 50 m
9	9	I = EtherNet/IP; E = EtherCAT®; N = PROFINET / measuring length 2 m, 3 m
9	9	I = EtherNet/IP; E = EtherCAT®; N = PROFINET / measuring length 5 m, 10 m, 20 m, 30 m
9	9	I = EtherNet/IP; E = EtherCAT®; N = PROFINET / measuring length 50 m
6	1	Q = IO-Link / Basic
6	2	Q = IO-Link / Advanced

| B | T | F | | | - | | 1 | M | | | | |

1) Only in combination with measuring length 02 and 03.
2) Only in combination with measuring length 05, 10, 15, 20, 25, 30.
3) Only in combination with measuring length 50, 60.
4) Field bus adapter for CANopen, DeviceNet, and PROFIBUS please order separatly.
5) Only in combination with communication interface A.
6) Only in combination with communication interfaces E, I, N and P.
7) In combination with communication interfaces C, D and P).
8) Only in combination with communication interface C.
9) Only in combination with communication interface Q.

Analog

Construction size		
0	8	80 mm [1]
1	3	130 mm [2]

Communication interface	
K	Analog / Current / 4 … 20 mA
L	Analog / Voltage / 0 … 10 V

Connection type	
E	Male connector, M12, 5-pin, radial

Measuring length		
0	2	2 meters
0	3	3 meters
0	5	5 meters
1	0	10 meters
2	0	20 meters

resolution coefficient		
P	P	Programmable

B	T	F			-		1	M				

1) Only in combination with measuring length 02 and 03.
2) Only in combination with measuring length 05, 10, 20.

Incremental

Construction size

0	8	80 mm [1]
1	3	130 mm [2]
1	9	190 mm [3]

Communication interface

A	4.5 V ... 5.5 V, TTL/RS422
E	10 V ... 32 V, HTL/push pull
P	4.5 V ... 32 V, TTL/HTL, programmable (on request)
C	10 V ... 32 V, TTL/RS-422

Connection type

A	Male connector, M23, 12-pin, radial (on request)
B	Male connector, M23, 12-pin, axial (on request)
C	Male connector, M12, 8-pin, radial (on request)
K	Cable, 8-wire, universal, 1.5 m (on request)
L	Cable, 8-wire, universal, 3.0 m (on request)
M	Cable, 8-wire, universal, 5.0 m (on request)

Measuring length

0	2	2 meters
0	3	3 meters
0	5	5 meters
1	0	10 meters
2	0	20 meters
3	0	30 meters
5	0	50 meters

resolution coefficient

4	0	A = 4.5 V ... 5.5 V, TTL/RS422 / measuring length 2 m, 3 m
2	0	C = 10 V ... 32 V TTL/push pull / measuring length 5 m, 10 m, 20 m, 30 m
1	0	E = 10 V ... 32 V HTL/push pull / measuring length 50 m
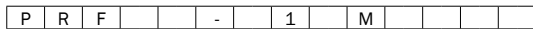
P	R	F			-	1		M				

[1] Only in combination with measuring length 02 and 03.
[2] Only in combination with measuring length 05, 10, 20, 30.
[3] Only in combination with measuring length 50.

Ordering information

- **Measuring range:** 0 m … 2 m
- **Mounted mechanic:** MRA-F080-102D2, 6028625

Communication interface	Connection type	Resolution (wire draw + encoder)	Mounted encoder	Type	Part no.
Analog / Current / 4…20 mA	Male connector, M12, 5-pin, radial	0.02 mm	ACM60, ACM60B-S1KE13X06, 6045312	BTF08-K1EM02PP	1060964
Analog / Voltage / 0…10 V	Male connector, M12, 5-pin, radial	0.02 mm	ACM60, ACM60B-S1LE13X06, 6045313	BTF08-L1EM02PP	1060965
CANopen	Connection adapter for CANopen [1]	0.02 mm	ATM60 CANopen, ATM60-C1H13X13, 1030025	BTF08-C1HM0241	1034317
	Male connector, M12, 5-pin, universal	0.01 mm	AHM36 CANopen, AHM36A-S3CC014X12, 1065999	BTF08-C1QM0282	1068885
DeviceNet™	Connection adapter for DeviceNet [1]	0.02 mm	ATM60 DeviceNet, ATM60-D1H13X13, 1030018	BTF08-D1HM0241	1034311
EtherCAT®	Male connector, 1 x M12, 4-pin, axial	0.0008 mm	AFM60 EtherCAT®, AFM60A-S1EB018X12, 1059061	BTF08-E1BM0299	1060969
EtherNet/IP™	Female connector, 2 x M12, 4-pin, axial	0.0008 mm	AFM60 EtherNet/IP, AFM60A-S1IB018X12, 1055331	BTF08-I1BM0299	1060968
IO-Link / V1.1 / COM3 (230,4 kBaud)	Male connector, M12, 4-pin, universal	0.01 mm	AHM36 IO-Link Advanced, AHM36A-S3QC014X12, 1101532	BTF08-Q1RM0262	1110592
		0.05 mm	AHM36 IO-Link Basic, AHM36B-S3QC012X12, 1092014	BTF08-Q1RM0261	1097307
Incremental / TTL / Push pull	Male connector, M23, 12-pin, radial	0.02 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF08-E1AM0240	1034335
Incremental / TTL / RS-422	Cable, 8-wire, universal, 5 m	0.1 mm	DFS60, DFS60E-S1CK02000, 1084353	PRF08-C1KM0240	1084449
	Male connector, M23, 12-pin, radial	0.02 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF08-A1AM0240	1034323
				PRF08-C1AM0240	1034329
PROFIBUS DP	Connection adapter for PROFIBUS [1]	0.02 mm	ATM60 PROFIBUS, ATM60-P1H13X13, 1030014	BTF08-P1HM0241	1034305
	Male connector, 2 x M12, 5-pin, axial Female connector, 1 x M12, 5-pin, axial	0.02 mm	A3M60 PROFIBUS, A3M60B-S1PB013X13, 1051018	BTF08-P1BM0241	1060966
PROFINET	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial	0.0008 mm	AFM60 PROFINET, AFM60A-S1NB018X12, 1059040	BTF08-N1BM0299	1060967
SSI	Male connector, M12, 8-pin, universal	0.02 mm	AHM36 SSI, AHM36A-S3PC013X12, 1068330	BTF08-A1NM0241	1068884
	Male connector, M23, 12-pin, radial	0.02 mm	ATM60 SSI, ATM60-A1A0-K18, 1034293	BTF08-A1AM0240	1034299

[1] Please order the bus adaptor seperately.

- **Measuring range:** 0 m ... 3 m
- **Mounted mechanic:** MRA-F080-103D2, 6030125

Communication interface	Connection type	Resolution (wire draw + encoder)	Mounted encoder	Type	Part no.
Analog / Current / 4...20 mA	Male connector, M12, 5-pin, radial	0.04 mm	ACM60, ACM60B-S1KE13X06, 6045312	BTF08-K1EM03PP	1060970
Analog / Voltage / 0...10 V	Male connector, M12, 5-pin, radial	0.04 mm	ACM60, ACM60B-S1LE13X06, 6045313	BTF08-L1EM03PP	1060973
CANopen	Connection adapter for CANopen [1]	0.04 mm	ATM60 CANopen, ATM60-C1H13X13, 1030025	BTF08-C1HM0341	1034895
	Male connector, M12, 5-pin, universal	0.02 mm	AHM36 CANopen, AHM36A-S3CC014X12, 1065999	BTF08-C1QM0382	1068887
DeviceNet™	Connection adapter for DeviceNet [1]	0.04 mm	ATM60 DeviceNet, ATM60-D1H13X13, 1030018	BTF08-D1HM0341	1034894
EtherCAT®	Male connector, 1 x M12, 4-pin, axial	0.001 mm	AFM60 EtherCAT®, AFM60A-S1EB018X12, 1059061	BTF08-E1BM0399	1060980
EtherNet/IP™	Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 EtherNet/IP, AFM60A-S1IB018X12, 1055331	BTF08-I1BM0399	1060978
IO-Link / V1.1 / COM3 (230,4 kBaud)	Male connector, M12, 4-pin, universal	0.01 mm	AHM36 IO-Link Advanced, AHM36A-S3QC014X12, 1101532	BTF08-Q1RM0362	1110594
		0.05 mm	AHM36 IO-Link Basic, AHM36B-S3QC012X12, 1092014	BTF08-Q1RM0361	1097316
Incremental / TTL / HTL	Male connector, M12, 8-pin, radial	0.03 mm	DFS60, DFS60B-S1PC10000, 1036756	PRF08-P1CM0340	1100153
Incremental / TTL / Push pull	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF08-E1AM0340	1034898
Incremental / TTL / RS-422	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF08-A1AM0340	1034896
				PRF08-C1AM0340	1034897
PROFIBUS DP	Connection adapter for PROFIBUS [1]	0.04 mm	ATM60 PROFIBUS, ATM60-P1H13X13, 1030014	BTF08-P1HM0341	1034893
	Male connector, 2 x M12, 5-pin, axial Female connector, 1 x M12, 5-pin, axial	0.04 mm	A3M60 PROFIBUS, A3M60B-S1PB013X13, 1051018	BTF08-P1BM0341	1060975
PROFINET	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 PROFINET, AFM60A-S1NB018X12, 1059040	BTF08-N1BM0399	1060976
SSI	Cable, 8-wire, universal, 5 m	0.04 mm	AHM36 SSI, AHM36A-S3PM013X12, 1097369	BTF08-A1MM0341	1097808
	Male connector, M12, 8-pin, universal	0.04 mm	AHM36 SSI, AHM36A-S3PC013X12, 1068330	BTF08-A1NM0341	1068886
	Male connector, M23, 12-pin, radial	0.04 mm	ATM60 SSI, ATM60-A1A0-K18, 1034293	BTF08-A1AM0340	1034892

[1] Please order the bus adaptor seperately.

- **Measuring range:** 0 m ... 5 m
- **Mounted mechanic:** MRA-F130-105D2, 6028626

Communication interface	Connection type	Resolution (wire draw + encoder)	Mounted encoder	Type	Part no.
Analog / Current / 4...20 mA	Male connector, M12, 5-pin, radial	0.04 mm	ACM60, ACM60B-S1KE13X06, 6045312	BTF13-K1EM05PP	1060982
Analog / Voltage / 0...10 V	Male connector, M12, 5-pin, radial	0.04 mm	ACM60, ACM60B-S1LE13X06, 6045313	BTF13-L1EM05PP	1060983
CANopen	Connection adapter for CANopen [1]	0.04 mm	ATM60 CANopen, ATM60-C1H13X13, 1030025	BTF13-C1HM0525	1034318
	Male connector, M12, 5-pin, universal	0.02 mm	AHM36 CANopen, AHM36A-S3CC014X12, 1065999	BTF13-C1QM0549	1068889
DeviceNet™	Connection adapter for DeviceNet [1]	0.04 mm	ATM60 DeviceNet, ATM60-D1H13X13, 1030018	BTF13-D1HM0525	1034312
EtherCAT®	Male connector, 1 x M12, 4-pin, axial	0.001 mm	AFM60 EtherCAT®, AFM60A-S1EB018X12, 1059061	BTF13-E1BM0599	1060988
EtherNet/IP™	Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 EtherNet/IP, AFM60A-S1IB018X12, 1055331	BTF13-I1BM0599	1060987
IO-Link / V1.1 / COM3 (230,4 kBaud)	Male connector, M12, 4-pin, universal	0.02 mm	AHM36 IO-Link Advanced, AHM36A-S3QC014X12, 1101532	BTF13-Q1RM0562	1110595
		0.08 mm	AHM36 IO-Link Basic, AHM36B-S3QC012X12, 1092014	BTF13-Q1RM0561	1097317
Incremental / TTL / Push pull	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF13-E1AM0520	1034336
Incremental / TTL / RS-422	Cable, 8-wire, universal, 1.5 m	0.2 mm	DFS60, DFS60B-S1CK01670, 1084354	PRF13-C1KM0520	1084425
	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF13-A1AM0520	1034324
				PRF13-C1AM0520	1034330
PROFIBUS DP	Connection adapter for PROFIBUS [1]	0.04 mm	ATM60 PROFIBUS, ATM60-P1H13X13, 1030014	BTF13-P1HM0525	1034306
	Male connector, 2 x M12, 5-pin, axial Female connector, 1 x M12, 5-pin, axial	0.04 mm	A3M60 PROFIBUS, A3M60B-S1PB013X13, 1051018	BTF13-P1BM0525	1060985
PROFINET	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 PROFINET, AFM60A-S1NB018X12, 1059040	BTF13-N1BM0599	1060986
SSI	Cable, 8-wire, universal, 5 m	0.04 mm	AHM36 SSI, AHM36A-S3PM013X12, 1097369	BTF13-A1MM0524	1097422
	Male connector, M12, 8-pin, universal	0.04 mm	AHM36 SSI, AHM36A-S3PC013X12, 1068330	BTF13-A1NM0524	1068888
	Male connector, M23, 12-pin, radial	0.04 mm	ATM60 SSI, ATM60-A1A0-K19, 1034294	BTF13-A1AM0520	1034300

[1] Please order the bus adaptor seperately.

- **Measuring range:** 0 m ... 10 m

Communication interface	Connection type	Resolution (wire draw + encoder)	Mounted encoder	Mounted mechanic	Type	Part no.
Analog / Current / 4...20 mA	Male connector, M12, 5-pin, radial	0.04 mm	ACM60, ACM60B-S1KE13X06, 6045312	MRA-F130-110D2, 6028627	BTF13-K1EM10PP	1060989
Analog / Voltage / 0...10 V	Male connector, M12, 5-pin, radial	0.04 mm	ACM60, ACM60B-S1LE13X06, 6045313	MRA-F130-110D2, 6028627	BTF13-L1EM10PP	1060990
CANopen	Connection adapter for CANopen [1]	0.04 mm	ATM60 CANopen, ATM60-C1H13X13, 1030025	MRA-F130-110D2, 6028627	BTF13-C1HM1025	1034319
	Male connector, M12, 5-pin, universal	0.02 mm	AHM36 CANopen, AHM36A-S3C-C014X12, 1065999	MRA-F130-110D2, 6028627	BTF13-C1QM1049	1068891
DeviceNet™	Connection adapter for DeviceNet [1]	0.04 mm	ATM60 DeviceNet, ATM60-D1H13X13, 1030018	MRA-F130-110D2, 6028627	BTF13-D1HM1025	1034313
EtherCAT®	Male connector, 1 x M12, 4-pin, axial	0.001 mm	AFM60 EtherCAT®, AFM60A-S1E-B018X12, 1059061	MRA-F130-110D2, 6028627	BTF13-E1BM1099	1060994
EtherNet/IP™	Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 EtherNet/IP, AFM60A-S1IB018X12, 1055331	MRA-F130-110D2, 6028627	BTF13-I1BM1099	1060993
IO-Link / V1.1 / COM3 (230,4 kBaud)	Male connector, M12, 4-pin, universal	0.02 mm	AHM36 IO-Link Advanced, AHM36A-S3QC014X12, 1101532	MRA-F130-110D2, 6028627	BTF13-Q1RM1062	1110596
				MRA-F130-115D2, 6072738	BTF13-Q1RM1562	1110597
		0.08 mm	AHM36 IO-Link Basic, AHM36B-S3QC012X12, 1092014	MRA-F130-110D2, 6028627	BTF13-Q1RM1061	1097318
Incremental / TTL / Push pull	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	MRA-F130-110D2, 6028627	PRF13-E1AM1020	1034337
Incremental / TTL / RS-422	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	MRA-F130-110D2, 6028627	PRF13-A1AM1020	1034325
					PRF13-C1AM1020	1034331
PROFIBUS DP	Connection adapter for PROFIBUS [1]	0.04 mm	ATM60 PROFIBUS, ATM60-P1H13X13, 1030014	MRA-F130-110D2, 6028627	BTF13-P1HM1025	1034307
	Male connector, 2 x M12, 5-pin, axial Female connector, 1 x M12, 5-pin, axial	0.04 mm	A3M60 PROFIBUS, A3M60B-S1P-B013X13, 1051018	MRA-F130-110D2, 6028627	BTF13-P1BM1025	1060991
PROFINET	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 PROFINET, AFM60A-S1N-B018X12, 1059040	MRA-F130-110D2, 6028627	BTF13-N1BM1099	1060992
SSI	Male connector, M12, 8-pin, universal	0.04 mm	AHM36 SSI, AHM36A-S3PC013X12, 1068330	MRA-F130-110D2, 6028627	BTF13-A1NM1024	1068890
	Male connector, M23, 12-pin, radial	0.04 mm	ATM60 SSI, ATM60-A1A0-K19, 1034294	MRA-F130-110D2, 6028627	BTF13-A1AM1020	1034301

[1] Please order the bus adaptor seperately.

- **Measuring range:** 0 m … 15 m
- **Connection type:** male connector, 1 x M12, 4-pin, axial, Female connector, 2 x M12, 4-pin, axial
- **Resolution (wire draw + encoder):** 0.001 mm
- **Mounted mechanic:** MRA-F130-115D2, 6072738

Communication interface	Mounted encoder	Type	Part no.
EtherCAT®	AFM60 EtherCAT®, AFM60A-S1EB018X12, 1059061	BTF13-E1BM1599	1112107
EtherNet/IP™	AFM60 EtherNet/IP, AFM60A-S1IB018X12, 1055331	BTF13-I1BM1599	1105976

- **Measuring range:** 0 m … 20 m
- **Mounted mechanic:** MRA-F130-120D1, 6028628

Communication interface	Connection type	Resolution (wire draw + encoder)	Mounted encoder	Type	Part no.
Analog / Current / 4…20 mA	Male connector, M12, 5-pin, radial	0.04 mm	ACM60, ACM60B-S1KE13X06, 6045312	BTF13-K1EM20PP	1060995
Analog / Voltage / 0…10 V	Male connector, M12, 5-pin, radial	0.04 mm	ACM60, ACM60B-S1LE13X06, 6045313	BTF13-L1EM20PP	1060996
CANopen	Connection adapter for CANopen [1]	0.04 mm	ATM60 CANopen, ATM60-C1H13X13, 1030025	BTF13-C1HM2025	1034320
	Male connector, M12, 5-pin, universal	0.02 mm	AHM36 CANopen, AHM36A-S3CC014X12, 1065999	BTF13-C1QM2049	1068893
DeviceNet™	Connection adapter for DeviceNet [1]	0.04 mm	ATM60 DeviceNet, ATM60-D1H13X13, 1030018	BTF13-D1HM2025	1034314
EtherCAT®	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 EtherCAT®, AFM60A-S1EB018X12, 1059061	BTF13-E1BM2099	1061000
EtherNet/IP™		0.001 mm	AFM60 EtherNet/IP, AFM60A-S1IB018X12, 1055331	BTF13-I1BM2099	1060999
IO-Link / V1.1 / COM3 (230,4 kBaud)	Male connector, M12, 4-pin, universal	0.02 mm	AHM36 IO-Link Advanced, AHM36A-S3QC014X12, 1101532	BTF13-Q1RM2062	1110599
		0.08 mm	AHM36 IO-Link Basic, AHM36B-S3QC012X12, 1092014	BTF13-Q1RM2061	1097319
Incremental / TTL / Push pull	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF13-E1AM2020	1034338
Incremental / TTL / RS-422	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF13-A1AM2020	1034326
				PRF13-C1AM2020	1034332
PROFIBUS DP	Connection adapter for PROFIBUS [1]	0.04 mm	ATM60 PROFIBUS, ATM60-P1H13X13, 1030014	BTF13-P1HM2025	1034308
	Male connector, 2 x M12, 5-pin, axial Female connector, 1 x M12, 5-pin, axial	0.04 mm	A3M60 PROFIBUS, A3M60B-S1PB013X13, 1051018	BTF13-P1BM2025	1060997
PROFINET	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 PROFINET, AFM60A-S1NB018X12, 1059040	BTF13-N1BM2099	1060998
SSI	Male connector, M12, 8-pin, universal	0.04 mm	AHM36 SSI, AHM36A-S3PC013X12, 1068330	BTF13-A1NM2025	1068892
	Male connector, M23, 12-pin, radial	0.05 mm	ATM60 SSI, ATM60-A1A0-K20, 1034295	BTF13-A1AM2020	1034302

[1] Please order the bus adaptor seperately.

- **Measuring range:** 0 m ... 30 m
- **Mounted mechanic:** MRA-F130-130D1, 6028629

Communication interface	Connection type	Resolution (wire draw + encoder)	Mounted encoder	Type	Part no.
CANopen	Connection adapter for CANopen [1]	0.04 mm	ATM60 CANopen, ATM60-C1H13X13, 1030025	BTF13-C1HM3025	1034321
	Male connector, M12, 5-pin, universal	0.02 mm	AHM36 CANopen, AHM36A-S3CC014X12, 1065999	BTF13-C1QM3049	1068896
DeviceNet™	Connection adapter for DeviceNet [1]	0.04 mm	ATM60 DeviceNet, ATM60-D1H13X13, 1030018	BTF13-D1HM3025	1034315
EtherCAT®	Male connector, 1 x M12, 4-pin, axial	0.001 mm	AFM60 EtherCAT®, AFM60A-S1EB018X12, 1059061	BTF13-E1BM3099	1061006
EtherNet/IP™	Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 EtherNet/IP, AFM60A-S1IB018X12, 1055331	BTF13-I1BM3099	1061005
IO-Link / V1.1 / COM3 (230,4 kBaud)	Male connector, M12, 4-pin, universal	0.02 mm	AHM36 IO-Link Advanced, AH-M36A-S3QC014X12, 1101532	BTF13-Q1RM3062	1110601
		0.08 mm	AHM36 IO-Link Basic, AHM36B-S3QC012X12, 1092014	BTF13-Q1RM3061	1097320
Incremental / TTL / Push pull	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF13-E1AM3020	1034339
Incremental / TTL / RS-422	Male connector, M23, 12-pin, radial	0.03 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF13-A1AM3020	1034327
				PRF13-C1AM3020	1034333
PROFIBUS DP	Connection adapter for PROFIBUS [1]	0.04 mm	ATM60 PROFIBUS, ATM60-P1H13X13, 1030014	BTF13-P1HM3025	1034309
	Male connector, 2 x M12, 5-pin, axial Female connector, 1 x M12, 5-pin, axial	0.04 mm	A3M60 PROFIBUS, A3M60B-S1PB013X13, 1051018	BTF13-P1BM3025	1061003
PROFINET	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial	0.001 mm	AFM60 PROFINET, AFM60A-S1NB018X12, 1059040	BTF13-N1BM3099	1061004
SSI	Male connector, M12, 8-pin, universal	0.04 mm	AHM36 SSI, AH-M36A-S3PC013X12, 1068330	BTF13-A1NM3025	1068894
	Male connector, M23, 12-pin, radial	0.04 mm	ATM60 SSI, ATM60-A1A0-K20, 1034295	BTF13-A1AM3020	1034303

[1] Please order the bus adaptor seperately.

- **Measuring range:** 0 m … 50 m
- **Mounted mechanic:** MRA-F190-150D2, 6028630

Communication interface	Connection type	Resolution (wire draw + encoder)	Mounted encoder	Type	Part no.
CANopen	Connection adapter for CANopen [1]	0.06 mm	ATM60 CANopen, ATM60-C1H13X13, 1030025	BTF19-C1HM5017	1034322
	Male connector, M12, 5-pin, universal	0.03 mm	AHM36 CANopen, AHM36A-S3CC014X12, 1065999	BTF19-C1QM5033	1068898
DeviceNet™	Connection adapter for DeviceNet [1]	0.06 mm	ATM60 DeviceNet, ATM60-D1H13X13, 1030018	BTF19-D1HM5017	1034316
EtherCAT®	Male connector, 1 x M12, 4-pin, axial	0.002 mm	AFM60 EtherCAT®, AFM60A-S1EB018X12, 1059061	BTF19-E1BM5099	1061012
EtherNet/IP™	Female connector, 2 x M12, 4-pin, axial	0.002 mm	AFM60 EtherNet/IP, AFM60A-S1IB018X12, 1055331	BTF19-I1BM5099	1061011
IO-Link / V1.1 / COM3 (230,4 kBaud)	Male connector, M12, 4-pin, universal	0.03 mm	AHM36 IO-Link Advanced, AHM36A-S3QC014X12, 1101532	BTF19-Q1RM5062	1110602
		0.12 mm	AHM36 IO-Link Basic, AHM36B-S3QC012X12, 1092014	BTF19-Q1RM5061	1097321
Incremental / TTL / Push pull	Male connector, M23, 12-pin, radial	0.05 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF19-E1AM5010	1034340
Incremental / TTL / RS-422	Male connector, M23, 12-pin, radial	0.05 mm	DFS60, DFS60B-S1MA10000, 1056866	PRF19-A1AM5010	1034328
				PRF19-C1AM5010	1034334
PROFIBUS DP	Connection adapter for PROFIBUS [1]	0.06 mm	ATM60 PROFIBUS, ATM60-P1H13X13, 1030014	BTF19-P1HM5017	1034310
	Male connector, 2 x M12, 5-pin, axial Female connector, 1 x M12, 5-pin, axial	0.06 mm	A3M60 PROFIBUS, A3M60B-S1PB013X13, 1051018	BTF19-P1BM5017	1061009
PROFINET	Male connector, 1 x M12, 4-pin, axial Female connector, 2 x M12, 4-pin, axial	0.002 mm	AFM60 PROFINET, AFM60A-S1NB018X12, 1059040	BTF19-N1BM5099	1061010
SSI	Male connector, M12, 8-pin, universal	0.06 mm	AHM36 SSI, AHM36A-S3PC013X12, 1068330	BTF19-A1NM5017	1068897
	Male connector, M23, 12-pin, radial	0.06 mm	ATM60 SSI, ATM60-A1A0-K21, 1034296	BTF19-A1AM5010	1034304

[1] Please order the bus adaptor seperately.

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