

TR-Electronic
Explosion-Protected Encoders
Product Information
AEV / AEW 70
ADV 75



TR-Electronic – Your Partner in Automation










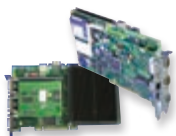








TR-Electronic can look back on more than 25 years of success, and is represented worldwide with an export share of more than 40 %. The core business comprises the development and manufacture of industrial angular and position measuring technology, as well as compact drive technology with integrated position control and measurement. The company is divided into three Business Units (BU) and is thus well positioned for further growth in the future.

Products in the **Rotary Encoder Business Unit** with optical or magnetic scanning precisely acquire position in steel production, wind power plants, cranes and ships as well as in explosion-proof versions in painting lines. Miniature versions ensure the correct position in medical technology. SIL3 approved absolute rotary encoders ensure the necessary safety.

In the **Linear Encoders Business Unit** magnetostrictive position sensors position injection molding machines, for example, or are directly integrated into hydraulic cylinders. Cascadable distance measurement sensors position parting units. With their high precision, glass scales on machine tools ensure precise position. Laser sensors based on phase difference measuring techniques position aisle stackers in warehousing and materials handling technology.

In the **Drives Business Unit** angle sensors are combined with compact drives: no external electronics are required, position, speed and torque controllers, power electronics and absolute rotary encoders are compactly integrated into the drive and thus bring intelligence directly to the drive shaft via the field bus. Compact drives are used for diverse applications in the printing and packaging industry and on palletizers.



Rotary Encoder	Linear Encoder	Drives	Components	Engineering	Unidor
 Incremental Encoder	 Magnetostriction	 Actuator	 I/O Module	Automation Solutions 	Punching and forming Measurement and control systems 
 Absolute Encoder	 Glass scale	 Positioning Drive	 Controls	Retrofit 	Sensors 
 Draw Wire Encoder	 TOF laser	 Processing Drive	 Industrial-PC	Process monitoring tools 	 Barcode Positioning

The portfolio is supplemented by the affiliated TRsystems with customized controls, industrial PCs, hydraulic controls as well as control units and sensors for punching and forming.

An essential factor for the success of TR-Electronic are the now more than 300 employees who actively help to shape the product portfolio with innovations and successfully implement customer projects. Through its commitment to the regional colleges, TR-Electronic supports the high quality training of young employees and thus guarantees the highest level of innovation and quality at its Trossingen location.

A high degree of vertical integration allows customer-specific requirements to be responded to very quickly. The constantly new requirements on the mechanical design of sensors, on innovative new operating interfaces and new plug connectors result in a rapidly increasing product diversity. With TR-Electronic you have a partner who can fulfil these requirements.

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„RISK MINIMIZATION IN EXPLOSIVE ATMOSPHERE – PROTECT PEOPLE & THE ENVIRONMENT!“

ATEX Contributes to your Safety

TR-Electronic has been your leading partner in the area of explosion protection for over a decade. The protection of foremost people, but also property, against explosions is a matter of the highest priority. With the housing series A_V 70, you use the interface diversity of series 58 also in potentially explosive atmospheres such as zone 1 (gases) and zone 21 (dusts).

TR-Electronic is an accredited manufacturer for this protection solution, therefore, flexible solutions for different interfaces can be realized in accordance with the latest requirements. Solutions for direct interfaces (SSI, Analog) and field buses (PROFIBUS) are equally possible.

For aggressive or hygienically sensitive environments, the complete housing is manufactured from stainless steel – optimal protection in flour mills and flour processing, for example.

In the standard housing, the AEV 70 can be used e.g. in excavating and conveying systems in brown coal opencast mining, as well as in the conveying systems of complete painting lines. Applications in plastic

mills or the woodworking industry are also possible. Protect yourself, your employees and the environment, and you will targetedly minimize risks in potentially explosive environments.

Thanks to ATEX, you play it safe - our devices fulfill all requirements (CE conformity, EC conformity declaration including non-electrical devices, certification of the QS system, operating instructions, ...).

TR-Electronic is a partner you can rely on in matters of explosion protection.

An economic at version to combine explosion protection and functional safety can be found in the ADV 75 (see page 8).

It covers the range of Zone 2/22. Despite its very compact design, it is comprehensively fitted, e.g. PROFIBUS with PROFIsafe, 13 bit resolution and 32,768 revolution and much more.

For the first time you can achieve functional safety and explosion protection in one completely tested and approved device.

Fields of application

- _ transfer systems
- _ in painting lines
- _ filling/bagging plants
- _ position measurement
- _ in opencast mines
- _ fuel pumps in filling stations
- _ motion control
- _ in plastic mills
- _ and flour mills
- _ textile and wood processing
- _ industry
- _ geothermal energy and much more

EX zones are characterized by a mixture of air and flammable gases, vapors, mists and dusts and can be everywhere where flammable cases, dusts or liquids are produced, filled, transported or stored.

No ATEX requirements
ZONE 2/22

ZONE 1/21

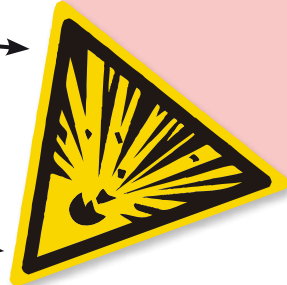
ZONE 0/20



Upper explosion limit

Lower explosion limit

Oxygen
+ ignition source
+ fuel



Classification in Temperature Classes

Gases are divided into temperature classes in order to take the different ignition temperatures into consideration. To avoid an ignition, the maximum occurring surface temperature of a device has to be lower than the ignition temperature of the flammable material or mixture. Correspondingly, the devices are classified and identified according to temperature classes. Generally, the higher temperature class covers the lower temperature classes. A device that is labeled Ex ... IIC T6 thus covers all known gases. In devices used for dust explosion protection, the maximum surface temperature is specified in degrees Celsius.

T1	T2	T3	T4	T5	T6
400°C	300°C	200°C	135°C	100°C	85°C

increasing requirement

Classification in EX Classes

Depending on the ignition protection type, explosion-protected equipment for gases, mists, vapors and dusts is divided into three explosion groups (IIA-IIB-IIC). The explosion group indicates how flammable gases are (explosive atmosphere). The requirements demanded of the equipment increased from II A to II C.



gas, mist, vapor and dust

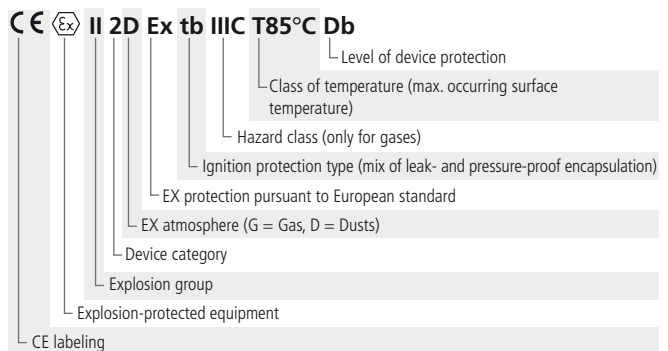


Identification of EX Equipment

All ATEX devices have to be identified, including non-electronic devices. Identification is structured as follows:

Classification into EX Zones

EX atmospheres are divided into six zones. The table below describes how the zones are classified, according to hazardous environments for gases, vapors, mists on the one hand and dusts on the other. Additionally, a distinction is made between the risk category and the probability of a hazard occurring. Ultimately, the EX categories are allocated describing the degree of safety of the device. The table shows which specifications the device has to fulfill in order to be used in a specific zone. Naturally, the devices belonging to higher categories fulfill the requirements of the lower categories.



Flammable materials	Probability	Classification of explosive atmospheres	Identification of equipment		
			Device group	Device category for EX atmosphere	
Gases Mist Vapors	permanent, long-term or frequent	Zone 0	II		
	occasional	Zone 1	II	1 G	
	unlikely	Zone 2	II		2 G 3 G
Dusts	permanent	Zone 20	II		
	occasional	Zone 21	II	1 D	
	unlikely	Zone 22	II		2 D 3 D

ATEX EX Protection for Absolute Encoders, 10 mm shaft

- + zone 1/21, for absolute and incremental encoders of the 58 series
- + optional stainless steel housing for aggressive environments
- + housing developed and produced by TR-Electronic
- + large range of housing variants certified
- + solid shaft design
- + CE Ex II 2G Ex db IIC T6
- + CE Ex II 2D Ex tb IIIC T80°C



SSI



CANopen



Mechanical characteristics

Supply voltage	11 ... 27 V DC
Mechanically permissible speed	$\leq 6,000 \text{ min}^{-1}$
Shaft load (shaft end)	$\leq 40 \text{ N}$ axial, $\leq 60 \text{ N}$ radial

General information

Available interfaces	PROFIBUS (set address, address bus can be programmed)
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Capacity	S.: $\leq 11 \text{ bit}$ / M.: $\leq 23 \text{ bit}$
	S.: $\leq 13 \text{ bit}$ / M.: $\leq 30 \text{ bit}$
	S.: $\leq 18 \text{ bit}$ / M.: $\leq 36 \text{ bit}$

Incremental	Rectangle
Resolution can be programmed	1 ... 36,000
Flange with centering collar	36 mm
Available shaft diameter	10 mm with surface or smooth
Dimensions	typically 1 ... 1.6 kg

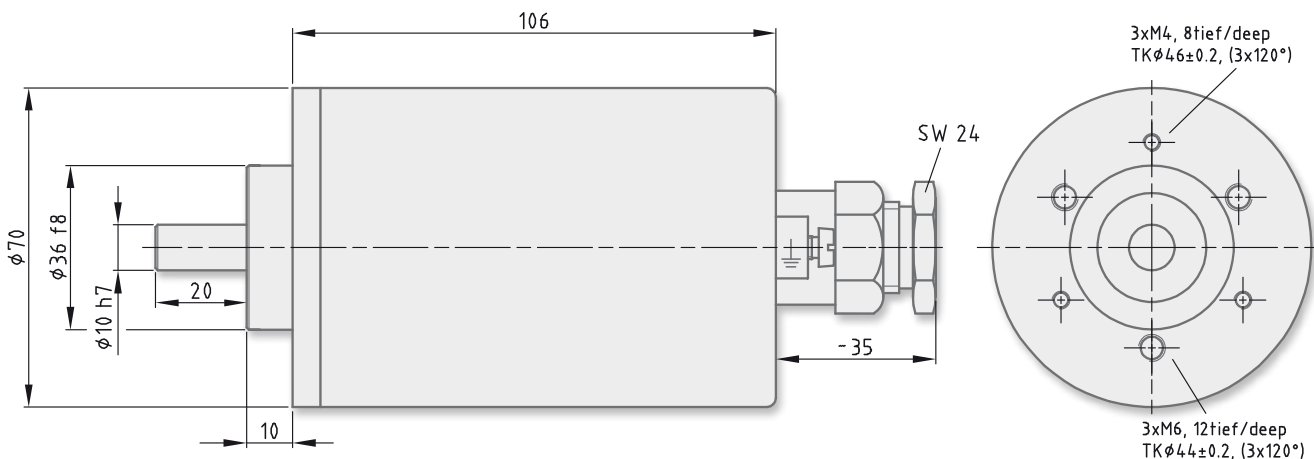
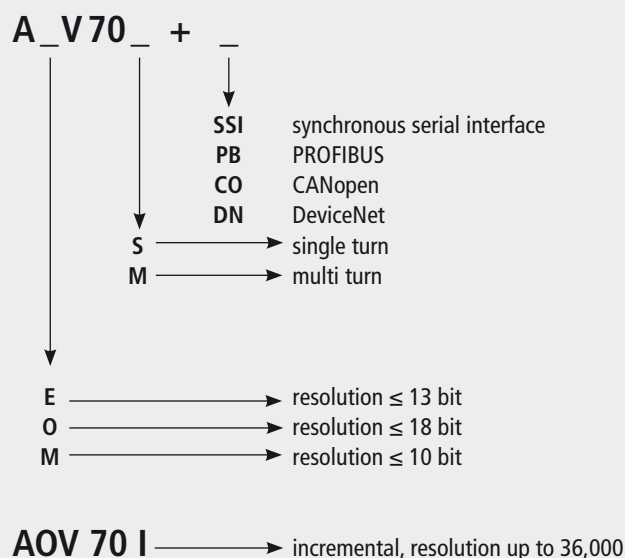
Environmental conditions

Protection class	IP 65, opt. IP 67 (with shaft sealing ring)
Working temperature	-20 °C ... +40 °C
Vibration, DIN EN 60068-2-6	$\leq 100 \text{ m} / \text{s}^2$, sine 50–2000 Hz
Shock, DIN EN 60068-2-27	$\leq 1000 \text{ m} / \text{s}^2$, half sine, 11 ms



Device name

Explanation of



Please request detailed drawings for your configuration.

ATEX EX Protection for Draw-Wire Encoders

- + variety of interfaces and ATEX combines them according to the latest standard
- + type approved, optional in stainless steel
- + long life cycle, approx. 1 million cycles
- + encoder shaft with side-attached cable winch box
- + coupling is free of play and easy to assemble
- + stable, separated sprung case, compact design
- + CE Ex II 2G Ex db IIC T6, CE Ex II 2D Ex tb IIIC T80°C


SSI

CANopen


Mechanical characteristics

Supply voltage	11 ... 27 V DC
Mechanically permissible speed	$\leq 6,000 \text{ min}^{-1}$
Shaft load (shaft end)	$\leq 40 \text{ N axial}, \leq 60 \text{ N radial}$
Life cycle	approx. 1 million cycles

General information

Available interfaces	PROFIBUS (set address, address bus can be programmed)
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Capacity	S.: $\leq 11 \text{ bit}$ / M.: $\leq 23 \text{ bit}$ S.: $\leq 13 \text{ bit}$ / M.: $\leq 30 \text{ bit}$ S.: $\leq 18 \text{ bit}$ / M.: $\leq 36 \text{ bit}$
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Incremental	Rectangle
Resolution can be programmed	1 ... 36,000
Flange with centering collar	36 mm
Available shaft diameter	10 mm with surface or smooth
Dimensions (encoder)	typically 1 ... 1.6 kg
- draw-wire encoder, up to 2 m	+ 1.6 kg
- draw-wire encoder, up to 10 m	+ 3.6 kg
- draw-wire encoder, up to 25 m	+ 7.8 kg

Environmental conditions

Protection class	IP 65
Working temperature	-20 °C ... +40 °C
Vibration, DIN EN 60068-2-6	$\leq 100 \text{ m} / \text{s}^2$, sine 50–2000 Hz
Shock, DIN EN 60068-2-27	$\leq 1000 \text{ m} / \text{s}^2$, half sine, 11 ms

Key technical data

Draw-wire encoder

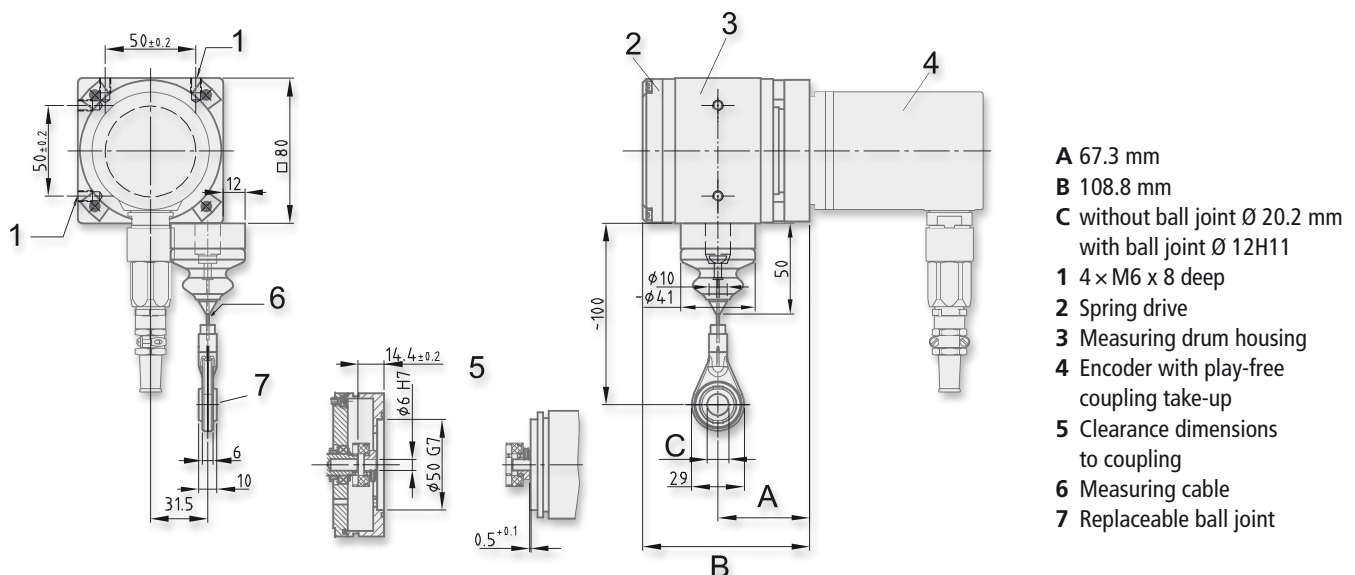
Housing construction	$\leq 80 \text{ mm}$
Translation	5 U/m $\pm 0.06 \text{ mm/U}$
Measuring drum housing material	Anodized aluminum 3.3206.71 ALMgSi0.5F22
Measuring cable material	Stainless steel braid 1.4401 X5 CrNiMo 18 10
Cable bending radius R	$\geq 16 \text{ mm}$
Linearity	type ± 0.05
Reproducibility	0.1 mm



Reliable Protection with Encoder Wire Unit

The TR explosion protection housing made of aluminum or stainless steel with integrated measuring system and evaluation electronics registers changes in angles for fixed installation application. Changes in angle are transmitted via a shaft to the evaluation electronics system. The TR explosion protection housing is encapsulated in a pressure-proof material and therefore, prevents a potential explosion inside the housing from being transferred to the surrounding explosive atmosphere.

The construction as well as the interplay of the individual components and the types of housing in view of how they can be applied in explosive atmospheres are examined by TR-Electronic GmbH and confirmed by the appropriate labeling on the type plate.



Please request detailed drawings for your configuration.

Combines SIL 3/PL e Certified Encoders with an Explosion-Safe Housing

- + PROFIBUS interface with PROFIsafe protocol
- + solid shaft design
- + functional safety in accordance with DIN EN 61508: SIL 3
EN ISO 13849-1: PL e
- + 13 Bit resolution, 32.768 revolutions
- + SIN/COS-signals or incremental signals to return to position
- + CE Ex II 3G Ex nAc IIC T6 X
- + CE Ex II 3D Ex tc IIIC T65°C IP 64 X



SIL3, PL e



Electrical characteristics

Supply voltage	11 ... 27 V DC
Power consumption without load	< 150 mA, at 24 V DC

Main measuring system

Capacity	28 bit
Number of steps/revolution	8,192
Revolutions	32,768

Safety system

2 redundant scanning units with internal triangulation.
Adjustable difference window.
Safety system can be externally integrated as an option.

Capacity	The data from the internal safety system are not output separately.
Number of steps/revolution	
Revolutions	

Safety standard

Safety Integrity Level (SIL)	SIL 3 (DIN EN 61508)
Performance Level (PL)	PL e (EN ISO 13849)
PFH, overall system	8.45×10^{-10} 1/h

Mechanical characteristics

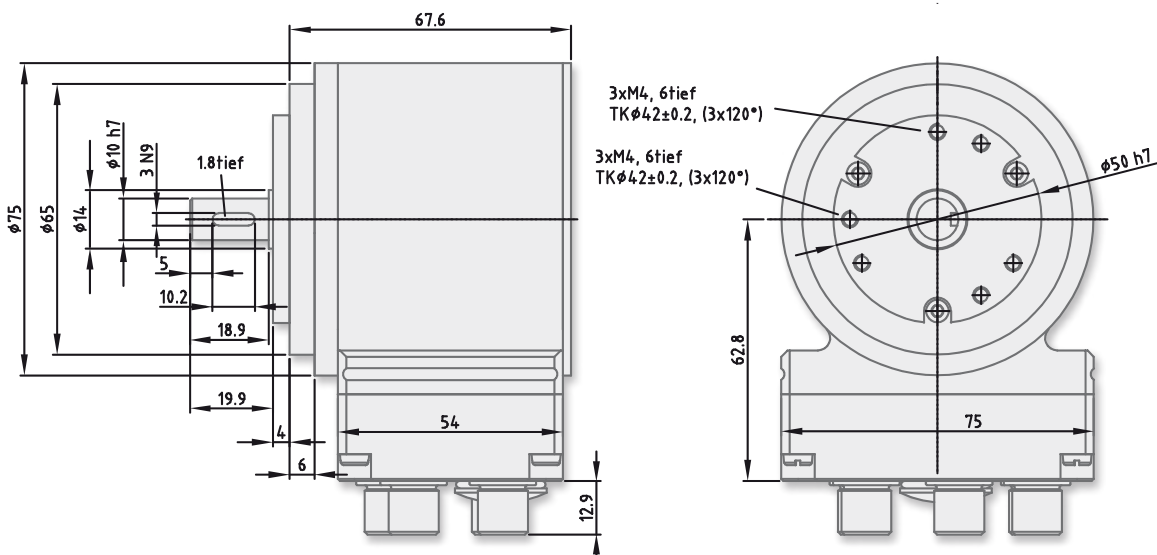
Mechanically permissible speed	$\leq 6,000 \text{ min}^{-1}$
Shaft load (shaft end)	$\leq 50 \text{ N}$ axial, $\leq 90 \text{ N}$ radial
Bearing life	$\geq 3.9 \times 10^{10}$ revolutions at
- at the speed of revolution	$\leq 3,000 \text{ min}^{-1}$
- at the operating temperature	$\leq 60 \text{ °C}$
Permissible angular acceleration	$\leq 10^4 \text{ rad/s}^2$
Dimensions (typical)	1 kg

Environmental conditions

Protection class DIN EN 60529	IP 64
Working temperature	-20 °C ... +40 °C
Operating humidity	98 %, non-condensing
DIN EN 60068-3-4	
Storage temperature	-30 °C ... +80 °C, dry
Vibration DIN EN 60068-2-6	$\leq 100 \text{ m/s}^2$, sine 50–2.000 Hz
Shock DIN EN 60068-2-27	$\leq 1.000 \text{ m/s}^2$, half sine, 11 ms
Transient emissions	class B, industrial environment

Interface

Protocol	PROFIsafe
Transferred values	secure position, safe speed (PROFIsafe); position, speed (PROFIBUS)
Programmable parameters	integration time, differences window, direction of rotation, preset
Unsafe incremental interface	A, A-, B, B-
Number of impulses (fixed setting)	SIN/COS (1 Vss): 1,024 or 4,096 or
Number of impulses (fixed setting)	rectangle (RS 422): 1,024, 2,048, 4,096, 8,192, 16,384 or 32,768



Please request detailed drawings for your configuration.

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