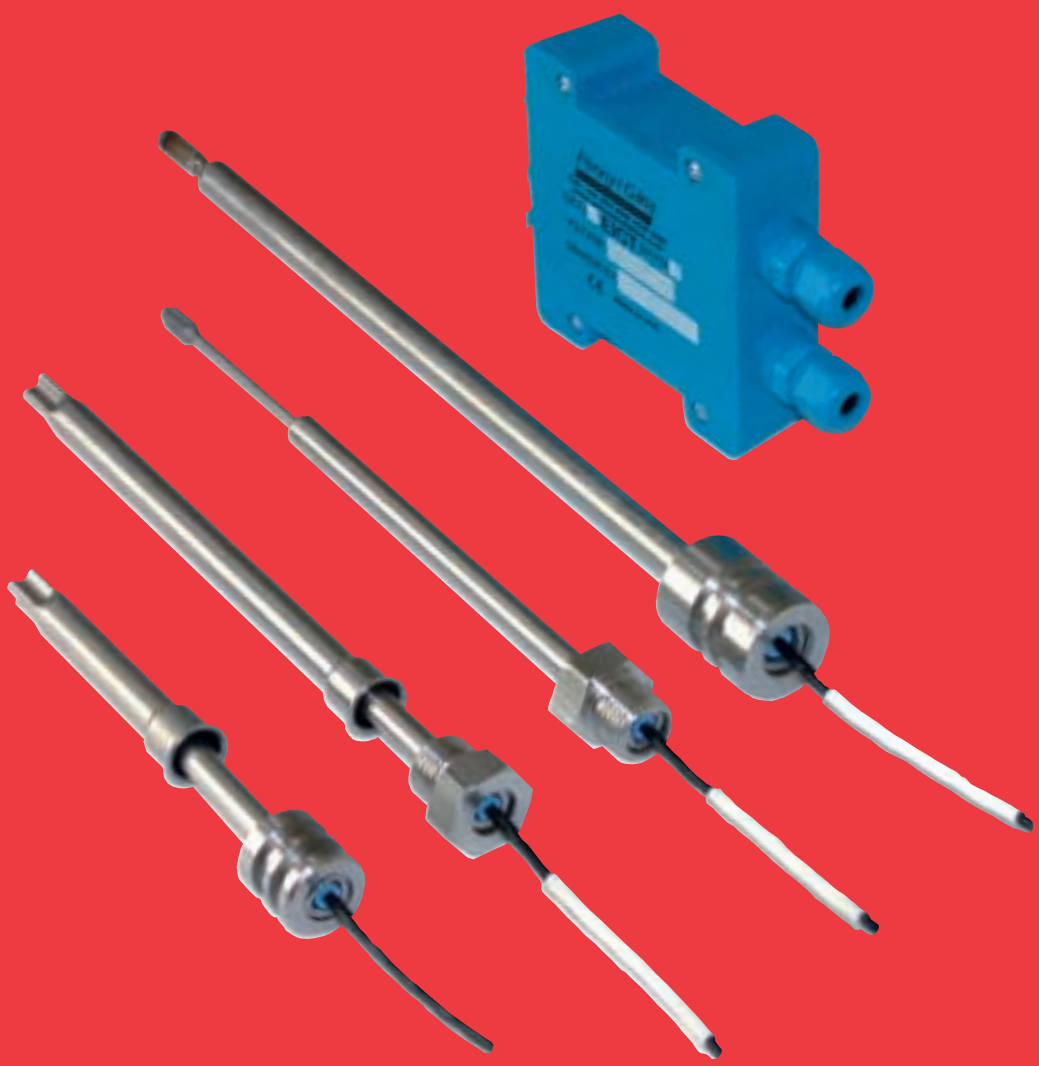
Penny+Giles

A Curtiss-Wright Company

REVISED SPECIFICATION



ICT SERIES

IN-CYLINDER TRANSDUCERS

Innovation In Motion

INNOVATION IN MOTION

ICT080 and ICT100 are a new range of Contactless In-Cylinder linear position transducers designed for integration into hydraulic and pneumatic actuators where the transducer is fitted inside the pressurised environment. The transducer uses an innovative single coil design within a rugged stainless steel housing and provides an analogue position signal proportional to the cylinder rod position. Offering one of the most cost-effective solutions for absolute position sensing, this transducer is ideally suited to both static and mobile hydraulic systems, including military vehicles

Impressive temperature and pressure resistance

ICT080 and ICT100 have been designed with 21st century applications in mind. They can withstand system pressures to 670Bar (10,000psi) and actuator temperatures to +200°C (+392°F). The transducer design has been developed to provide a minimum impact on actuator designs. The short body length and compact body diameter will allow installation into smaller diameter actuators.

Choice of installation styles

The ICT080 and ICT100 can both be supplied with a choice of mounting styles. The Internal flange style (IN) is more suited to clevis style actuators, where the pressure flange is hidden within the cylinder rear bulkhead. The External flange style (EM/EU) is suited to tie-rod style actuators and is fitted through the cylinder rear via a threaded hole. A new style of threaded flange (RM/RU) is also offered to allow cylinder designers to fit the transducer within the actuator footprint and is suited to tie-rod, welded or clevis type actuators.

Features	*Benefits*
• **No contact between the sensing elements**	• **Virtually infinite life**
• **Infinite resolution**	• **All displacement will be sensed**
• **Absolute measurement**	• **No loss of position on power down**
• **Flexible mounting styles**	• **Suitable for a variety of actuator formats**
• **Rugged stainless steel construction**	• **Maximum reliability under shock and vibration**
• **Working pressure to 670 Bar (10,000psi)**	• **Suited to high performance hydraulics**
• **High temperature capability to +200°C (+392°F)**	• **Maximum reliablity in hostile environments**
• **CE approved**	• **Confidence in EMC performance**
• **Rapid despatch of any option**	• **Eliminates customer inventory**

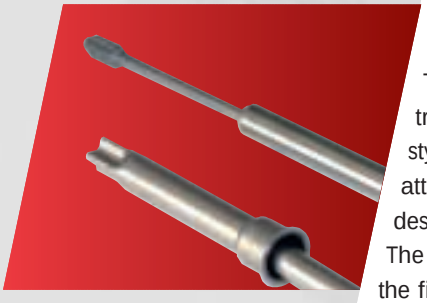
CE

EMC Directive 89/336/EEC
The transducers and signal conditioning module detailed in this document have been tested together as a system, to the requirements of EN 50081-1 (Emissions) and EN 50082-2 (Immunity)

Quality Assurance
Penny + Giles are accredited to BS EN ISO9001:2000
Quality is at the heart of all our systems ensuring the reliability of our products from initial design to final despatch.

Certificate No. LRQ 0924881

ICT080 & ICT100 IN-CYLINDER POSITION TRANSDUCERS

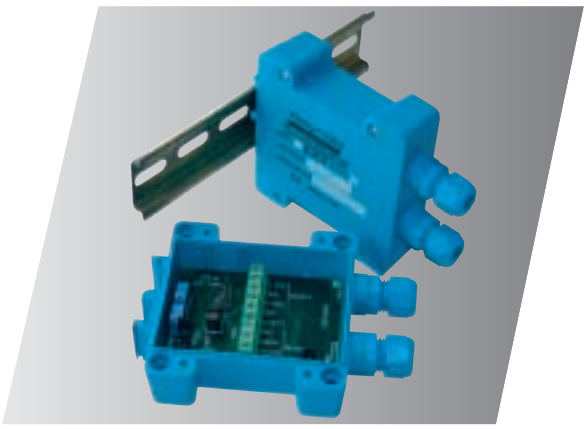


Choice of transducer core styles

The operating principle of the ICT transducer uses a core moving within the transducer body to supply the signal proportional to cylinder rod displacement. Two styles of core are available to the actuator designer. The threaded core (T) allows attachment to the cylinder rod with the smallest transducer footprint, enabling the designer to maximise cylinder rod wall thickness whilst minimising machining costs. The sleeved core (S) allows the cylinder rod to be simply machined and attached with the fixings supplied. This style gives the option of retro-fitting existing servo-actuators with an upgrade to contactless ICT technology.

Separate signal conditioning

To minimise the transducer size and the impact on the cylinder design, we provide separate signal conditioning electronics (EICT) housed in a rugged IP66 rated enclosure. This can be located up to 10m away from the transducer, well away from any hostile conditions (vibration, shock, temperature) that the cylinder may encounter during operation. The result is a more reliable transducer solution, easily installed and adjusted and more flexible in the choice of outputs available.



Total reliability

The ICT series provides a highly reliable solution for absolute position sensing in hydraulic/pneumatic actuators. The contactless operating principle allows a fit-and-forget installation so that zero maintenance programs can be incorporated within plant or equipment service schedules.

World leading availability

The ICT080 and ICT100 have been 'designed for manufacture' enabling assembly in a state-of the-art manufacturing cell. This means that we can supply any one of over 6,600 different transducer combinations in five to ten days from ordering. This allows OEMs to reduce or eliminate their inventory, and call on Penny + Giles to supply 'on demand'.

ICT080 IN-CYLINDER LINEAR POSITION TRANSDUCER

The ICT080 In-Cylinder Linear Transducer has a body diameter of only 8mm and is ideal for installation into hydraulic and pneumatic actuator applications where space is at a premium. The ICT080 is primarily suited for use in most small to medium size actuators operating in arduous conditions and can be supplied in stroke ranges from 25 to 1000mm.

PERFORMANCE

Transducer body diameter	**mm**	8
Electrical stroke range E	**mm**	25 to 1000
Stroke increments	**mm**	25 to 200 in 5mm increments 210 to 1000 in 10mm increments
Linearity*		Typically less than ±0.2% total stroke, ±0.25% maximum
Resolution		Virtually infinite
Operational temperature	**°C**	-20 to +200
Storage temperature	**°C**	-50 to +200
Temperature performance		< ± 100ppm of electrical stroke/°C (+20 to +60°C) < ± 200 ppm of electrical stroke/°C (–20 to +100°C) < ± 300 ppm of electrical stroke/°C (–20 to +200°C)
Insulation resistance		Greater than 50MΩ at 50Vdc
Life		Contactless - no limitation to transducer life
Velocity - maximum	**m/s**	2 in hydraulic applications (ISO VG 32 mineral oil)
Vibration		RTCA/DO-160D 10Hz to 2000Hz, 4.12g (rms) - all axes
Shock		20g, 11.0mS, half sine profile - all axes Survives 2500g - all axes (tested on 25mm stroke unit)
Pressure - working	**Bar**	670
burst	**Bar**	1000
pulsed	**Bar**	0 to 470 in 1 second (tested to 100,000 cycles)
Working fluid		Tested for compatibility with a wide range of hydraulic fluids. Ask for more details

The performance specified is only valid when the ICT080 is operated in conjunction with the signal conditioning unit - model EICT.

*Linearity measured using the Least-Squares method on a computerised calibration system

OPTIONS

Mounting	Internal or threaded flange styles can be specified
Core configurations	Threaded or sleeved core to suit your cylinder rod mounting preference
Extended cable length	1m or 6m output cable can be specified

AVAILABILITY

All options can be supplied within five days from the factory

ORDERING CODE THREADED FLANGE

ICT080/..... /..... /..... /.....

Flange option
Metric flange = EM
Unified flange = EU
Reversed metric flange = RM
Reversed unified flange = RU

Core option
Sleeved core = S
Threaded core = T

Cable option
01 = 1m cable
06 = 6m cable

Stroke range E in mm

ORDERING CODE INTERNAL FLANGE

ICT080/..... /..... /..... /.....

Flange option
Internal flange = IN

Core option
Sleeved core = S
Threaded core metric = TM
Threaded core unified = TU

Cable option
01 = 1m cable
06 = 6m cable

Stroke range E in mm

INSTALLATION

Installation details and recommendations for cylinder designers are shown on pages 10 & 11
An installation kit is provided comprising: O rings, wave washers, shims, circlips and lock nuts.

SIGNAL CONDITIONING

See page 8 for full EICT module performance and dimensions

Input voltage	**Vdc**	+10 to +60 nominal
Output voltage		
standard	**Vdc**	0.5 to 4.5
options	**Vdc**	0 to 5, 0 to 10, ±2.5, ±5, ±7.5, ±10 (using Voltage Module VM output option card)
Output current - option	**mA**	4 -20 (using Current Module CM output option card)

The transducer is supplied with a Sensor Calibration Module Card (SCMC) which is calibrated to match the transducer electrical stroke. This card must be inserted into the EICT signal conditioning unit before operation.
Full details on installation and set-up are included in the manual supplied with the EICT module.

DIMENSIONS

Note: drawings not to scale

ICT080/IN/TM or TU internal flange threaded core-
(M) metric M6x1
(U) unified 1/4in-28UNF

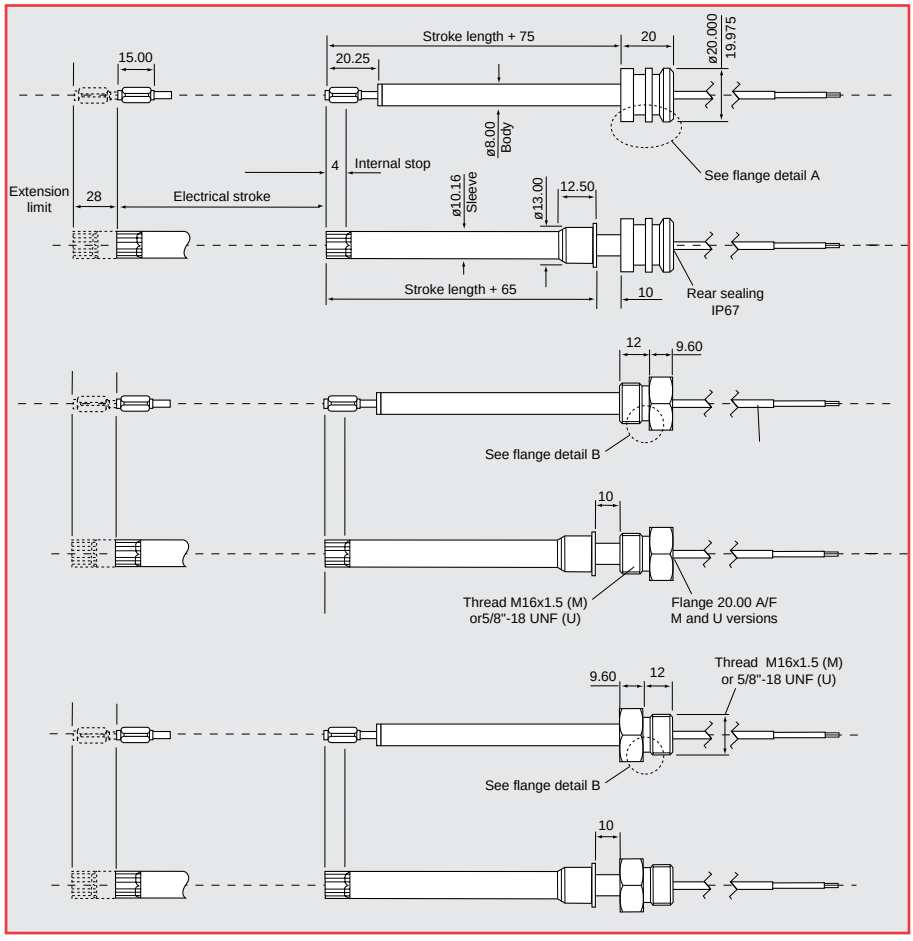
ICT080/IN/S internal flange sleeved core.

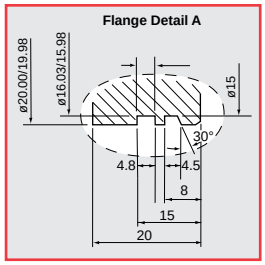
ICT080/EM or EU/T threaded flange threaded core.

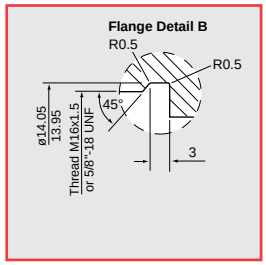
ICT080/EM or EU/S threaded flange sleeved core.

ICT080/RM or RU/T reverse threaded flange, threaded core.

ICT080/RM or RU/S reverse threaded flange, sleeved core.

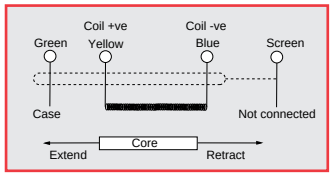






ELECTRICAL CONNECTIONS

3 core cable: FEP sheathed 1m or 6m long with PTFE insulated 19/0.125 cores. 90% braided screen.



Recommended cable minimum bend radius is 10mm.

ICT100 IN-CYLINDER LINEAR POSITION TRANSDUCER

The ICT100 In-Cylinder Linear Transducer has a body diameter of only 10.1mm and is ideal for installation into hydraulic and pneumatic actuator applications where space is at a premium. The ICT100 is primarily suited for use in most medium size actuators operating in arduous conditions and can be supplied in stroke ranges from 25 to 2000mm.

PERFORMANCE

Transducer body diameter	**mm**	10.1
Electrical stroke range E	**mm**	25 to 2000
Stroke increments	**mm**	25 to 200 in 5mm increments 210 to 1100 in 10mm increments 1120 to 2000 in 20mm increments
Linearity*		Typically less than ±0.2% total stroke, ±0.25% maximum
Resolution		Virtually infinite
Operational temperature	**°C**	-20 to +200
Storage temperature	**°C**	-50 to +200
Temperature performance		< ± 100 ppm of electrical stroke/°C (+20 to +60°C) < ± 200 ppm of electrical stroke/°C (–20 to +100°C) < ± 300 ppm of electrical stroke/°C (–20 to +200°C)
Insulation resistance		Greater than 50MΩ at 50Vdc
Life		Contactless - no limitation to transducer life
Velocity - maximum	**m/s**	2 in hydraulic applications (ISO VG 32 mineral oil)
Vibration		RTCA/DO-160D 10Hz to 2000Hz, 4.12g (rms) - all axes
Shock		20g, 11.0mS, half sine profile - all axes Survives 2500g - all axes (tested on 25mm stroke unit)
Pressure - working	**Bar**	670
burst	**Bar**	1000
pulsed	**Bar**	0 to 470 in 1 second (tested to 100,000 cycles)
Working fluid		Tested for compatibility with a wide range of hydraulic fluids. Ask for more details

The performance specified is only valid when the ICT100 is operated in conjunction with the signal conditioning unit - model EICT.

*Linearity measured using the Least-Squares method on a computerised calibration system

OPTIONS

Mounting	Internal or threaded flange styles can be specified
Core configurations	Threaded or sleeved core to suit your cylinder rod mounting preference
Extended cable length	1m or 6m output cable can be specified

AVAILABILITY

Up to 1400mm stroke - all configurations can be supplied within five days from the factory

1420 to 2000mm stroke - all configurations can be supplied within ten days from the factory

ORDERING CODE THREADED FLANGE

ICT100/..... /..... /..... /.....

Flange option
- Metric flange = EM
- Unified flange = EU
- Reversed metric flange = RM
- Reversed unified flange = RU

Core option
- Sleeved core = S
- Threaded core = T

Cable option
- 01 = 1m cable
- 06 = 6m cable

Stroke range E in mm

ORDERING CODE INTERNAL FLANGE

ICT100/..... /..... /..... /.....

Flange option
- Internal flange = IN

Core option
- Sleeved core = S
- Threaded core metric = TM
- Threaded core unified = TU

Cable option
- 01 = 1m cable
- 06 = 6m cable

Stroke range E in mm

INSTALLATION

Installation details and recommendations for cylinder designers are shown on pages 10 & 11

An installation kit is provided comprising: O rings, wave washers, shims, circlips and lock nuts.

SIGNAL CONDITIONING

See page 8 for full EICT module performance and dimensions

Input voltage	**Vdc**	+10 to +60 nominal
Output voltage		
standard	**Vdc**	0.5 to 4.5
options	**Vdc**	0 to 5, 0 to 10, ±2.5, ±5, ±7.5, ±10 (using Voltage Module VM output option card)
Output current - option	**mA**	4 -20 (using Current Module CM output option card)

The transducer is supplied with a Sensor Calibration Module Card (SCMC) which is calibrated to match the transducer electrical stroke. This card must be inserted into the EICT signal conditioning unit before operation.
Full details on installation and set-up are included in the manual supplied with the EICT module.

DIMENSIONS

Note: drawings not to scale

ICT0100/IN/TM or TU internal flange threaded core-
(M) metric M8x1.25
(U) unified 5/16in-24UNF

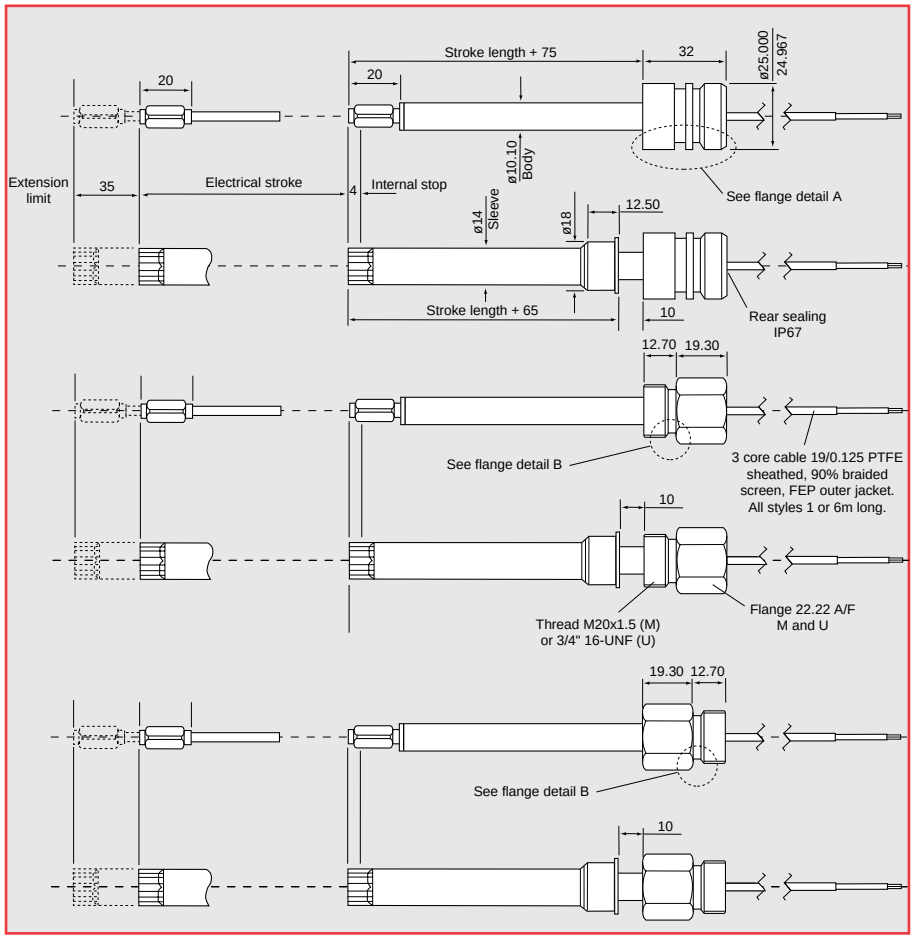
ICT100/IN/S internal flange sleeved core.

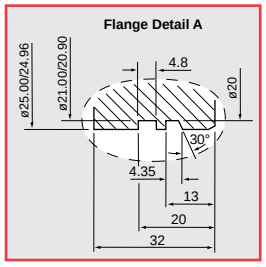
ICT100/EM or EU/T threaded flange threaded core.

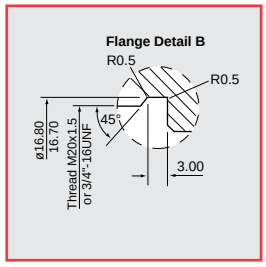
ICT100/EM or EU/S threaded flange sleeved core.

ICT100/RM or RU/T reverse threaded flange, threaded core.

ICT100/RM or RU/S reverse threaded flange, sleeved core.

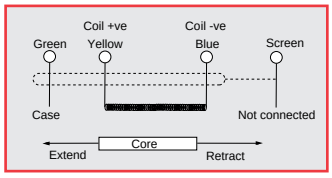






ELECTRICAL CONNECTIONS

3 core cable: FEP sheathed 1m or 6m long with PTFE insulated 19/0.125 cores. 90% braided screen.



Recommended cable minimum bend radius is 10mm.

EICT SIGNAL CONDITIONING MODULE

The EICT signal conditioning module has been specifically designed to operate the ICT range of contactless linear position transducers. This module, housed in a high strength IP66 enclosure, incorporates a high performance circuit that drives the transducer and provides a choice of output signals with zero and span adjustment for simple user configuration.

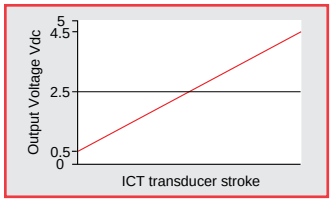
PERFORMANCE

Supply voltage, unregulated Vdc † limited to 13.5 min. on certain ranges - see options table		10 - 60 or ±(10 - 30) for standard output voltage range (**EICT** only) 10† - 30 or ±(10† - 30) for extended output voltage range (**VM** card fitted) 10 - 30 or ±(10 - 30) for current output (**CM** card fitted)
Supply current	**mA**	10 maximum (19 with **VM** card fitted, 12.6 plus output current with **CM** card fitted)
Output voltage signal	**Vdc**	0.5-4.5 See details on page 9 for additional output options
Output current signal	**mA**	4-20 See details on page 9 for options
Output ripple	**mVrms**	<5
Output load	**Ω**	10k minimum (resistive to 0V line)
Frequency response	**Hz**	30 (-3dB) [equivalent to 5mS output lag]
Line regulation		<0.001% output span/Volt
Power on settlement		Within 0.25% of final output in less than 300 milliseconds
Output adjustment range		
zero adjustment		-10 to 60% of span
gain adjustment		40 to 110% of span
Operational temperature	**°C**	0 to +70
Storage temperature	**°C**	-40 to +85
Temperature stability	**ppm/°C**	200 (300 if VM card fitted)
EMC Immunity level (see note 2)		Threat 100V/m : derangement <0.05% FS (Metal housing, adjacent to transducer)
EN61000-6-2: 10kHz to 1GHz		Threat 10V/m : derangement <0.05% FS (Standard EICT housing, 1m cable)
Transducer types		Will only operate Penny+Giles ICT range of transducers
Mechanical housing		Corrosion resistant enclosure sealed to IP66, with detail to fit rail DIN EN50022 or EN50035 or bulkhead mount via four M5 screws.
Weight maximum	**g**	105

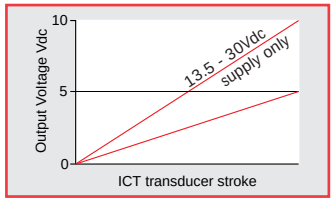
Maximum recommended distance between transducer and EICT module is 10m.

OUTPUT CHARACTERISTICS

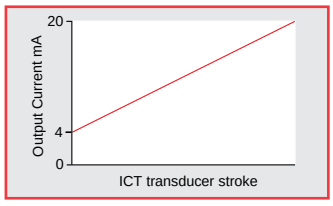
EICT standard unit
10 - 60Vdc supply



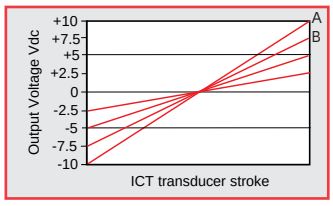
EICT with VM card fitted
10 - 30Vdc supply



EICT with CM card fitted
10 - 30Vdc or ± (10 - 30) Vdc supply



EICT with VM card fitted
10 - 30Vdc or ± (10 - 30) Vdc supply



Note: A and B outputs only available with a ±(13.5 - 30) Vdc supply

Notes:

1. The ICT transducer is supplied with a Sensor Calibration Module Card (SCMC) which is calibrated to match the transducer electrical stroke. This card must be inserted into the EICT signal conditioning unit before operation. The EICT is user configurable for input and output options.
   Full details on installation and set-up are included in the manual supplied with the EICT module.

2. For EMC Immunity levels above 10V/m, please contact our technical sales team to discuss your application. Special housings have been developed to provide increased immunity to EMC.

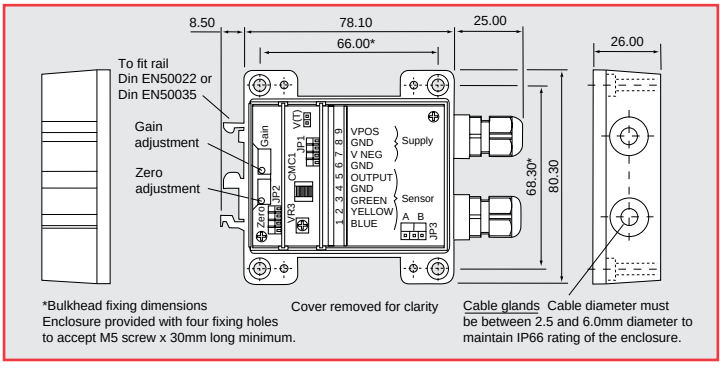
OUTPUT OPTIONS

Output option	Supply voltage range Vdc Single or (Dual) supply	EICT	EICT with **VM** option card	EICT with **CM** option card
0.5 - 4.5Vdc	10 - 60 or ±(10 - 30)	✔	N/A	N/A
0 - 5Vdc	10 - 30 or ±(10 - 30)	N/A	✔	N/A
0 - 10Vdc	13.5 - 30 or ±(13.5 - 30)	N/A	✔	N/A
±2.5Vdc	10 - 30 or ±(10 - 30)	N/A	✔	N/A
±5Vdc	10 - 30 or ±(10 - 30)	N/A	✔	N/A
±7.5Vdc	13.5 - 30 or ±(13.5 - 30)	N/A	✔	N/A
±10Vdc	13.5 - 30 or ±(13.5 - 30)	N/A	✔	N/A
4 - 20mA	10 - 30 or ±(10 - 30)	N/A	N/A	✔
Slope reversal		✔	✔	✔

Continual development of output options means we are working on PWM and CAN output options. Please ask for details

DIMENSIONS

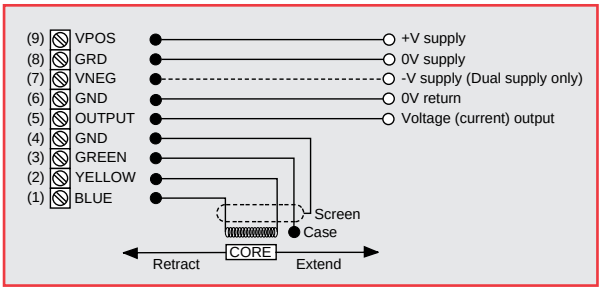
Note: drawings not to scale



ELECTRICAL CONNECTIONS

Screw terminals

Misconnection of the supply may cause permanant damage



Note: refer to the EICT set-up guide for details on how to connect to a split rail power supply.

AVAILABILITY

Normally available from stock

ORDERING CODES

EICT - standard module with 0.5 to 4.5 Vdc output

ACCESSORIES order separately

VM - voltage module output option card

CM - current module output option card

The ICT080 and ICT100 transducers are designed for use inside hydraulic or pneumatic actuators. These notes have been developed to assist cylinder designers determine the electrical stroke, mounting style and core type related to their actuator design. If you encounter any difficulty with these notes please use the contact details on the rear cover to ask for assistance.

In most applications, the designer will need answers to the following questions:-

- **What length of transducer do I need to order to match my cylinder stroke? – see STEP 1**
- **How will I mount the transducer body? – see STEP 2**
- **How will I attach the transducer core? – see STEP 3**

STEP 1 Determine electrical stroke range. This is part of the ordering code (E).

The transducer can only be ordered by electrical stroke range – not mechanical stroke of the actuator/cylinder. Select a transducer (ICT080 or ICT100) to suit your cylinder stroke and piston rod bore diameter

ICT080 can be specified in stroke range increments of 5mm for 25mm to 200mm and 10mm for 210mm to 1000mm electrical strokes.

ICT100 can be specified in stroke range increments of 5mm for 25mm to 200mm, 10mm for 210mm to 1100mm and 20mm for 1120 to 2000mm electrical strokes.

You should specify a transducer that will give you sufficient range to cover the mechanical stroke of your cylinder. The EICT signal conditioning module provides GAIN and ZERO adjustment to match your required output range signals over the specified cylinder stroke. Details are included in the set-up guide supplied with the module.

STEP 2 Decide on transducer mounting style. This is part of the ordering code.

ICT080 and ICT100 are both available with a choice of mounting flange styles. See pages 5 and 7

Threaded flanges (EU/EM) are intended for mounting through the cylinder rear via a threaded hole. See Figs.1 and 3 for recommended installation and machining details. The threaded flange is also available in a reversed format (RU/RM) which will allow the transducer to be fitted within the actuator footprint. See Figs.1 and 4 for installation details.

Internal (IN) flange style is suited to clevis style actuators, where the transducer is embedded in the cylinder rear. See Figs.5 and 6 for recommended installation and machining details.

STEP 3 Decide on transducer core type. This is part of the ordering code.

ICT080 and ICT100 can be supplied with two transducer core styles.

The sleeved core (S) allows the cylinder rod to be simply machined and attached with the mounting hardware supplied. See Figs.1 and 2 for schematics and recommended machining details. Sleeve lengths are shown on pages 5 and 7, to allow the full diameter drill depth to be calculated.

The threaded core (T) allows attachment to the cylinder rod with the smallest transducer footprint. *See* Fig.3 for threaded core details and recommended machining dimensions.

Each transducer is supplied with the mounting hardware to mount the transducer body and core. The kit includes all components for all types of transducer available. Spare mounting hardware kits can be ordered as part number AI202799 (ICT080) and AI202800 (ICT100).

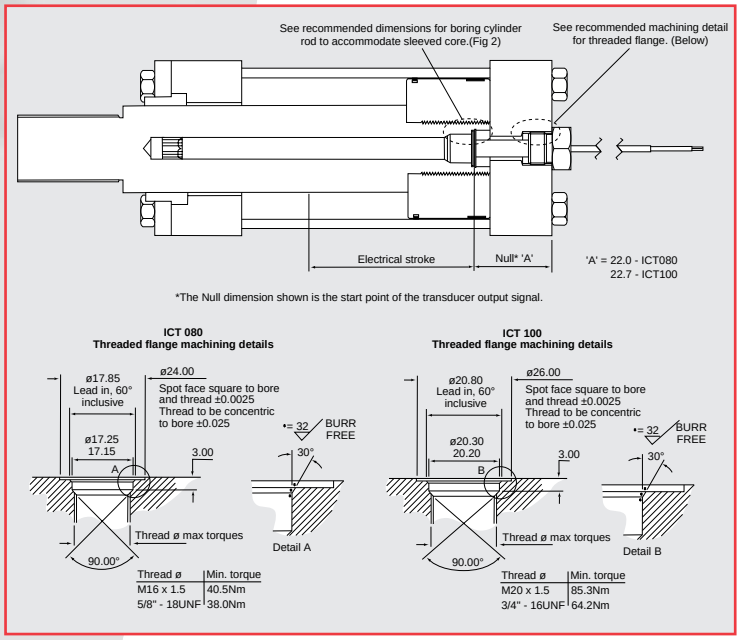


Fig 1 - Typical installation for tie-rod actuator. Recommended machining details for threaded flange attachment.

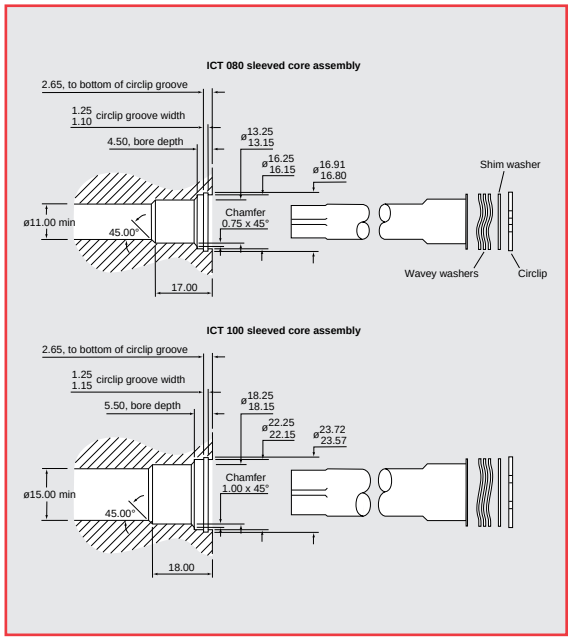


Fig 2 - Recommended machining detail for sleeved core assemblies

Fig 3 - Alternative core option and machining details

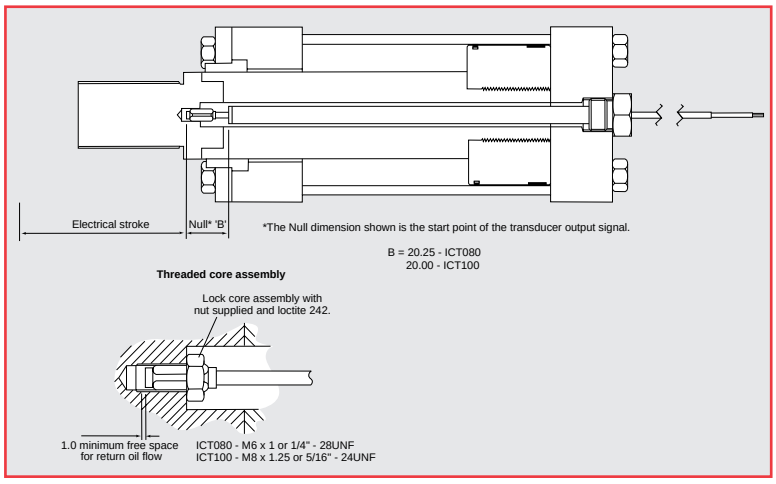


Fig 4 - Typical installation showing reversed threaded flange option

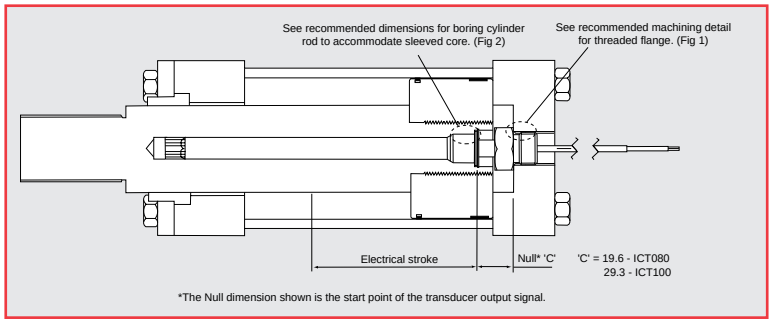


Fig 5 - Typical installation showing internal flange option

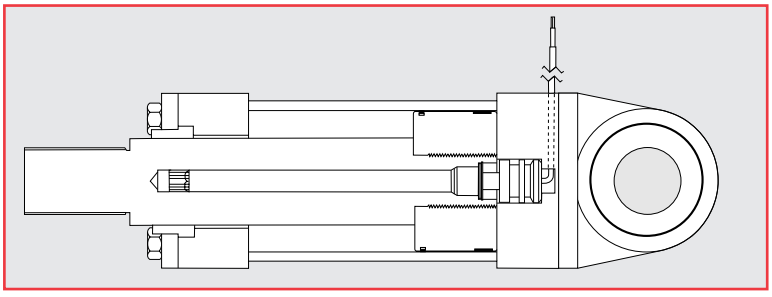
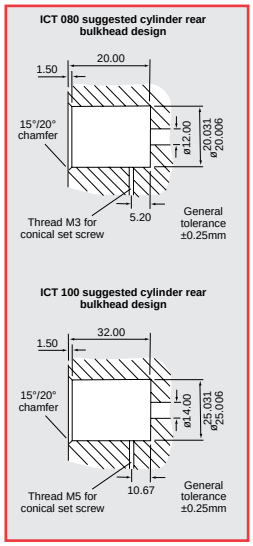


Fig 6 - Recommended machining details for internal flange attachment



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