

# SIGNUM™ with FANUC serial interface



The FANUC serial compatible Si-FN interface is part of the **SIGNUM™** family of optical position encoders featuring the **IN-TRAC™** autophase reference mark.

The interface connects to a standard SR readhead which works with the RESM high accuracy angle encoder providing FANUC serial output to work with FANUC CNC controllers.

Like all Renishaw encoders, the **SIGNUM™** range offers high speed, reliable operation and open, non-contact performance with excellent immunity to dirt and electrical noise.

The interface incorporates dynamic signal control which, combined with the patented filtering optics ensure excellent signal integrity and low cyclic error.

The Si-FN interface can be mounted remotely and a small connector on the readhead cable allows it to be fed easily through machines where access is restricted.

#### Readhead (SR)

SR005A – 0.5 m cable
SR010A – 1.0 m cable
SR015A – 1.5 m cable
SR030A – 3.0 m cable
SR050A – 5.0 m cable
SR100A – 10.0 m cable

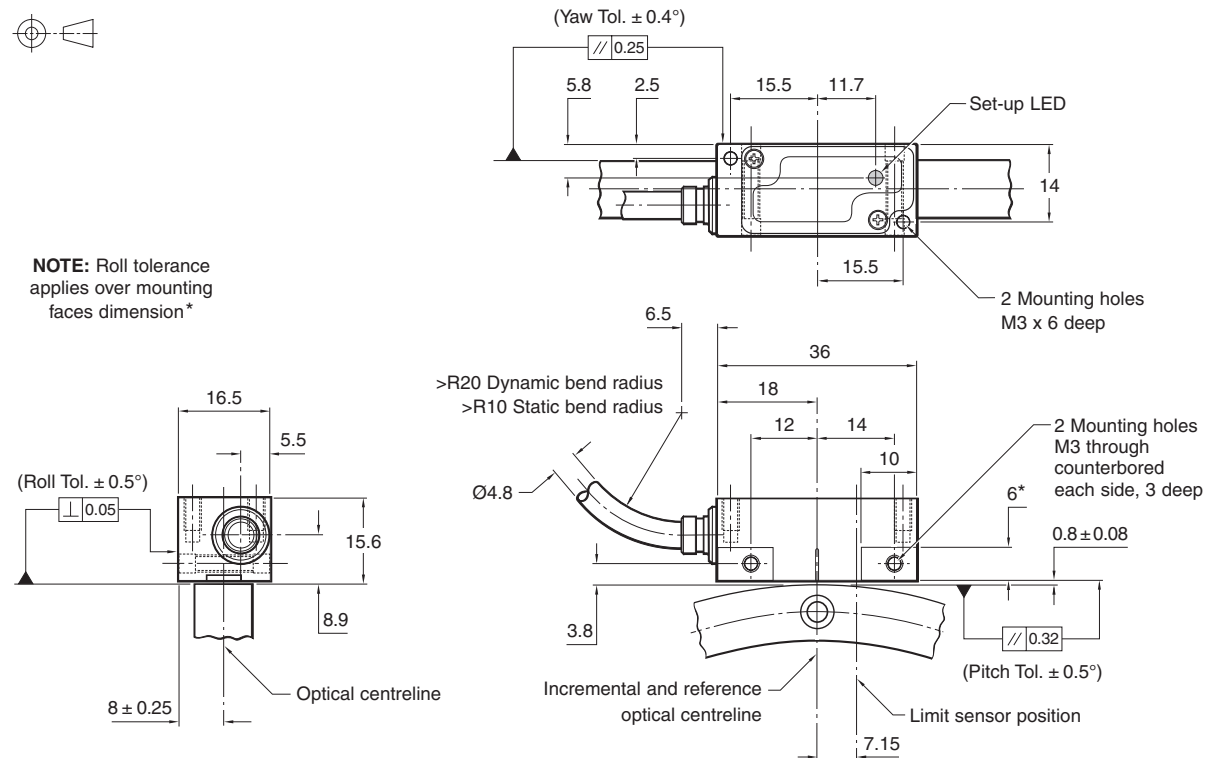
#### Interface unit (Si)

Si-FN-0052 – Ø52 mm ring
Si-FN-0104 – Ø104 mm ring
Si-FN-0209 – Ø209 mm ring
Si-FN-0417 – Ø417 mm ring

- FANUC compatible serial communication eliminates need for FANUC 'High Resolution Serial Output Circuit'
- Resolutions up to  $2^{26}$  positions per revolution
- **IN-TRAC™** bi-directional reference mark and on-scale dual limit outputs
- IP64 sealed readhead
- Compatible with RESM (52 mm, 104 mm, 209 mm and 417 mm diameters)
- Operating temperature up to +85 °C
- Speeds up to 12.5 m/sec (4,591 rev/min @ Ø52 mm)
- Dynamic signal control to give cyclic error of less than  $\pm 40$  nm
- **SIGNUM™** software for ease of installation and system diagnostics
- Integral LEDs for optimum set-up and system diagnostics
- Non-contact design for exceptional dynamic performance
- High flex, UL approved cable

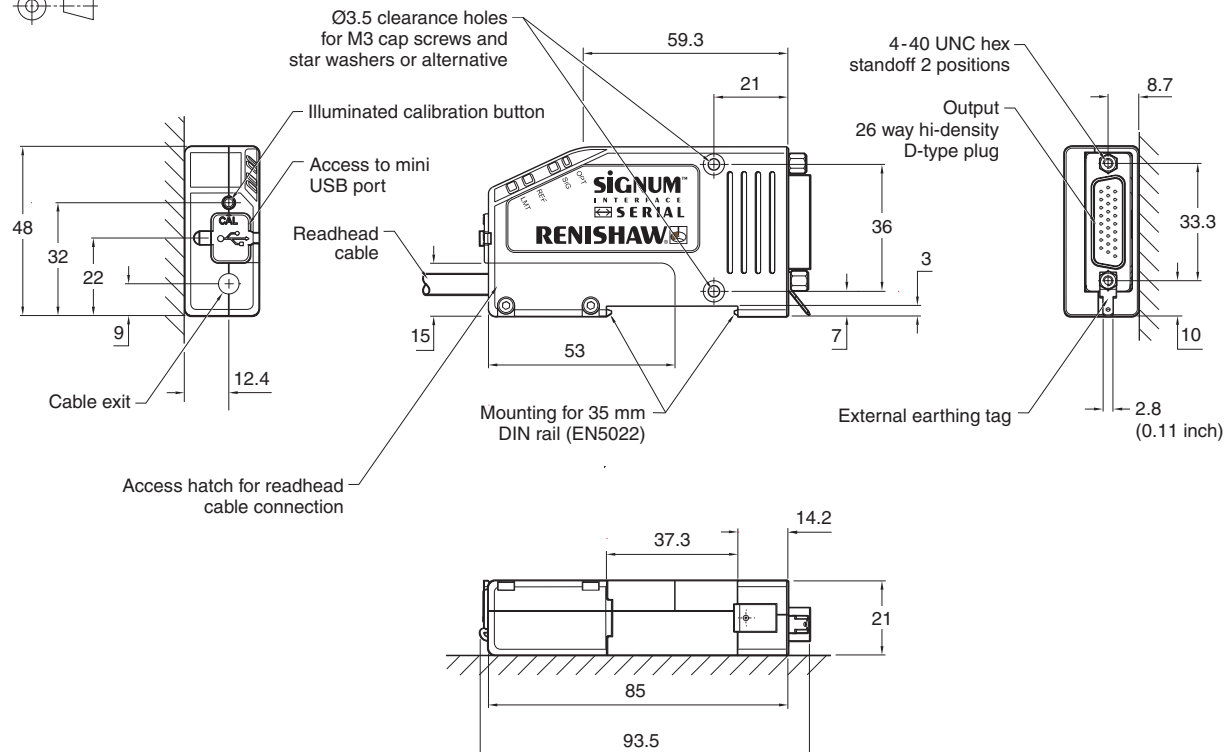
## SR installation drawing

Dimensions and tolerances in mm



## Si-FN installation drawing

Dimensions and tolerances in mm



## Operating and electrical specifications

<b>Power supply</b>	5 V ± 10%	<250 mA (typical)
	Ripple	200 mVpp maximum @ frequency up to 500 kHz maximum
<b>Temperature (system) (readhead) (interface)</b>	Storage	-20 °C to +70 °C
	Operating	0 °C to +85 °C
	Operating	0 °C to +70 °C
<b>Humidity</b>	Storage	95% maximum relative humidity (non-condensing)
	Operating	80% maximum relative humidity (non-condensing)
<b>Sealing (readhead) (interface)</b>		IP64
		IP30
<b>Acceleration (system)</b>	Operating	500 m/s <sup>2</sup> BS EN 60068-2-7:1993 (IEC 68-2-7:1983)
<b>Shock</b>	Non-operating	1000 m/s <sup>2</sup> , 6 ms, ½ sine BS EN 60068-2-27:1993 (IEC 68-2-27:1987)
<b>Vibration</b>	Operating	100 m/s <sup>2</sup> max @ 55 Hz to 2000 Hz BS EN 60068-2-6:1996 (IEC 68-2-6:1995)
<b>Mass</b>	Readhead	15 g
	Interface	205 g
	Cable	35 g/m
<b>EMC compliance (system)</b>	BS EN 61326	
<b>Cable</b>	Double-shielded, outside diameter 4.8 mm maximum Flex life >20 x 10 <sup>6</sup> cycles at 20 mm bend radius UL approved	

**NOTE: Class 1M LED product. LED radiation. Do not view directly with optical instruments.**

## Resolution and maximum speed (rev/min)

Interface	Ring diameter	Line count	Positions per revolution	FANUC serial resolution format	Maximum speed (rev/min)
Si-FN-0052-N1	52 mm	8,192	1,048,576 (20 bits)	Normal	4,591
Si-FN-0104-N1	104 mm	16,384	1,048,576 (20 bits)	Normal	2,295
Si-FN-0209-N1	209 mm	32,768	1,048,576 (20 bits)	Normal	1,142
Si-FN-0052-A1	52 mm	8,192	8,388,608 (23 bits)	High type A	1,200
Si-FN-0104-A1	104 mm	16,384	8,388,608 (23 bits)	High type A	600
Si-FN-0209-A1	209 mm	32,768	8,388,608 (23 bits)	High type A	300
Si-FN-0417-A1	417 mm	65,536	8,388,608 (23 bits)	High type A	572
Si-FN-0104-B1	104 mm	16,384	16,777,216 (24 bits)	High type B	600
Si-FN-0209-B1	209 mm	32,768	33,554,432 (25 bits)	High type B	300
Si-FN-0417-B1	417 mm	65,536	67,108,864 (26 bits)	High type B	150

## System features



### IN-TRAC™ optical reference mark

- Integrated within the scale graduations for compact dimensions and simplified alignment
- Electronically phased, requiring no physical adjustment
- Sub arc second repeatability in both directions of travel over full operating temperature and speed range

### Dynamic signal control

- Real time signal conditioning for optimized performance across a range of operating conditions
- Includes Auto Gain Control (AGC), Auto Offset Control (AOC) and Auto Balance Control (ABC)
- Ultra low cyclic error, typically  $< \pm 40$  nm

### Calibration at the touch of a button

- Click of a mouse via **siGNUM™** Software or CAL button on Si interface
- Optimization for all output signals

### Integrated LED diagnostics

- Remote access for convenient viewing
- Simplifies initial alignment and set-up
- Reference mark and limit status



### Dual optical limit switch



- Provides end-of-travel indication
- User selectable positioning
- Independent output for each limit position
- Ideal for partial rotation applications eg Machine tool A or B axes (RESM ring encoder)

### siGNUM™ software

- PC based, providing real-time set-up, calibration and diagnostics
- Full function DRO capability
- USB connection to **siGNUM™** Si interface
- Simultaneous multiple axis connectivity

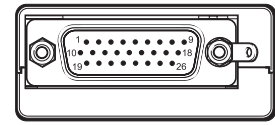
Recommended minimum PC requirements for the software:

- USB1.1
- .NET Framework 1.1 (redistributable version included with the software)
- Microsoft® Windows® 98 (2<sup>nd</sup> edition), Millennium edition (Me), 2000 or XP
- Microsoft® Internet Explorer 5.01 or later
- Pentium® II processor
- 128 MB RAM
- Screen resolution 800 x 600, 16-bit colours



## Connections Si FANUC serial comms output

Function	Output type	Signal	Pin	
Power		5 V Power	26	
		5 V Sense	18	
		0 V Power	9	
		0 V Sense	8	
Serial communications	Fanuc serial communications	REQ	5	
		*REQ	14	
		SD	15	
		*SD	23	
Alarm	RS422A	E+	16	
		E-	6	
Incremental signals	Analogue	Cosine	V1+	1
			V1-	19
		Sine	V2+	2
			V2-	11
Reference mark	Analogue	V0+	12	
		V0-	20	
Limits	Open collector	P	4	
		Q	13	
Warning	Open collector	W	22	
Readhead pitch adjustment	-	XS	10	
Do not connect	-	-	21, 3, 7, 17, 24, 25	
Shield	-	Inner shield	Not connected	
	-	Outer shield	Case	

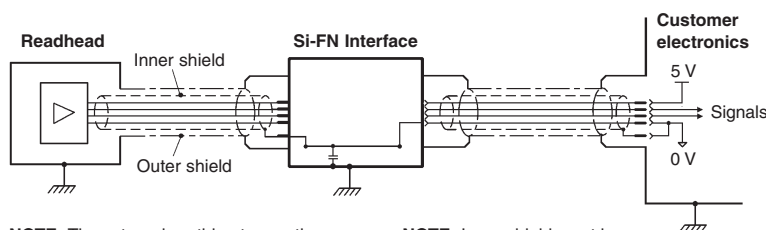


26 pin high density 'D' type plug

**NOTE:** Only power and serial communication pins should be connected to the 'FANUC  $\alpha$  series servo amplifier' or 'Separate Detector Interface Unit'. The other outputs are auxiliary connections that can be used to extend the functionality of a machine if required.

## Electrical connections

### Si-FN and SR grounding and shielding



### Maximum cable length

Readhead to interface: 10 m

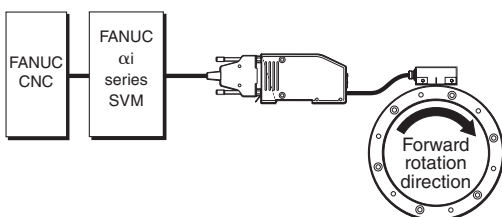
Interface to controller: 50 m

**NOTE:** The external earthing tag on the interface should be used when mounting the interface on a DIN rail

**NOTE:** Inner shield must be connected to 0V at customer electronics only

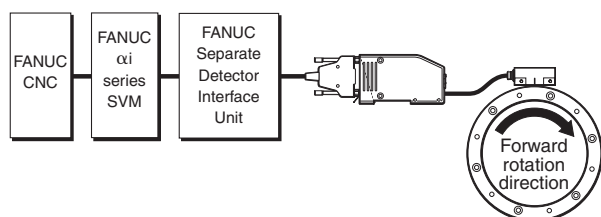
### In case of connection directly to SVM

(Position detector usage for direct-drive rotary applications).

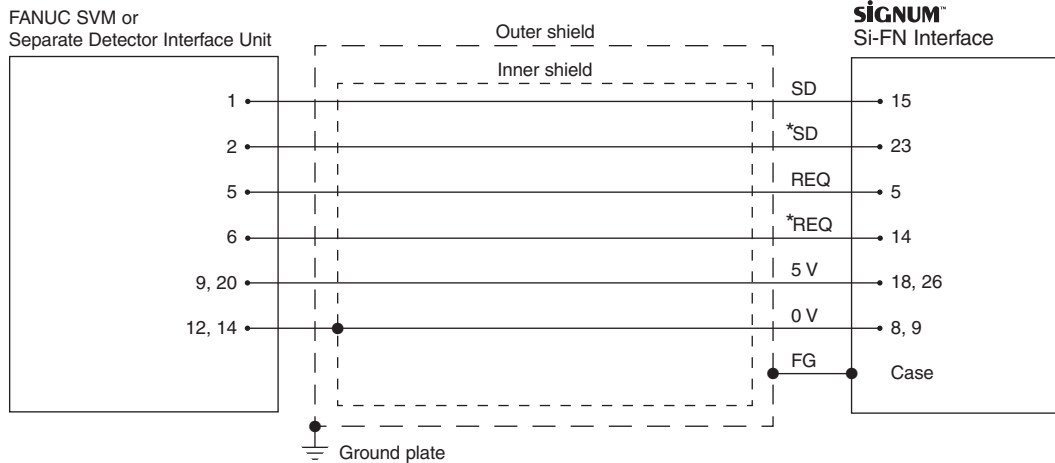


### In case of connection directly to Separate Detector Interface Unit

(Position detector usage for gear-driven rotary applications).



## Connections to FANUC SVM or Separate Detector Interface Unit

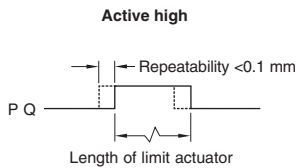


### Auxiliary signals

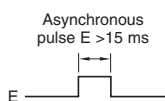
Analogue output signals available from all Si units. Auxiliary signals can be used to extend machine functionality if an advanced user requires. The Alarm signal is output as a differential line driven signal. Note that alarm status information is also contained in the serial data.

#### On-scale limits

Open collector output, asynchronous pulse



#### Alarm†

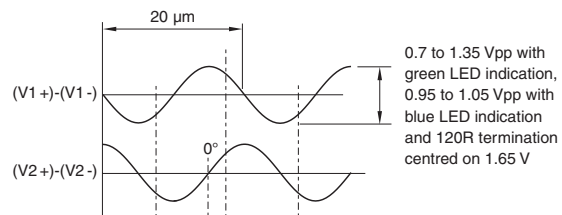


Alarm asserted when analogue signal amplitude is less than 20% or greater than 135%, or if the readhead exceeds its maximum operational speed, or if the Lissajous becomes offset.

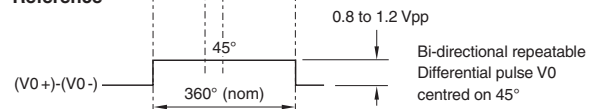
†Note: Inverse signals not shown for clarity

#### Analogue output signals

**Incremental** 2 channels V1 and V2 differential sinusoids in quadrature (90° phase shifted)

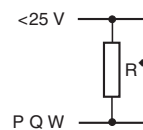


#### Reference

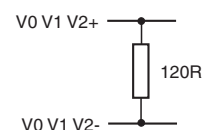


#### Recommended signal termination

##### Limit outputs



##### Analogue outputs



\*Select R so max. current does not exceed 20mA

Alternatively, use a suitable relay or opto-isolator

For worldwide contact details, please visit our main website at [www.renishaw.com/contact](http://www.renishaw.com/contact)

