Newall Measurement Systems

For Spherosyn and Microsyn
A Technical Reference

Contents

NOTE: ***NEWALL MEASUREMENT SYSTEMS RESERVE THE RIGHT TO*** CHANGE SPECIFICATIONS WITHOUT PRIOR NOTICE.

1.0 Introduction

The Spherosyn and Microsyn transducers were designed for use with the Newall Measurement systems digital readouts. The transducers robustness and resistance to harsh industrial environments makes them well suited to more general applications, for example CNC machine tools.

The Icon interface is used to convert the output of Newall's transducers to industry standard, quadrature TTL, signals that can connect to a wide range of control systems and counters.

The Icon interface can generate 1, 2, 5 and 10μm output resolutions. Scale types can be mixed on the same unit. The only restriction is when the interface is set-up for 1μm resolution, scale types can be mixed but all axes must be 1μm resolution.

The Icon unit requires a nominal 24V supply. Where this is not provided by the host control system Newall have designed a separate power supply unit, (PSU), which generates the required voltages from either a 230V or 110V mains supply.

1.1 Low Voltage Compliance

The Icon power supply unit (PSU) conforms to the relevant European standard for the low voltage directive as detailed below.

BS EN 61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use.

ISO 9001 BSI REGISTERED FIRM NATIONAL ACCREDITATION OF CERTIFICATION BODIES

Certificate No FM36096

CE

2.0 Icon Power Supply Unit
2.1 Technical Specification

Dimensions:	Height:	76mm (3.0in)
	Width:	126mm (5.0in)
	Depth:	114mm (4.5in)
	Weight:	0.87kg (1.9lbs)
	Input Lead:	Greater than 1m
	Output Lead:	Greater than 0.5m
Nominal Supply:	115/230 V; 140/70mA	
Supply Voltage Fluctuation:	Not to exceed ±15% of the operating voltage	
Supply Frequency:	50 to 60 Hz	
Output Voltage:	Specific to Icon^2 interface unit	
Rated Output Current:	400mA, maximum	
Operating Temperature:	0 to 40ºC	
Storage Temperature:	-20 to 70ºC	
Environmental Conditions:	Indoor use, IP20 (IEC 529) Installation (over-voltage) category II of IEC664	

2.2 Installation and Maintenance

ALL INSTALLATION AND MAINTENANCE WORK IS TO BE CARRIED OUT BY QUALIFIED AND TRAINED SERVICE PERSONNEL ONLY.

2.2.1 Mounting

The Icon PSU is provided with four mounting tabs drilled with M6 clearance holes. These mountings are to be used to secure the unit in its operating environment.

The location of the unit should be chosen with due regard to safety and ease of maintenance. Keep clear of moving parts and coolant spray. Ensure the natural ventilation around the unit is not restricted.

Mount the unit as close as possible to the Icon interface to keep the power supply output lead as short as possible. Do not route PSU cables near high power cables.

2.2.2 Power Supply

The Icon PSU is to be installed as ***PERMANENTLY CONNECTED EQUIPMENT***. An approved disconnect device, (e.g. EN60947), with a minimum 3mm contact separation must be used. The disconnect device must be readily accessible.

BEFORE CONNECTING THE ELECTRICAL SUPPLY TO THE UNIT CHECK THAT THE VOLTAGE SELECTOR SWITCH IS CORRECTLY SET.

THIS EQUIPMENT MUST BE EARTHED

The mains supply cord and output flying-leads should be secured with cable ties to ensure that they cannot drop into a hazardous position.

The mains supply fuse is a 20x5mm, type T0.5A, 250V. If the fuse blows it is a possible indication of some significant problem with the power source. Check the supply and wiring carefully. If the fuse is replaced, the unit must first be disconnected from the supply by the disconnect device.

2.2.3 Output

The output flying lead is a twin core cable. The red lead is the positive supply and the black lead the negative supply. Ensure the power supply is turned off using the mains disconnect device prior to connecting the output lead to the Icon interface. To maintain safety all interconnections must be at a separated extra low voltage (SELV) level.

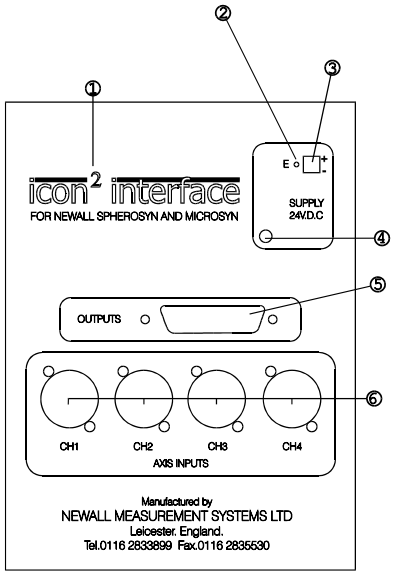
The output fuse is a 20x5mm, type F0.5A, 250V. If the fuse is replaced first disconnect the unit from the supply using the disconnect device.

The Icon PSU is only intended to power the Newall Measurement Systems Icon interface. Connection to other equipment or use in a manner not specified by the manufacturer may impair the protection provided by the equipment.

3.0 Icon^2 Interface

3.1 Technical Specification

Dimensions:	Height:	195mm (7.7in)
	Width:	122mm (4.8in)
	Depth:	69mm (2.7in)
Power supply:	24Vdc	@ 400mA (3 axes, 100Ω loads on quad outputs)
	24Vdc	@ 300mA (2 axes, 100Ω loads on quad outputs)
	24Vdc	@ 200mA (1 axis, 100Ω loads on quad outputs)
Inputs:	Up to three axes, Microsyn and/or Spherosyn	
Max. head velocity:	Spherosyn 2 m/s Microsyn 0.75 m/s	
Resolutions:	1μm (0.00005in) / 2μm (0.0001in) 5μm (0.0002in) / 10μm (0.0005in)	
Output drivers:	34C87 (Quadrature TTL)	
Output levels (worst case):	V_{oH} >= 2.5 V V_{oL} <= 0.5 V	
Maximum quad clock rates:	3.1250 MHz (1μm resolution) 1.5625 MHz (2μm resolution) 781.25 kHz (5μm resolution) 312.50 kHz (10μm resolution)	
Reference: marker width:	One count wide (I.e. 1μ wide on a 1μ system)	
Operating temperature:	0 to 40°C (32 to 104 °F)	
Storage temperature:	-20 to 70°C (-4 to 158°F)	



Connections

1. Denotes Icon programmable
2. Case earth fixing
3. Power supply input
4. Power on LED
5. Output port (25 way D type)
6. Transducer input ports (Bleecon)

3.2 Installation and Maintenance

ALL INSTALLATION AND MAINTENANCE WORK IS TO BE CARRIED OUT BY QUALIFIED AND TRAINED SERVICE PERSONNEL ONLY.

The unit should be mounted in a dry, dust free environment as close as possible to the connected equipment. Four mounting tabs drilled with M6 clearance holes are provided for this purpose. These mountings are to be used to secure the unit in its operating environment. Connecting cables between the two should be kept as short as possible and not run in trunking with power cables or routed close to sources of interference (motors, transformers etc).

The case of the Icon^2 must be physically bonded to the machine earth point using 1mm cable suitably terminated under the case earth fixing screw.

The unit requires a 24V DC (see technical specification for current rating) regulated supply. If such a supply exists on the machine tool it must be fused at 1A. If not, a suitable supply is available from Newall Ltd. A red LED on the Icon indicates the presence of the internal 5V supply.

To connect to external equipment use data cable with screened, twisted pairs. The differential mode of connection is recommended (ref. Section 3.3.1). All screens, including the overall cable screen should be terminated under the strain relief of a metal 25-way backshell thereby making a good connection to earth.

The connector retaining screws **MUST** be used to prevent undue strain on the Icon^2 output plug. (Tapped pillars are provided for this purpose)

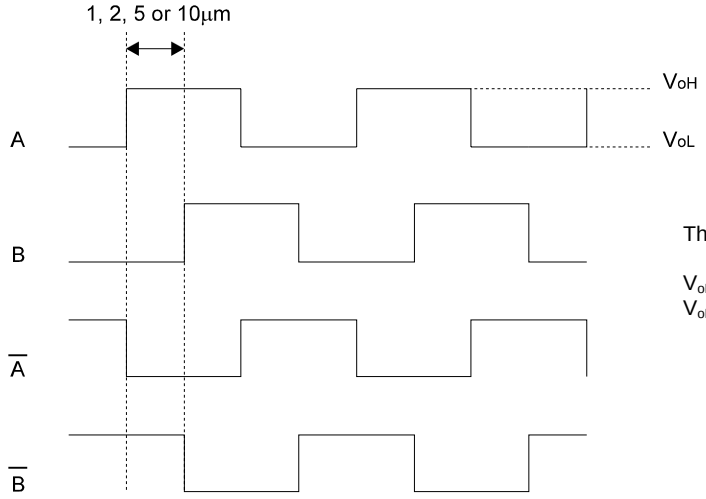
The 0V connection (PIN 1) should be separately connected to the logic 0V of the connected equipment. (Refer to manufacturers data).

NOTE: DO NOT MAKE ANY CONNECTION BETWEEN THE 5V (PIN 14) OF THE ICON^2 AND THE RECEIVING EQUIPMENT.

3.3 Connections

The Icon interface can generate 1, 2, 5 and 10μm output resolutions with scale types, Spherosyn and Microsyn, capable of being mixed on the same unit. The only restriction is when the interface is configured for 1μm resolution, scale types can be mixed but all axes must be 1μm resolution.

The outputs from the Icon^2 unit are referred to as quadrature TTL. Quadrature relates to the phase relationship of the signals and TTL indicates the signal levels. Figure 1 shows the relationship between the quadrature output, A, /A, B, /B signals for one channel.



The voltage levels for the 34C87 device are:

V_{oH} (High level output)	3.4V typ. (2.5V min)
V_{oL} (Low level output)	0.3V typ. (0.5V max)

Figure 1. Quadrature Output Relationships

Icon^2 implements industry standard, RS422, 34C87 differential line drivers on all outputs.

NOTE: VOLTAGE LEVELS VARY WITH THE LOAD PLACED ON EACH CHANNEL. THE LOAD ON AN INDIVIDUAL SIGNAL SHOULD NOT GO BELOW 100 OHMS.

For each channel there are six output signals A, /A, B, /B, RM and /RM, the A and B signals along with their complements form the quadrature count signals. RM and its complement is the reference marker.

The outputs of the line drivers can be used in two ways, either single ended or differential. These modes are discussed in more detain in Sections 3.3.1 and 3.3.2.

Figure 2 shows the output connector pin-outs.

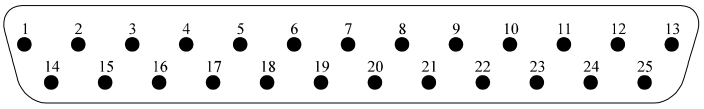


Figure 2. Icon^2 25 way D connector, pin view

Pin	Function	Pin	Function	Pin	Function	Pin	Function	Pin	Function
1	0V	6	CH2-RM	11	CH1-/B	16	CH3-B	21	CH2-A
2	CH3-RM	7	CH2-/B	12	CH1-/A	17	CH3-A	22	Reserved
3	CH3-/B	8	CH2-/A	13	NC	18	Reserved	23	CH1-/RM
4	CH3-/A	9	Reserved	14	5V	19	CH2-/RM	24	CH1-B
5	Reserved	10	CH1-RM	15	CH3-/RM	20	CH2-B	25	CH1-A

Where:

NC = No Connection
Reserved = Should be left floating
5V = ***DO NOT CONNECT TO RECEIVING EQUIPMENT***

3.3.1 Differential Operation

In the differential mode all six signals are used, A with /A, B with /B and RM with /RM to drive a line receiver or opto-isolator input stage to the counter. This mode of operation is more resilient to noise corruption and is therefore the mode that should be used whenever possible.

The /B is the complement (inverse) of B and if swapped, (differential mode), or replaced, (single ended mode), with B the direction of the count will reverse.

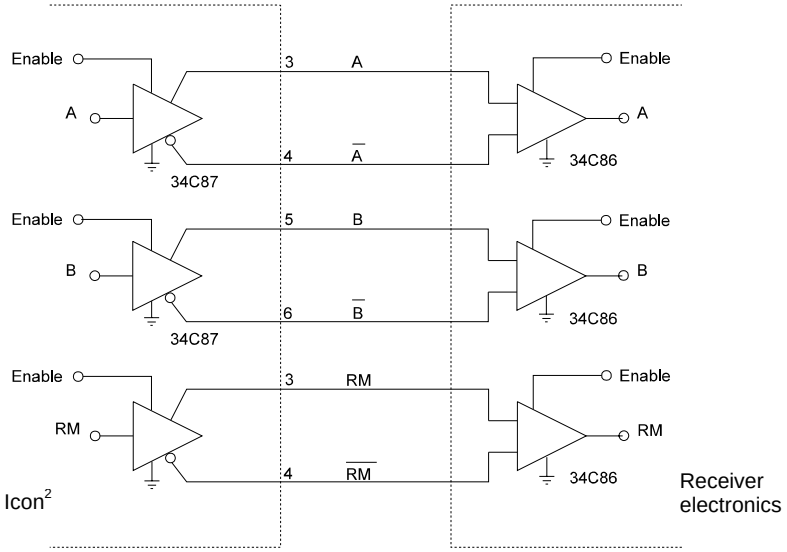
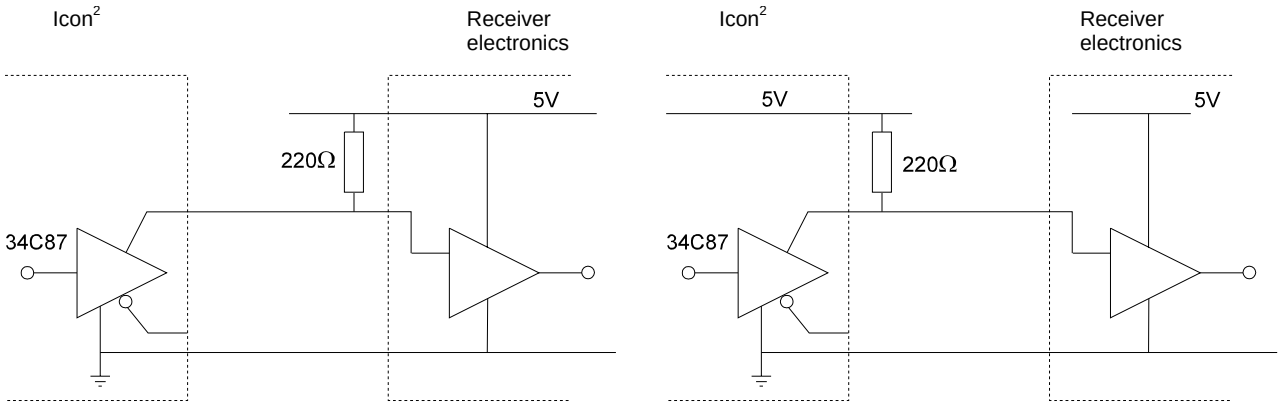


Figure 3. Icont^2 output stage for each axis connected in differential operating mode

3.3.1 Single-ended Operation

In the single ended mode, two signals referenced to zero volts are used to give the count signals. This mode can be susceptible to external noise corrupting the signals. Some single-ended receiver control systems require 5V levels that are not TTL compatible. Where this is required 'pull-up' resistors may be used in one of two configurations. Figure 4.



a).Preferred single-ended configuration

b). Alternative single-ended configuration

Figure 4. Single-ended connection options for non-TTL compatible receivers.

NOTE: THE RESISTOR IS NOT REQUIRED FOR TTL COMPATIBLE INPUTS

3.4 Description of Operation

The Spherosyn and Microsyn transducers operation is based on a 1kHz sine wave reference signal. The Icon^2 generates this reference and processes the return signal from the transducer to give positional updates every 0.843 to 1.157 milliseconds. The update time is linked to the 1kHz reference but depends on the speed and direction of the transducer head. A finite time is required to process the signal from the transducer before a chain of quadrature pulses can be output. Hence the output waveform is in blocks of quadrature TTL pulses, Figure 5.

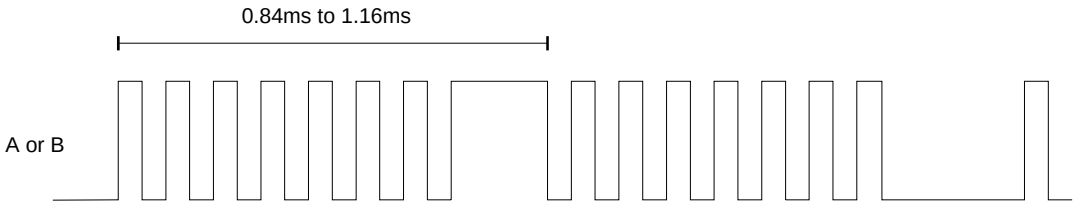


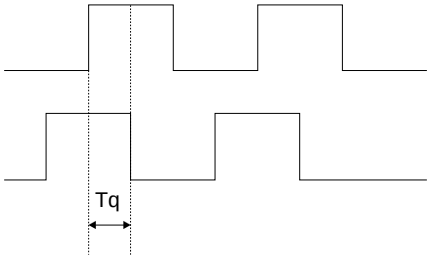
Figure 5. Example of quadrature output bursts

Because the interface has to wait for 0.843 to 1.157 milliseconds before updating positional data it follows that this data will lag the actual position of the head, this error is termed velocity lag. Clearly the faster the movement of the head the greater the velocity lag.

Due to the pulsed nature of the Icon^2 outputs, it is not recommended that the interface be used in a velocity feedback system. The Icon^2 could be used in such a system, if positional data could be averaged over a long enough period in order to reduce the ripple to an acceptable level. Consult your control system dealer if in any doubt.

3.4.1 Quadrature Output Rate.

The quadrature output rate is defined as the clock rate of consecutive quadrature edges within an output burst, Figure 6 shows this graphically.



Quad clock rate (frequency) = $\frac{1}{Tq}$ Hz (counts per second)

Figure 6. Graphical representation of quadrature clock rate

The output rate is variable and depends on the speed at which the head moved in the previous sample period. The rate can be determined using the graph given in Figure 7. The absolute maximum output rates are quoted in the technical specification.

3.4.2 Reference Marker Pulse Operation.

A periodic reference marker pulse is provided by the interface to allow control systems to reference themselves to a set position. The marker pulse is 1 resolution count wide, for example on a 2μm resolution system the reference marker pulse will be 2μm wide.

For a Spherosyn transducer the reference marker occurs every 12.7mm (0.5") and for a Microsyn transducer every 5mm. The pulse is not synchronised to the quadrature output due to the burst nature of the quadrature signals.

When using the reference marker pulse it is recommended that the marker be approached at a slow, constant speed and always in the same direction.

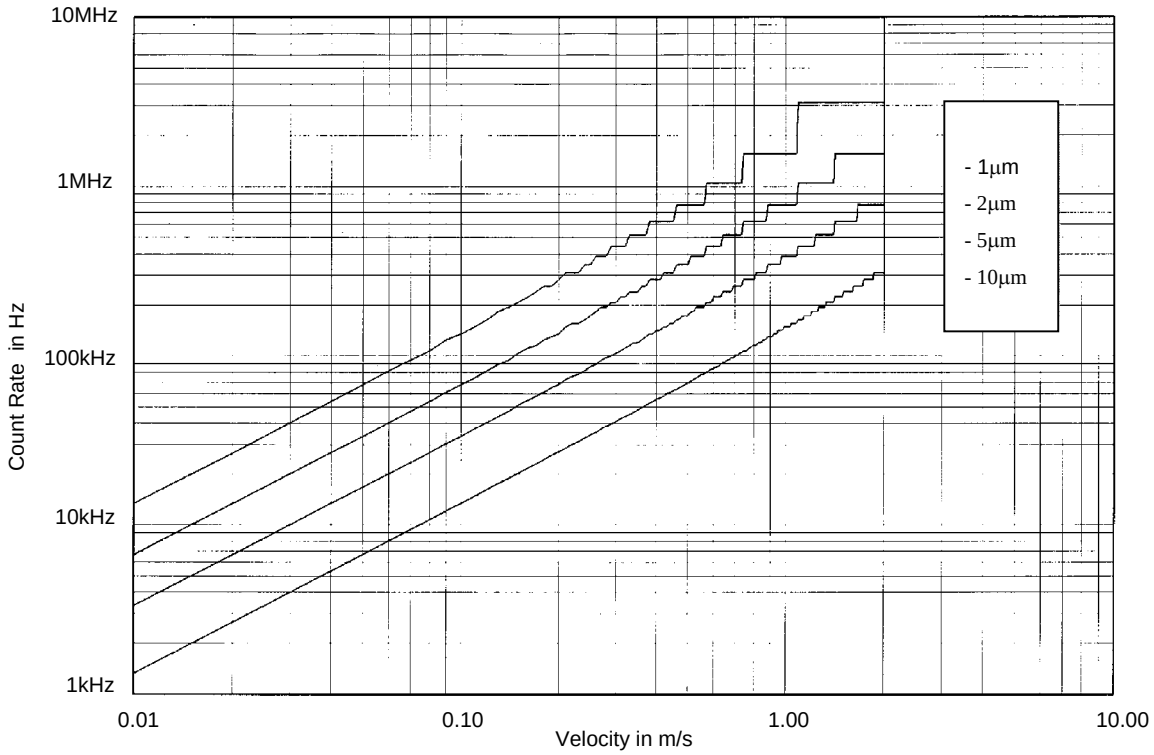


Figure 7. Maximum Icon^2 quadrature clock rate

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