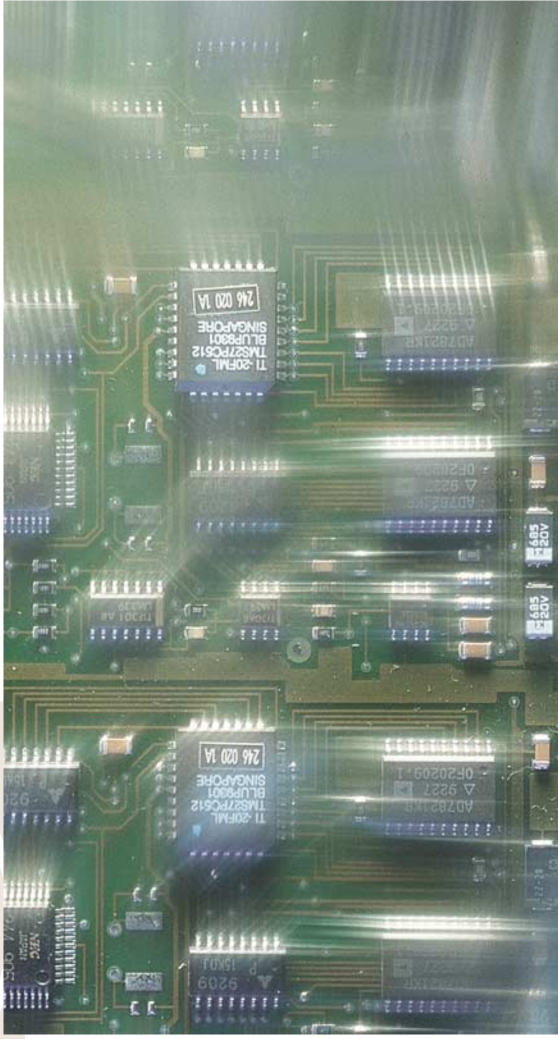
HEIDENHAIN



Interpolation and Digitizing Electronics

Overview

	Model	Interpolation	Clock frequency f_T	Encoder inputs	Power supply	Specifications see page
EXE Type: input signals ∿ 11 µA$_{PP}$	**EXE 602 E**	Without and 5-fold	Non-clocked	1	5 V ± 5 %	**8**
	EXE 610 C	5-fold or 10-fold	2 MHz	1		
	EXE 612	5-fold or 10-fold	8 MHz	1		
	EXE 650 B	25-fold	8 MHz	1		
		50-fold				
	EXE 660 B	25-fold, 50-fold, 100-fold, 200-fold or 400-fold	20 MHz	1		
	EXE 914	25-fold	8 MHz	1	Primary-clocked power supply 85 to 265 V	**12**
	EXE 922	Without,	Non-clocked	2		
		5-fold or 10-fold	2 MHz			
	EXE 924	25-fold	8 MHz	2		
	EXE 932	Without,	Non-clocked	3		
		5-fold or 10-fold	2 MHz			
	EXE 934	25-fold	8 MHz	3		
	EXE 935	50-fold	8 MHz	3		
IBV Type: input signals ∿ 1 V$_{PP}$	**IBV 600**	Without	Non-clocked	1	5 V ± 5 %	**16**
	IBV 606	2-fold	Non-clocked	1		
	IBV 610	5-fold or 10-fold	8 MHz	1		
	IBV 650	50-fold	8 MHz	1		
	IBV 660 B	25-fold, 50-fold, 100-fold, 200-fold or 400-fold	20 MHz	1		

Contents

Measuring Signal Processing

HEIDENHAIN linear, rotary and angle encoders operate on the principle of photoelectrically scanning very fine gratings. These encoders normally produce sinusoidal scanning signals with levels of approximately 11 μA_{PP} (current signals) or 1 V_{PP} (voltage signals). The subsequent electronics first interpolates the scanning signals and then converts them into square-wave pulses (digitizing).

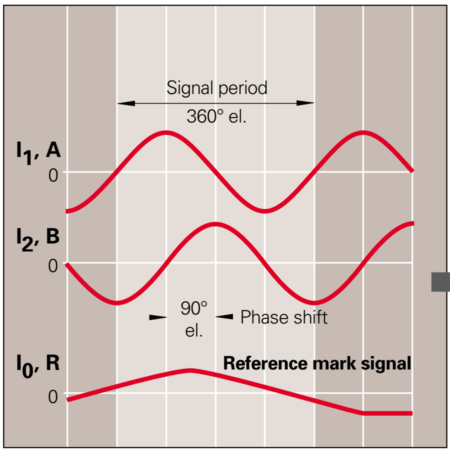
The interpolation and digitizing circuitry is either integrated in the NC control (e.g. a HEIDENHAIN TNC) or display unit (e.g. an ND or POSITIP from HEIDENHAIN), or is available as a separate unit of the **EXE** type (for current signals I_1, I_2 and I_0) or **IBV** type (for voltage signals A, B and R).

EXE and IBV units deliver two square-wave pulse trains U_{a1} and U_{a2} plus a reference pulse U_{a0}.

Within one signal period, each of the four signal edges of U_{a1} and U_{a2} can be used as a counting pulse.

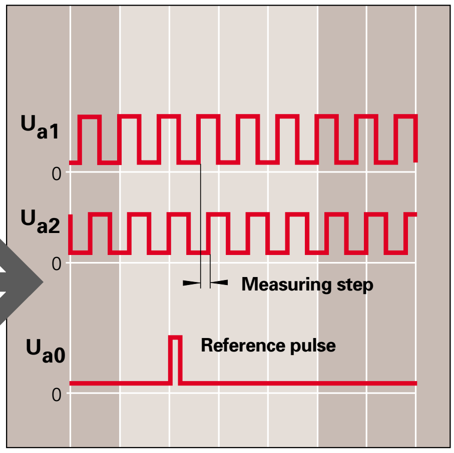
The distance between two subsequent edges of U_{a1} and U_{a2} is one measuring step. For example, after 5-fold interpolation this distance is 1/20 of a grating period (see the following example).

Example: With 5-fold interpolation of the measuring signal and the usual 4-fold evaluation of the square-wave pulses in the subsequent electronics, a linear encoder with a grating period of 20 µm can provide a measuring step of 1 µm.



Scanning signals

EXE or **IBV** interpolation and digitizing electronics



Measuring signals after 5-fold interpolation and digitizing

The inverse signals $\overline{U_{a1}}$, $\overline{U_{a2}}$ and $\overline{U_{a0}}$ have been omitted from the illustration to improve clarity.

Input Frequency f_i

The permissible **traversing speed** of linear encoders, and the permissible **shaft speed** of rotary and angle encoders, is limited by the mechanically and electrically permissible traversing or shaft speed (see encoder data sheets). The electrically permissible output frequency of the encoder is usually higher than the permissible input frequency of the EXE or IBV. For this reason, the electrically **permissible traversing speed v** or **shaft speed n** depends directly on the maximum **input frequency fi** of the EXE or IBV unit (see Overview). Exception: IBV 600 and IBV 606; in this case the –3dB limit frequency of the encoder cannot be exceeded.

Electrically permissible traversing speed v
with linear encoders:

$\mathbf{v}$ [m/min] = $\mathbf{p} \times \mathbf{f_i} \times 6 \times 10^{-2}$

p signal or grating period of the linear encoder in µm

$\mathbf{f_i}$ maximum input frequency of the EXE/IBV in kHz

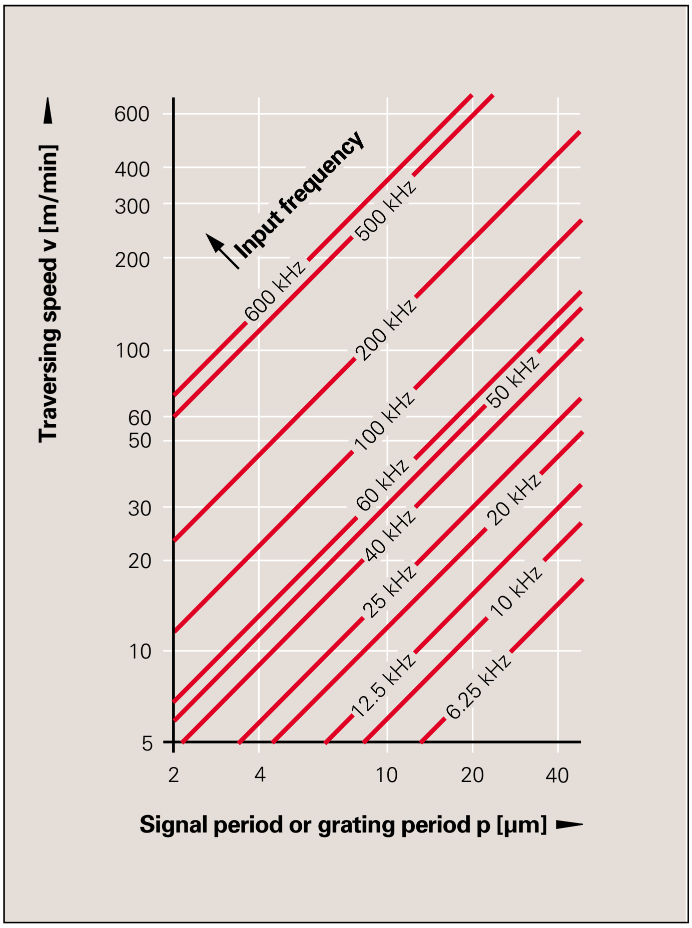
Electrically permissible shaft speed n
with rotary encoders:

$\mathbf{n}$ [rpm] = $\frac{\mathbf{f_i}}{\mathbf{z}} \times 6 \times 10^4$

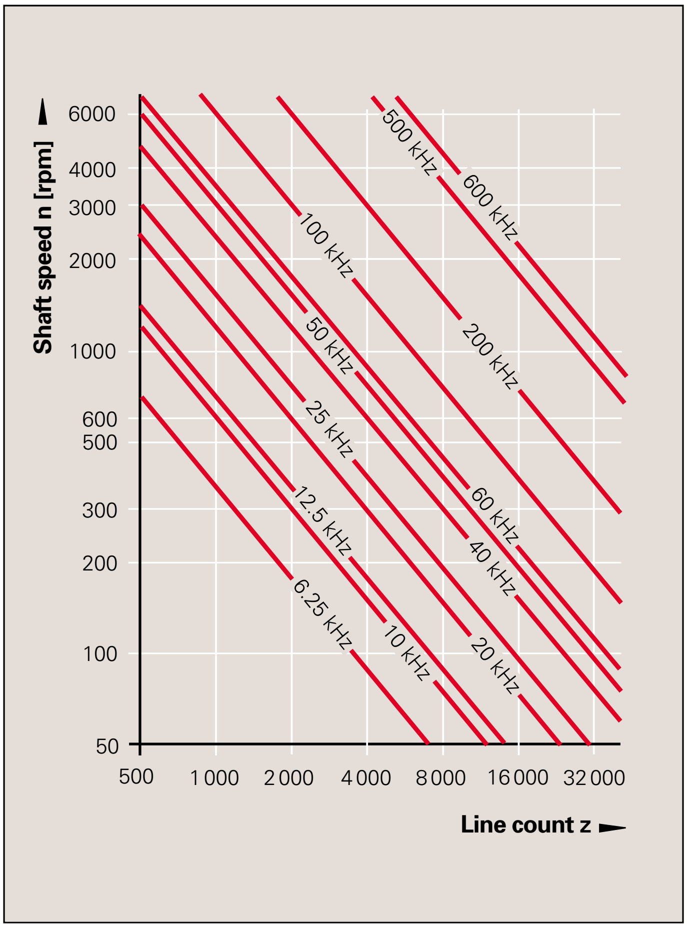
$\mathbf{f_i}$ maximum input frequency of the EXE/IBV in kHz

Z line count of encoder

Input frequency $\mathbf{f_i}$ of the interpolation and digitizing electronics and highest possible traversing speeds **v** with incremental linear encoders



Input frequency $\mathbf{f_i}$ of the interpolation and digitizing electronics and highest possible shaft speeds **n** with incremental rotary encoders



Edge Separation a

As a rule, the electronics subsequent to the EXE can only evaluate signals whose edge separation between any two successive square-wave signals U_{a1} and U_{a2} does not fall below a certain value.

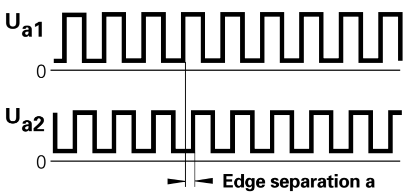
Minimum edge separation a_{min}: the shortest time span between two successive edges of EXE output signals. The minimum edge separation is listed in the model overviews.

The edge separation may reach the minimum permissible value even when the encoders are nearly motionless (for example due to vibration). For this reason, the subsequent electronics must be able to process the selected minimum edge separation correctly, regardless of the input frequency of the EXE or IBV. You should calculate a safety margin of at least 20 ns + 0.2 ns/m for differences in transit time over the transmission distances, taking into account the length of the output cable.

Clocked EXE/IBV
In the case of electronics with clocked output signals, the maximum input frequency and the edge separation are determined by the clock frequency f_T. The indicated values for the maximum input frequency thus represent an absolute functional limit. The edge separation can assume whole-number multiples of a_{min} without dropping below the minimum value of a_{min}.

To adjust the edge separation to the subsequent electronics, the time span between two successive edges can be varied. The maximum permissible input frequency changes correspondingly.

Non-clocked EXE/IBV
For electronics with non-clocked output signals, the minimum edge separation a_{min} resulting from the maximum permissible input frequency is listed in the specifications. If the input frequency is reduced, the edge separation increases correspondingly.



Connection Recommendations

Connecting cable

- Encoder ∿ $11\ \mu A_{PP}$ to EXE:
  Use recommended HEIDENHAIN cable or double-shielded cable
  [3 (2 x 0.14 mm^2) + (2 x 1.0 mm^2)].
- Encoder ∿ $1\ V_{PP}$ to IBV:
  Use recommended HEIDENHAIN cable or single-shielded cable
  [4 (2 x 0.14 mm^2) + (4 x 0.5 mm^2)].
- EXE/IBV to subsequent electronics:
  Use recommended HEIDENHAIN cable or single-shielded cable
  [4 (2 x 0.14 mm^2) + (4 x 0.5 mm^2)].
- Use original HEIDENHAIN connecting elements or metal connecting elements, preferably with insulating plastic covering.

Shielding

The housings of the connecting elements, terminal boxes and EXE or IBV must be connected to each other via the outer cable shield.

The cable shielding has the function of a potential compensating line. If compensating currents are to be expected within the total setup, a separate potential compensating line must be provided (> 6 mm^2 Cu).

Contact to the machine chassis is normally made at the machine mounting screws, on sealed linear encoders at the mounting block and scale unit. If the EXE or IBV unit is mounted on painted surfaces, provide metallic contact via the EXE/IBV grounding screw.

Permissible bending radii for connecting cable <u>without</u> metal armor tubing

Cable	**Permissible bending radius** for	
	Frequent flexing	Rigid configuration
Dia. 8 mm (0.31 in.)	R ≥ 100 mm (4 in.)	R ≥ 40 mm (1.6 in.)
Dia. 6 mm (0.24 in.)	R ≥ 75 mm (3 in.)	R ≥ 20 mm (0.8 in.)
Dia. 4.5 mm (0.18 in.)	R ≥ 50 mm (2 in.)	R ≥ 10 mm (0.4 in.)

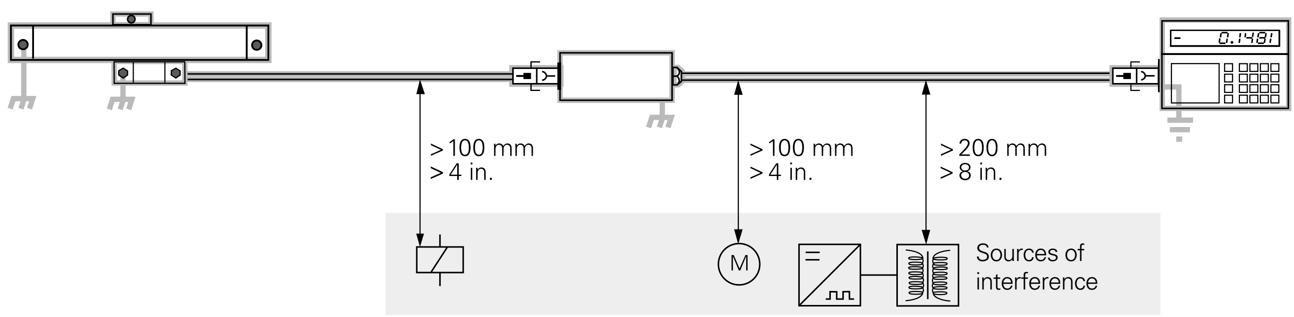
Cable configuration

When configuring the cable, take into account possible influences from sources of electromagnetic interference such as power cables, contactors, motors, magnetic valves, or stray magnetic fields from switch-mode power supplies. To ensure trouble-free operation, maintain a minimum clearance of 0.1 m (4 in.) between EXE/IBV connecting cables and sources of interference, and at least 0.2 m (8 in.) to inductors.

If a cable train contains connecting elements, take steps to prevent possible contact between the connector housings and other metal parts. Use original HEIDENHAIN cables and connecting elements with insulated housings.

Permissible bending radii for connecting cable <u>with</u> metal armor tubing

Cable	**Permissible bending radius** for	
	Frequent flexing	Rigid configuration
Dia. 10 mm (0.39 in.)	R ≥ 75 mm (3 in.)	R ≥ 35 mm (1.4 in.)
Dia. 14 mm (0.55 in.)	R ≥ 100 mm (4 in.)	R ≥ 50 mm (2 in.)



EXE 600 Series – Model Overview

EXE Interpolation and Digitizing Electronics
Input: ∿ 11 µAPP
Output: ⊓⊔ TTL

The EXE 600 series features one input for linear or angle encoders with 11 µAPP sinusoidal output signals.

These EXE units deliver TTL-compatible square-wave signals over a flange socket.

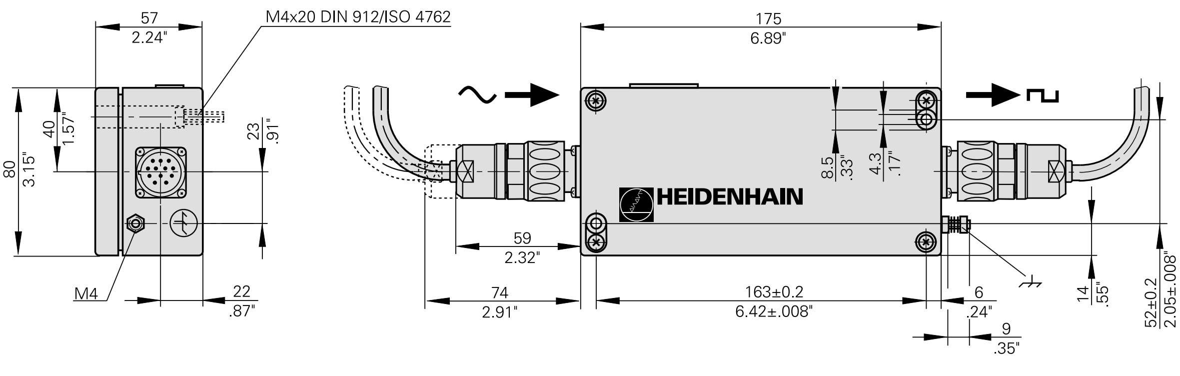
The necessary 5 V ± 5 % power supply must be provided by the subsequent electronics.

Model	Inter-polation		Input frequency f_i	Clock frequency f_T	Minimum edge separation a
EXE 602 E	Adjustable	Without	50 kHz	Non-clocked	2.5 µs
		5-fold	25 kHz		0.5 µs
EXE 610 C	Adjustable	5-fold	50 kHz 25 kHz 12.5 kHz 6.25 kHz	2 MHz	1 µs 2 µs 4 µs 8 µs
		10-fold	50 kHz 25 kHz 12.5 kHz 6.25 kHz		0.5 µs 1 µs 2 µs 4 µs
EXE 612	Adjustable	5-fold	100 kHz 100 kHz 50 kHz 25 kHz	8 MHz	0.25 µs 0.5 µs 1 µs 2 µs
		10-fold	100 kHz 100 kHz 50 kHz 25 kHz		0.125 µs 0.25 µs 0.5 µs 1 µs
EXE 650 B		50-fold	40 kHz 20 kHz 10 kHz 5 kHz	8 MHz	0.125 µs 0.25 µs 0.5 µs 1 µs
		25-fold	60 kHz 40 kHz 20 kHz 10 kHz	8 MHz	0.125 µs 0.25 µs 0.5 µs 1 µs
EXE 660 B	Adjustable	25-fold	50 kHz 50 kHz 25 kHz 12.5 kHz	20 MHz	0.1 µs 0.2 µs 0.4 µs 0.8 µs
		50-fold	50 kHz 25 kHz 12.5 kHz 6.25 kHz		0.1 µs 0.2 µs 0.4 µs 0.8 µs
		100-fold	25 kHz 12.5 kHz 6.25 kHz 3.12 kHz		0.1 µs 0.2 µs 0.4 µs 0.8 µs
		200-fold	12.5 kHz 6.25 kHz 3.12 kHz 1.56 kHz		0.1 µs 0.2 µs 0.4 µs 0.8 µs
		400-fold	6.25 kHz 3.12 kHz 1.56 kHz 0.78 kHz		0.1 µs 0.2 µs 0.4 µs 0.8 µs

EXE 600 Series

■ **Mechanical Data**	
Weight	Approx. 0.7 kg
Protection (IEC 529)	IP 65
Operating temperature **Storage temperature**	0 to 70° C (32 to 158° F) –30 to 80° C (–22 to 176° F)
Vibration (50 to 2000 Hz) **Shock** (11 ms)	$\leq$ 10 m/s^2 $\leq$ 300 m/s^2

Dimensions
in mm/inches



■ **Electrical Data**

EXE 600 Series

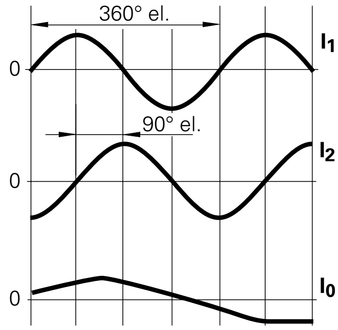
Power supply U_P = 5 V ± 5 %

Current consumption
(without encoder light source or output load)

EXE 602E	typ. 55 mA,	max. 90 mA
EXE 610C	typ. 65 mA,	max. 100 mA
EXE 612	typ. 65 mA,	max. 100 mA
EXE 650B	typ. 120 mA,	max. 160 mA
EXE 660B	typ. 100 mA,	max. 120 mA

With the recommended input circuitry for the subsequent electronics, the maximum permissible current consumption increases by Δ I = 80 mA.

Input signals

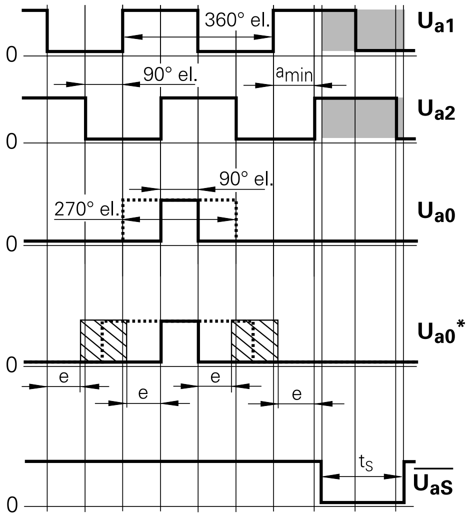


Sinusoidal scanning signals — preferably from HEIDENHAIN linear and angle encoders.

Signal levels **I_1, I_2:** 7 to 16 μA_{PP}
I_0: 2 to 8.5 µA

Input frequency f_i: see Model Overview

Output signals



Incremental signals: Square-wave pulse trains U_{a1} and U_{a2} and their inverted pulse trains $\overline{U_{a1}}$ and $\overline{U_{a2}}$ (according to RS-422).

Edge separation a: see Model Overview

Reference signal: Square-wave pulse U_{a0} and its inverted pulse $\overline{U_{a0}}$.
Width: **EXE with interpolation**
Standard 90° el., switchable to 270° el.

EXE without interpolation
Standard 90° el., switchable to non-gated (e > $^a/_2$)

Fault-detection signal: Square-wave pulse $\overline{U_{aS}}$
Duration: **EXE 6xx** $t_S \geq$ 20 ms
EXE 602E $t_S \geq$ 250 µs or $t_S \geq$ 40 ms (switchable)

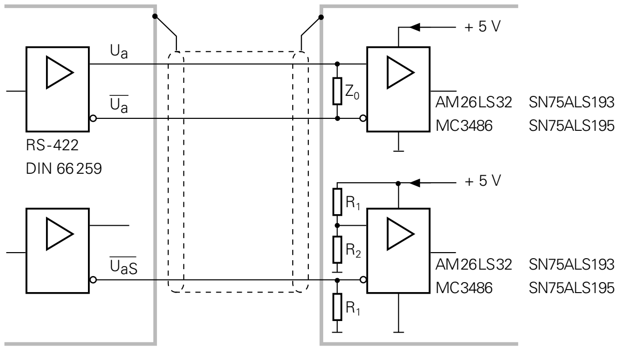
Tristate: With $\overline{U_{aS}}$ = Low, outputs for U_{a1}, U_{a2} and $\overline{U_{a1}}$, $\overline{U_{a2}}$ can be switched to high impedance.
Standard setting: Tristate inactive, can be switched to active

Signal levels TTL-compatible
$U_{High} \geq$ 2.5 V at $-I_{High} \leq$ 20 mA
$U_{Low} \leq$ 0.5 V at $I_{Low} \leq$ 20 mA

Load capacity $-I_{High}$ ≤ 20 mA
I_{Low} ≤ 20 mA
C_{Load} ≤ 1 000 pF against 0 V
Temporary short circuit of all outputs against 0 V permissible.
One output permanently short-circuit proof when T_0 < 25° C (77° F).

Switching times With 1 m (3.3 ft) cable and recommended input circuitry of subsequent electronics:
Rise time t_+ = typ. 10 ns, max. 30 ns
Fall time t_- = typ. 10 ns, max. 30 ns

Recommended input circuitry of subsequent electronics



$R_1 = 4.7\ k\Omega$
$R_2 = 1.8\ k\Omega$
$Z_0 = 120\ \Omega$

Permissible cable lengths

Input

EXE 6xx: max. 30 m (100 ft) with HEIDENHAIN cable [3 (2 x 0.14 mm^2) + (2 x 1.0 mm^2)] when $I_{encoder} \leq 120$ mA

EXE 612: max. 10 m (33 ft)

Output

Max. 50 m (164 ft) with HEIDENHAIN cable [4 (2 × 0.14 mm^2) + (4 × 0.5 mm^2)] and recommended input circuitry of subsequent electronics.
The supply voltage level — measured at the cable end via the sensor line — must be maintained.

Max. 20 m (66 ft) with minimum edge separation a = 0.1 µs or 0.125 µs

Pin layout – Output
(Colors valid for HEIDENHAIN cable)

12-pin flange socket (male)

	5	6	8	1	3	4	12	10	2	11	9	7	/
	U_{a1}	**$\overline{U_{a1}}$**	**U_{a2}**	**$\overline{U_{a2}}$**	**U_{a0}**	**$\overline{U_{a0}}$**	**5 V** (U_P)	**0 V** (U_N)	**5 V** Sensor*	**0 V** Sensor*	**Vacant**	**$\overline{U_{aS}}$**	1)
	Brown	Green	Gray	Pink	Red	Black	Brown/ green	White/ green	Blue	White	/	Violet	Yellow

* The sensor line is connected internally to the supply line.

IEC 742 EN 50 178

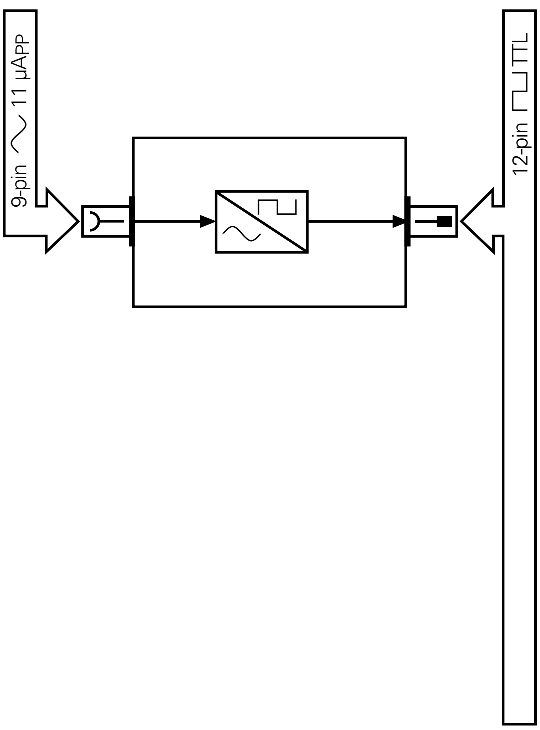
Shield on housing

HEIDENHAIN connecting elements

Input

Cable and **connector** 9-pin, see HEIDENHAIN catalogs
"Rotary Encoders,"
"Angle Encoders,"
"Exposed Linear Encoders,"
"Sealed Linear Encoders"

EXE 600



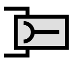
Output

Cable 12-pin
Complete with connector (female) and connector (male),
Id.-Nr. 298 399-xx

With one connector (female)
Id.-Nr. 309 777-xx

Cable only
PUR [4(2 × 0.14 mm^2) + (4 × 0.5 mm^2)]
Id.-Nr. 244 957-01

Connector (female) 12-pin
Id.-Nr. 291 697-05



EXE 900 Series – Model Overview

EXE Interpolation and Digitizing Electronics
Input: ∼ 11 µA$_{PP}$
Output: ⊓⊔ TTL

The EXE 900 series features an integral primary-clocked power supply (85 to 265 V AC).
Versions are available for one to a maximum of three incremental linear or angle encoders with sinusoidal output signals and a signal level of 11 µA$_{PP}$. The standard output signals of the EXE 900 series are TTL-compatible square-wave signals (one for each encoder connected).

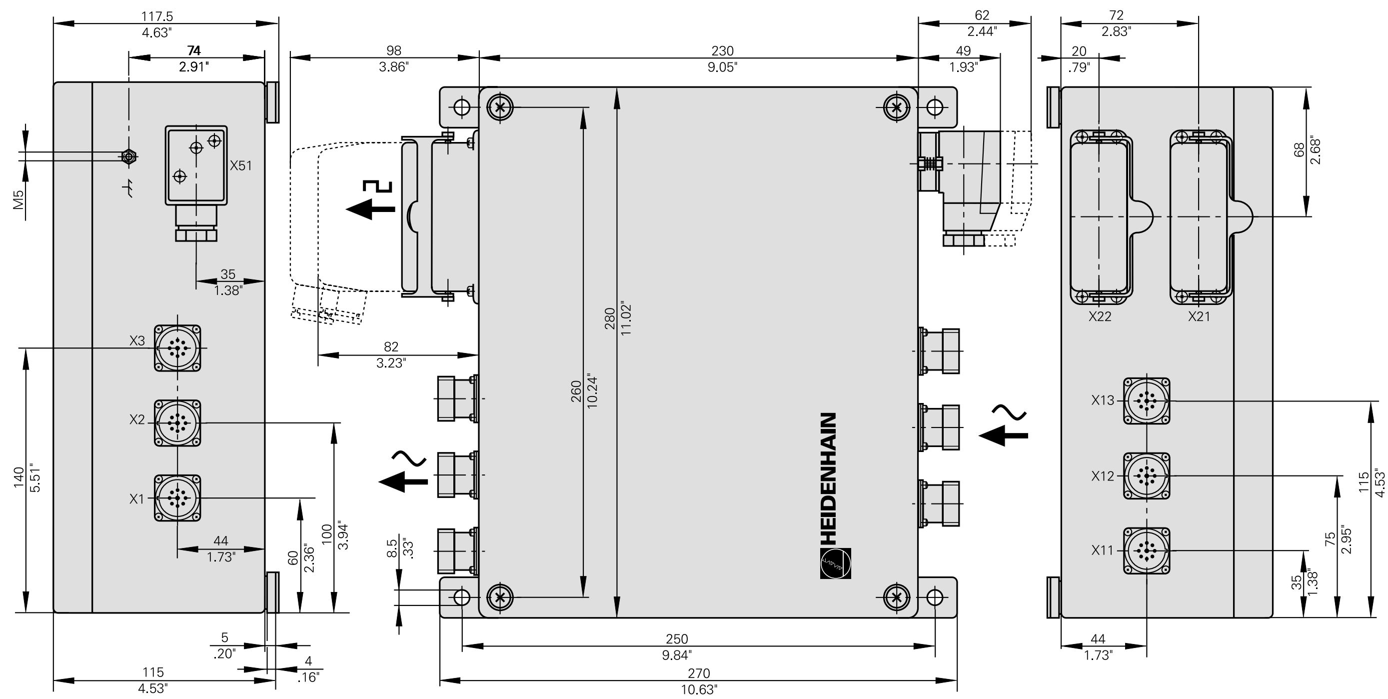
Additional flange sockets can be specified, providing one additional TTL signal for each encoder input. As a further option, the sinusoidal input signals can be output again.

Encoder inputs	Model	Inter-polation	Input frequency f_i	Clock frequency f_T	Minimum edge sepa-ration a	Outputs per input
1	**EXE 914**	25-fold	60 kHz 40 kHz 20 kHz 10 kHz	8 MHz	0.125 µs 0.25 µs 0.5 µs 1 µs	1 TTL Option: + 1 TTL + 1 ∼
2	**EXE 922**	Each input adjustable: Without	50 kHz	Non-clocked	2.5 µs	1 TTL Option: + 1 TTL + 1 ∼
		5-fold	50 kHz 25 kHz 12.5 kHz 6.25 kHz	2 MHz	1 µs 2 µs 4 µs 8 µs	
		10-fold	50 kHz 25 kHz 12.5 kHz 6.25 kHz		0.5 µs 1 µs 2 µs 4 µs	
	EXE 924	25-fold	60 kHz 40 kHz 20 kHz 10 kHz	8 MHz	0.125 µs 0.25 µs 0.5 µs 1 µs	1 TTL Option: + 1 TTL + 1 ∼
3	**EXE 932**	See EXE 922				
	EXE 934	See EXE 924				
	EXE 935	50-fold	40 kHz 20 kHz 10 kHz 5 kHz	8 MHz	0.125 µs 0.25 µs 0.5 µs 1 µs	1 TTL Option: + 1 TTL + 1 ∼

EXE 900 Series

■ **Mechanical Data**	
Weight	Approx. 5.0 kg
Protection (IEC 529)	IP 65
Operating temperature **Storage temperature**	0 to 45° C (32 to 113° F) –30 to 80° C (–22 to 176° F)
Vibration (50 to 2000 Hz) **Shock** (11 ms)	≤ 10 m/s^2 ≤ 300 m/s^2

Dimensions
in mm/inches



EXE 900 Series

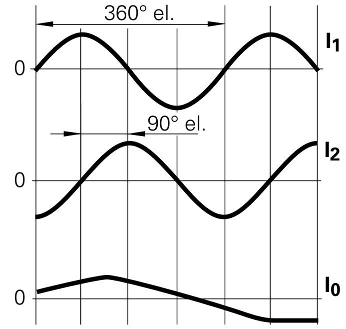
Power supply

Incorporated primary-clocked power supply
85 to 265 V AC
48 to 62 Hz

Power consumption

Max. 15 VA

Input signals



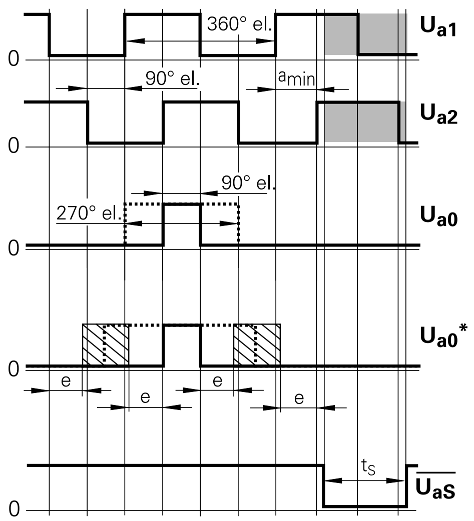
Sinusoidal scanning signals — preferably from HEIDENHAIN linear and angle encoders.

Signal levels **I_1, I_2:** 7 to 16 μA_{PP}
I_0: 2 to 8.5 µA

Input frequency f_i: see Model Overview

Total current consumption of all connected encoders: max. 700 mA

Output signals



Incremental signals: Square-wave pulse trains U_{a1} and U_{a2} and their inverted pulse trains $\overline{U_{a1}}$ and $\overline{U_{a2}}$ (according to RS-422).

Edge separation **a**: see Model Overview

Reference signal: Square-wave pulse U_{a0} and its inverted pulse $\overline{U_{a0}}$.
Width: **EXE with interpolation**
Standard 90° el., switchable to 270° el.

EXE without interpolation
Standard 90° el., switchable to non-gated (e > $^a/_2$)

Fault-detection signal: Square-wave pulse $\overline{U_{aS}}$ (U_{aS} is also provided).
Duration: $t_S \geq 20$ ms

Tristate: With $\overline{U_{aS}}$ = Low, outputs for U_{a1}, U_{a2} and $\overline{U_{a1}}$, $\overline{U_{a2}}$ can be switched to high impedance.
Standard setting: Tristate inactive, can be switched to active

Signal levels TTL-compatible

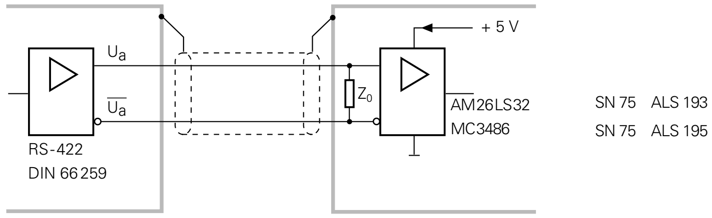
$U_{High} \geq 2.5$ V at $-I_{High} \leq 20$ mA
$U_{Low} \leq 0.5$ V at $I_{Low} \leq 20$ mA

Load capacity $-I_{High} \leq 20$ mA
$I_{Low} \leq 20$ mA
$C_{Load} \leq 1000$ pF against 0 V
Temporary short circuit of all outputs against 0 V permissible.
One output permanently short-circuit proof when $T_0 < 25°$ C (77° F).

Switching times With 1 m (3.3 ft) cable and recommended input circuitry of subsequent electronics:
Rise time t_+ = typ. 10 ns, max. 30 ns
Fall time t_- = typ. 10 ns, max. 30 ns

Recommended input circuitry of subsequent electronics

Square-wave signals



$Z_0 = 120\ \Omega$

Sinusoidal signals: see encoder specifications

zulässige Kabellängen		
	Input	max. 30 m with HEIDENHAIN cable [3 (2 × 0.14 mm^2) + (2 × 1.0 mm^2)]
	TTL output	max. 50 m (164 ft) with HEIDENHAIN cable [25 x 0.34 mm^2] and recommended input circuitry of subsequent electronics, max. 20 m (66 ft) with minimum edge separation a = 0.125 µs
	∼ output	max. 30 m (100 ft) with HEIDENHAIN cable [3 (2 x 0.14 mm^2) + (2 x 1.0 mm^2)]

Pin layout – Output
(Colors valid for HEIDENHAIN cable)

25-pin flange socket (female)

X1								X2								X3								*
B2	A1	A2	C1	C2	B3	B4	A3	A4	C3	C4	B5	B6	A5	A6	C5	C6	B7	B8	A7	A8	C7	A9	C8	C9
$\overline{U_{a1}}$	U_{a1}	$\overline{U_{a2}}$	U_{a2}	$\overline{U_{a0}}$	U_{a0}	$\overline{U_{aS}}$	U_{aS}	$\overline{U_{a1}}$	U_{a1}	$\overline{U_{a2}}$	U_{a2}	$\overline{U_{a0}}$	U_{a0}	$\overline{U_{aS}}$	U_{aS}	$\overline{U_{a1}}$	U_{a1}	$\overline{U_{a2}}$	U_{a2}	$\overline{U_{a0}}$	U_{a0}	$\overline{U_{aS}}$	U_{aS}	U_{aN}
White	Brown	Green	Yellow	Gray	Pink	Blue	Red	Black	Violet	Gray/pink	Red/blue	White/green	Brown/green	White/yellow	Yellow/brown	White/gray	Gray/brown	White/pink	Pink/brown	White/blue	Brown/blue	White/red	Brown/red	White/black

*U_{aN} Reference potential for signals.

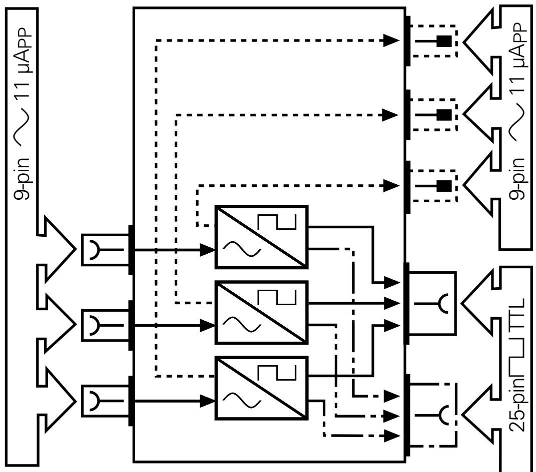
Shield on housing

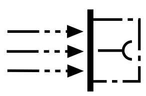
HEIDENHAIN connecting elements

Input

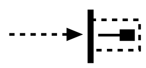
Cable and **connector** 9-pin, see HEIDENHAIN catalogs
"Rotary Encoders,"
"Angle Encoders,"
"Exposed Linear Encoders,"
"Sealed Linear Encoders"

EXE 900





Option:
⊓⊔ **TTL output assembly**
(for all encoder inputs)
Id.-Nr. 284 477-xx



Option:
∼ **11 µAPP output assembly**
(for each encoder input)
Id.-Nr. 237 280-xx

Output

Cable 9-pin
Complete with connector (female) and connector (male)
Id.-Nr. 309 773-xx

Cable 25-pin
Complete with connector (male) and connector (female)
Id.-Nr. 207 620-xx

With one connector (male)
Id.-Nr. 209 009-xx

Cable only
PUR [25 × 0.34 mm^2]
Id.-Nr. 209 991-01

Connector (female) 12-pin
Id.-Nr. 207 985-01

IBV 600 Series – Model Overview

IBV Interpolation and Digitizing Electronics
Input: ∿ 1 V_{PP}
Output: ⊓⊔ TTL

The IBV 600 series features one input for incremental linear or angle encoders with sinusoidal output signals and a signal level of 1 V_{PP}.

IBV 600 models deliver TTL-compatible square-wave output signals over a flange socket.

The IBV 606 provides output signals at two flange sockets simultaneously. The connections inside the IBV 606 can be changed such that either one flange socket or both flange sockets deliver sinusoidal voltage signals with a signal level of 1 V_{PP} instead of square-wave output signals.

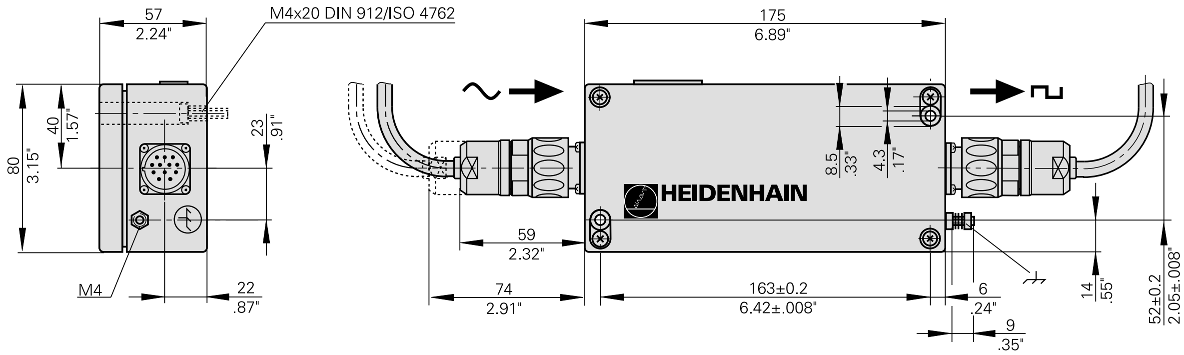
The necessary 5 V ± 5 % power supply must be provided by the subsequent electronics.

Model	Interpolation	Input frequency f_i	Clock frequency f_T	Minimum edge separation a
IBV 600	Without	600 kHz	Non-clocked	0.2 µs
IBV 606	2-fold	500 kHz	Non-clocked	0.15 µs
IBV 610	Adjustable: 5-fold	200 kHz 100 kHz 50 kHz 25 kHz	8 MHz	0.25 µs 0.5 µs 1 µs 2 µs
	Adjustable: 10-fold	200 kHz 100 kHz 50 kHz 25 kHz		0.125 µs 0.25 µs 0.5 µs 1 µs
IBV 650	50-fold	40 kHz 20 kHz 10 kHz 5 kHz	8 MHz	0.125 µs 0.25 µs 0.5 µs 1 µs
IBV 660 B	Adjustable: 25-fold	100 kHz 50 kHz 25 kHz 12.5 kHz	20 MHz	0.1 µs 0.2 µs 0.4 µs 0.8 µs
	Adjustable: 50-fold	50 kHz 25 kHz 12.5 kHz 6.25 kHz		0.1 µs 0.2 µs 0.4 µs 0.8 µs
	Adjustable: 100-fold	25 kHz 12.5 kHz 6.25 kHz 3.12 kHz		0.1 µs 0.2 µs 0.4 µs 0.8 µs
	Adjustable: 200-fold	12.5 kHz 6.25 kHz 3.12 kHz 1.56 kHz		0.1 µs 0.2 µs 0.4 µs 0.8 µs
	Adjustable: 400-fold	6.25 kHz 3.12 kHz 1.56 kHz 0.78 kHz		0.1 µs 0.2 µs 0.4 µs 0.8 µs

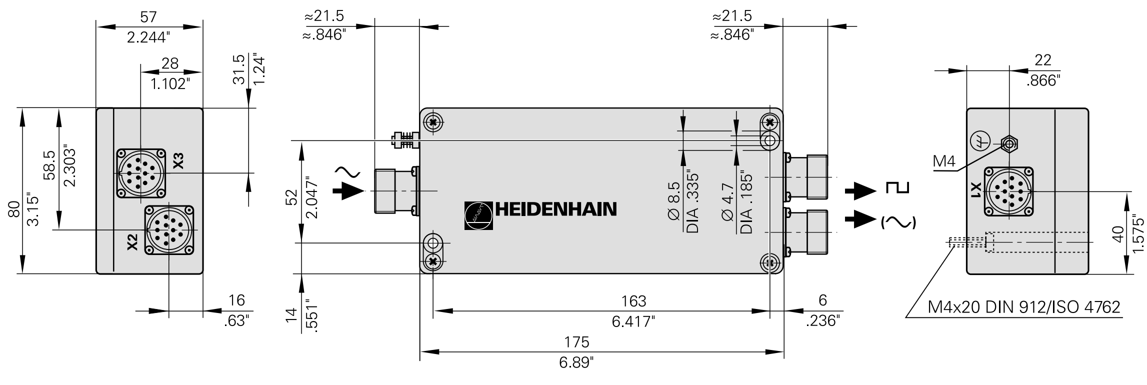
IBV 600 Series

■ **Mechanical Data**	
Weight	Approx. 0.7 kg
Protection (IEC 529)	IP 65
Operating temperature **Storage temperature**	0 to 70° C (32 to 158° F) –30 to 80° C (–22 to 176° F)
Vibration (50 to 2000 Hz) **Shock** (11 ms)	≤ 10 m/s^2 ≤ 300 m/s^2

Dimensions
in mm/inches



IBV 606



IBV 600 Series

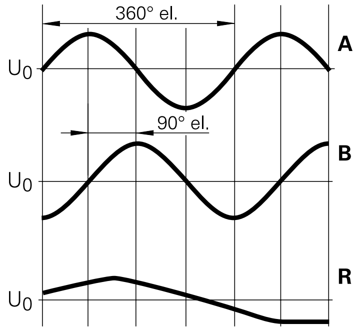
Power supply — U_P = 5 V ± 5 %

Current consumption
(Without encoder light source or output load)

IBV 600	typ. 50 mA, max. 85 mA
IBV 610	typ. 65 mA, max. 110 mA
IBV 650	typ. 120 mA, max. 160 mA
IBV 660 B	typ. 100 mA, max. 120 mA

With the recommended input circuitry for the subsequent electronics, the maximum permissible current consumption increases by ΔI = 80 mA.

Input signals

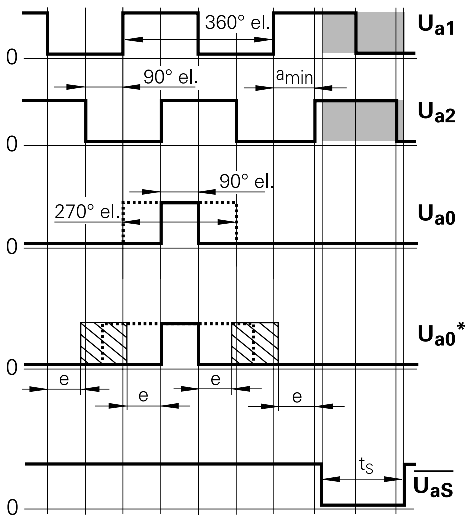


Sinusoidal scanning signals — preferably from HEIDENHAIN linear and angle encoders.

Signal levels — **A, B:** 0.6 to 1.2 V_{PP}; **R:** 0.2 to 0.85 V

Input frequency f_i: see Model Overview

Output signals



Incremental signals: Square-wave pulse trains U_{a1} and U_{a2} and their inverted pulse trains $\overline{U_{a1}}$ and $\overline{U_{a2}}$ (according to RS-422).

Edge separation **a**: see Model Overview

Reference signal: Square-wave pulse U_{a0} and its inverted pulse $\overline{U_{a0}}$.
Width: **IBV with interpolation**
Standard 90° el., switchable to 270° el.

IBV without interpolation
Standard 90° el., switchable to non-gated ($e > {}^{a}/_{2}$)

Fault-detection signal: Square-wave pulse $\overline{U_{aS}}$
Duration: $t_S \geq 20$ ms

Tristate: With $\overline{U_{aS}}$ = Low, outputs for U_{a1}, U_{a2} and $\overline{U_{a1}}$, $\overline{U_{a2}}$ can be switched to high impedance.
Standard setting: Tristate inactive, can be switched to active

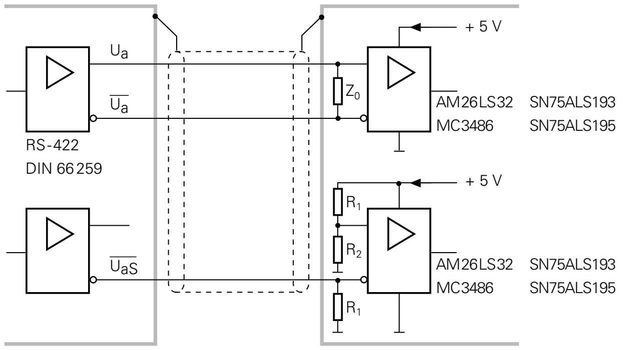
Signal levels TTL-compatible

$U_{High} \geq 2.5$ V at $-I_{High} \leq 20$ mA
$U_{Low} \leq 0.5$ V at $I_{Low} \leq 20$ mA

Load capacity
$-I_{High} \leq 20$ mA
$I_{Low} \leq 20$ mA
$C_{Load} \leq 1000$ pF against 0 V
Temporary short circuit of all outputs against 0 V permissible.
One output permanently short-circuit proof when T_0 < 25° C (77° F).

Switching times
With 1 m (3.3 ft) cable and recommended input circuitry of subsequent electronics:
Rise time t_+ = typ. 10 ns, max. 30 ns
Fall time t_- = typ. 10 ns, max. 30 ns

Recommended input circuitry of subsequent electronics



R_1 = 4.7 kΩ
R_2 = 1.8 kΩ
Z_0 = 120 Ω

Permissible cable lengths

Input

U_P > 4.75 V: max. 30 m (100 ft) with HEIDENHAIN cable [4 (2 × 0.14 mm^2) + (4 × 0.5 mm^2)] when $I_{encoder}$ ≤ 120 mA

U_P > 4.9 V: max. 60 m (200 ft)

Output

max. 50 m (164 ft) with HEIDENHAIN cable [4 (2 × 0.14 mm^2) + (4 × 0.5 mm^2)] and recommended input circuitry of subsequent electronics.
The supply voltage level — measured at the cable end via the sensor line — must be maintained.
Max. 20 m (66 ft) with minimum edge separation a ≤ 0.125 µs

Pin layout — Output
(Colors valid for HEIDENHAIN cable)

12-pin flange socket (male)

	5	6	8	1	3	4	12	10	2	11	9	7	/
	U_{a1}	**$\overline{U_{a1}}$**	**U_{a2}**	**$\overline{U_{a2}}$**	**U_{a0}**	**$\overline{U_{a0}}$**	**5 V*** (U_P)	**0 V*** (U_N)	**5 V** Sensor	**0 V** Sensor	**Vacant**	**$\overline{U_{aS}}$**	**Vacant**
	Brown	Green	Gray	Pink	Red	Black	Brown/ green	White/ green	Blue	White	/	Violet	Yellow

The sensor line is connected internally to the supply line
*With IBV 606: Power supply at X2 only.

IEC 742 EN 50 178

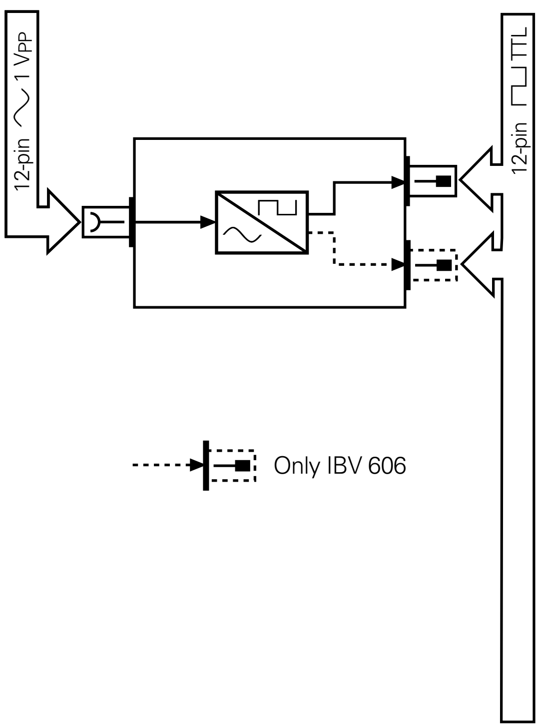
Shield on housing

HEIDENHAIN connecting elements

Input

Cable and **connector** 12-pin, see HEIDENHAIN catalogs *"Rotary Encoders," "Angle Encoders," "Exposed Linear Encoders," "Sealed Linear Encoders"*

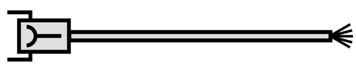
IBV 600



Output

Cable 12-pin
Complete with connector (female) and connector (male)
Id.-Nr. 298 399-xx

With one connector (female)
Id.-Nr. 309 777-xx



Cable only
PUR [4(2 × 0.14 mm^2) + (4 × 0.5 mm^2)]
Id.-Nr. 244 957-01

Connector (male) 12-pin
Id.-Nr. 291 697-05