



ACCU»CODER™
by Encoder Products Company

BRITISH
ENCODER
PRODUCTS COMPANY



Installation and Wiring Guide



Precision Products For Every Application

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BEPC - The Responsive People in Motion Control

Company History

British Encoder Products Company (BEPC) is the European Branch of Encoder Products Company Inc. (EPC) is a leading designer and world-wide manufacturer of motion sensing devices. Founded in 1969 by William Watt, EPC began operations with a small line of custom encoders. Today, more than 37 years later, EPC's popular Accu-Coder™ brand is the most complete line of incremental and absolute shaft encoders in the industry. Our core philosophy is that each and every customer deserves quality products, superior customer service, and expert support.



Leading The Industry By Innovation

Concentrating specifically on encoders, we have paved the path of the encoder industry, providing many of the current encoder standards. Our industry leading advancements include the Cube™ style encoder, flex-mount system used on hollow-bore encoders, Opto-ASIC technology for enhanced signal quality, 120° C operating temperature for extreme environments, 6000 PPR in a 38mm diameter encoder, a three year standard warranty, and many others.

Custom Encoders Our Specialty

Through years of experience, we understand each industrial environment is different, and customize encoders for your specific situations. Many of our customers depend on BEPC/EPC to provide encoders which fit their specifications, not someone else's. Using state of the art technology, we can design and deliver custom encoders faster than most suppliers standard products - often shipping your unique encoder in 2 to 6 days, or sooner. Plus, with ISO 9001:2000 quality systems, you will receive the quality you deserve.



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Congratulations on your purchase of a genuine BEPC/EPC brand encoder. Every Encoder is built to exact standards, and thoroughly tested during the manufacturing process. Improper installation is the major cause of most common problems. By following the guidelines given in this pamphlet, we hope to eliminate any problems before they start, thus providing the maximum life from your encoder. Properly installed and cared for, your Encoder will give you years of trouble free use. Technical Bulletins, which provide general encoder information, and cover specific installations, can be found under the "Support" heading on www.encoder.co.uk. If you have any questions concerning installation, please feel free to call Customer Service @ +44(0)1978262100. **Thank you!**

WARRANTY INFORMATION

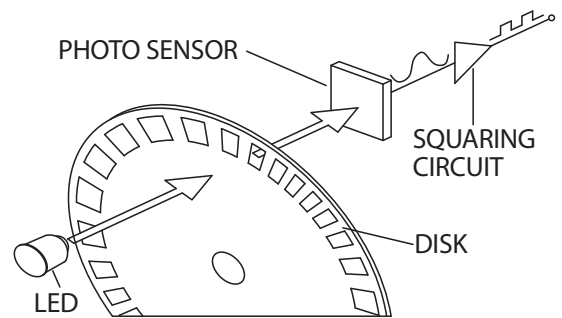
Your Accu-Coder™ is guaranteed against defects in materials, and workmanship by the best three year standard warranty in the business. The warranty applies to all standard catalogue products starting three years from the date of shipment. To learn more about our three year standard warranty, go to www.encoder.co.uk, under the "Support" menu, select "Warranty."

ENCODER BASICS

Encoders provide motion control systems information on position, count, speed, and direction. As the encoder shaft rotates, output signals are produced, proportional to the distance (angle) of rotation. The signal may be in the form of a square wave (for an incremental encoder) or an absolute measure of position (for an absolute encoder).

Due to the performance and reliability advantages of the semi-conductor technology they incorporate, optical encoders are the preferred solution in many common computer, industrial, and automotive applications. Optical encoders also benefit from ease of customization, are suitable to numerous environments, and suffer no effects from high levels of stray magnetic fields.

The basic construction of an incremental encoder is shown to the right. A beam of light emitted from an LED passes through a transparent disk patterned with opaque lines, and is picked up by a photodiode array. The photodiode array (also called a photosensor) responds by producing a sinusoidal waveform which is transformed into a square wave, or pulse train.






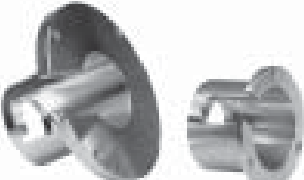


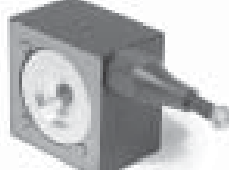
Incremental encoders are available in two basic output types, single channel and quadrature. A single channel encoder, often called a tachometer, is normally used in systems that rotate in one direction only, and require simple position and velocity information. Quadrature encoders have dual channels (A and B), phased 90 electrical degrees apart. These two output signals determine the direction or rotation by detecting the leading or lagging signal in their phase relationship. Quadrature encoders provide very high speed bi-directional information for very complex motion control applications.

Incremental encoders can provide a once-per-revolution pulse (often called index, marker, or reference) that occurs at the same mechanical point of encoder shaft revolution. This pulse is on a separate output channel (Z) from the signal channel or quadrature outputs. The index pulse is often used to position motion control applications to a known mechanical reference.

Resolution is a term used to describe the Pulses Per Revolution (PPR) for incremental encoders, or the total number of unique positions per revolution for an absolute encoder. Each incremental encoder has a defined number of cycles that are generated for each full 360 degree revolution. These pulses are monitored by a counter or motion controller and converted to counts for position or velocity control. Absolute encoders generate a unique code word for every resolvable shaft angle (often called bits or counts per revolution).

ACCESSORIES

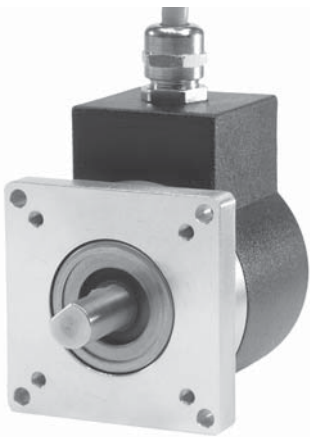
Accessory items are often the difference between an installation that goes smoothly, and one that does not. BEPC offers a range of accessories that are designed to not only make your life easier, but are manufactured to BEPC's high standards, ensuring years of trouble free service. In addition, they have been tested with the products they complement, so that you do not have to worry about proper form, fit, or function.

	<p>Connectors/Cables High quality connectors, cables, cable assemblies, and cord sets selected to optimize encoder performance; most can be ordered with MS style or M12 connectors.</p>
	<p>Shaft Couplings Precision shaft couplings carefully manufactured to optimize performance and reduce the chance of premature failure; designed to restrict the transfer of thermal and mechanical stress; wide range of choices to match your exact requirement.</p>
	<p>Protective Covers Covers help protect encoders from damage. They also allow a wider variety of encoders to be used in harsh environments.</p>
	<p>Hub/Flanges Allow Accu-Coder™ encoders to be easily mounted to industry standard housing styles; NEMA, servo, 5PY, and other styles available; rugged, reliable construction.</p>
	<p>Mounting Brackets Used to mount measuring wheels to Cube and 702 Series Accu-Coders™. Two types: single pivot and dual pivot; single pivot pivots vertically while dual pivot pivots vertically and longitudinally.</p>
	<p>Measuring Wheels Used to obtain linear motion feedback from a rotating shaft; range of surface finishes (urethane, rubber, knurled, grooved) for proper mating to nearly any application surface; available in several sizes to allow you to satisfy your exact requirements.</p>
	<p>Linear Cable Adapter The linear cable adapter (LCA) used with a Cube Series standard or industrial housing, provides a low cost alternative for obtaining accurate linear measurement.</p>

MOUNTING AND MECHANICAL INSTALLATION

For over 35 years, our engineers have been designing encoders that are quick and easy to install. With a variety of mounting options available, your encoder should be a perfect match for your existing equipment. Accessories such as pivoting mounting brackets, measuring wheels, flexible couplings, etc., are available from BEPC to ease installation. The first principle for every encoder installation is "Don't force it!". Striking or using excessive force can either damage your new encoder, or introduce excessive shaft loading, shaft misalignment, or other conditions shortening its expected life. Tighten all couplings and bolts to their recommended torque. Remember, tighter isn't always better!

Shaft Style Encoders



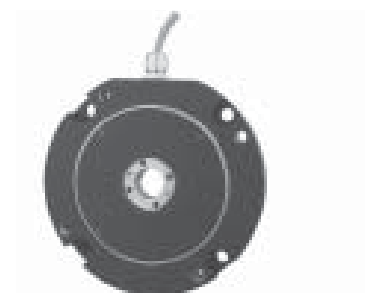
- Gently couple the shaft of the Encoder to the driving shaft, using a correctly sized flexible shaft coupling. **Never use a rigid coupling.**
- Verify proper alignment between the Encoder shaft and the driving shaft.
- If using pulleys or gears, mount them on the shaft as close as possible to the Encoder to reduce bearing load.
- Axial and radial shaft loading should be low as possible. Never exceed printed specifications.
- Use recommended torques to tighten all clamping bolts and couplings.

Hollow Bore Encoders



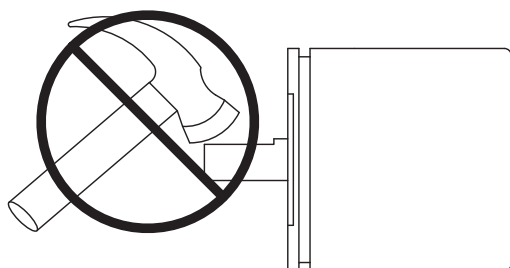
- Make sure driving shaft is free from burrs and other defects.
- With flex mount flush against surface, tighten clamp or set screws first, then bolt flex mount to surface.
- Check for best possible alignment with hollow shaft and driving shaft to reduce wobble.
- Runout of the driving shaft, or misalignment between the driving shaft and the encoder's hollow bore, decreases the accuracy and bearing life of the encoder and adds vibration to the system. Re-installing the encoder on the driving shaft may improve alignment.

C-Face Style Encoders

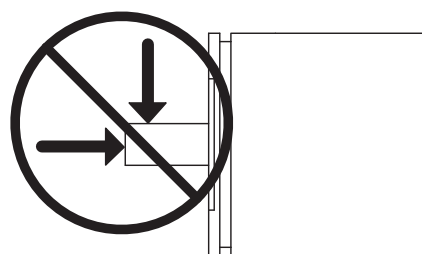


- Verify that mounting holes are in exact alignment with holes or studs on the motor frame.
- Tighten all fasteners with equal torque so as not to distort the shape of the ring.

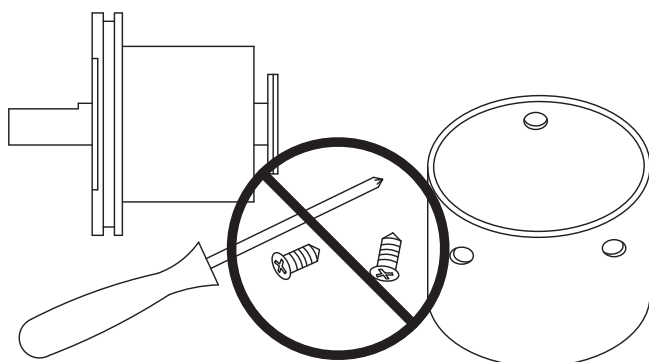
Caution: Avoid damage to your Accu-Coder™. The following actions may cause damage, and void product warranty.



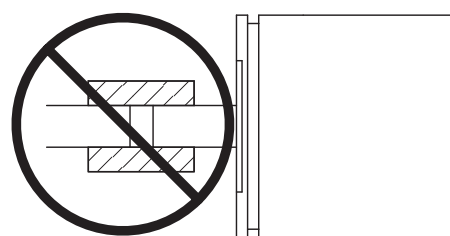
Do not shock or strike.



Do not subject shaft to excessive axial or radial shaft stresses.



Do not disassemble.



Do not use a rigid coupling.

RECOMMENDED BOLT TORQUES

MODEL	STYLE	DESC./LOCATION	THREAD	TORQUE	HEX KEY
15T/H	All	Set Screws / Shaft	M3	0.211 to 0.317 Nm	1.5 mm
25T/H	Clamp	Clamp Bolt	6-32	1.12 to 1.69 Nm	7/64"
225	All	Set Screws / Shaft	6-32	0.211 to 0.282 Nm	1/16"
260, 960	Clamp	Clamp Bolt	2-56	0.706 to 0.847 Nm	5/64"
702	Flex Hollow	Set Screws / Shaft	6-32	0.353 to 0.564 Nm	1/16"
	Flex Hollow	Clamp Bolt / Shaft	4-40	0.812 to 1.129 Nm	3/32"
755	Flex Hollow	Set Screws / Shaft	6-32	0.247 to 0.353 Nm	1/16"
	Flex Hollow	Set Screws / 0.75" Shaft	4-40	0.176 to 0.282 Nm	0.050"
770	Collet	Cup / Cone Bolts	4-40	0.847 to 1.412 Nm	3/32"
771	1.0" up to 1.375"	Clamp Bolt	8-32	3.38 to 3.95 Nm	9/64"
	>1.375" to 1.875"	Clamp Bolt	6-32	1.69 to 2.82 Nm	7/64"
775	Collet	Cup / Cone Bolts	4-40	0.847 to 1.412 Nm	3/32"
	Clamp	Clamp Bolt	8-32	3.38 to 3.95 Nm	9/64"
776	Clamp	Clamp Bolt	6-32	1.69 to 2.82 Nm	7/64"
770, 775, 776	All	Protective Cover	4-40	0.494 to 0.847 Nm	3/32"
771	All	Protective Cover	3/8"-16	20.33 to 27.11 Nm	5/16"
TR1	All	Pivot Bolt/Shaft	1/4"-20, M6	4.51 to 6.77 Nm	5/32"
	All	Set Screw/Torque Adj	10-32	1.69 to 2.03 Nm	3/32"
TR1	All	Set Screw/Wheel	4-40	0.176 to 0.282 Nm	0.050"
TR2	All	Set Screw/Pinion	6-32	0.247 to 0.353 Nm	1/16"

** = These Models are not offered by the European Branch (BEPC)

ELECTRICAL CONNECTION ---

Proper wiring and grounding are essential for the longevity and proper operation of your Encoder. In addition, electrical noise should be minimized to prevent improper counts and/or damage to the electronic components.

Since an Encoder can be used with a wide variety of input devices (PLC's, counters, servo controllers, etc.), from many different manufacturers, it is important to determine proper wiring and connections before installation.

Common Signals

Most Encoders have the following electrical connections:

Power, Common or Ground, and one or more Output Signals.

Power (Also called supply, power source, encoder power, +V, or +VCC/VDC)

- Always use a direct current (DC) voltage.
- Attach power to the positive (+) side of the power source.
- Verify that the Encoder is receiving the proper voltage, since most electrical failures are caused by an improper or improperly regulated power source.
- The use of surge protection is highly recommended.

Common (Also called Com, supply common, 0 Volts and ground)

- Attach common to the negative (-) side of the power source.

Output Signals (Always at least one, but may be as many as six)

- The most common are A, B, and Z. Commutation outputs include U, V, and W.
- Encoders with a Line Driver output also have the complement (A and A', B and B', etc.) as separate outputs that are used to provide differential signals for reduced noise and greater drive capability.
- **Never connect the output signals together, or to the power source!**

Connections

- Verify and match up pin numbers, wire colors, or terminal blocks with the input device.
- Be aware that identification terminology may not always be identical.
- Once proper wiring is determined, document it for future reference.

Cable Routing

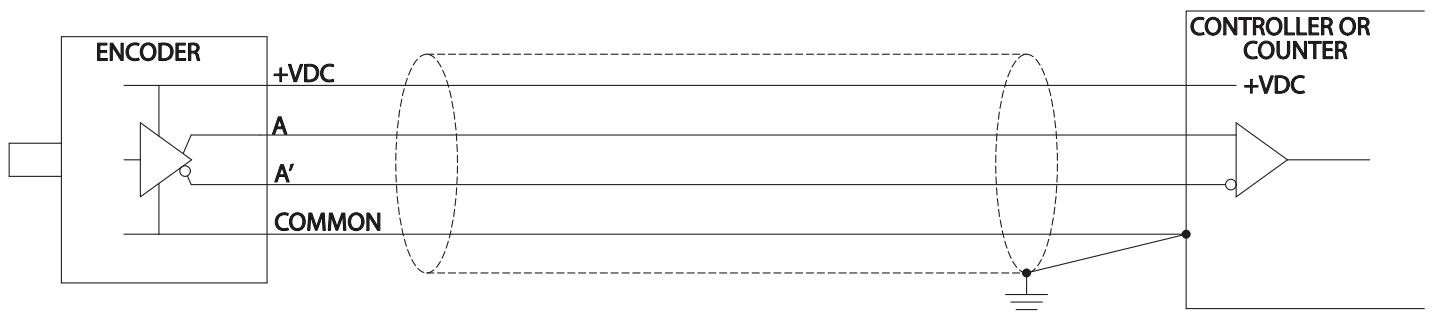
- Cable length should be minimized by using the shortest route possible.
- All cabling should be installed in dedicated metal conduits, or located at least 30cm away from other wiring.
- Route cables away from high current conductors to minimize pulses caused by electrical transients.
- Signal wire continuity should be maintained from the encoder to the controller/counter. Avoid junctions and splices, if possible.

Radiated Electrical Noise

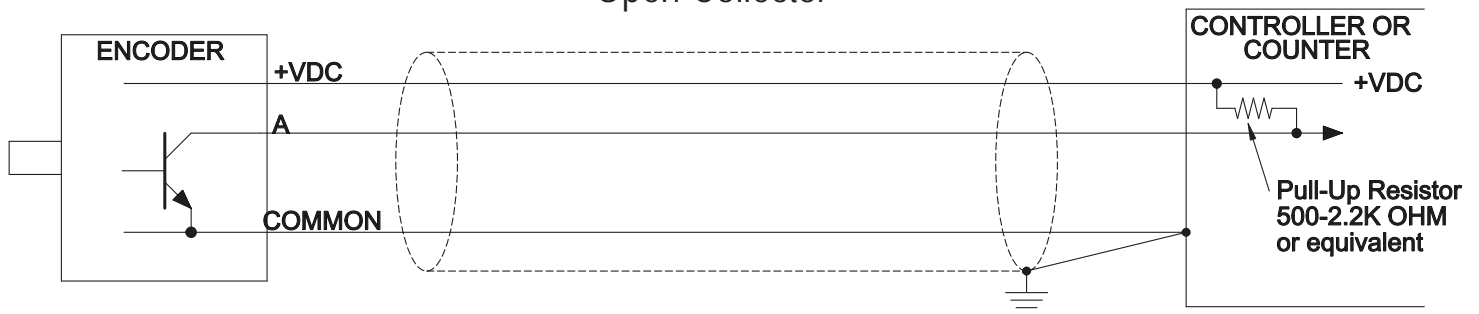
- Noise can be generated by solenoids, relays, motors, starters, and similar devices.
- Using shielded cables will dramatically reduce the effects of noise. Most Accu-Coder™ cables are double shielded (foil and braid) for optimum protection.
- Ensure all equipment is properly grounded. (Motors, drives, shafts, etc.)
- Connect encoder cable shield to ground at controller/counter end, leaving the end near the encoder unconnected. Connecting the shield at both ends can cause ground loops, and improper operation.
- If possible, use *differential line driver* outputs with high quality shielded, twisted pair cable. (Complementary signals greatly reduce common mode noise levels, as well as signal distortion resulting from long cable lengths.)
- BEPC's line of Repeaters and Converters may help reduce the effects of electrical noise.

Typical Electrical Hook-Ups

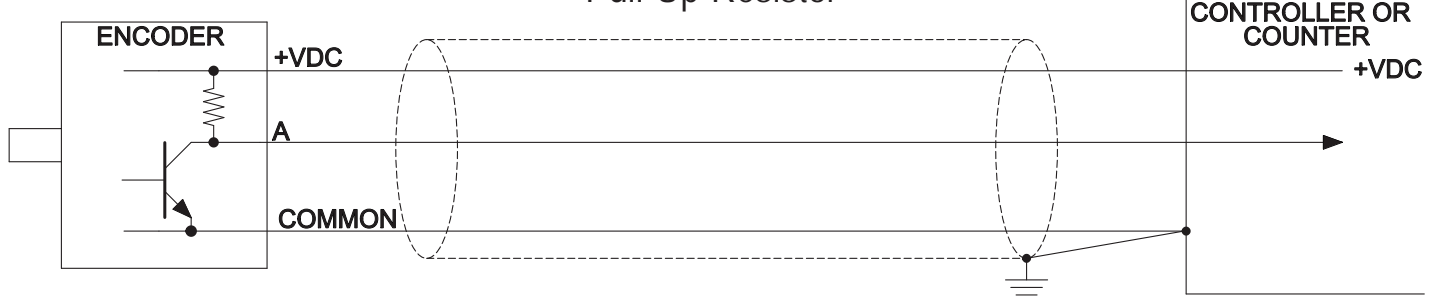
Differential Line Driver



Open Collector

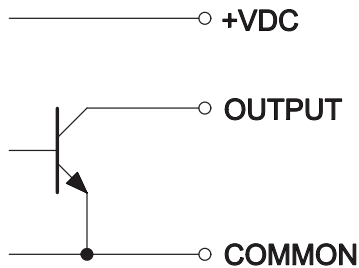


Pull-Up Resistor



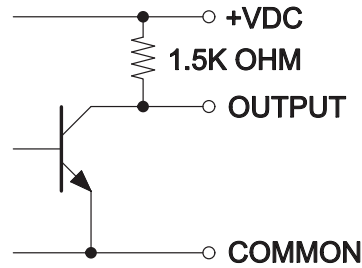
OUTPUT CIRCUIT DIAGRAMS

Open Collector (OC, OD)

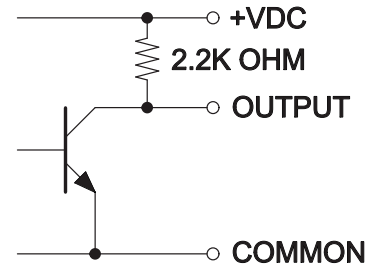


Models 15T/H, 15S, 121, 260, 702, 711, 716, 725, 755A, 758, 770, 771, 775, 776, 802S, 858S, 925, 958, 960, LCE, TR1, TR3

Pull-Up (PU)

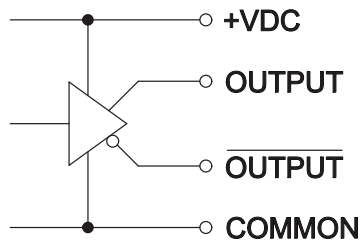


Models 711, 716, LCE



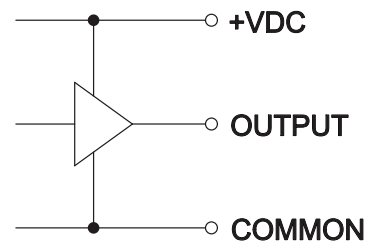
Models 702, 725, 755A, 758, 770, 771, 775, 776, 802S, 858S, TR1, TR3

Line Driver (HV, L5)



Models 15T/H, 15S, 121, 260, 702, 711, 716, 725, 755A, 758, 770, 771, 775, 776, 802S, 858S, LCE, TR1, TR3

Push-Pull (PP, LP)



Models 15T/H, 15S, 121, 260, 702, 711, 716, 725, 755A, 758, 770, 771, 775, 776, 802S, 858S, 925, 958, 960, LCE, TR1, TR3

RXTXD - Din Rail Mounted Unit

- Level Changes from Vcc to 5V.
- Signal Conditioner, or Repeater for Distance Transmission.
- 2 or 3 Way Splitter/Level Changer.
- Encoder Tester/Verifier.

This lightweight DIN rail mountable unit, Line Driver and Line Receiver, comes in a stylish green PC/ABS self-extinguishing material blend. Configurable as a level changer, line repeater, splitter or encoder tester. The RXTXD will accept TTL, RS422, RS485, PP, NPN, NPN OC, or, PNP encoder inputs at 5V, or HTL, PP, NPN, NPN OC & PNP at 6-28V. It will provide up to 3 outputs in any combination of TTL, RS422, RS485, PP, NPN or PNP, at 5V, or, HTL, PP, NPN or PNP, at 6-28V. A series of LEDs on the front panel indicates power and signal presence. Connections are made via the easily accessible screw terminals as standard. This device may be used as both a Line Driver and Line Receiver.



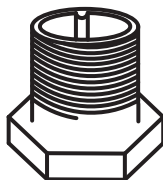
THE RXTX CONVERTER

INCREMENTAL ENCODER WIRING TABLES

M12 CONNECTORS

Pin	8 PIN		5 PIN
	711, 716, LCE, 15S, 15T/H, 25T/H, 260, 702, 725, 755A 758, 770, 771, 775, 776, TR1, TR3		711, 716, LCE, 15S, 15T/H, 25T/H, 260, 702, 725, 755A 758, 770, 771, 775, 776, TR1, TR3
	HV, L5	OC, PU, PP, LP	HV, OC, PU PP, L5, LP
	Func	Func	Func
1	A	A	+VCC
2	+VCC	+VCC	B
3	A'	---	0 Volts
4	B	B	A
5	B'	---	Z
6	Z	Z	---
7	0 Volts	0 Volts	---
8	Z'	Screen	---

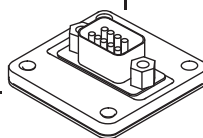
Unless Specified Screen is connected to Connector Case.



D-SUB MINIATURE (9-pin) CONNECTORS

Pin	702, 725, 775, 776			
	HV, L5	OC, PU, PP, LP		
	Func	Func		
1	+VCC	+VCC		
2	A	A		
3	A'	---		
4	B	B		
5	B'	---		
6	Z	Z		
7	Z'	---		
8	Case*	Case*		
9	0 Volts	0 Volts		

*Case Ground = Screen



BEPC ONLY - M12 CABLES

Function	CONDUCTORS			
	8	5	4	3
0 Volts	Black	Black	Black	Black
+VCC	White	White	White	White
A	Brown	Brown	Brown	Brown
A'	Yellow	---	---	---
B	Red	Red	Red	---
B'	Green	---	---	---
Z	Orange	Orange	---	---
Z'	Blue	---	---	---
Case	Bare*	Bare*	Bare*	Bare*

*Bare wire = Shield / Case Ground

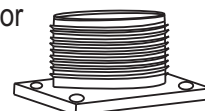


MS CONNECTORS

Pin	10-PIN	7-PIN		6-PIN	
	711, 716, LCE, 25T/H, 702, 725, 758, 770, 771, 775, 776	711, 716, LCE, 25T/H, 702, 725, 758, 770, 771, 775, 776		711, 716, LCE	711, 716, LCE, 25T/H, 702, 725, 775, 776
	HV, L5	HV, L5	OC, PU, PP, LP	HV (No Index)	OC, PU, PP, LP
Pin	Func	Func	Func	Func	Func
	Func	Func	Func	Func	Func
A	A	A	A	A	A
B	B	B	B	B	B
C	Z	A'	Z	A'	---
D	+VCC	+VCC	+VCC	+ VCC	+ VCC
E	---	B'	---	B'	---
F	0 Volts	0 Volts	0 Volts	0 Volts	0 Volts
G	Case*	Case*	Case*	#	#
H	A'	---	---	---	---
I	B'	---	---	---	---
J	Z'	---	---	---	---

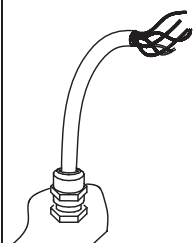
* Pin G is Always connected to Case Ground

Screen Wire connected to Connector Case



INCREMENTAL ENCODER WIRING TABLES (Continued)

CABLE OPTIONS



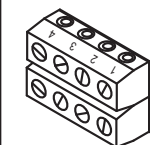
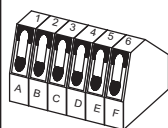
Func	15T/H, 15S, 121, 25T/H, 260, TR1, TR3		755A, 758, 858, 725, 702, 744, 745	802S, 770, 771, 775, 776	711, 716, LCE		225A**	225Q**
	HV, OD, LO	OC, PP, PU	HV, L5, OC, PU, PP, LP	HV, L5, OC, PU, PP, LP	HV	OC, PU, PP	OC, PU,	OC, PU,
	Wire Color	Wire Color	Wire Color	Wire Color	Wire Color	Wire Color	Wire Color	Wire Color
0 Volts	Black	Black	Black	Black	Black	Black	Black	Black
+VCC	White	White	White	Red	Red	Red	Red	Red
A	Brown	Brown	Brown	White	White	White	White	White
A'	Yellow	---	Yellow	Brown	Brown	---	---	---
B	Red	Red	Red	Blue	Blue	Blue	---	Green
B'	Green	---	Green	Violet	Violet	---	---	---
Z	Orange	Orange	Orange	Orange	Orange	Orange	---	---
Z'	Blue	---	Blue	Yellow	Yellow	---	---	---
U	Violet	Violet	---	---	---	---	---	---
U'	Gray	---	---	---	---	---	---	---
V	Pink	Pink	---	---	---	---	---	---
V'	Turquoise	---	---	---	---	---	---	---
W	Red/Grn	Red/Grn	---	---	---	---	---	---
W'	Red/Yel	---	---	---	---	---	---	---
Case	---	---	---	Green**	Green***	---	---	---
Shield	Bare*	Bare*	Bare*	Bare*	Bare*	Bare	Bare	Bare

*Cable shield (bare wire) is connected to internal case

**Not available from European Branch

***E-Cube Only

TERMINAL BLOCK

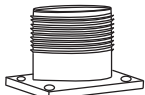
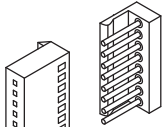
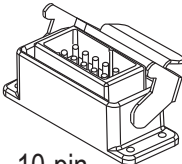


Pin	770, 771		755A	225A#	225Q#	711, 716, LCE	
	HV	OC, PU, PP	HV, L5, OC, PU, PP, LP	OC, PP	OC, PP	HV No Index	OC, PU, PP, LP
	Func	Func	Func	Func	Func	Func	Func
1	+VCC	+VCC	A	0 Volts	0 Volts	0 Volts	0 Volts
2	0 Volts	0 Volts	A'	+VCC	+VCC	+VCC	+VCC
3	A	A	B	A	A	A	Z
4	A'	---	B'	---	B	A'	A
5	B	B	Z	---	---	B	B
6	B'	---	Z'	---	---	B'	0 Volts
7	Z	Z	0 Volts	---	---	---	---
8	Z'	---	+VCC	---	---	---	---
9	Case*	Case*	---	---	---	---	---

*CE Option Only

Not available from BEPC

MISC OPTIONS

 12-pin		12 Pin Option "C" (ccw pin layout)		8 PIN MOLEX	10 PIN INDUSTRIAL CLAMP		10 PIN BAYONET	
		758		755A	770, 771		25T/H	
		HV, L5	OC, PU PP, LP	HV, OC, PU, PP	HV	OC, PU, PP	HV, L5, OD, PU, PP, OC, LP	
	Pin	Func	Func	Func	Func	Func	Pin	Func
 8-pin Molex	1	B'	---	+VCC	0 Volts	0 Volts	F	0 Volts
	2	+VCC Sense	+VCC Sense	0 Volts	B	B	D	+VCC
	3	Z	Z	B'	A	A	A	A
	4	Z'	---	B	Z	Z	H	A'
 10-pin Industrial Clamp	5	A	A	Z'	---	---	B	B
	6	A'	---	Z	+VCC	+VCC	J	B'
	7	---	---	A'	B'	---	C	Z
	8	B	B	A	A'	---	K	Z'
	9	Case	Case	---	Z'	---	G	Case
	10	0 Volts	0 Volts	---	Case	Case		
	11	0 Volts Sense	0 Volts Sense	---	---	---		
	12	+VCC	+VCC	---	---	---		

BEPC ENCODER CABLE ASSEMBLIES

Function	STANDARD											
	10-PIN MS		7-PIN MS		6-PIN MS		9-PIN D-SUB		12-PIN		8-PIN M12	
	HV	ST	HV	ST	HV	ST	HV	ST	HV	ST	HV	ST
0 Volts	Black	Black	Black	Black	Black	Black	Black	Black	Black	Black	Black	Black
+VCC	White	White	White	White	White	White	White	White	White	White	White	White
A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
A'	Yellow	---	Yellow	---	Yellow	---	Yellow	---	Yellow	---	Yellow	---
B	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red	Red
B'	Green	---	Green	---	Green	---	Green	---	Green	---	Green	---
Z	Orange	Orange	---	Orange	---	Orange	Orange	Orange	Orange	Orange	Orange	Orange
Z'	Blue	---	---	---	---	---	Blue	---	Blue	---	Blue	---
Case	*	*	*	*	*	*	*	*	*	*	*	*
Shield	Bare*	Bare*	Bare*	Bare*	Bare*	Bare*	Bare*	Bare*	Bare*	Bare*	Bare*	Bare*
Com Sense	---	---	---	---	---	---	---	---	Black	Black	---	---
+VDC Sense	---	---	---	---	---	---	---	---	White	White	---	---

*Bare shield wire connected to case

ABSOLUTE ENCODER WIRING TABLES

Function	19-PIN KPT 02E14-19P	16-PIN	10-PIN* MS	Gland Cable or Mating Conn.	NOTES:
	925, 958	925, 958	925	925, 958	
	Pin	Pin	Pin	Wire Color	
S1 MSB	A	3	A	Brown	<p>* Only available with 8-bit resolution encoders</p> <p>** Where Fitted</p> <p>*** Direction Control- Standard is CW increasing when viewed from the shaft end. Direction pin is pulled high normally to 5V internally. Direction pin must be pulled low (GND, Common) to reverse count direction. Applied voltage to direction pin should not exceed 5V</p>
S2	B	5	B	White	
S3	C	6	C	Green	
S4	D	7	D	Orange	
S5	E	8	E	Blue	
S6	F	9	F	Violet	
S7	G	10	G	Grey	
S8 LSB 8-bit	H	11	H	Pink	
S9 LSB 9-bit	J	12	---	Red/Green	
S10 LSB 10-bit	K	13	---	Red/Yellow	
S11 LSB 11-bit	L	14	---	Turquoise	
S12 LSB 12-bit	M	15	—	Yellow	
Direction***	R	4	---	Red/Blue	
Case Ground	S	16	---	Drain/Screen	
0V Common	T	1	J	Black	
Special**	U	---	---	White/Red	
+VDC	V	2	I	Red	

Function	Gland Cable	NOTES:
	960	
	Wire Color	
Common	Black	<p>* CE Option Only</p> <p>** Standard is CW increasing count (when viewed from shaft end, and using brown wire for MSB). Red/Blue is pulled up internally to 5 VDC. To reverse count direction, RED/Blue must be pulled low (0 VDC). If 5VDC is applied to Red/Blue, unit remains in standard CW increasing count mode. Count direction can also be reversed by using the Yellow MSB wire instead of the Brown. At no time should voltage applied to Red/Blue exceed 5 VDC.</p>
+VDC	Red	
S1 cw MSB	Brown	
S1 ccw MSB	Yellow	
S2	White	
S3	Green	
S4	Orange	
S5	Blue	
S6	Violet	
S7	Grey	
S8 LSB 8-bit	Pink	
S9 LSB 9-bit	Red/Green	
S10 LSB 10-bit	Red/Yellow	
S11 LSB 11-bit	Turquoise	
Direction Control**	Red/Blue	
Case Ground*	Shield	

TROUBLESHOOTING

No Output/No Counts

- If there is no mechanical movement, there will be no output. Therefore, verify that the Encoder is rotating.
- Check to make sure the proper supply voltage is present. It is best to do this at the Encoder end, if possible.
- Verify all wiring between the Encoder, the counter/controller, and the power supply.
- Make sure that the proper signal type (OC, PU, HV, PP) is being used for the application.
- Verify that the counter/controller is properly installed and operational. Consult the appropriate User's Manual if necessary.
- If another Encoder is available, try it to determine if the encoder is the problem.

Erratic Output/Missing or Extra Counts

- Electrical: Check for loose wiring connections, ground loops, encoder outputs incompatible with the counter/controller, a noisy power supply, electrical noise, proper termination of shields, or a combination of these problems.
- Mechanical: Check for improper alignment, loose coupling, or, if used, slippage in the measuring belt or wheel.

Counts Indicate Wrong Direction

- Check for reversed wiring of the quadrature signals. Reverse if needed.
- If differential signals are being used, make sure that both sides are properly wired.
- **Note: If an index/marker pulse is being used, reversing the wiring will cause the reference alignment to change.**

Counts In Only One Direction

- Make sure that the counter/controller is capable of, and programmed for, bi-directional counting.
- On quadrature units, both channels (A and B) must be present and operational. Check by using a dual channel oscilloscope.
- Make sure the input selection type programmed into the counter/controller, matches the Encoder. If there is a mis-match, the system may not work properly.

Index/Marker Pulse Not Working

- The index pulse occurs only once per revolution, and can be difficult to check with a volt meter. Check index pulses with an oscilloscope.
- The counter/controller may not be capable of detecting the index pulse at higher RPM's. Slowing down the rotation may allow for detection of the index pulse.
- Verify wiring.

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