User's Manual

EXA

Model ISC202G [Style: S2], ISC202S [Style: S3]

2-wire Inductive Conductivity Transmitter

IM 12D06A03-01E

vigilantplant®

YOKOGAWA
Yokogawa Electric Corporation

IM 12D06A03-01E
7th Edition

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IM 12D06A03-01E
7th Edition: Oct. 2009(YK)

In this manual a **mA** sign appears if it concerns the ISC202G-A and ISC202S-A, -N, -K.

DANGER

Electric discharge

The EXA analyzer contains devices that can be damaged by electrostatic discharge. When servicing this equipment, please observe proper procedures to prevent such damage. Replacement components should be shipped in conductive packaging. Repair work should be done at grounded workstations using grounded soldering irons and wrist straps to avoid electrostatic discharge.

Installation and wiring

The EXA analyzer should only be used with equipment that meets the relevant international and regional standards. Yokogawa accepts no responsibility for the misuse of this unit.

CAUTION

The instrument is packed carefully with shock absorbing materials, nevertheless, the instrument may be damaged or broken if subjected to strong shock, such as if the instrument is dropped. Handle with care.

Although the instrument has a weatherproof construction, the transmitter can be harmed if it becomes submerged in water or becomes excessively wet.

Do not use an abrasive material or solvent when cleaning the instrument.

Do not modify the ISC202 transmitter.

WARNING

Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, e.g., rubbing with a dry cloth.

Warning label

Because the enclosure of the Dissolved Oxygen transmitter Type ISC202S-A, -P, -F are made of aluminium, if it is mounted in an area where the use of category 1 G Zone 0 apparatus is required, it must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

Notice

- This manual should be passed on to the end user.
- The contents of this manual are subject to change without prior notice.
- The contents of this manual shall not be reproduced or copied, in part or in whole, without permission.
- This manual explains the functions contained in this product, but does not warrant that they are suitable the particular purpose of the user.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, when you realize mistaken expressions or omissions, please contact the nearest Yokogawa Electric representative or sales office.
- This manual does not cover the special specifications. This manual may be left unchanged on any change of specification, construction or parts when the change does not affect the functions or performance of the product.

- If the product is not used in a manner specified in this manual, the safety of this product may be impaired.

Yokogawa is not responsible for damage to the instrument, poor performance of the instrument or losses resulting from such, if the problems are caused by:

- Improper operation by the user.
- Use of the instrument in improper applications
- Use of the instrument in an improper environment or improper utility program
- Repair or modification of the related instrument by an engineer not authorized by Yokogawa.

Safety and Modification Precautions

- Follow the safety precautions in this manual when using the product to ensure protection and safety of the human body, the product and the system containing the product.

The following safety symbols are used on the product as well as in this manual.

DANGER

This symbol indicates that an operator must follow the instructions laid out in this manual in order to avoid the risks, for the human body, of injury, electric shock, or fatalities. The manual describes what special care the operator must take to avoid such risks.

WARNING

This symbol indicates that the operator must refer to the instructions in this manual in order to prevent the instrument (hardware) or software from being damaged, or a system failure from occurring.

CAUTION

This symbol gives information essential for understanding the operations and functions.

This symbol indicates Protective Ground Terminal

This symbol indicates Function Ground Terminal (Do not use this terminal as the protective ground terminal.)

This symbol indicates Alternating current.

This symbol indicates Direct current.

Warranty and service

Yokogawa products and parts are guaranteed free from defects in workmanship and material under normal use and service for a period of (typically) 12 months from the date of shipment from the manufacturer. Individual sales organizations can deviate from the typical warranty period, and the conditions of sale relating to the original purchase order should be consulted. Damage caused by wear and tear, inadequate maintenance, corrosion, or by the effects of chemical processes are excluded from this warranty coverage.

In the event of warranty claim, the defective goods should be sent (freight paid) to the service department of the relevant sales organization for repair or replacement (at Yokogawa discretion). The following information must be included in the letter accompanying the returned goods:

- Part number, model code and serial number
- Original purchase order and date
- Length of time in service and a description of the process
- Description of the fault, and the circumstances of failure
- Process/environmental conditions that may be related to the installation failure of the device
- A statement whether warranty or non-warranty service is requested
- Complete shipping and billing instructions for return of material, plus the name and phone number of a contact person who can be reached for further information.

Returned goods that have been in contact with process fluids must be decontaminated/disinfected before shipment. Goods should carry a certificate to this effect, for the health and safety of our employees. Material safety data sheets should also be included for all components of the processes to which the equipment has been exposed.

ATEX Documentation

This procedure is only applicable to the countries in European Union.

GB

All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK

Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF

Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöhjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellännne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR

Όλα τα εγχειρίδια λειτονργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.

SK

Všetky návody na obsluhu pre prístroje s ATEX Ex sú k dispozícii v jazyku anglickom, nemeckom a francúzskom. V prípade potreby návodu pre Ex-prístroje vo Vašom národnom jazyku, skontaktujte prosím miestnu kanceláriu firmy Yokogawa.

CZ

Všechny uživatelské příručky pro výrobky, na něž se vztahuje nevýbušné schválení ATEX Ex, jsou dostupné v angličtině, němčině a francouzštině. Požadujete-li pokyny týkající se výrobků s nevýbušným schválením ve vašem lokálním jazyku, kontaktujte prosím vaši nejbližší reprezentační kancelář Yokogawa.

LT

Visos gaminiø ATEX Ex kategorijos Eksploatavimo instrukcijos teikiami anglø, vokieèiø ir prancûzø kalbomis. Norëdami gauti prietaisø Ex dokumentacijà kitomis kalbomis susisiekite su artimiausiu bendrovës “Yokogawa” biuru arba atstovu.

LV

Visas ATEX Ex kategorijas izstrâdâjumu Lietoðanas instrukcijas tiek piegâdâtas angïu, vâcu un franèu valodâs. Ja vçlaties saòemt Ex ierîèu dokumentâciju citâ valodâ, Jums ir jâsazinâs ar firmas Jokogava (Yokogawa) tuvâko ofisu vai pârstâvi.

EST

Kõik ATEX Ex toodete kasutamisjuhendid on esitatud inglise, saksa ja prantsuse keeles. Ex seadmete muukeelse dokumentatsiooni saamiseks pöörduge lähima Iokagava (Yokogawa) kontori või esindaja poole.

PL

Wszystkie instrukcje obsługi dla urządzeń w wykonaniu przeciwwybuchowym Ex, zgodnych z wymaganiami ATEX, dostępne są w języku angielskim, niemieckim i francuskim. Jeżeli wymagana jest instrukcja obsługi w Państwa lokalnym języku, prosimy o kontakt z najbliższym biurem Yokogawy.

SLO

Vsi predpisi in navodila za ATEX Ex sorodni pridelki so pri roki v anglišèini, nemšèini ter francošèini. Èe so Ex sorodna navodila potrebna v vašem tukejnjem jeziku, kontaktirajte vaš najbliši Yokogawa office ili predstaunika.

H

Az ATEX Ex mûszerek gépkönyveit angol, német és francia nyelven adjuk ki. Amennyiben helyi nyelven kérik az Ex eszközök leírásait, kérjük keressék fel a legközelebbi Yokogawa irodát, vagy képviseletet.

BG

Всички упътвания за продукти от серията ATEX Ex се предлагат на английски, немски и френски език. Ако се нуждаете от упътвания за продукти от серията Ex на родния ви език, се свържете с най-близкия офис или представителство на фирма Yokogawa.

RO

Toate manualele de instructiuni pentru produsele ATEX Ex sunt in limba engleza, germana si franceza. In cazul in care doriti instructiunile in limba locala, trebuie sa contactati cel mai apropiat birou sau reprezentant Yokogawa.

M

Il manwali kollha ta' l istruzzjonijiet għal prodotti mmarbuta ma' ATEX Ex huma disponibbli bl-Ingliż, bil-Ġermaniż u bil-Franċiż. Jekk tkun teħtieġ struzzjonijiet marbuta ma' Ex fil-lingwa lokali tiegħek, għandek tikkuntattja lill-eqreb rappreżentan jew uffiċċju ta' Yokogawa

1. INTRODUCTION AND GENERAL DESCRIPTION

The Yokogawa EXA 202 is a 2-wire transmitter designed for industrial process monitoring, measurement and control applications. This user's manual contains the information needed to install, set up, operate and maintain the unit correctly. This manual also includes a basic troubleshooting guide to answer typical user questions.

Yokogawa can not be responsible for the performance of the EXA transmitter if these instructions are not followed.

1-1. Instrument check

Upon delivery, unpack the instrument carefully and inspect it to ensure that it was not damaged during shipment. If damage is found, retain the original packing materials (including the outer box) and then immediately notify the carrier and the relevant Yokogawa sales office.

Make sure the model number on the textplate affixed to the side of the instrument agrees with your order. Examples of nameplates are shown below.

mA

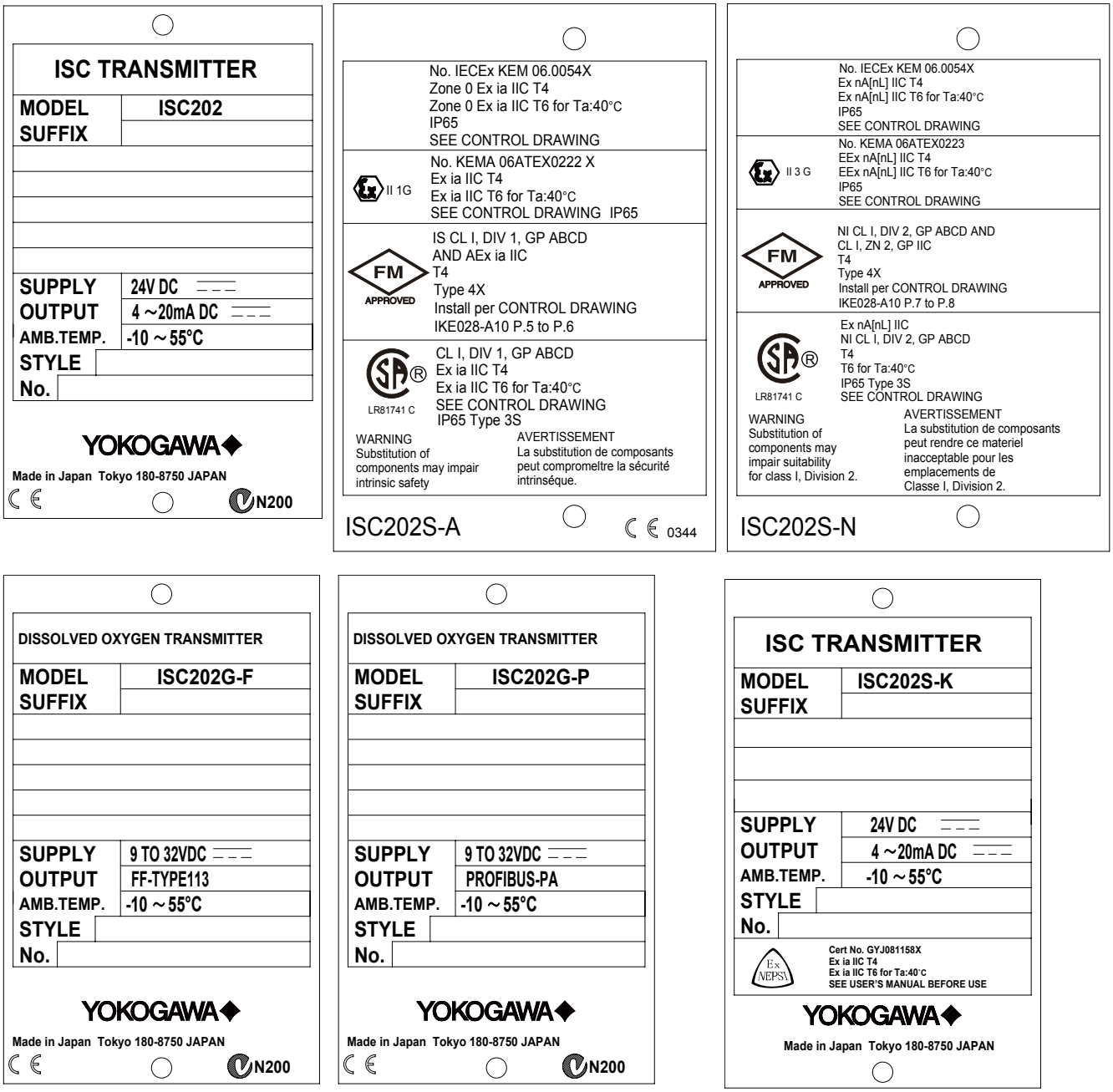


Figure 1-1. Nameplate

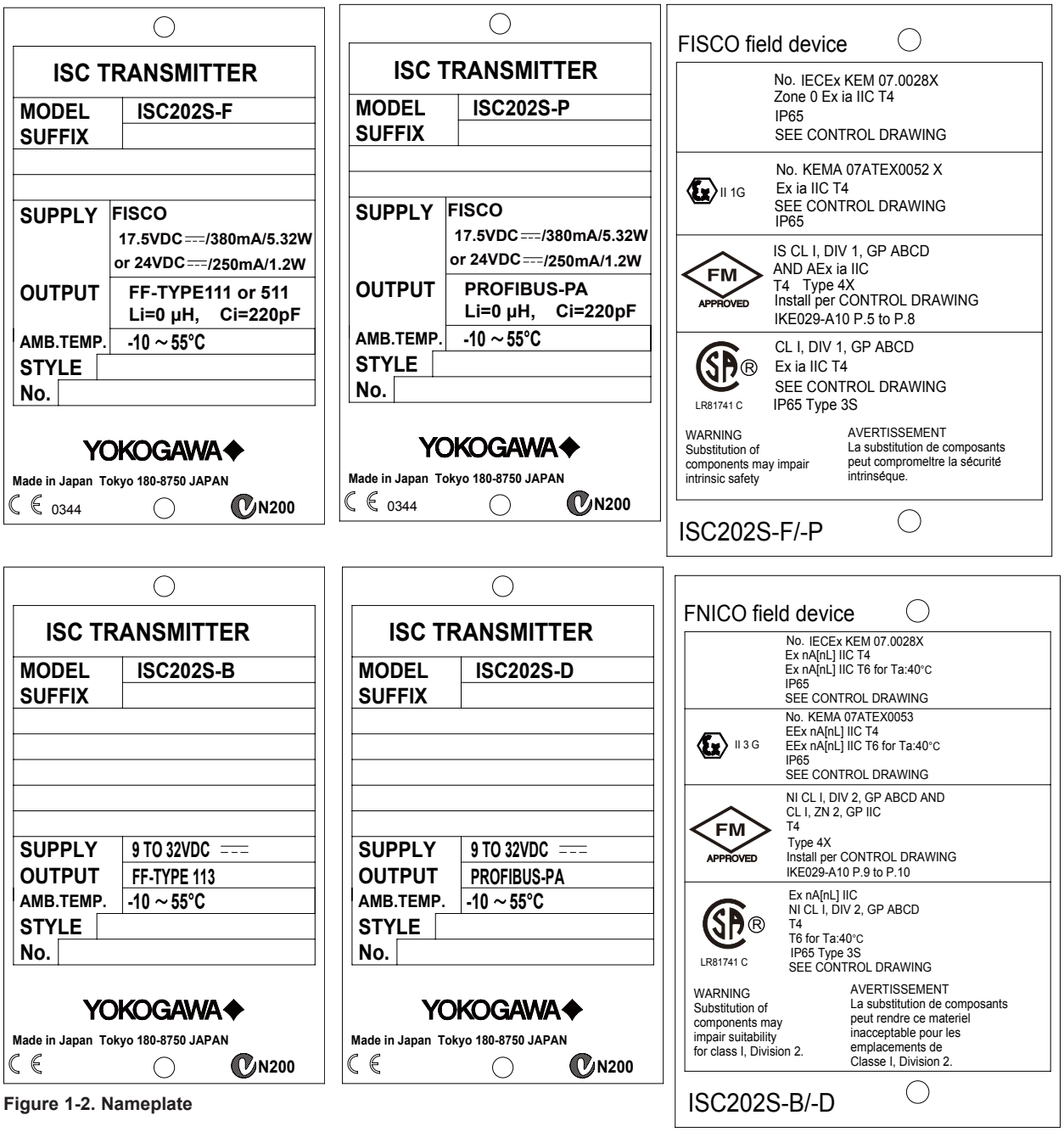


Figure 1-2. Nameplate

NOTE:

Check that all the parts are present, including mounting hardware, as specified in the option codes at the end of the model number. For a description of the model codes, refer to Section 2 of this manual under General Specifications.

Basic Parts List: Transmitter ISC202
User's Manual English
Optional mounting hardware when specified (See model code)

1-2. Application

The EXA transmitter is intended to be used for continuous on-line measurement in industrial installations. The unit combines simple operation and microprocessor-based performance with advanced self-diagnostics and enhanced communications capability to meet the most advanced requirements. The measurement can be used as part of an automated process control system. It can also be used to indicate dangerous limits of a process, to monitor product quality, or to function as a simple controller for a dosing/neutralization system.

Yokogawa designed the EXA transmitter to withstand harsh environments. The transmitter may be installed

either indoors or outside because the IP65 and NEMA 4X housing and cabling glands ensure the unit is adequately protected. The flexible polycarbonate window on the front door of the EXA allows pushbutton access to the keypad, thus preserving the water and dust protection of the unit even during routine maintenance operations.

A variety of EXA hardware is optionally available to allow wall, pipe, or panel mounting. Selecting a proper installation site will permit ease of operation. Sensors should normally be mounted close to the transmitter in order to ensure easy calibration and peak performance. If the unit must be mounted remotely from the sensors, WF10 extension cable can be used up to a maximum of 50 mtr (150 feet) with a BA10 junction box.

The EXA is delivered with a general purpose default setting for programmable items. (Default settings are listed in Section 5 and again in Chapter 11). While this initial configuration allows easy start-up, the configuration should be adjusted to suit each particular application. An example of an adjustable item is the type of temperature sensor used. The EXA can be adjusted for two different types of temperature sensors.

To record such configuration adjustments, write changes in the space provided in Chapter 11 of this manual. Because the EXA is suitable for use as a monitor, a controller or an alarm instrument, program configuration possibilities are numerous.

Details provided in this user's manual are sufficient to operate the EXA with all Yokogawa sensor systems and a wide range of third-party commercially available probes. For best results, read this manual in conjunction with the corresponding sensor user's manual.

Yokogawa designed and built the EXA to meet the CE regulatory standards. To assure the user of continued accurate performance in even the most demanding industrial installations.

2. GENERAL SPECIFICATIONS

2-1. Specifications

A) Input specifications

:One inductive conductivity sensor and one temperature sensor. Compatible with the ISC40 series with integrated temperature sensor. ISC202S: use with ISC40S

B) Input range

- Conductivity: 0 to 1999 mS/cm at 25 °C (77˚F) reference temperature.
- Temperature: -20 to 140 °C (4 to 284˚F)
- Cable length: max. 60 mtr (200 feet) 10 mtr (35 feet) fixed sensor cable + 50 mtr (165 feet) WF10 extension cable. Influence of cable can be adjusted by doing an AIR CAL with the cable connected to a dry cell.

C) Functional specifications

Accuracy (under reference conditions):
(Output span is 0 – 100 µS/cm or more)

- Conductivity :

Linearity : ± (0.4 %FS + 0.3 µS/cm)
Repeatability : ± (0.4 %FS + 0.3 µS/cm)

- Temperature: ± 0.3ºC (0.6ºF)

Note: The following tolerance is added to the above performance.
mA output tolerance: ±0.02 mA of "4-20 mA"

- Step response ≤ 8 seconds for 90% (2 decade step).

E) Indicating range:

- Main display 0 to 1999 mS/cm (1st compensation)
- Message display 0 to 1999 mS/cm (2nd compensation), Temperature -20 to 140 ºC (0 to 280 ºF) Concentration 0 to 100.0% Temperature compensation methods NaCl, T.C., Matrix mA- Output Cell constant [cm^{-1}] Reference Temperature (ºC/ºF) Software Release.

mA F) Transmission signal:

- General Isolated output of 4-20 mA DC.Burn up (21 mA) or Burn down (3.6 mA when HART® or distributor comm. is non-used, 3.9 mA when HART® or distributor comm. is used) or pulse of 21 mA to signal failure.
- Hold Outputs may be set to hold the last or a fixed value during maintenance.

mA G) Transmission range:

- Conductivity Minimum span: 100 µS/cm Maximum span: 1999 mS/cm Setting value at 4 mA output: ≤ 90 % of setting value at 20 mA output

mA H) Serial Communication:

Bi-directional HART® digital communication superimposed on the 4-20 mA signal.

I) DD specification

The ISC202G(S) Device Description (DD) is available enabling communications with the hand held communicator and compatible devices. For more information contact your local Yokogawa sales offices.

Maximum load resistance :

For the ISC202G, see figure 2-1.
200Ω or less with the PH201G
50Ω or less with the SDBT
For the ISC202S, see figure 2-2.

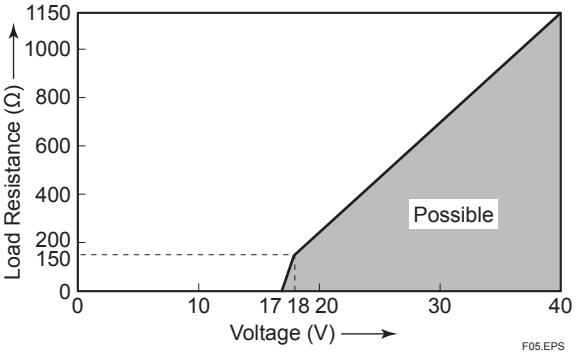


Fig.2-1 Supply voltage/ load diagram for the ISC202G

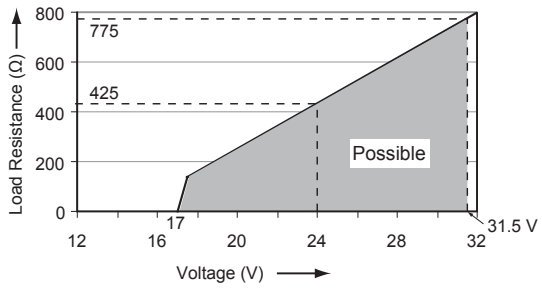


Fig.2-2 Supply voltage/ load diagram for the ISC202S

J) Temperature compensation:

- Sensor types: Pt1000Ω or 30kΩ NTC
- Automatic: -20 to 140 ºC (0 to 280 ºF)
- Algorithm: selectable as mentioned below NaCl according to IEC 60746-3 tables.
  Two T.C. setting possible between 0.00 to 3.50 %/°C
  Matrix: user selectable/ configurable. 8 selectable for concentrated solutions, 1 free programmable.

mA **K) Sensor diagnostics:**

Abnormal temperature (open, short), abnormal conductivity values (E5/E6 free programmable), e.g. dry cell, wiring problems.

L) Calibration:

Manual, calibration Input pre-measureds data (cell constant).

M) Logbook:

Software record of important events and diagnostic data.

N) Display:

Custom liquid crystal display.

- Main display: 3½ digits, 12.5 mm high, zero change included.
- Message display: 6 alphanumeric characters, 7 mm high.
- Special fields: Flags for status indication : FAIL and HOLD.
- Measuring units: µS/cm or mS/cm
- Key prompts: YES, NO, >, ^, ENT, Menu pointer
- Keys: 6 keys operated through flexible window with tactile feedback. One hidden key behind the front cover.

O) Power supply:

Power supply : Normal 24 V DC loop powered system, see Figure 2-1, 2-2.
ISC202G: 17 - 40 V DC
ISC202S: 17 - 31.5 V DC

- Input Isolation: Maximum 1000 VDC

P) Housing:

- Material : Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window.
- Color : Case : Off-white (Equivalent to Munsell 2.5Y8.4/1.2)
  Cover : Deepsea Moss green(Equivalent to Munsell 0.6GY3.1/ 2.0)
- Cable gland : 2-Pg13.5

Q) Mounting:

Pipe, Wall or Panel.

R) Shipping details:

Package size : W x H x D, 290 x 300 x 290 mm (11.5 x 11.8 x 11.5 inch).

S) Environment and operational conditions:

- Ambient temp.: -10 to 55 ºC (+10 to +130 ºF)
  LCD operational temperature is specified -10 to 70 ºC (14 to 160 ºF)
  Excursions to -30 to +70 ºC will not damage the instrument.
- Storage temp.: -30 to +70 ºC (-20 to +160 ºF).
- Relative humidity: 10 to 90% RH at 40 ºC ambient temperature, non condensing
- Data protection: EEPROM for configuration and logbook. Battery supported clock.
- Watchdog timer : Checks microprocessor.
- Automatic safeguard: Return to measurement after 10 minutes when no keystroke.

Operation protection: 3 digital pass codes (programmable).
Power down: No effect, reset to measurement.

mA **T) HART® specifications**:

Minimum cable diameter: 0.51 mm, 24 AWG.
Maximum cable length: 1500 m
Refer to standard HART® specifications for more details.
See www.hartcomm.org

U) EMC Conformity standard CE , N200

EN 61326-1 Class A, Table 2
(For use in industrial locations)
EN 61326-2-3
EN 61326-2-5 (pending)

CAUTION

This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

V) Explosionproof type

Refer to Control Drawings.

mA

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Vmax=31.5 V, Imax=100 mA, Pmax=1.2 W, Ci=22 nF, Li=35 µH	**-A**
	FM Non-incendive safe Approval Applicable standard: FM3600, FM3611, FM3810 Non-incendive Safe for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Vmax=31.5 V, Ci=22 nF, Li=35 µH	**-N**
CENELEC ATEX	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26 Certificate: KEMA 06ATEX0222 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	**-A**
	CENELEC ATEX (KEMA) Type of protection "n" Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 06ATEX0223 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	**-N**

2.EPS

Item	Description	Code
Factory Mutual (FM)	**FM Intrinsically safe Approval** Applicable standard: FM3600, FM3610, FM3810 Intrinsically Safe for Class I, Division 1, Groups ABCD Class I, Zone 0, AEx ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Intrinsically Safe Apparatus Parameters Entity { Vmax=24 V, Imax=250 mA, Pmax=1.2 W, Ci=220 pF, Li=0 µH FISCO { Vmax=17.5 V, Imax=380 mA, Pmax=5.32 W, Ci=220pF, Li=0 µH	**-P** **or** **-F**
	FM Non-incendive safe Approval Applicable standard: FM3600, FM3611, FM3810 Non-incendive Safe for Class I, Division 2, Groups ABCD, Zone 2 Temp. Class: T4, Amb. Temp.: -10 to 55°C Non-incendive Safe Apparatus Parameters Entity { Vmax=32 V, Pmax=1.2 W, Ci=220 pF, Li=0 µH FNICO { Vmax=32 V, Pmax=5.32 W, Ci=220 pF, Li=0 µH	**-B** **or** **-D**

FM.EPS

Item	Description	Code
CENELEC ATEX Entity	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26 Certificate: KEMA 07ATEX0052 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	**-P** **or**
CENELEC ATEX FISCO	**CENELEC ATEX (KEMA) Intrinsically safe Approval** Applicable standard: EN60079-0, EN50020 EN60079-26, EN60079-27 Certificate: KEMA 07ATEX0052 X Ex ia IIC, Group: II, Category: 1G Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	**-F**
CENELEC ATEX	**CENELEC ATEX (KEMA) Type of protection "n"** Applicable standard: EN60079-0:2006, EN60079-15:2003 Certificate: KEMA 07ATEX0053 EEx nA [nL] IIC, Group: II, Category: 3G Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	**-B** **or** **-D**

ATEX.EPS

mA

Item	Description	Code
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1 Ex ia Class I, Division 1, Groups ABCD Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ii(Imax)=100 mA, Pi(Pmax)=1.2 W, Ci=22 nF, Li=35 µH	**-A**
	CSA Non-incendive safe Approval or type of protection "n" Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No.61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui(Vmax)=31.5 V, Ci=22 nF, Li=35 µH	**-N**
IECEx Scheme	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 06.0054X Zone 0 Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ii=100 mA, Pi=1.2 W, Ci=22 nF, Li=35 µH	**-A**
	IECEx Type of protection "n" Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 06.0054X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=31.5 V, Ci=22 nF, Li=35 µH	**-N**

T12E.EPS

Item	Description	Code
Canadian Standards Association (CSA)	**CSA Intrinsically safe Approval** Applicable standard: C22.2, No. 0-M1991, C22.2, No. 04-M2004, C22.2, No. 157-M1992, C22.2, No. 61010-1 Ex ia Class I, Division 1, Groups ABCD Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Entity { Ui(Vmax)=24 V, Ii(Imax)=250 mA, Pi(Pmax)=1.2 W, Ci=220 pF, Li=0 µH FISCO { Ui(Vmax)=17.5 V, Ii(Imax)=380 mA, Pi(Pmax)=5.32 W, Ci=220 pF, Li=0 µH	**-P** **or** **-F**
	CSA Non-incendive safe Approval or type of protection "n" Applicable standard: C22.2, No.0-M1991, C22.2, No.04-M2004, C22.2, No.157-M1992, C22.2, No.213-M1987, C22.2, No. 61010-1 Class I, Division 2, Groups ABCD Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Entity: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH FNICO: Ui(Vmax)=32 V, Ci=220 pF, Li=0 µH	**-B** **or** **-D**

CSA.EPS

Item	Description	Code
IECEx Scheme Entity	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26 Certificate: IECEx KEM 07.0028X Zone 0 Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=24 V, Ii=250 mA, Pi=1.2 W, Ci=220 pF, Li=0 µH	**-P** **or**
IECEx Scheme FISCO	**IECEx Intrinsically safe** Applicable standard: IEC 60079-0, IEC60079-11, IEC60079-26, IEC60079-27 Certificate: IECEx KEM 07.0028X Zone 0 Ex ia IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C Ui=17.5 V, Ii=380 mA, Pi=5.32 W, Ci=220 pF, Li=0 µH	**-F**
IECEx Scheme	**IECEx Type of protection "n"** Applicable standard: IEC 60079-15:2001, IEC 60079-0:2004 Certificate: IECEx KEM 07.0028X Ex nA [nL] IIC Temp. Class: T4, Amb. Temp.: -10 to 55°C T6, Amb. Temp.: -10 to 40°C Ui=32 V, Ci=220 pF, Li=0 µH	**-B** **or** **-D**

IEC.EPS

mA **NEPSI Certification (ISC202S-K)**

NEPSI Intrinsically Safe Type

Cert No. GYJ081158X

- Applicable Standard:
  GB3836.1-2000, GB3836.4-2000
- Type of Protection and Marking Code:
  Ex ia IIC T4/T6
- Ambient Temperature :
  T6; –10 to 40°C, T4; –10 to 55°C

Note 1 Entity Parameters

- Intrinsically safe input parameters
  (terminal + and -):
  Maximum Input Voltage (Ui) = 31.5 V
  Maximum Input Current (Ii) = 100 mA
  Maximum Input Power (Pi) = 1.2 W
  Maximum Internal Capacitance (Ci) = 22 nF
  Maximum Internal Inductance (Li) = 35 µH
- Intrinsically safe output parameters and maximum external parameters
  (terminal 11 and 17):
  Uo=14.4 V, Io=20 mA, Po=190 mW, Co=600 nF, Lo=88 mH

Note 2 Installation

- Electrostatic charges on the display window shall be avoided.
- The external earth connection facility shall be connected reliably.
- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation and will void NEPSI Intrinsically safe certification.
- The user shall not change the configuration in order to maintain/ensure the explosion protection performance of the equipment. Any change may impair safety.
- For installation, use and maintenance of the product, the end user shall observe the instruction manual and the following standards:
  GB50257-1996 "Code for construction and acceptance of electric device for explosion atmospheres and fire hazard electrical equipment installation engineering".
  GB3836.13-1997 "Electrical apparatus for explosive gas atmospheres Part 13: Repair and overhaul for apparatus used in explosive gas atmospheres".
  GB3836.15-2000 "Electrical apparatus for explosive gas atmospheres- Part 15: Electrical installations in hazardous area (other than mines)" .
  GB3836.16-2006 "Electrical apparatus for explosive gas atmospheres- Part 16: Inspection and maintenance of electrical installation (other than mines)".

mA

mA-HART® communication

A. Input : Two wire system 4-20 mA

B. Power supply :

ISC202G : up to 40 volts
ISC202S : up to 31.5 volts

Note: The transmitter contains a switched power supply, drawing its energy from the 0-4 mA section of the signal. Consequently the 17 volt limit is applied at 4 mA. The characteristic of the unit is such that above about 7 mA on the output, the terminal voltage can drop to 14.5 volts without problem.

C. Transmission: Isolated output of 4 to 20 mA DC.

D. Signal : Maximum load 425Ω at 24 VDC. (see figure 2-1)
Burn to signal failure acc. NAMUR Recommendation NE43 (18.01.1994)

E. Operating range : 3.9 to 21 mA

F. Communication
: HART®, 1200 Baud, FSK modulated on 4 to 20 mA signal

G. Configuration : Local with 6 keys

H. Software : Firmware based on Yokogawa stack.

I. Hardware : Yokogawa HART® Modem F9197UB

J. Other Control systems
: Yokogawa PRM, Rosemount AMS, Siemens PDM

K. Hand Terminal : Rosemount HHT 275/375

L. Other control systems: Yokogawa PRM, Rosemount AMS, Siemens PDM\

M. Output span :

- Conductivity : min 0.01µS/cm, max. 1999 mS/cm.
  (max 90% zero suppression)
- Resistivity : min 0.001kΩ·cm, max. 999 MΩ·cm.
  (max 90% zero suppression) The instrument is user programmable for linear or non-linear conductivity ranges.

N. Cable specification
: 0.5 mm diameter or 24 AWG over maximum length of 1500 m

O. DD specification
: The ISC202 Device Description is available enabling communications with the Handheld Communicator and compatible devices.

PROFIBUS-PA communications

A. Input signal: Digital
B. Supply voltage: 9 to 32 V DC
C. Operating current: 26.0 mA
D. Operating values: According to IEC 1158-2
E. Bus connection
: Fieldbus interface base on IEC1158-2 according to FISCO-Model
F. Power supply: Power supply is achieved dependant on the application by means of segment coupler
G. Data transfer: According to PROFIBUS- PA profile class B based on EN 50170 and DIN 19245 part 4
H. GSD file: The actual file can be downloaded from www.profibus.com
Configuration: Local with 6 keys
I. Software: Firmware based on Siemens DPC31 stack.
J. Hardware:
PC- or PCMCIA-interfaces from Siemens
K. Other control: Siemens PDM systems
L Electrical connection:
Terminals acc. to IEC 1158-2
M. Fieldbus-cable-types:
Twisted and shielded two wire cable according to recommendation based on IEC 1158-2 Cable diameter: 6 to 12 mm (0.24 to 0.47 inch)

FOUNDATION FIELDBUS H1 communications

A. Input signal: Digital
B. Supply voltage: 9 to 32 V DC
C. Operating current: 26.0 mA (base current)
D. Operating values: According to IEC 1158-2
E. Bus connection
: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
F. Power supply:
Power supply is achieved dependant on application by means of segment coupler
G. Data transfer:
FF specification Rev. 1.4 Basic device
H. Function blocks:
3 x AI, Transducer, Resource
I. Files: Actual file can be downloaded from our homepage
J. Configuration: locally with 6 keys
K. Software:
National Instruments:
NI-FBUS configurator
L. Hardware: F-BUS interfaces from National Instruments (AT-FBUS, PCMIA-FBUS)
M. Other control systems:
YOKOGAWA PRM, DTM

2-2. Model and suffix codes

1. 2-wire Inductive conductivity transmitter (General purpose)

[Style: S2]

Model	Suffix Code		Option Code	Description
ISC202G	·····		·····	2-wire Inductive conductivity transmitter
Type	-A		·····	mA with HART
	-P		·····	Profibus
	-F		·····	FF
Language		-J	·····	Japanese
		-E	·····	English
Option	Mounting Hardware		/U	Pipe, wall mounting bracket (Stainless steel)
			/PM	Panel Mounting bracket(Stainless steel)
	Hood		/H	Hood for sun protection (Carbon steel)
			/H2	Hood for sun protection (Stainless steel)
	Tag Plate		/SCT	Stainless steel tag plate
	Conduit Adapter		/AFTG	G1/2
			/ANSI	1/2NPT
			/TB	Screw terminal (*1)
			/X1	Epoxy baked finish (*2)

(*1) It can be specified when the suffix code -A is selected.

(*2) The housing is coated with epoxy resin.

2. 2-wire Inductive conductivity transmitter (Explosionproof type)

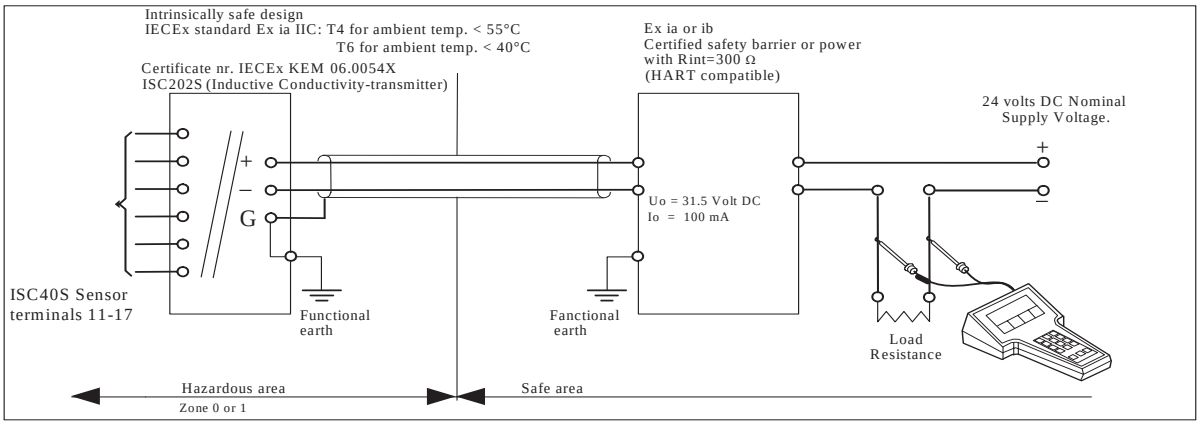
[Style: S3]

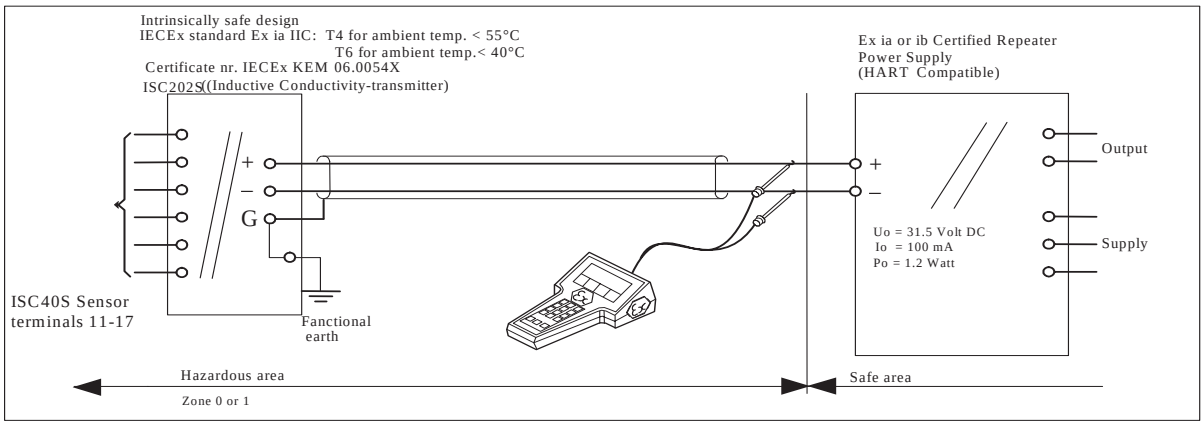
Model	Suffix Code		Option Code	Description
ISC202S	·····		·····	2-wire inductive conductivity transmitter
Type	-A		·····	Intrinsic mA with HART (ATEX, CSA, FM)
	-K		·····	Intrinsic mA with HART (NEPSI)
	-P		·····	Intrinsic safe Profibus (ATEX, CSA, FM)
	-F		·····	Intrinsic safe FF (ATEX, CSA, FM)
	-B		·····	Non incendive FF (ATEX, CSA, FM) (*2)
	-N		·····	Non incendive mA with HART (ATEX, CSA, FM) (*2)
	-D		·····	Non incendive Profibus (ATEX, CSA, FM) (*2)
Language		-J	·····	Japanese
		-E	·····	English
Option	Mounting Hardware		/U	Pipe, wall mounting bracket (Stainless steel)
			/PM	Panel Mounting bracket(Stainless steel)
	Hood		/H	Hood for sun protection (Carbon steel)
			/H2	Hood for sun protection (Stainless steel)
	Tag Plate		/SCT	Stainless steel tag plate
	Conduit Adapter		/AFTG	G1/2
			/ANSI	1/2NPT
			/X1	Epoxy baked finish (*1)

(*1) The housing is coated with epoxy resin.

(*2) When the instrument with Suffix Code "-B, -N, -D" is used, take measures so that the display window is not exposed to direct sunlight.

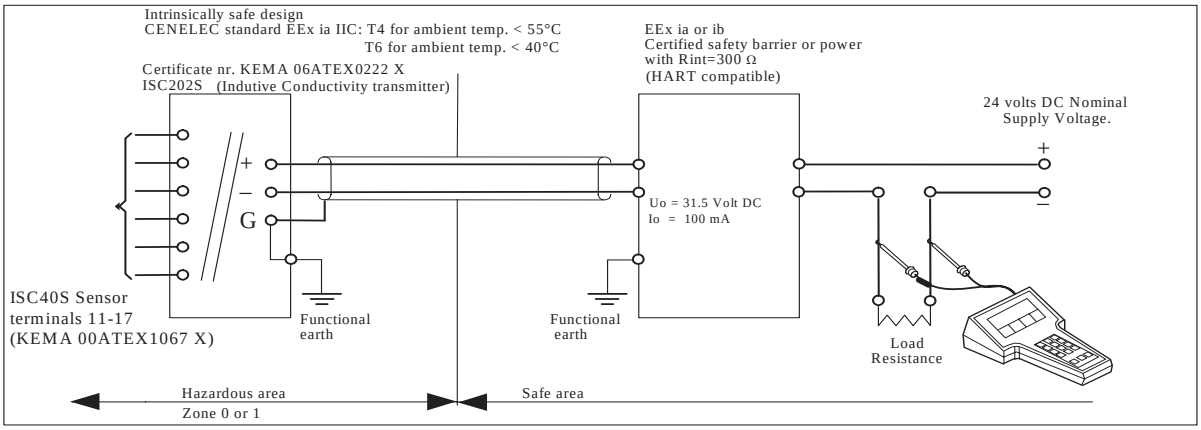
2-3. Control Drawing ISC202S mA HART® Specification (IECEx).

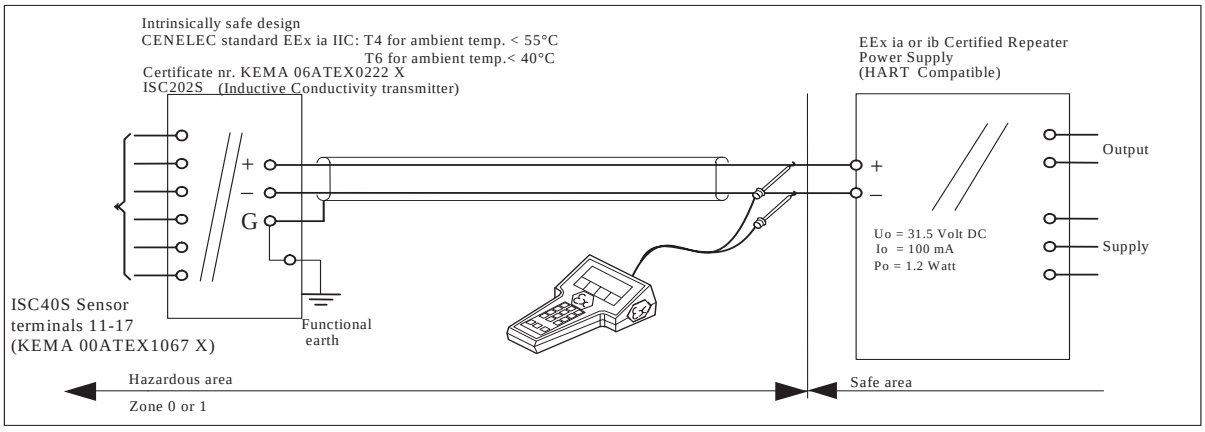




- Electrical data of the ISC202S.
  - Supply and output circuit (terminals + and -):
    Maximum input voltage U_i = 31.5 V. Maximum input current I_i = 100 mA.
    Maximum input power P_i = 1.2 W.
    Effective internal capacitance C_i = 22 nF.
    Effective internal inductance L_i = 35 µH.
  - Sensor input circuit (terminals 11 through 17):
    Maximum output voltage U_o = 14.4 V. Maximum output current I_o = 20 mA.
    Maximum allowed external capacitance C_o = 600 nF (for ISC202S-A),
    C_o = 3.5 µF (for ISC202S-N)
    Maximum allowed external inductance L_o = 88 mH (for ISC202S-A),
    L_o = 200mH (for ISC202S-N)
- Barriers and power supply specification must not exceed the maximum values as shown in the diagram above. These safety descriptions cover most of the commonly used industry standard barriers, isolators and power supplies.
- The Hand Held Communicator must be of a IECEx certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area or of a IECEx certified non-incendive type in case it is used in the non-incendive circuit in the hazardous area.

2-4. Control Drawing ISC202S mA HART® Specification (ATEX)





- Electrical data of the ISC202S.
  - Supply and output circuit (terminals + and -):
    Maximum input voltage U_i = 31.5 V. Maximum input current I_i = 100 mA.
    Maximum input power P_i = 1.2 W.
    Effective internal capacitance C_i = 22 nF.
    Effective internal inductance L_i = 35 μH.
  - Sensor input circuit (terminals 11 through 17):
    Maximum output voltage U_o = 14.4 V. Maximum output current I_o = 20 mA.
    Maximum allowed external capacitance C_o = 600 nF (for ISC202S-A),
    C_o = 3.5 μF (for ISC202S-N)
    Maximum allowed external inductance L_o = 88 mH (for ISC202S-A),
    L_o = 200mH (for ISC202S-N)
- Barriers and power supply specification must not exceed the maximum values as shown in the diagram above. These safety descriptions cover most of the commonly used industry standard barriers, isolators and power supplies.
- The Hand Held Communicator must be of a ATEX certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area or of a ATEX certified non-incendive type in case it is used in the non-incendive circuit in the hazardous area.

2-5. Control Drawing ISC202S mA HART® Specification (FM Intrinsically safe design)

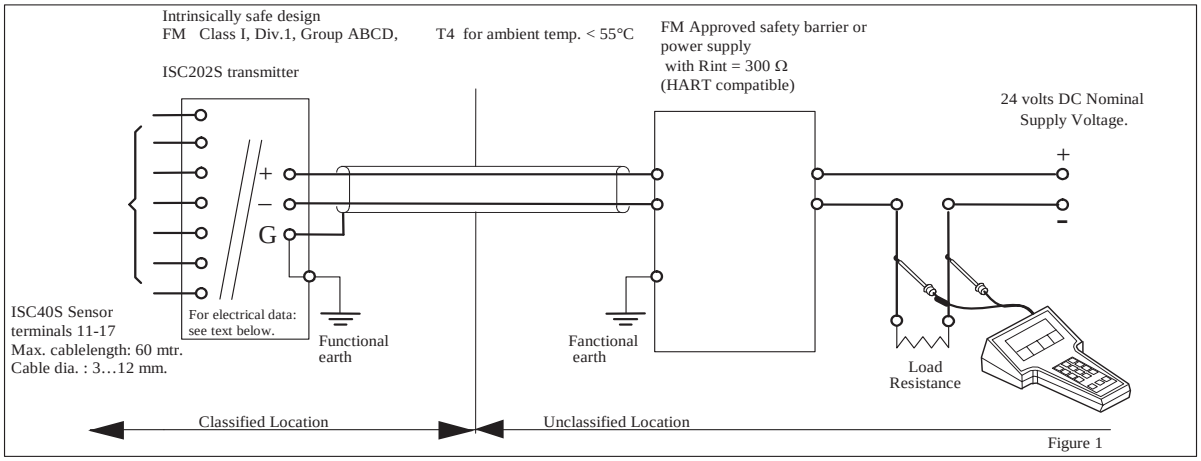


Figure 1

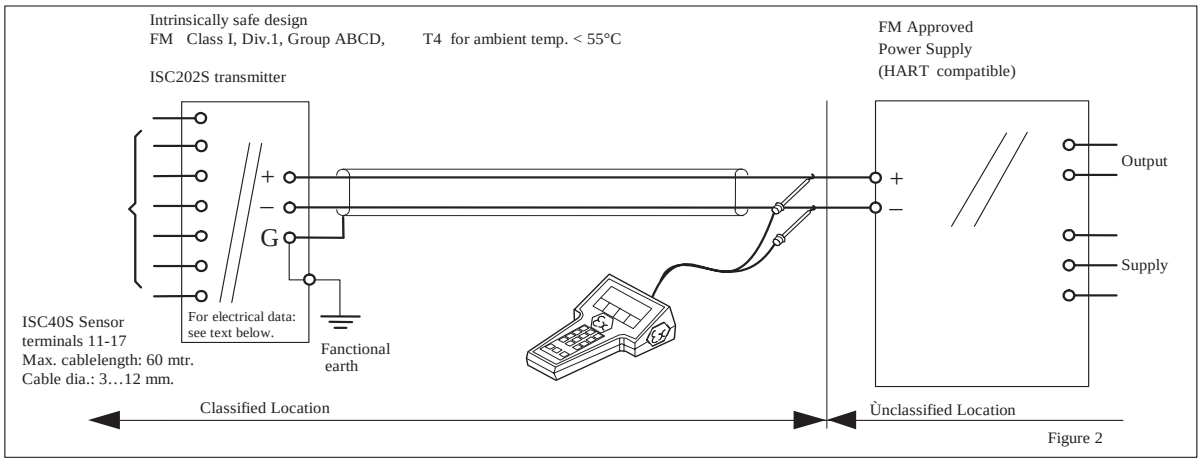


Figure 2

・Electrical data of the ISC202S.

- Supply circuit (terminals + and -):
  Maximum input voltage V_{max} = 31.5 V. Maximum input current I_{max} = 100 mA.
  Maximum input power P_{max} = 1.2 W.
  Effective internal capacitance C_i = 22 nF. Effective internal inductance L_i = 35 µH.
- Sensor input circuit (terminals 11 through 17):
  Maximum output voltage V_t = 14.4 V. Maximum output current I_t = 20 mA.
  Maximum allowed external capacitance C_a = 600 nF
  Maximum allowed external inductance L_a = 88 mH.

・If Hand Held Terminal (HHT) is not connected to the power supply lines of the ISC202S (see figure 1):
Any FM Approved barrier or power supply may be used that meets the following requirements.
V_{oc} or $V_t \leq$ 31.5 V; I_{sc} or $I_t \leq$ 100 mA; $C_a \geq$ 22nF + C_{cable} ; $L_a \geq$ 35µH + L_{cable}
If HHT is connected to the power supply lines of the ISC202S (see figure 2):
The Hand Held Terminal must be FM Approved. Refer to the manufacturers control drawing of the HHT and the barrier/power supply to determine the cable parameters.
(V_{oc} or V_t) + $V_{HHT} \leq$ 31.5 V; (I_{sc} or I_t) + $I_{HHT} \leq$ 100 mA;
$C_a \geq$ 22nF + C_{cable}+ C_{HHT} ; $L_a \geq$ 35µH + L_{cable}+ L_{HHT}
When installing this equipment, follow the manufacturer's installation drawing.
Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
Control equipment connected to the barrier/power supply must not use or generate more than 250 Vrms or Vdc.

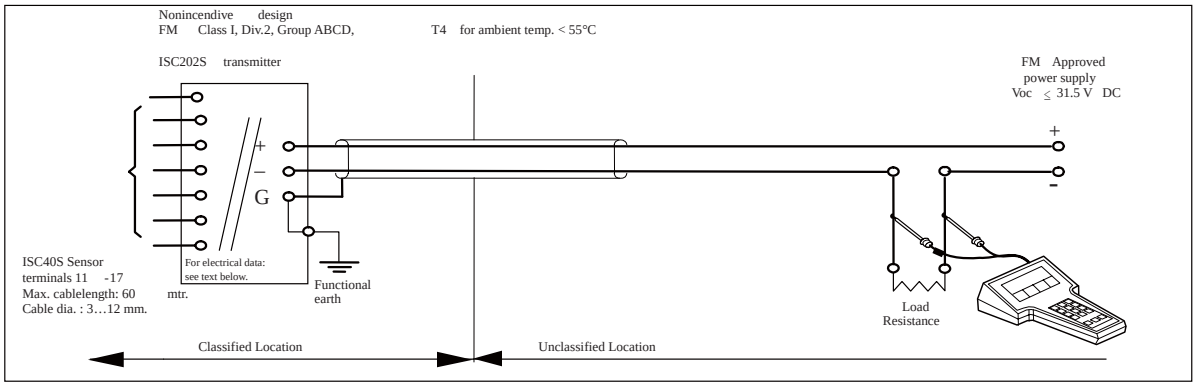
・Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.

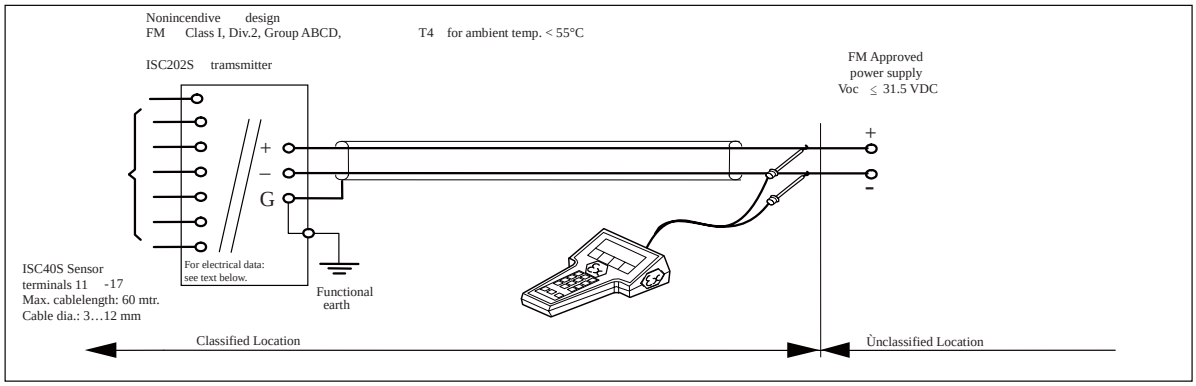
・In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING

- Substitution of components may impair Intrinsic Safety
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's'live maintenance procedures.

2-6. Control Drawing ISC202S mA HART® Specification (FM Non-incendive design)





・Electrical data of the ISC202S.

- Supply circuit (terminals + and -):

  Maximum input voltage V_{max} = 31.5 V. Maximum input power P_{max} = 1.2 W

  Effective internal capacitance Ci = 22 nF Effective internal inductance Li = 35 μH

- Sensor input circuit (terminals 11 through 17):

  Maximum output voltage V_t = 14.4 V. Maximum output current I_t = 20 mA.

  Maximum allowed external capacitance C_a = 2.25 μF.

  Maximum allowed external inductance L_a = 160 mH.

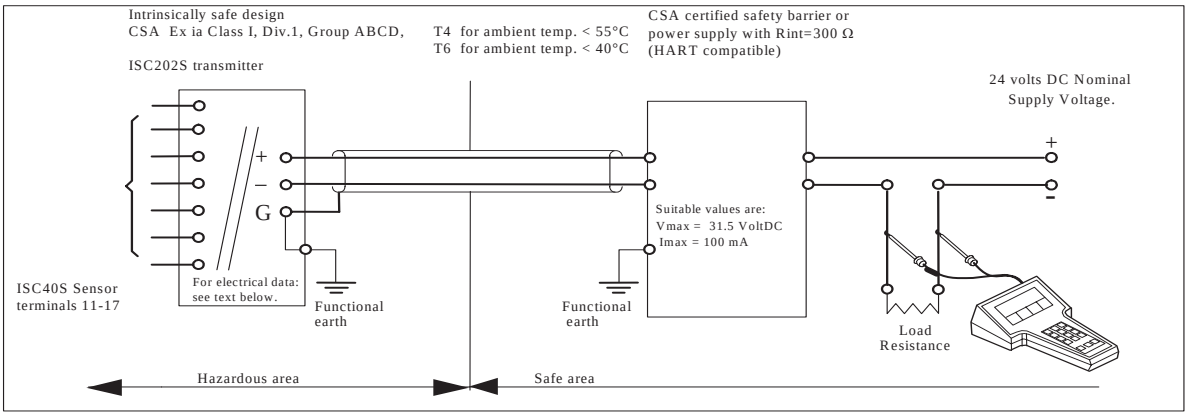
・The Hand Held Terminal must be FM Approved in case it is used in the classified location.
When installing this equipment, follow the manufacturers installation drawing.
Installation shall be in accordance with Article 501.4(B) of the National Electrical Code (ANSI/NFPA 79).
Non-incendive field wiring may be installed in accordance with Article 501 of the National Electrical Code.

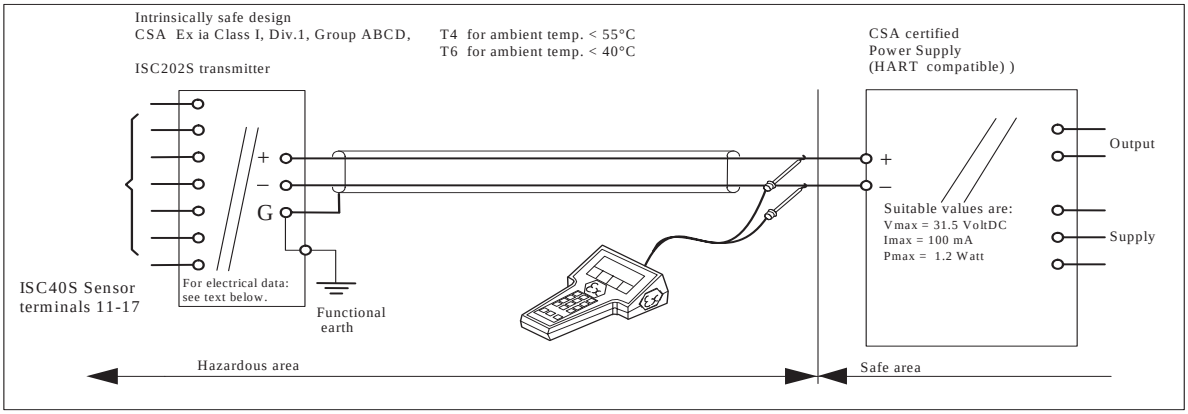
・Grounding shall be in accordance with Article 250 of the National Electrical code
・In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

Application Doc. No.: IKE028-A10 P.7 to P.8

2-7. Control Drawing of ISC202S mA HART® Specification (CSA)





Electrical data of the ISC202S.

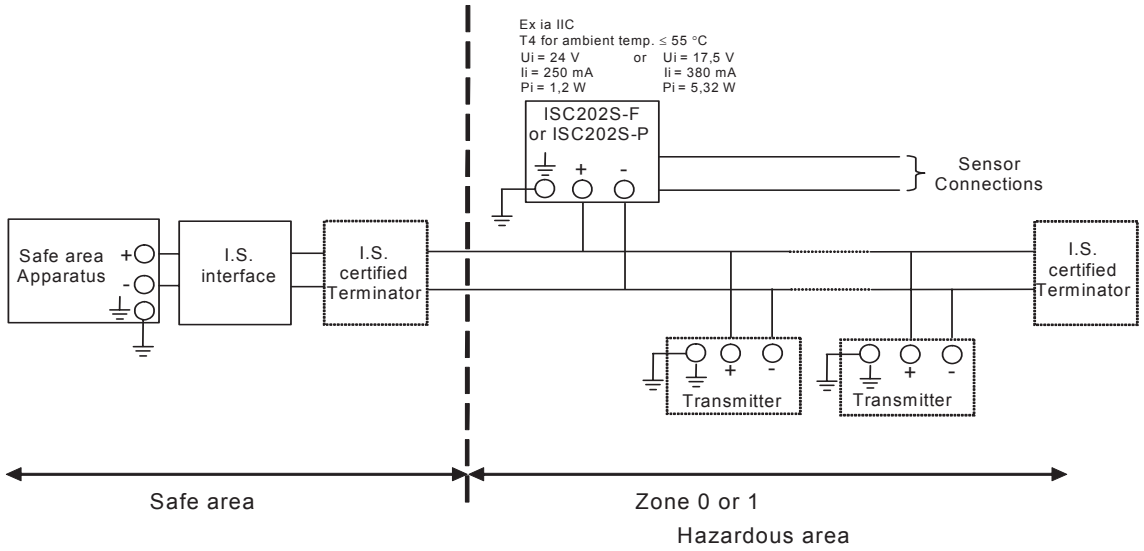
- Supply and output circuit (terminals + and -)
  Maximum input voltage V_{max} = 31.5 V. Maximum input current I_{max} = 100 mA.
  Maximum input power P_{max} = 1.2 W.
  Effective internal capacitance C_i = 22 nF. Effective internal inductance L_i = 35 µH.
- Sensor input circuit (terminals 11 through 17):
  Maximum output voltage V_{oc} = 14.4 V. Maximum output current I_{sc} = 20 mA.
  Maximum allowed external capacitance C_a = 600 nF.
  Maximum allowed external inductance L_a = 88 mH.

・Barriers and power supply should be CSA certified. The specifications must not exceed the maximum values as shown in the diagram above. Installation should be in accordance with Canadian Electrical Code, Part I.
Maximum safe area voltage should not exceed 250 V_{RMS}.

For Class I, Div. 2, Group ABCD the CSA certified barrier is not required, and the Sensor input circuit (terminals 11 through 17) is non-incendive having the parameters:
Maximum output voltage V_{oc} = 14.4 V.
Maximum output current I_{sc} = 20 mA.
Maximum allowed external capacitance C_a = 3.5µF.
Maximum allowed external inductance L_a = 200 mH.

・The Hand Held Communicator must be of a CSA certified intrinsically safe type in case it is used on the intrinsically safe circuit in the hazardous area, or of a CSA certified non-incendive type in case it is used on the non-incendive circuit in the hazardous area.

2-8. Control Drawing of ISC202S FF/PB Specification (IECEx)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.

- Electrical data of the ISC202S-F & ISC202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui = 24 V
    Maximum input current Ii = 250 mA
    Maximum input power Pi = 1.2 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.

  or

    FISCO field device
    Maximum input voltage Ui =17.5 V
    Maximum input current Ii =380 mA
    Maximum input power Pi =5.32 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.

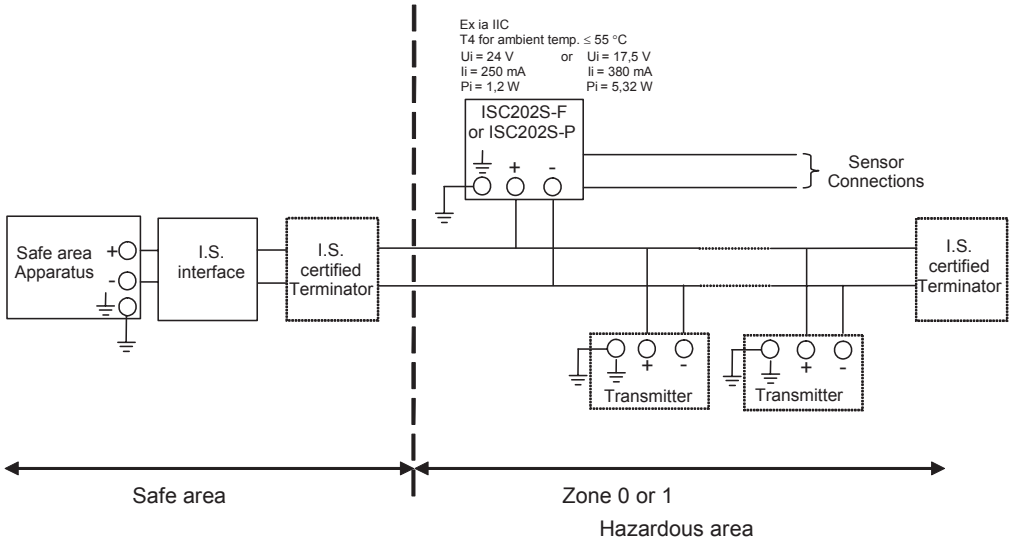
  - Sensor input circuit:
    Maximum output voltage Uo = 14.4 V; Maximum output current Io = 20 mA
    Maximum allowed external capacitance Co = 600 nF
    Maximum allowed external inductance Lo = 88 mH
- Any I.S. interface may be used that meets the following requirements:
    Uo ≤ 24 V
    Io ≤ 250 mA
    Po ≤ 1.2 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  or

    FISCO power supply
    Uo ≤ 17.5 V
    Io ≤ 380mA
    Po ≤ 5.32 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

- Electrical data of the ISC202S-B & ISC202S-D (Type of protection “n”)
  - Supply and output circuit:
    Maximum input voltage Ui = 32 V
    Effective internal capacitance Ci = 220 pF; Effective internal inductance Li = 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo = 14.4 V; Maximum output current Io = 20 mA
    Maximum allowed external capacitance Co = 3.5 µF
    Maximum allowed external inductance Lo = 200 mH

2-9. Control Drawing of ISC202S FF/PB Specification (ATEX)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus'.

- Electrical data of the ISC202S-F & ISC202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui =24 V
    Maximum input current Ii =250 mA
    Maximum input power Pi =1.2 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.

  or

    FISCO field device
    Maximum input voltage Ui = 17.5 V
    Maximum input current Ii = 380 mA
    Maximum input power Pi = 5.32 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.

  - Sensor input circuit:
    Maximum output voltage Uo = 14.4V; Maximum output current Io = 20 mA
    Maximum allowed external capacitance Co = 600 nF
    Maximum allowed external inductance Lo = 88 mH

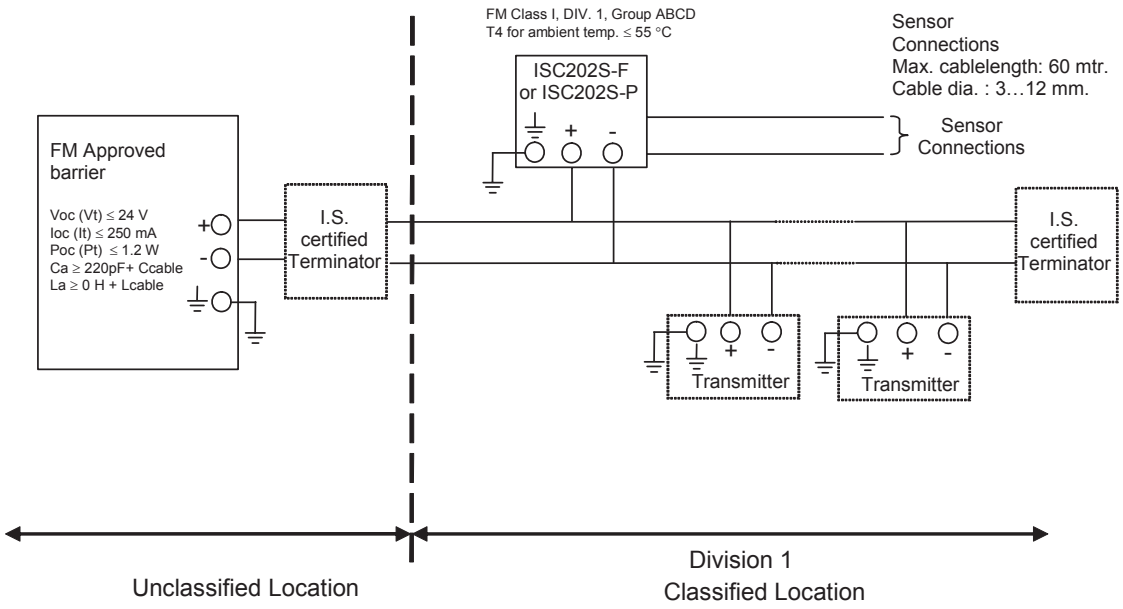
- Any I.S. interface may be used that meets the following requirements:
    Uo ≤ 24 V
    Io ≤ 250 mA
    Po ≤ 1.2 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  or

    FISCO power supply
    Uo ≤ 17.5 V
    Io ≤ 380 mA
    Po ≤ 5.32 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

- Electrical data of the ISC202S-B & ISC202S-D (Type of protection “n”)
  - Supply and output circuit:
    Maximum input voltage Ui = 32 V
    Effective internal capacitance Ci = 220 pF; Effective internal inductance Li = 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo= 14.4 V; Maximum output current Io = 20 mA
    Maximum allowed external capacitance Co = 3.5 µF
    Maximum allowed external inductance Lo = 200 mH

2-10. Control Drawing of ISC202S FF/PB Specification (FM Intrinsically safe Entity)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 μJ, or are FM Approvals entity approved and meet connection requirements.

- Electrical data of the ISC202S-F & ISC202S-P:
  - Supply circuit:
    Maximum input voltage Vmax = 24 V
    Maximum input current Imax = 250 mA
    Maximum input power Pi = 1.2 W
    Effective internal capacitance Ci = 220 pF; Effective internal inductance Li = 0 μH.
  - Sensor input circuit:
    Maximum output voltage Vt = 14.4 V; Maximum output current It = 20 mA
    Maximum allowed external capacitance Ca = 600 nF
    Maximum allowed external inductance La = 88 mH

- Any FM Approved barrier may be used that meets the following requirements:
  Voc or Vt ≤ 24 V
  Ioc or It ≤ 250 mA
  Poc or Pt ≤ 1.2 W
  Ca ≥ 220 pF + Ccable; La ≥ 0 μH + Lcable

  When installing this equipment, follow the manufacturer's installation drawing.
  Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
  Associated apparatus connected to the barrier must not use or generate more than 250 Vrms or Vdc.

- Resistance between Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

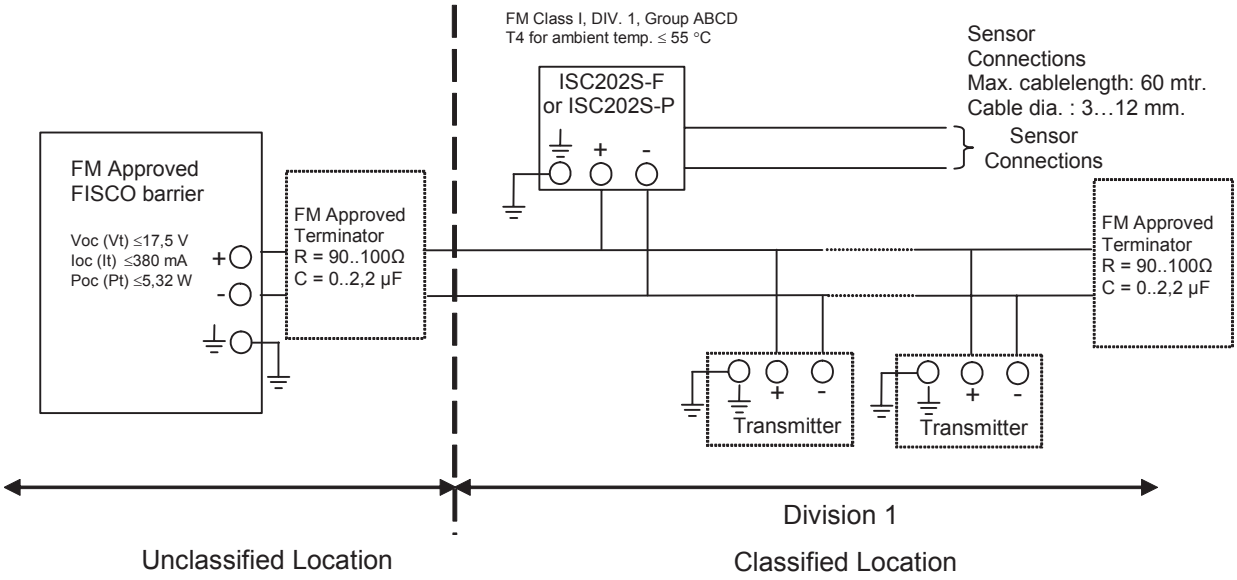
  WARNING
  - Substitution of components may impair Intrinsic Safety
  - To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

- The cable used to interconnect the devices needs to comply with the following parameters:
  Loop resistance R': 15 ... 150 Ω/km; Inductance per unit length L': 0,4 ... 1 mH/km
  Capacitance per unit length C': 80 ... 200 nF/km
  (C' = C' line/line + 0,5 C' line/screen if both line are floating)
  (C' = C' line/line + C' line/screen if the screen is connected to one line)
  Length of spur cable: max. 30 m
  Length of trunk cable: max. 1 km
  Length of splice : max. 1 m

  WARNING
  - Substitution of components may impair Intrinsic Safety
  - To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

Application Doc. No.: IKE029-A10 P.5 to P.6

2-11. Control Drawing of ISC202S FF/PB Specification (FM Intrinsically safe FISCO)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 µJ, or are FM Approvals entity approved and meet connection requirements.

- Electrical data of the ISC202S-F & ISC202S-P:
  - Supply circuit: Vmax = 17.5 V; Imax = 380 mA; Pi = 5.32 W; Ci = 220 pF; Li = 0 µH.
  - Sensor input circuit: Vt = 14.4 V; It = 20 mA; Ca = 600 nF; La = 88 mH

- Any FM Approved FISCO barrier may be used that meets the following requirements:
  Voc or Vt ≤ 17.5 V; Ioc or It ≤ 380 mA; Poc or Pt ≤ 5.32 W
  When installing this equipment, follow the manufacturer's installation drawing.
  Installation should be in accordance with ANSI/ISA RP 12.06.01 "Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations" and the National Electrical Code (ANSI/NFPA 70).
  Associated apparatus connected to the FISCO barrier must not use or generate more than 250 Vrms or Vdc.

- Resistance between FISCO Intrinsically Safe Ground and earth ground must be less than 1.0 Ohm.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

- The FISCO concept allows the interconnection of several I.S. apparatus not specifically examined in such combination. The criterion for such interconnection is that the voltage (Vmax), the current (Imax) and the power (Pi) which I.S. apparatus can receive and remain intrinsically safe, considering faults, must be equal to or greater that the voltage (Voc, Vt), the current (Ioc, It) and the power (Poc, Pt) which can be provided by the FM approved FISCO barrier. In addition, the maximum unprotected residual capacitance (Ci) and inductance (Li) of each apparatus (other than the terminator) connected to the Fieldbus must be less than or equal to 5nF and 10 µH respectively.

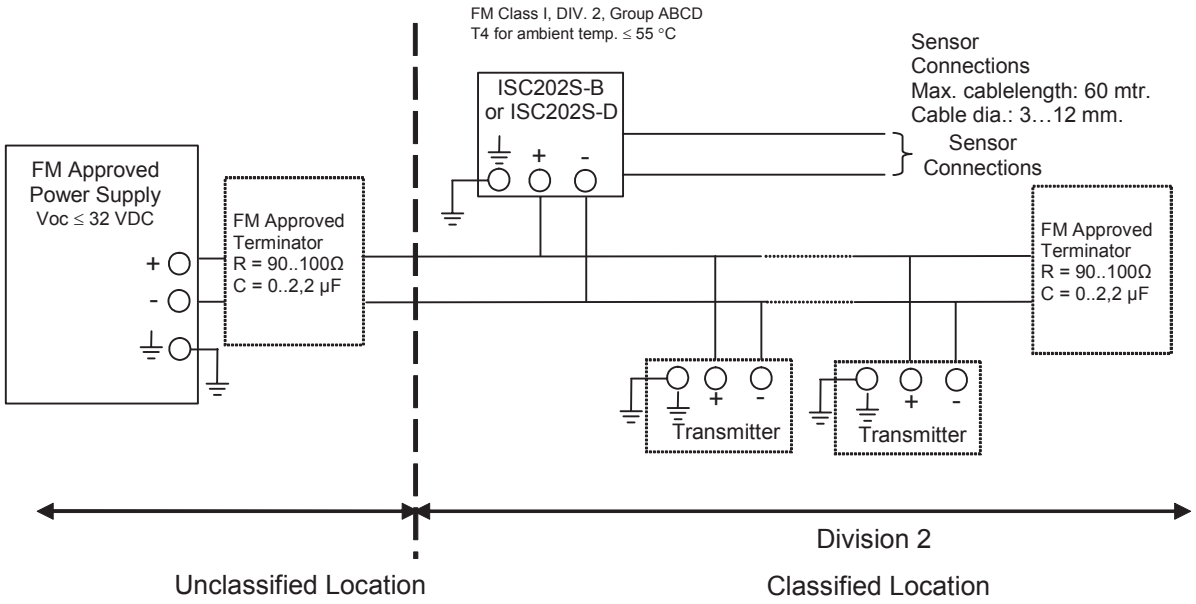
- In each I.S. Fieldbus segment only one active source, normally the FM Approved FISCO barrier, is allowed to provide the necessary power for the Fieldbus system. All other equipment connected to the bus cable has to be passive (not providing energy to the system), except to a leakage current of 50μA for each connected device. Seperately powered equipment needs a galvanic isolation to insure that the I.S. Fieldbus circuit remains passive.

- The cable used to interconnect the devices needs to comply with the following parameters:
  Loop resistance R': 15 ... 150 Ω/km; Inductance per unit length L': 0.4 ... 1 mH/km
  Capacitance per unit length C': 80 ... 200 nF/km
  (C' = C' line/line + 0,5 C' line/screen if both line are floating)
  (C' = C' line/line + C' line/screen if the screen is connected to one line)
  Length of spur cable: max. 30 m
  Length of trunk cable: max. 1 km
  Length of splice : max. 1 m

WARNING
- Substitution of components may impair Intrinsic Safety
- To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing or read, understand and adhere to the manufacturer's live maintenance procedures.

Application Doc. No.: IKE029-A10 P.7 to P.8

2-12. Control Drawing of ISC202S FF/PB Specification (FM Non-incendive Entity)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 µJ, or are FM Approvals entity approved and meet connection requirements.

- Electrical data of the ISC202S-B & ISC202S-D:
  - Supply circuit: Vmax = 32 V; Pi = 1.2 W; Ci = 220 pF; Li = 0 µH
  - Sensor input circuit: Vt = 14.4 V; It = 20 mA; Ca = 2.25 µF; La = 160 mH

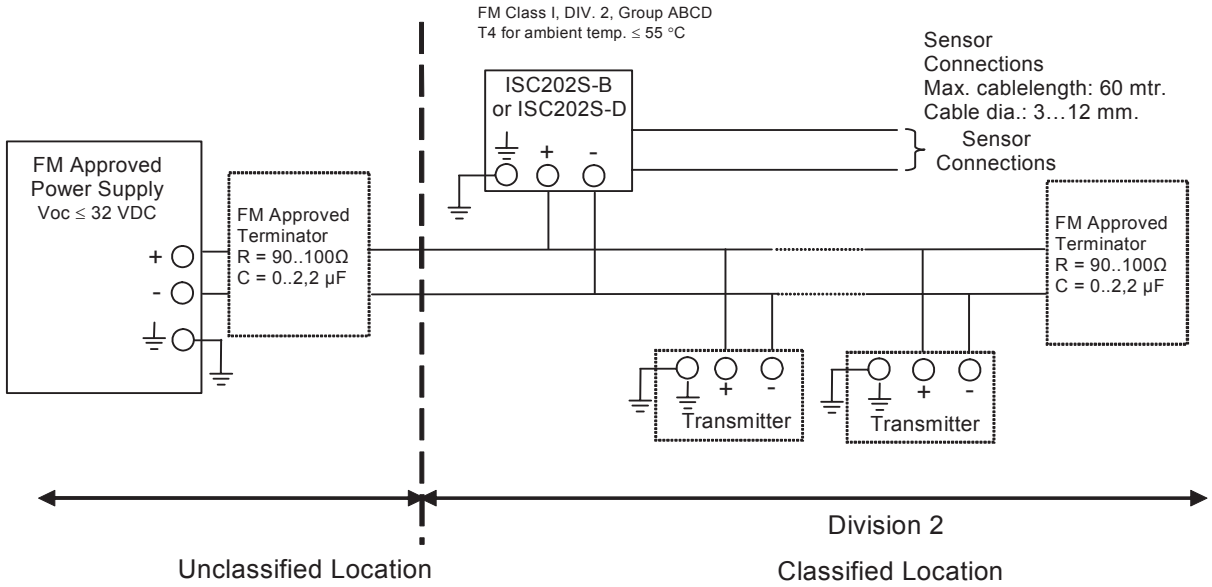
  When installing this equipment, follow the manufacturers installation drawing.
  Installation shall be in accordance with Article 501.4(B) of the National Electrical Code (ANSI/NFPA 79). Nonincendive field wiring may be installed in accordance with Article 501.4(B)(3)

- Grounding shall be in accordance with Article 250 of the National Electrical code.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2.
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

Application Doc. No.: IKE029-A10 P.9

2-13. Control Drawing of ISC202S FF/PB Specification (FM Non-incendive FNICO)



- Sensor(s) are of a passive type to be regarded as 'simple apparatus', devices which neither store nor generate voltages over 1.5 V, currents over 0.1 A, power over 25 mW or energy over 20 µJ, or are FM Approvals entity approved and meet connection requirements.

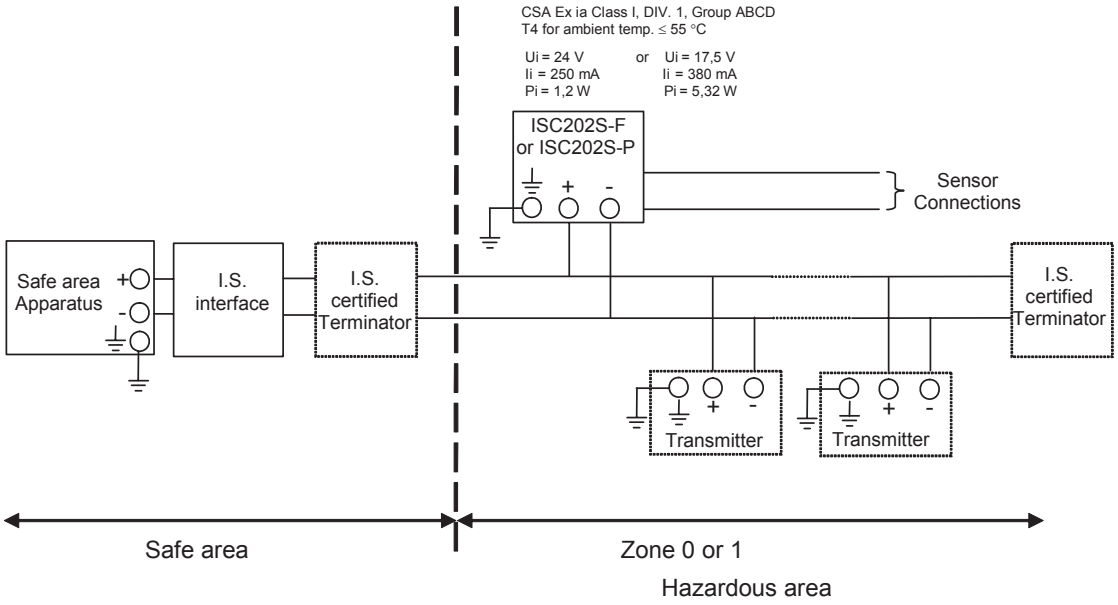
- Electrical data of the ISC202S-B & ISC202S-D:
  - Supply circuit: Vmax = 32 V; Pi = 5.32 W; Ci = 220 pF; Li = 0 µH
  - Sensor input circuit: Vt = 14.4 V; It = 20 mA; Ca = 2.25 µF; La = 160 mH

  When installing this equipment, follow the manufacturers installation drawing.
  Installation shall be in accordance with Article 501.4(B) of the National Electrical Code (ANSI/NFPA 79).
  Non-incendive field wiring may be installed in accordance with Article 501.4(B)(3)
- Grounding shall be in accordance with Article 250 of the National Electrical code.
- In case of using cable glands in Outdoor location, they shall be UV rated or made of metal.

WARNING
- Substitution of components may impair suitability for Division 2.
- Do not remove or replace while circuit is live unless area is know to be non-hazardous
- Explosion Hazard – Do not disconnect equipment unless area is know to be non-hazardous
- Do not reset circuit breaker unless power has been removed from the equipment or the area is know to be non-hazardous

Application Doc. No.: IKE029-A10 P.10

2-14. Control Drawing of ISC202S FF/PB Specification (CSA)



- Sensor(s) are a thermocouple, RTD's, passive resistive switch devices, or is CSA entity approved and meet connection requirements.
- Electrical data of the ISC202S-F & ISC202S-P:
  - Supply and output circuit:
    Maximum input voltage Ui = 24 V
    Maximum input current Ii = 250 mA
    Maximum input power Pi = 1.2 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.

  or

    FISCO field device
    Maximum input voltage Ui = 17.5 V
    Maximum input current Ii = 380 mA
    Maximum input power Pi = 5.32 W
    Effective internal capacitance Ci = 220 pF;
    Effective internal inductance Li = 0 µH.
  - Sensor input circuit:
    Maximum output voltage Uo = 14.4V; Maximum output current Io = 20 mA
    Maximum allowed external capacitance Co = 600 nF
    Maximum allowed external inductance Lo = 88 mH
- Any CSA approved I.S. interface may be used that meets the following requirements:
    Uo ≤ 24 V
    Io ≤ 250 mA
    Po ≤ 1.2 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  or

    FISCO field device
    Uo ≤ 17.5 V
    Io ≤ 380 mA
    Po ≤ 5.32 W
    Co ≥ 220 pF + Ccable; Lo ≥ 0 µH + Lcable

  Installation should be in accordance with Canadian Electrical Code, Part I or CEC, Part I.
  Maximum safe area voltage should not exceed 250 Vrms.

- Electrical data of the ISC202S-B & ISC202S-D (non-incendive):
  For Class I, Div.2, Group ABCD the CSA approved I.S. interface is not required, and the sensor input circuit is non-incendive having the parameters:
    Maximum output voltage Uo = 14.4 V; Maximum output current Io = 20 mA
    Maximum allowed external capacitance Co = 3.5 µF
    Maximum allowed external inductance Lo = 200 mH

3. INSTALLATION AND WIRING

3-1. Installation and dimensions

3-1-1. Installation site

The EXA transmitter is weatherproof and can be installed inside or outside. It should, however, be installed as close as possible to the sensor to avoid long cable runs between sensor and transmitter. In any case, the cable length should not exceed 60 mtr (200 feet). Select an installation site where:

- Mechanical vibrations and shocks are negligible
- No relay/power switches are in the direct environment
- Access is possible to the cable glands (see figure 3-1)
- The transmitter is not mounted in direct sunlight or severe weather conditions
  When the instrument with Suffix Code "-B,-N,-D" is used, take measures so that the display window is not exposed to direct sunlight.
- Maintenance procedures are possible (avoiding corrosive environments)

The ambient temperature and humidity of the installation environment must be within the limits of the instrument specifications. (See section 2).

3-1-2. Mounting methods

Refer to figures 3-2 and 3-3. Note that the EXA transmitter has universal mounting capabilities:

- Panel mounting using optinal bracket, refer to Fig. 3-2a.
- Panel mounting using two (2) self-tapping screws, refer to Fig. 3-2b.
- Surface mounting on a plate (using bolts from the back).
- Wall mounting on a bracket (for example, on a solid wall).
- Pipe mounting using a bracket on a horizontal or vertical pipe (nominal pipe diameter JIS 50A).

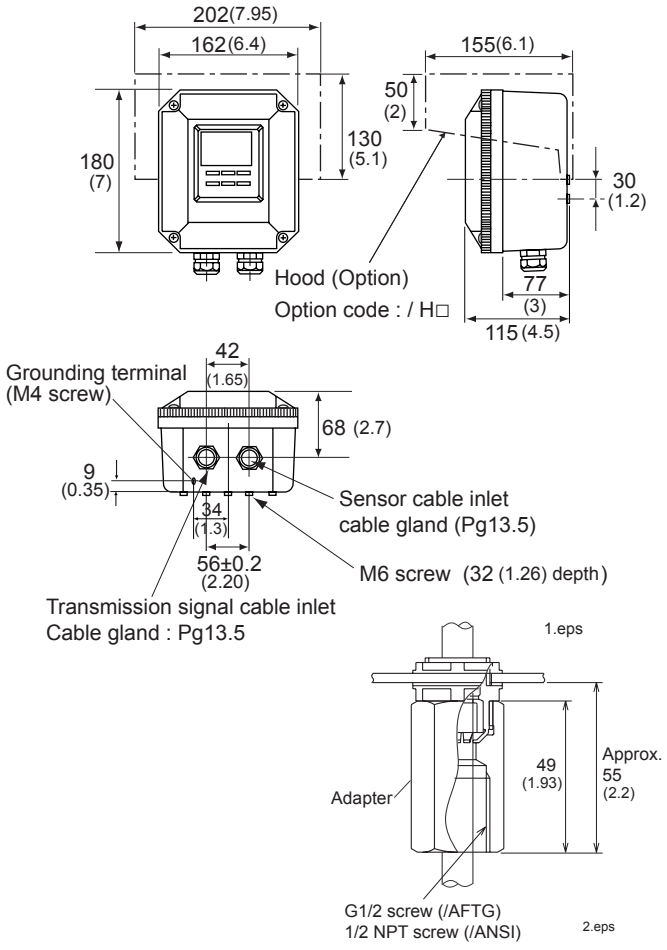


Fig. 3-1. Housing dimensions and layout of glands

Unit: mm (inch)

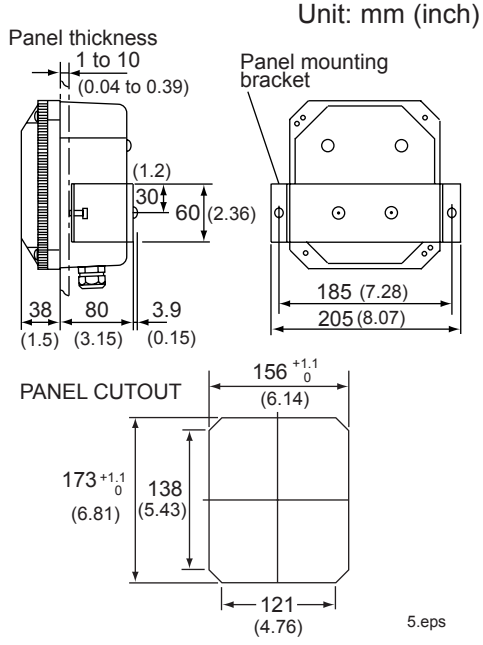


Fig. 3-2a. Panel mounting diagram

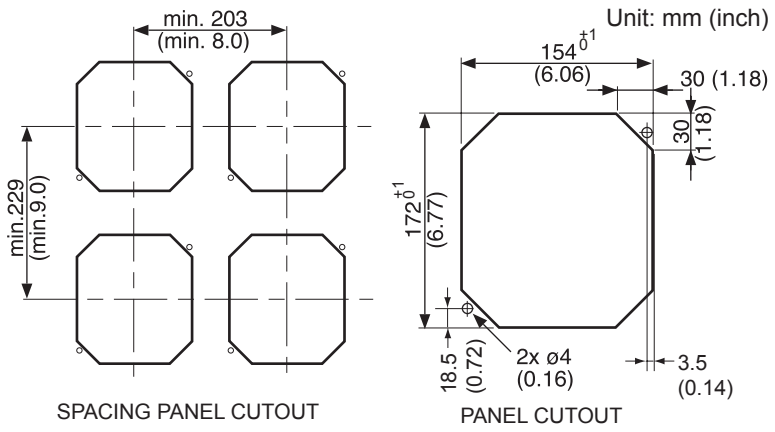


Fig. 3-2b. Panel mounting using two (2) self-tapping screws

Unit: mm (inch)

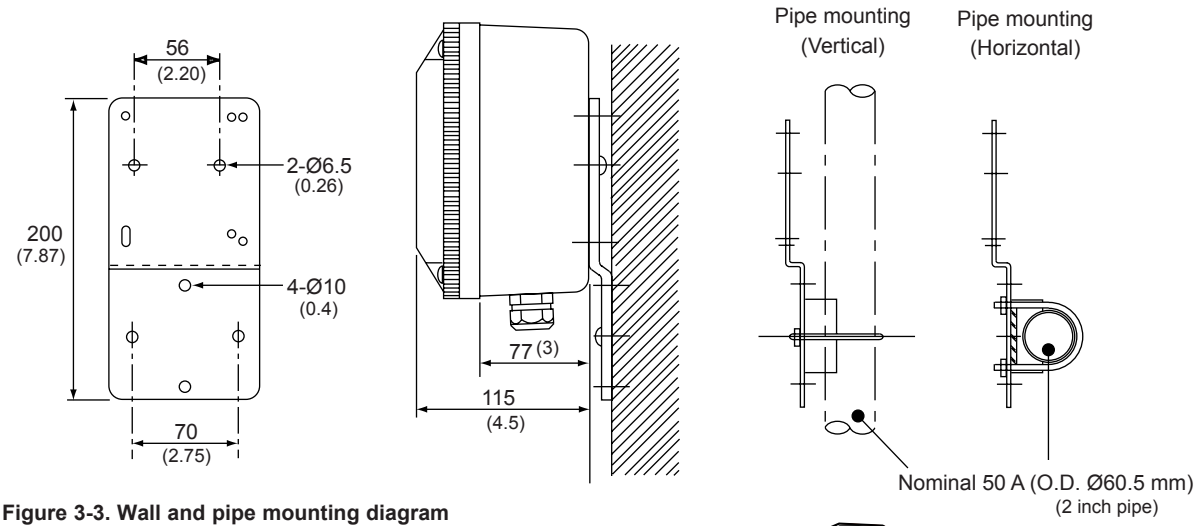


Figure 3-3. Wall and pipe mounting diagram

Figure 3-4. Internal view of EXA wiring compartment

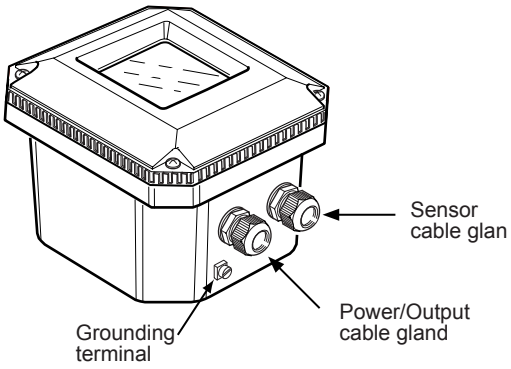


Figure 3-5. Glands to be used for cabling

mA

3-2. Preparation

The power/output connections and the sensor connections should be made in accordance with figure 3-5. The terminals are of a plug in style for ease of mounting.

To open the EXA for wiring:

1. Loosen the four frontplate screws and remove the cover.
2. The terminal strip is now visible.
3. Connect the power supply. Use the gland on the left for this cable.
4. Connect the sensor input, using the gland on the right (see fig. 3-5). Switch on the power. Commission the instrument as required or use the default settings.
5. Replace the cover and secure frontplate with the four screws.
6. Connect the grounding terminals to protective earth.
7. The optional hose connection is used to guide the cables coming from an immersion fitting through a protective plastic tubing to the transmitter.

Note that the sensor shall have a dielectric strength of 500 Vac with respect to earth and the interconnecting circuit to the transmitter shall be installed in such a way that mechanical damage is avoided.

3-2-1. Cables, terminals and glands

The EXA is equipped with terminals suitable for the connection of finished cables in the size range: 0.13

to 2.5 mm (26 to 14 AWG). The glands will form a tight seal on cables with an outside diameter in the range of 6 to 12 mm (0.24 to 0.47 inches).

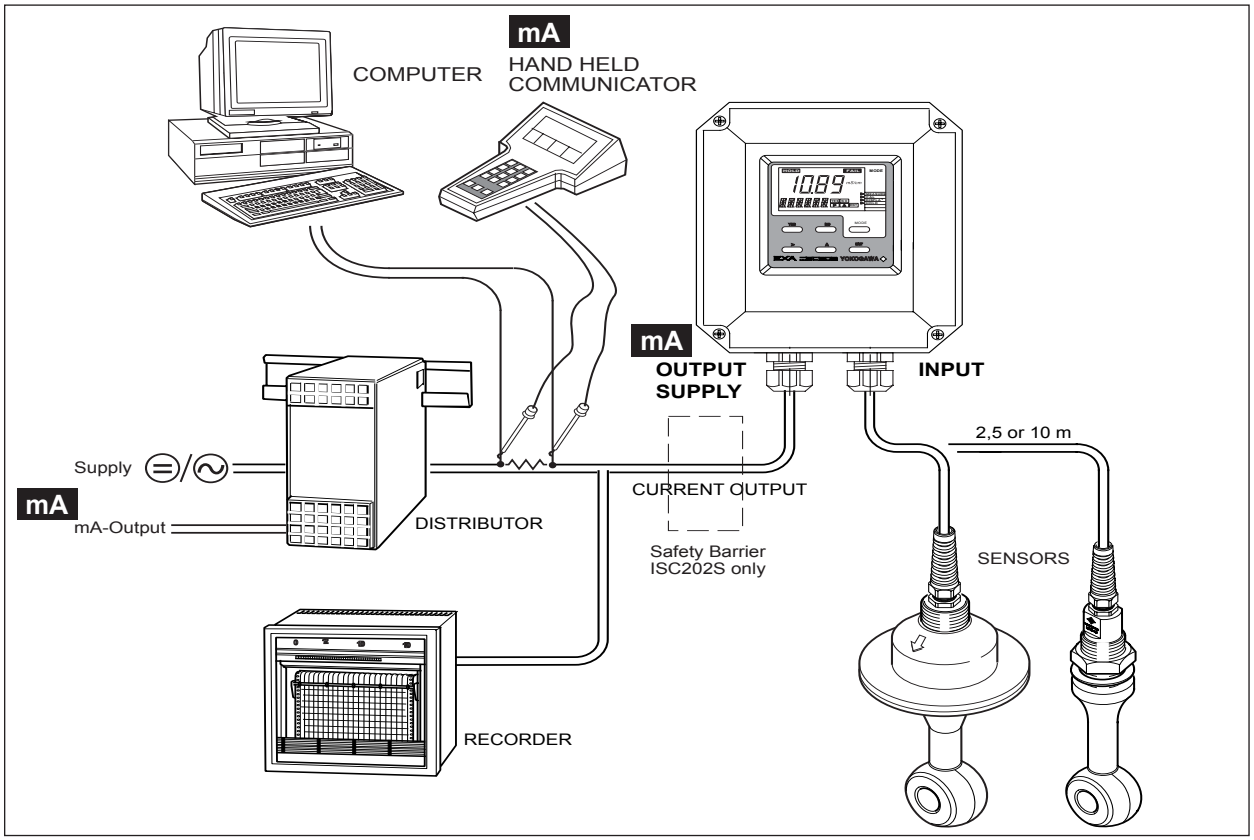


Figure 3-6. System configuration

3-3. Wiring of sensors

3-3-1. General precautions

Generally, transmission of signals from Inductive Conductivity sensors is at a low voltage and current level. Thus a lot of care must be taken to avoid interference. Before connecting sensor cables to the transmitter make sure that the following conditions are met:

- the sensor cables are not mounted in tracks together with high voltage and or power switching cables.
- only standard sensor cables or extension cable are used.
- the transmitter is mounted within the distance of the sensor cables (max. 10 m) + up to 50 m WF10 extension cable.
- the setup is kept flexible for easy insertion and retraction of the sensors in the fitting.

3-3-2. Additional precautions for installations in hazardous areas

Make sure that the total of capacitance and inductances connected to the input terminals of the EXA ISC202S do not exceed the limits given in the certificate.
This sets a limit to the cable and extensions used.

- The intrinsic safe version of the ISC202S instrument can be mounted in Zone 0 or 1 (ISC202S-B, -N, -D).
- The sensor can be installed in Zone 0 or Zone 1 if a safety barrier according to the limits given in the system certificate is used.
- Ensure that the total of capacitance and inductances connected to the terminals of the EXA ISC202S do not exceed the limits given in the certificate of the safety barrier or distributor.
- The cable used should preferably have a BLUE colour or marking on the outside.
- Installation for (sensors in Zone 0 or 1):
- Generally, the distributor with input/output isolation has no external earth connection. If there is an earth connection on the distributor and the external connection of the transmitter is connected to “protective” earth, the shield of the 2-wire cable may NOT be connected to “protective” earth at the distributor too.

3-3-3. Installation in: Hazardous Area-Non-Incendive

The EXA ISC202S-N may be installed in a Category 3/ Zone 2/ Div.2 area without the use of safety barriers. Maximum permissible supply voltage 31.5V.

3-4 Wiring of the power supply

3-4-1 General precautions

⚠ WARNING

First make sure that the DC-power supply is according the specifications given.

DO NOT USE ALTERNATING CURRENT OR MAINS POWER SUPPLY! !

The cable leading to the distributor (power supply) or safety barrier transports power to an output signal from the transmitter. Use a two conductor shielded cable with a size of at least 1.25 mm^2 and an outside diameter of 6 to 12 mm. The cable gland supplied with the instrument accepts these diameters. The maximum length of the cable is 2000 mtr, or 1500 mtr when using the communications. This ensures the minimum operating voltage for the instrument.

Grounding:
- If the transmitter is mounted on a grounded surface (e.g. a metal frame fixed in the soil) the shield of the 2-wire cable may NOT be connected to ground at the distributor.
- If the transmitter is mounted on a non-conducting surface (e.g. a brick wall) it is recommended to ground the shield of the 2-wire cable at the distributor end.

3-4-2. Connection of the power supply

The terminal strip is accessed as was described in 3-2-1. Use the left-hand gland to insert the supply/ output cable to the transmitter. Connect the supply to the terminals marked +, - and G as is indicated in figures 3-8.

3-4-3. Switching the instrument on

After all connections are made and checked, the power can be switched on from the distributor. Observe the correct activation of the instrument at the display. If for any reason the display does not indicate a value, consult the trouble shooting section.

3-5. Sensor wiring

Refer to figure 3-7, which includes drawings that outline sensor wiring.

To connect the sensors, simply match the terminal numbers in the instrument with the identification numbers on the cable ends.

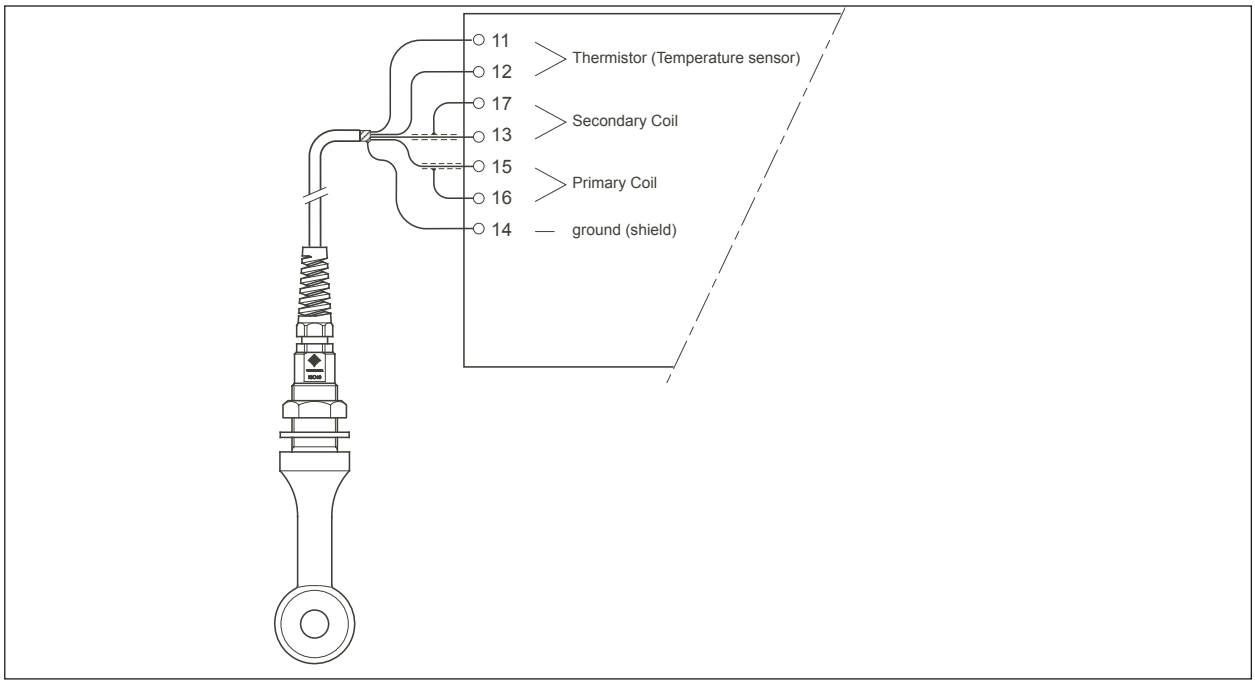


Figure 3-7. Sensor wiring diagrams

3-6. Other sensor systems

To connect other sensor systems, follow the general pattern of the terminal connections as listed below:

11 and 12 : Always used for temperature compensation resistor input.
13 and 17 : Used for the secondary ‘collector’ coil.
15 and 16 : Used for the primary ‘drive’ coil.
14 : Overall screen

Figure 3-8. Terminal identification label

3-6-1. Sensor cable connections using junction box (BA10) and extension cable (WF10)

Where a convenient installation is not possible using the standard cables between sensors and transmitter, a junction box and extension cable may be used. The Yokogawa BA10 junction box and the WF10 extension cable should be used. These items are manufactured to a very high standard and are necessary to ensure that the specifications of the system are not compromised. The total cable length should not exceed 60 mtr (e.g. 5 m fixed cable and 55 m extension cable).

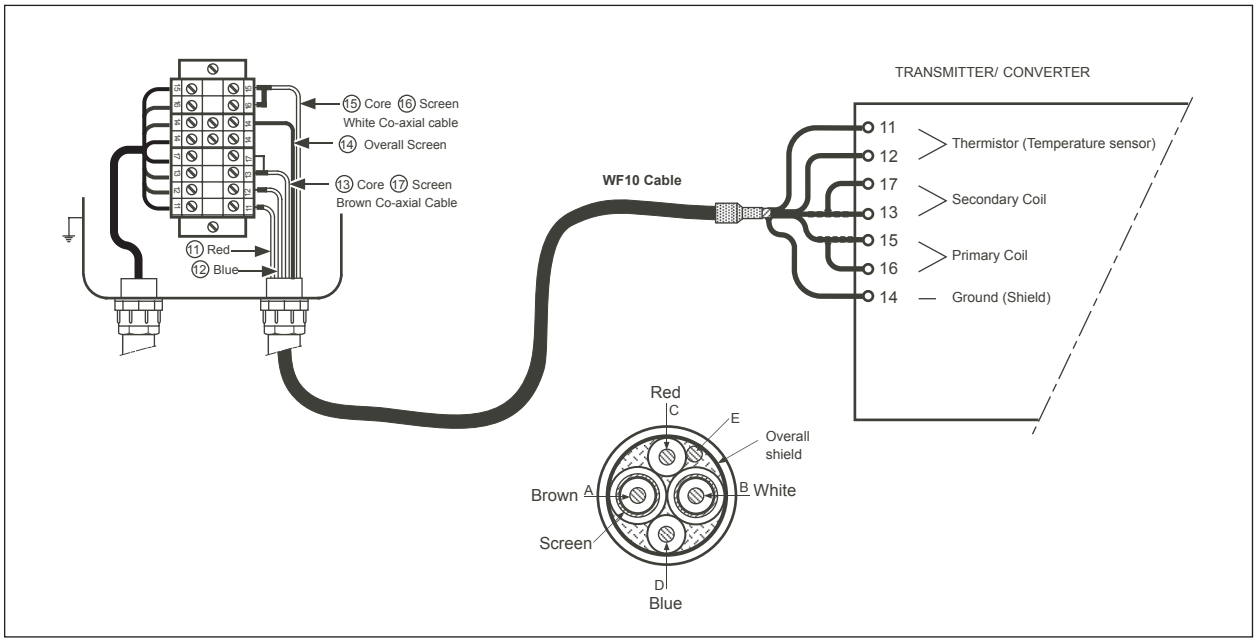
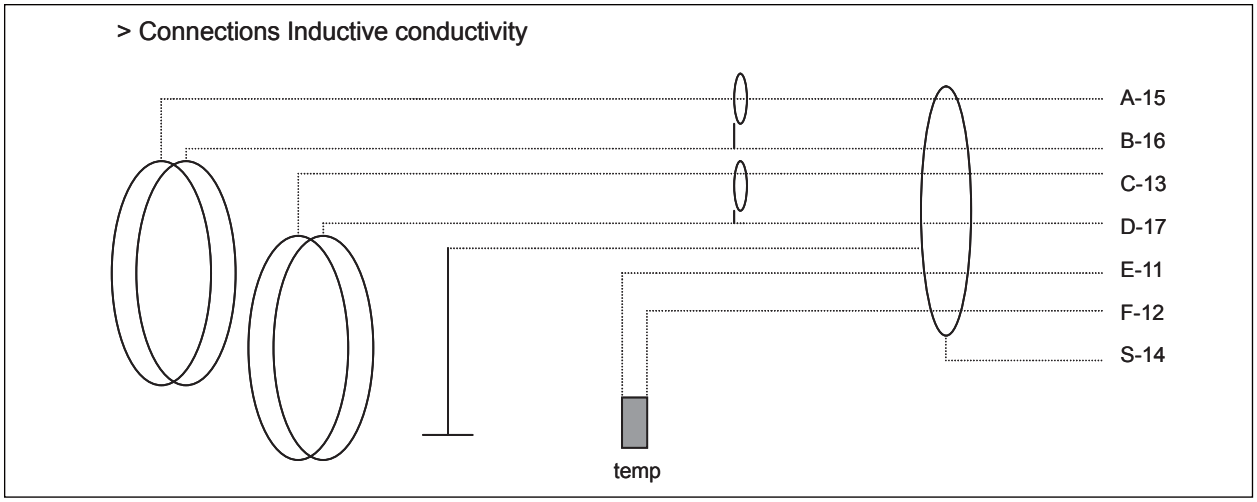


Fig. 3-9. Connection of WF10 extension cable and BA10/BP10 junction box



Extension cable may be purchased in bulk quantities, cut to length. Then it is necessary to terminate the cable as shown below.

Termination procedure for WF10 cable.
1. Slide 3 cm of heat shrink tube (9 x 1.5) over the cable end to be terminated.
2. Strip 9 cm of the outer (black) insulating material, taking care not to cut or damage internal cores.

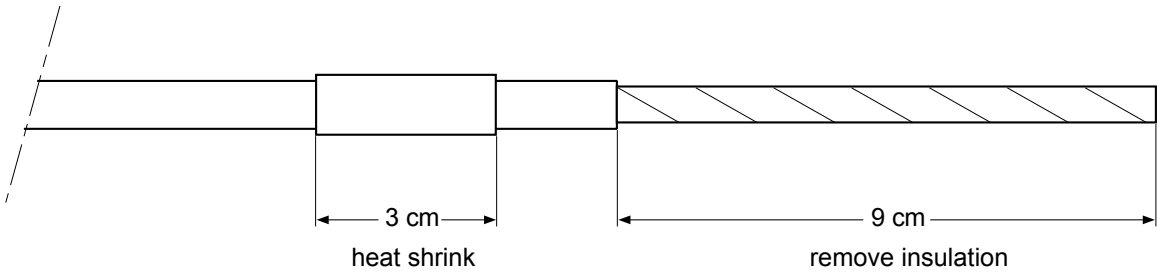


Fig. 3-10-1.

3. Remove loose copper screening, and cut off the cotton packing threads as short as possible.
4. Strip insulation from the last 3 cm of the brown, and the white coaxial cores.

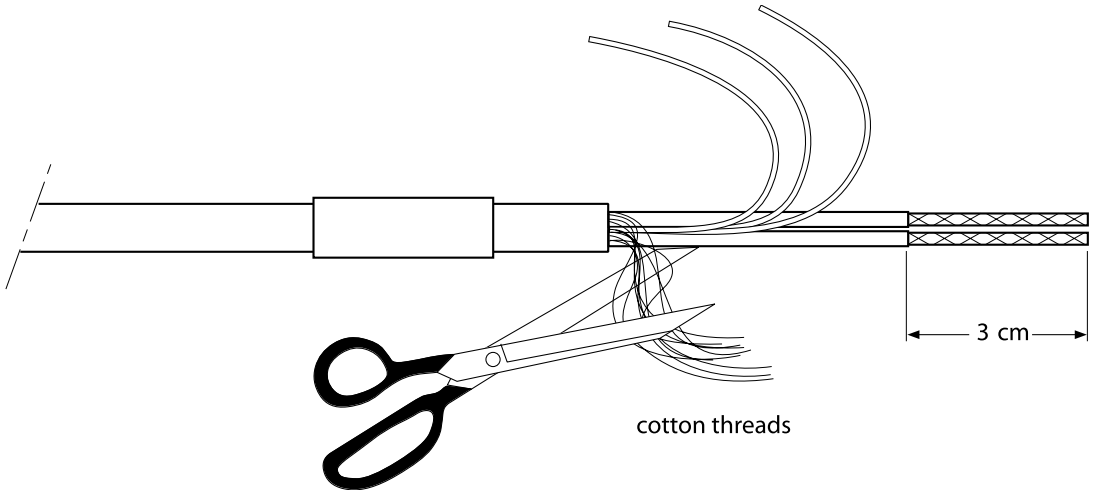


Fig. 3-10-2.

5. Extract the coaxial cores from the braid, and trim off the black (low-noise) screening material as short as possible.
6. Insulate the overall screen and drain wire (14) and the 2 coaxial screens with suitable plastic tubing.
7. Strip and terminate all ends with suitable (crimp) terminals and identify with numbers as shown.

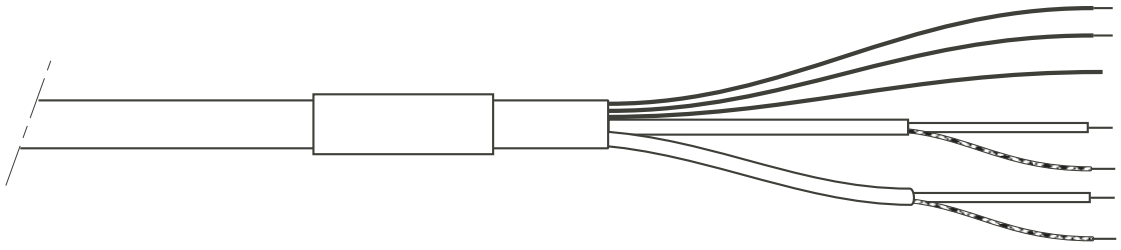


Fig. 3-10-3.

8. Finally shrink the overall heat shrink tube into position.

4. OPERATION; DISPLAY FUNCTIONS AND SETTING

4-1. Operator interface

This section provides an overview of the operation of the EXA operator interface. The basic procedures for obtaining access to the three levels of operation are described briefly. For a step-by-step guide to data entry, refer to the relevant section of this user's manual. Figure 4-1 shows the EXA operator interface.

LEVEL 1: Maintenance

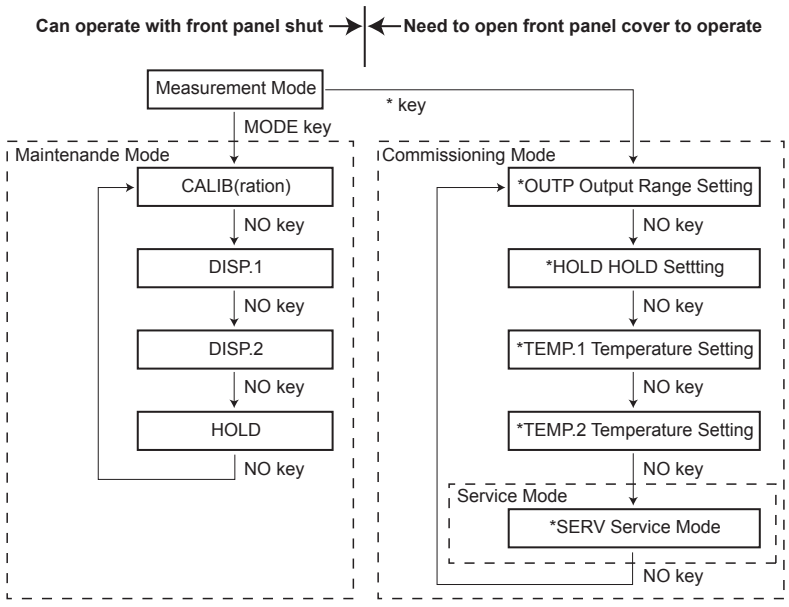
These functions are accessible by pushbutton through a flexible front cover window. The functions make up the normal day-to-day operations that an operator may be required to complete. Adjustment of the display and routine calibration are among the features accessible in this way. (See table 4-1).

LEVEL 2: Commissioning

A second menu is exposed when the EXA front cover is removed and the display board is revealed. Users gain access to this menu by pressing the button marked ∗ in the lower right of the display board. This menu is used to set such values as the output ranges and hold features. It also gives access to the service menu. (See table 4-1).

LEVEL 3: Service

For more advanced configuration selections, press the button marked ∗ , then press 'NO' repeatedly until you reach SERVICE. Now push the 'YES' button. Selecting and entering 'Service Code' numbers in the commissioning menu provide access to the more advanced functions. An explanation of the Service Codes is listed in chapter 5 and an overview table is shown in chapter 11.



· Select desired mode and press YES
· The MODE key is used as a "Cancel and Return to Measurement Mode" escape key

Table 4-1. Operations overview

	Routine	Function	Section
Maintena nce	CALIB DISP.1, 2 HOLD	Calibration with a standard solution or sample Read auxiliary data or set message display Switch hold on/off (when activated)	6 4, 5 5
Commissioning	*OUTP *HOLD *TEMP.1, 2	Adjust the output range Activate the hold function Select method of temperature compensation	5 5 5
Service (Access to coded entries from the commissioning level)	*SERV	Fine tune the specialized functions of the transmitter	5

NOTE:

All three levels may be separately protected by a password.
See Service Code 52 in chapter 5 Service Code table for details on setting passwords.

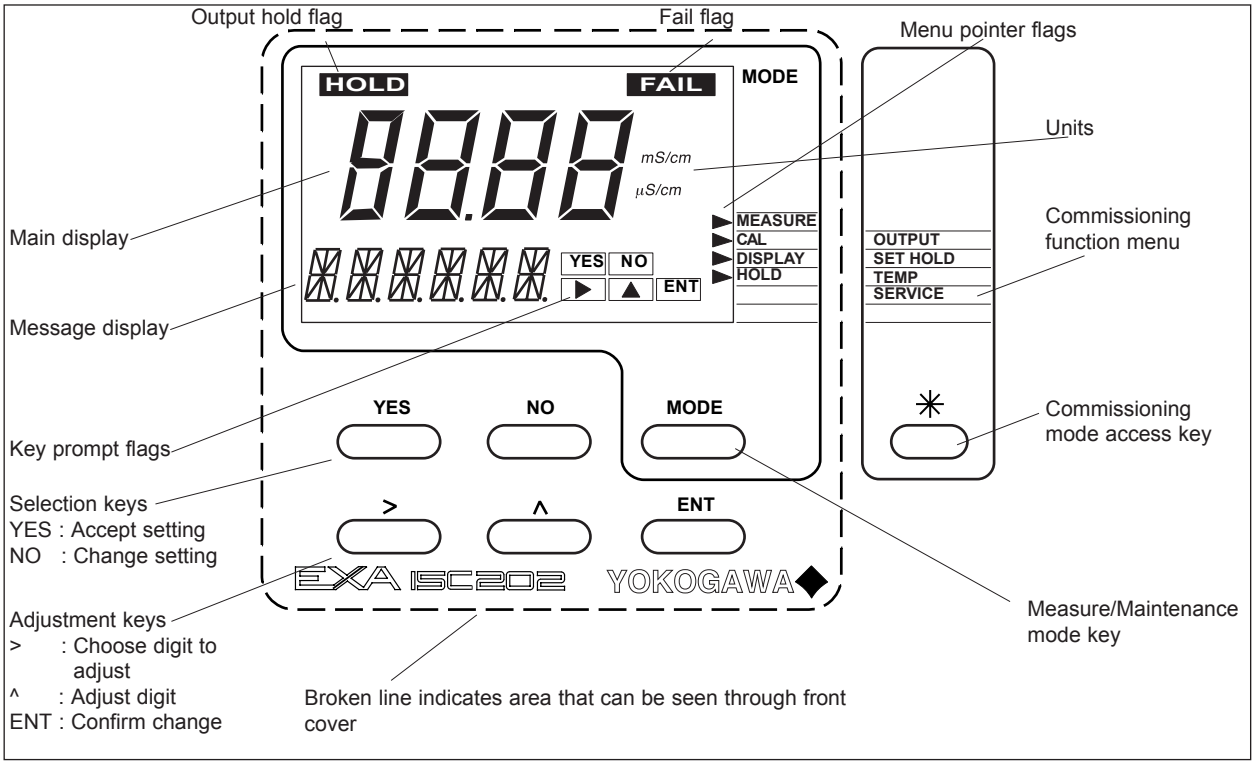


Figure 4-1. ISC202 operator interface

4-2. Explanation of operating keys

MODE key This key toggles between the measuring and maintenance modes. Press once to obtain access to the maintenance function menu.

CALIB
DISP.1
DISP.2 - (Only when second temp. compensation enabled, section 5.2)
HOLD - (only when enabled, section 5.2)

Press again to return to the measuring mode (press twice when hold is activated).

YES/NO keys These are used to select choices from the menu.
YES is used to accept a menu selection.
NO is used to reject a selection, or to move ahead to the next option.

DATA ENTRY keys ▶ ▲ ENT

▶ Is used as a 'cursor' key. Each press on this key moves the cursor or flashing digit one place to the right. This is used to select the digit to be changed when entering numerical data.

▲ Is used to change the value of a selected digit. Each press on this key increases the value by one unit. The value can not be decreased, so in order to obtain a lower value, increase past nine to zero, then increase to the required number.

ENT When the required value has been set using the ▶ and ▲ keys, press ENT to confirm the data entry. Please note that the EXA does not register any change of data until the ENT key is pressed.

✳**key** This is the commissioning mode key. It is used to obtain access to the commissioning menu. This can only be done with the cover removed or opened. Once this button has been used to initiate the commissioning menu, follow the prompts and use the other keys as described above.

4-3. Setting passcodes

4-3-1. Passcode protection

In Service Code 52, EXA users can set the passcode protection for each one of the three operating levels. This procedure should be completed after the initial commissioning (setup) of the instrument. The passcodes should then be recorded safely for future reference.

When passcodes have been set, the following additional steps are introduced to the configuration and programming operations:

Maintenance
Press MODE key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Maintenance Mode

Commissioning
Press * key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Commissioning Mode.

Service
From the commissioning menu, select *Service by pressing YES key. The display shows 000 and *PASS*
Enter a 3-digit passcode as set in Service Code 52 to obtain access to the Service Mode.

NOTE:
See Service Code 52 for the setting of passcodes.

4-4. Display examples

The following pages show the sequence of button presses and screens displayed when working in some standard configurations. More or less options will be made available by the configuration of some service codes, or by choices made in the commissioning menu.

The following deviations are possible:

☆ Item marked is omitted when switched off in commissioning mode.

☆☆ Temperature compensation will be displayed dependent on chosen compensation method: NaCl, TC or matrix.

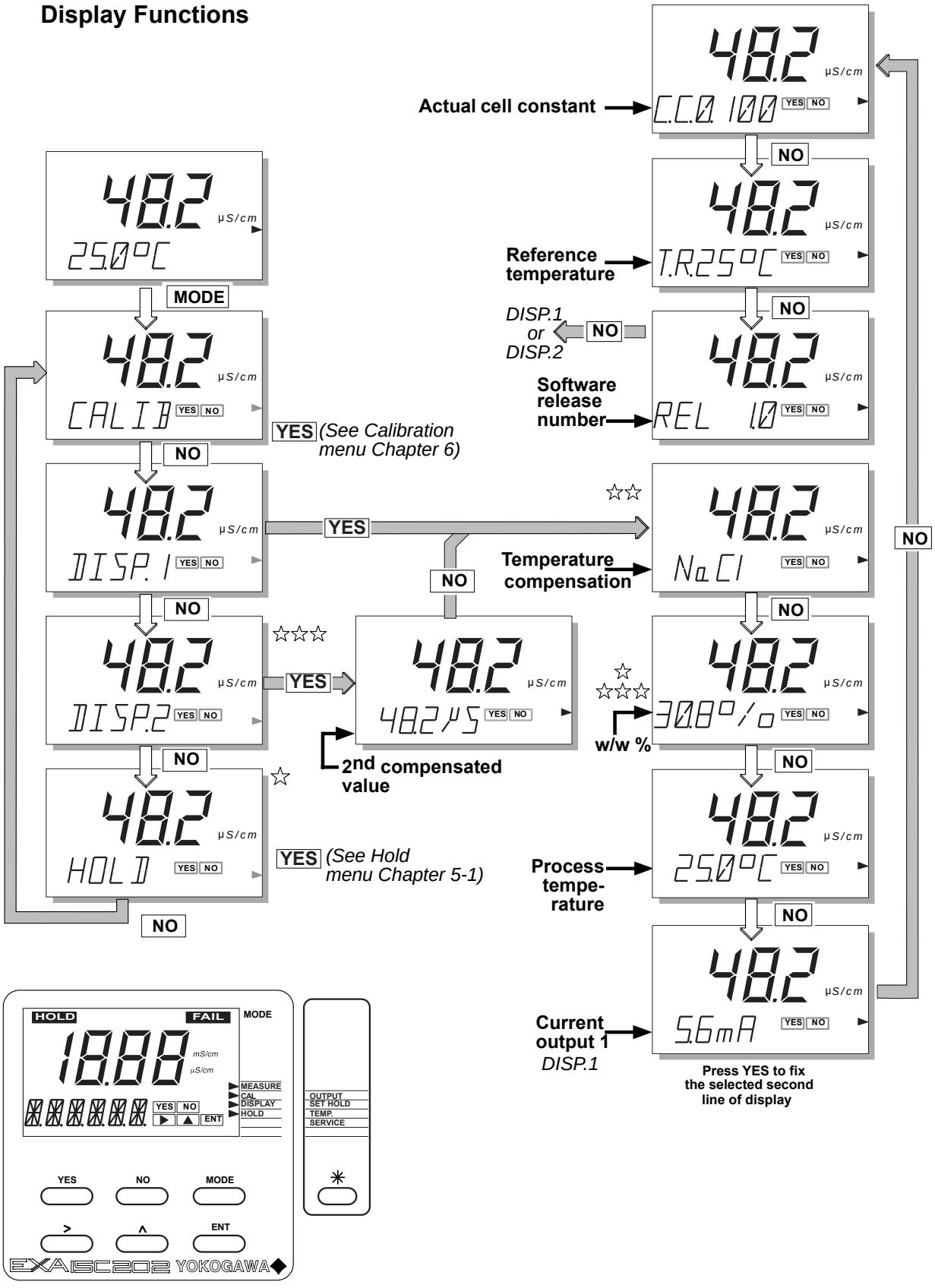
☆☆☆ DISP.2 only appears if a 2nd (different) temperature compensation is set.

☆
☆☆☆ W/W % only appears if switched on in service code 55. In display 2 W/W % never appears.

4-5. Display functions

Display functions daigram is shown below.

Display Functions



5. PARAMETER SETTING

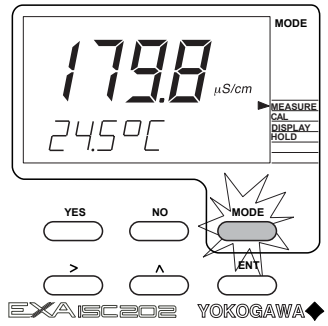
5-1. Maintenance mode

5-1-1. Introduction

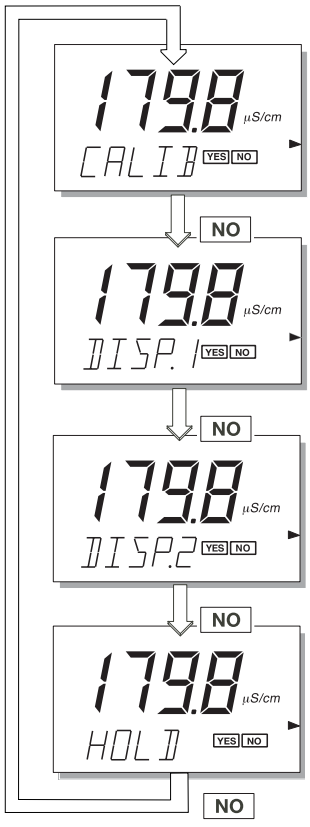
Standard operation of the EXA transmitter involves use of the Maintenance (or operating) mode to set up some of the parameters.

Access to the maintenance mode is available via the six keys that can be pressed through the flexible window in the instrument front cover. Press the 'MODE' key once to enter this dialog mode.
(Note that at this stage the user will be prompted for a passcode where this has been previously set up in service code 52, section 5-6)

Calibrate : See 'calibration' section 6.
Display setting : See 'operation' section 5-1-3, 5-1-4
Hold : Manually switch on/off 'hold' (when enabled in commissioning menu see section 5-2-2)



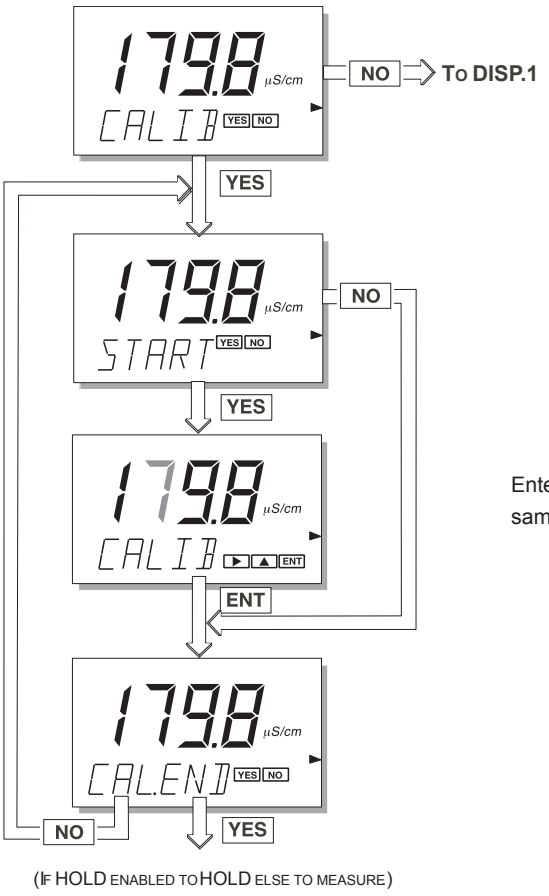
Press the **MODE** key



Only if enabled in commissioning mode section 5-2

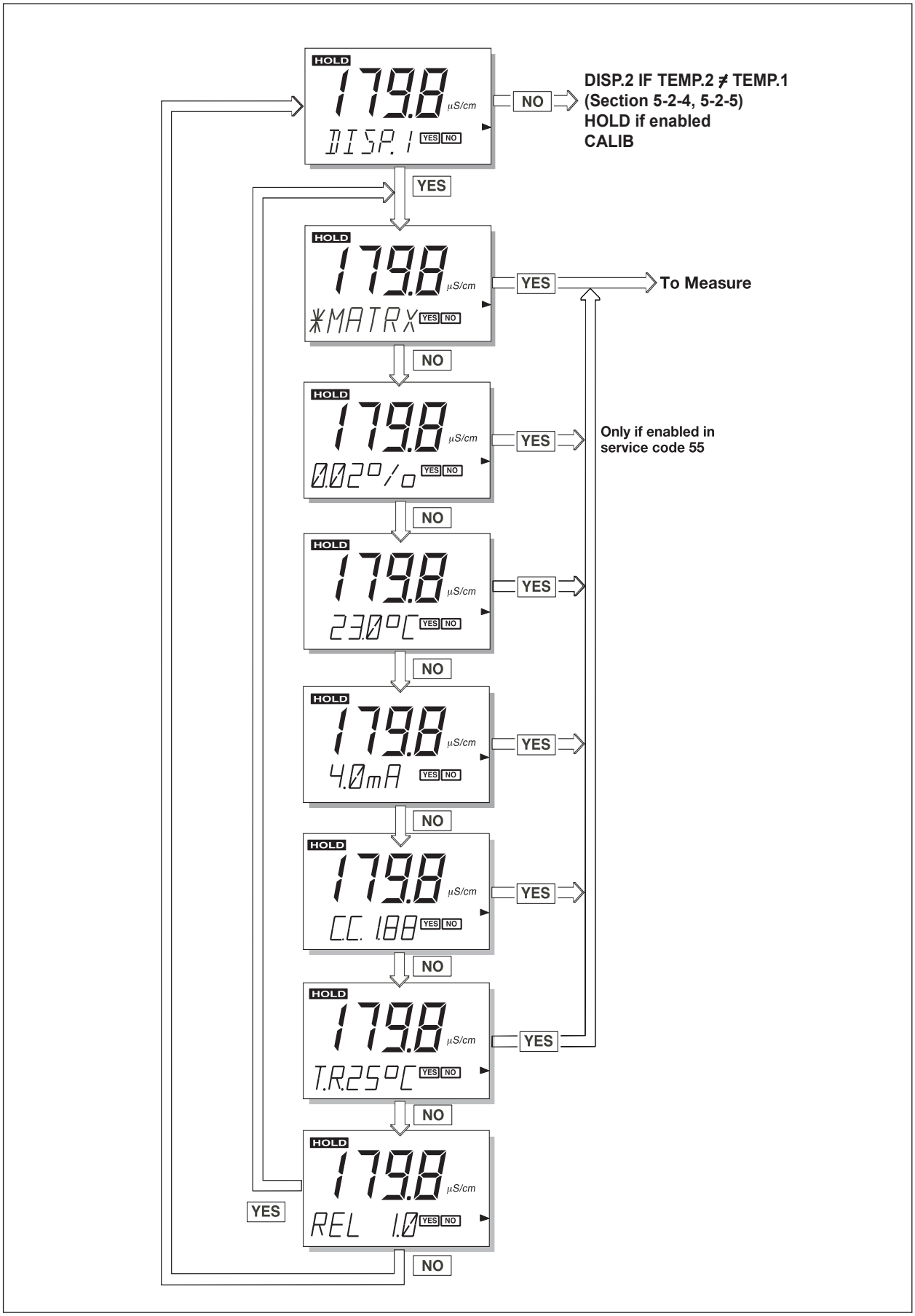
mA
Only if enabled in commissioning mode section 5-2

5-1-2. Manual calibration to determine the cell constant (C.C.)

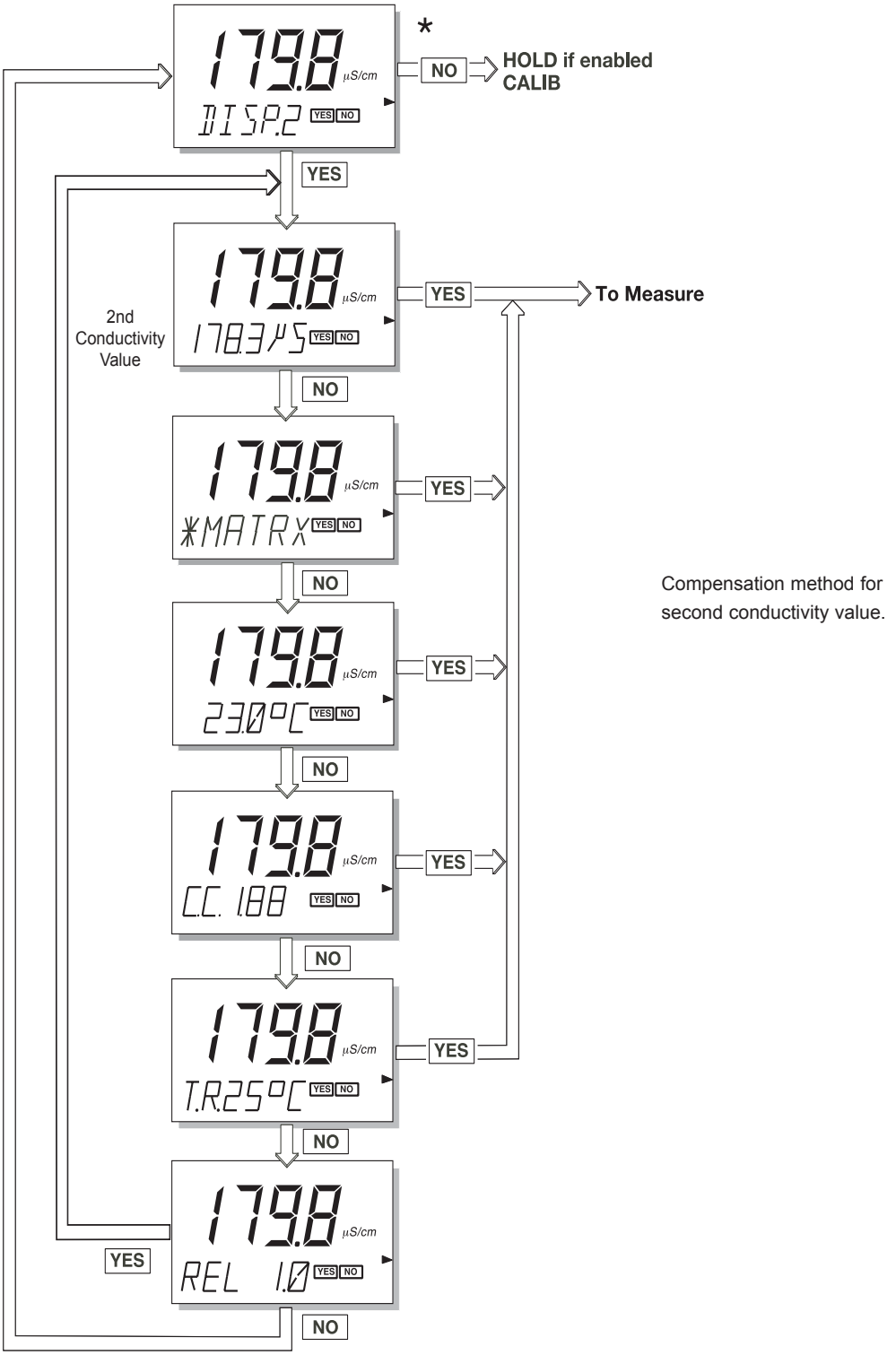


Enter the Conductivity value of the sample at reference temperature

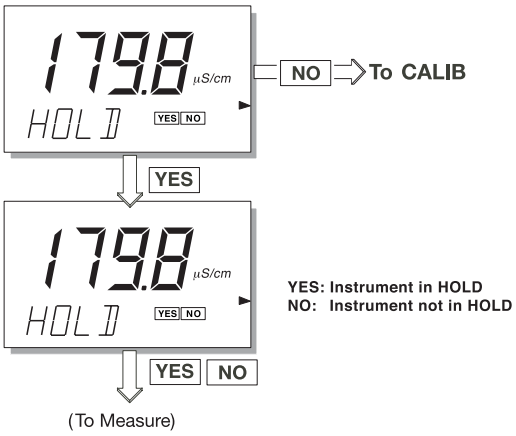
5-1-3. Second Line display. Referring to the first compensated conductivity.



5-1-4. Second Line display. Referring to the second compensated conductivity.



mA 5-1-5. Manual activation of HOLD



This option is only available if HOLD is enabled in Section 5-2.

5-2. Commissioning mode

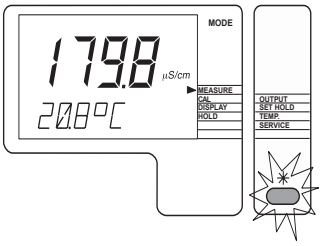
In order to obtain peak performance from the EXA ISC202, you must set it up for each custom application.

mA *OUTP : mA output is set as default to 0-1000 mS/cm.
For enhanced resolution in more stable measuring processes, it may be desirable to select for example 0-100 µS/cm range.

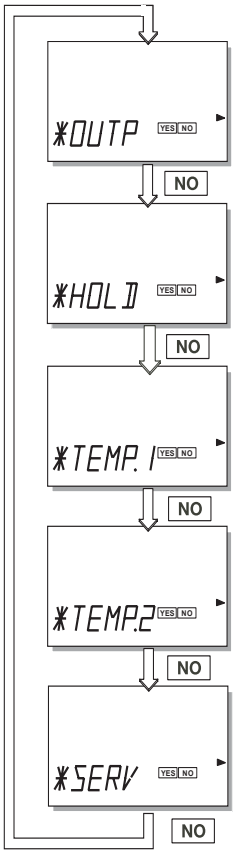
mA *HOLD : The EXA ISC202 transmitter has the ability to 'HOLD' the output during maintenance periods. This parameter should be set up to hold the last measured value, or a fixed value to suit the process (Section 5-2-2).

*TEMP.1, 2 : First/second temperature compensation types and values (see section 5-2-4 and 5-2-5).
* NaCl is used for neutral salt solutions. Strong solutions of salts are compensated, as are process waters, pure, and ultrapure water.
* T.C. temperature coefficient compensation uses a linear temperature compensation factor. This can be set by calibration (section 5) or configuration (service code 21).
* MATRX compensation is an extremely effective way of compensation. Choose from standard matrix tables, or configure your own to exactly suit your process.
The default setting for *TEMP.1 and *TEMP.2 is NaCl. *TEMP.2 is enabled when it is not equal to *TEMP.1.

*SERV : This selection provides access to the service menu.



Press the **COMMISSIONING** key



mA

Only if ***OUTP. F** is set as linear service code 31

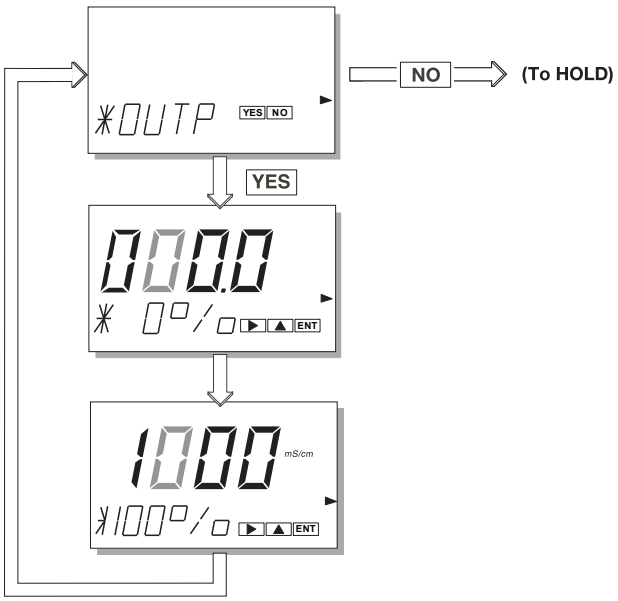
mA

Enables **HOLD**

Sets Temperature compensation method for first compensated conductivity

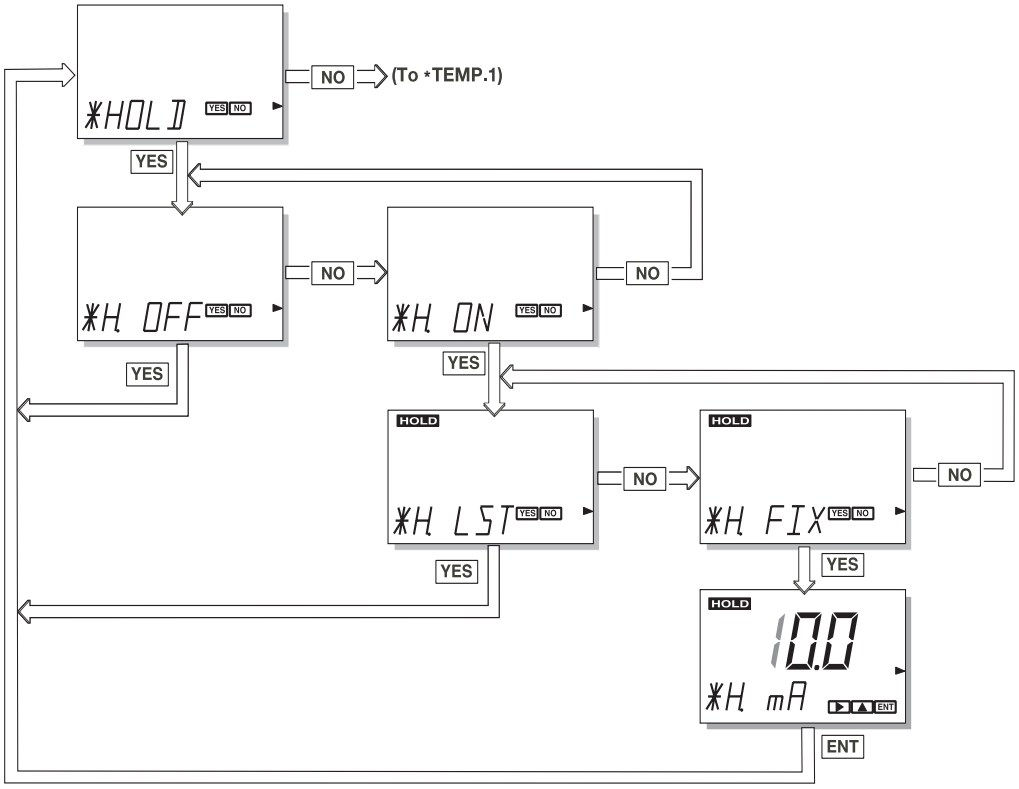
Enables and sets Temperature compensation method for second compensated conductivity

mA 5-2-1. Linear output (Range)



Note: 0% corresponds to 4 mA
100% corresponds to 20 mA

mA 5-2-2. HOLD



Here HOLD is enabled/disabled.

When enabled:

- The analyser's output will be set to HOLD when entering Maintenance-, Commissioning- or Service menu.
- Up on exiting one of the menus, the user is asked if HOLD should remain activated.
- Manual Hold will become available in "maintenance Mode" (to manually set the analyser's output in HOLD)

5-2-3. Temperature compensation

Why temperature compensation?
The conductivity of a solution is very dependent on temperature. Typically for every 1 °C change in temperature the solution conductivity will change by approximately 2 %. The effect of temperature varies from one solution to another and is determined by several factors like solution composition, concentration and temperature range. A coefficient (α) is introduced to express the amount of temperature influence in % change in conductivity per °C. In almost all applications this temperature influence must be compensated before the conductivity reading can be interpreted as an accurate measure of concentration or purity.

1 Standard temperature compensation (NaCl)
From the factory the EXA is calibrated with a general temperature compensation function based on a sodium chloride salt solution. This is suitable for many applications and is compatible with the compensation functions of typical laboratory or portable instruments.

Table 5-1. NaCl-compensation according to IEC 60746-3 with Tref = 25 °C

T	Kt	α	T	Kt	α	T	Kt	α
0	0.54	1.8	60	1.76	2.2	130	3.34	2.2
10	0.72	1.9	70	1.99	2.2	140	3.56	2.2
20	0.90	2.0	80	2.22	2.2	150	3.79	2.2
25	1.0	---	90	2.45	2.2	160	4.03	2.2
30	1.10	2.0	100	2.68	2.2	170	4.23	2.2
40	1.31	2.0	110	2.90	2.2	180	4.42	2.2
50	1.53	2.1	120	3.12	2.2	190	4.61	2.2
						200	4.78	2.2

2-A. Calculation of Temperature Coefficient Factor (α)
(With known conductivity at reference temperature).

$$\alpha = \frac{K_t - K_{ref}}{T - T_{ref}} \times \frac{100\%}{K_{ref}}$$

α = Temperature compensation factor (in % / °C)
T = Measured temperature (°C)
K_t = Conductivity at T
T_{ref} = Reference temperature (°C)
K_{ref} = Conductivity at T_{ref}

2-B. Calculation of Temperature Coefficient Factor (T.C.)
(with two known conductivity values at different temperatures)
Measure the conductivity of the liquid at two temperatures, one below the reference and above the reference temperature with the temperature coefficient set to 0.00% per °C and use the following equation to calculate a temperature coefficient (α).

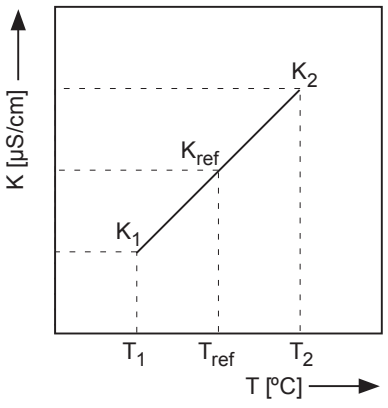
$$K_{ref} = \frac{K_t}{1 + \alpha (T - T_{ref})}$$

$$K_{ref} = \frac{K_1}{1 + \alpha (T_1 - T_{ref})} = \frac{K_2}{1 + \alpha (T_2 - T_{ref})}$$

$$K_1 (1 + \alpha (T_2 - T_{ref})) = K_2 (1 + \alpha (T_1 - T_{ref}))$$

$$K_1 \alpha (T_2 - T_{ref}) - K_2 \alpha (T_1 - T_{ref}) = K_2 - K_1$$

$$\alpha = \frac{K_2 - K_1}{K_1 (T_2 - T_{ref}) - K_2 (T_1 - T_{ref})} \times 100\%$$



T_1 , T_2 : liquid temperature (°C)
K_1 : conductivity at T_1 (°C)
K_2 : conductivity at T_2 (°C)

Calculation example
Calculate the temperature co-efficient of a liquid from the following data.
Conductivity 124.5 µS/cm at a liquid temperature of 18.0 °C and a conductivity 147.6 µS/cm at a liquid temperature of 31.0 °C.

Substituting the data in the above formula gives the following result.

$$\alpha = \frac{147.6 - 124.5}{124.5(31.0 - 25) - 147.6(18.0 - 25)} \times 100\% = 1.298\%/\ ºC$$

Set the temperature coefficient in the EXA transmitter.

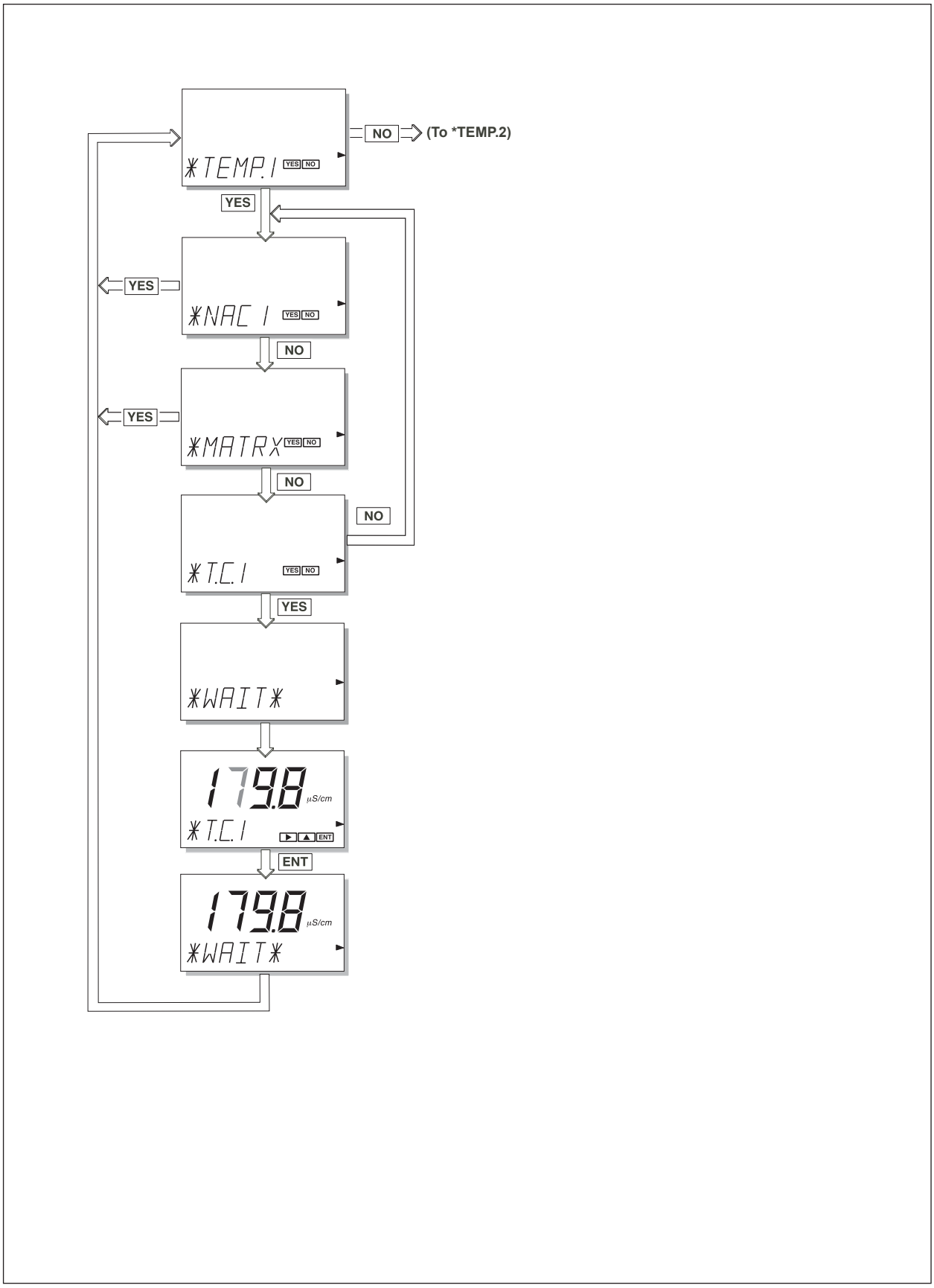
2-C. Checking
When the temperature coefficient already set is accurate, the conductivity to be displayed must be constant regardless of liquid temperature. The following check will make sure that the temperature coefficient already set is accurate.
If, when the liquid temperature is lowered, a larger conductivity value is indicated, the temperature coefficient already set is too small.
The opposite also applies. If a smaller conductivity value is indicated, the temperature coefficient already set is too large. In either case, change the temperature coefficient so that the conductivity no longer changes.

3. Matrix compensation
The compensation matrix is a table of temperature and conductivity values at differing concentrations. These values are used to calculate the temperature compensation applicable for a particular solution. Choose the component that you will be measuring in your application, and where appropriate the concentration range. EXA will do the rest.

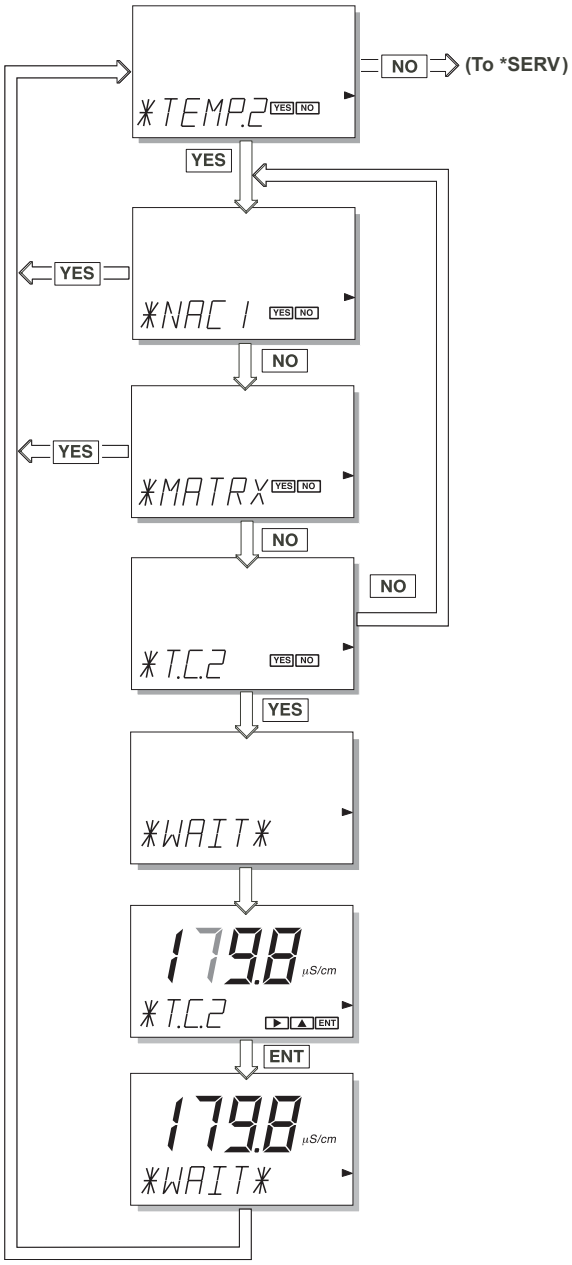
4. Manual temperature compensation (Section 5-2-4 and 5-2-5)
If the standard compensation function is found to be inaccurate for the sample to be measured, the transmitter can be set manually for a linear factor on site to match the application.
The procedure is as follows:
1. Take a representative sample of the process liquid to be measured.
2. Heat or cool this sample to the reference temperature of the transmitter (usually 25 °C).
3. Measure the conductivity of the sample with the EXA and note the value.
4. Bring the sample to the typical process temperature (to be measured with the EXA).
5. Adjust the display indication to the noted value at the reference temperature.
6. Check that the temperature compensation factor has been changed.
7. Insert the conductivity cell into the process again.

5. Other possibilities (section 5-3)
1. Enter calculated coefficient.
2. Enter matrix temperature compensation.

5-2-4. Temperature compensation for first conductivity value



5-2-5. Temperature Compensation for second conductivity value



5-3. Service Codes

Don't set or input service code numbers other than the code numbers defined in this manual. Setting an undefined service code may make the transmitter malfunction.
When an undefined service code is input by some accident, push the MODE key and escape from the service level.

5-3-1. Parameter specific functions

Code 03 *C.C. Enter the factory calibrated cellconstant mentioned on the textplate or on the fixed cable. This avoids the need for calibration. Any value between 0.2 and 19.99/cm may be entered.

Code 04 *AIR To avoid cable influences on the measurement, a 'zero' calibration with a dry sensor may be done. If a connection box (BA10) and extension cable (WF10) are be used, 'zero' calibration should be done including this connection equipment.

Code	Display	Function	Function detail	X	Y	Z	Default values	
Parameter specific functions								
03	*C.C.	Set cell constant	Use ▶ ▲ ENT keys to set value				1.88	/cm
04	*AIR *START *'WAIT' *END	Zero calibration	Zero calibration with dry cell connected Press YES to confirm selection Press YES to start, after briefly displaying 'WAIT', *END will be displayed Press YES to return to commissioning mode					

5-3-2. Temperature measuring functions

Code 10 *T.SENS Selection of the temperature compensation sensor. The default selection is the 30k NTC sensor, which gives excellent precision with the two wire connections used. The other option gives the flexibility to use a very wide range of other conductivity/inductive sensors.

Code 11 *T.UNIT Celsius or Fahrenheit temperature scales can be selected to suit user preference.

Code 12 *T.ADJ With the process temperature sensor at a stable known temperature, the temperature reading is adjusted in the main display to correspond. The calibration is a zero adjustment to allow for the cable resistance, which will obviously vary with length.The normal method is to immerse the sensor in a vessel with water in it, measure the temperature with an accurate thermometer, and adjust the reading for agreement.

Code	Display	Function	Function detail	X	Y	Z	Default values	
Temperature measuring functions								
10	*T.SENS	Temperature sensor	30k NTC Pt1000	0 1			0	30k NTC
11	*T.UNIT	Display in °C or °F	°C °F	0 1			0	°C
12	*T.ADJ	Calibrate temperature	Adjust reading to allow for cable resistance. Set value relative to current temperature Use ▶ ▲ ENT keys to adjust value				0.0	ºC

5-3-3. Temperature compensation functions

Code 20 *T.R.°C — Choose a temperature to which the measured conductivity (or resistivity) value must be compensated. Normally 25°C is used, therefore this temperature is chosen as default value. Limitations for this setting are: -20 to 140 °C.
If *T.UNIT in code 11 is set to °F, default value is 77°F and the limitations are 0 - 280°F.

Code 21 *T.C.1, 2 — In addition to the procedure described in section 5-2-4 and 5-2-5 it is possible to adjust the compensation factor directly. If the compensation factor of the sample liquid is known from laboratory experiments or has been previously determined, it can be introduced here.
Adjust the value between 0.00 to 3.50 % per °C. In combination with reference temperature setting in code 20 a linear compensation function is obtained, suitable for all kinds of chemical solutions.

Code 22 *MATRX — The EXA is equipped with a matrix type algorithm for accurate temperature compensation in various applications. Select the range as close as possible to the actual temperature/concentration range. The EXA will compensate by interpolation and extrapolation. Consequently, there is no need for a 100% coverage.
If 9 is selected the temperature compensation range for the adjustable matrix must be configured in code 23. Next the specific conductivity values at the different temperatures must be entered in codes 24 to 28. Matrix data is exeplified in Appendix 11-3

Code 23 *T1, *T2, *T3, *T4 & *T5 °C — Set the matrix compensation range. It is not necessary to enter equal temperature steps, but the values should increase from T1 to T5, otherwise the entrance will be refused. Example: 0, 10, 30, 60 and 100 ºC are valid values for the T1....T5. The minimum span for the range (T5 - T1) is 25 °C. The valid range for a temperature value is -20º to 140ºC.

Code 24-28 *L1xT1 - L5xT5 — In these access codes the specific conductivity values can be entered for 5 different concentrations of the process liquid; each one in one specific access code (24 to 28). The table below shows a matrix entering example for 0.5 - 5% H_2SO_4 solution for a temperature range from 0 - 100 °C. Conductivity range from 0.0 µS/cm to 1999 mS/cm.

NOTES:

1. In chapter 11 a table is included to record your programmed values. It will make programming easy for duplicate systems or in case of data loss.
2. Each matrix column has to increase in conductivity value.
3. Error code E4 occurs when two standard solutions have identical conductivity values at the same temperature within the temperature range.

Table 5-2. Default of user adjustable matrix

			T1	T2	T3	T4	T5
Code 23	Temp.		0 °C	25 °C	50 °C	75 °C	100 °C
Code 24	Solution 1	L1	33.8 mS/cm	47.0 mS/cm	57.5 mS/cm	63.7 mS/cm	68.0 mS/cm
Code 25	Solution 2	L2	63.5 mS/cm	92.3 mS/cm	112.5 mS/cm	126.0 mS/cm	137.5 mS/cm
Code 26	Solution 3	L3	95.0 mS/cm	135.3 mS/cm	166.0 mS/cm	188.5 mS/cm	206.0 mS/cm
Code 27	Solution 4	L4	124.5 mS/cm	178.0 mS/cm	220.0 mS/cm	249.0 mS/cm	273.0 mS/cm
Code 28	Solution 5	L5	154.0 mS/cm	218.0 mS/cm	270.0 mS/cm	307.0 mS/cm	336.0 mS/cm

Code	Display	Function	Function detail	X	Y	Z	Default values	
Temperature compensation functions								
20	*T.R.°C	Set reference temp.	Use ▶ ▲ ENT keys to set value					25 °C
21	*T.C.1	Set temp. coef. 1	Adjust compensation factor if set to *T.C. in section 5-2-5. Set value with ▶ ▲ ENT keys					2.10 % per °C
	*T.C.2	Set temp. coef. 2	Adjust compensation factor if set to *T.C. in section 5-2-5. Set value with ▶ ▲ ENT keys					2.10 % per °C
22	*MATRx	Select matrix	Choose matrix if set to *MATRX in section 5-2-5, using ▶ ▲ ENT keys H_2SO_4, 0 -100ºC, 0.5 - 5% H_2SO_4, 0 -100ºC, 2.5 - 25% HCl, 0 - 60ºC, 0.5 - 5% HCl, 0 - 60ºC, 1 - 20% HNO_3, 0 - 80ºC, 0.5 - 5% HNO_3, 0 -80ºC, 2.5 - 25% NaOH, 0 -100ºC, 0.5 - 5% NaOH, 0 -100ºC, 0.5 - 15% User programmable matrix	 1 2 3 4 5 6 7 8 9			1	H_2SO_4
23	*T1 °C (°F) *T2.. *T3.. *T4.. *T5..	Set temp. range	Enter 1st (lowest) matrix temp. value Enter 2nd matrix temp. value Enter 3rd matrix temp. value Enter 4th matrix temp. value Enter 5th (highest) matrix temp. value					
24	*L1xT1 *L1xT2 .... *L1xT5	Enter conductivity values for lowest concentration	Value for T1 Value for T2 Value for T5					
25	*L2xT1	Concentration 2	Similar to code 24					
26	*L3xT1	Concentration 3	Similar to code 24					
27	*L4xT1	Concentration 4	Similar to code 24					
28	*L5xT1	Concentration 5	Similar to code 24					
29			Not used					

mA 5-3-4. mA output functions

Code 31 *OUTP.F For the ISC202 the output may be chosen as linear to input, or configured in a 21 point table to a particular linearization. Enable the table setup in code 31, and configure the table in code 35.

Code 32 *BURN Diagnostic error messages can signal a problem by sending the output signals upscale or downscale (21 mA or 3.6 mA when HART or distributor comm. is non-used, 3.9 mA when HART or distributor comm. is used). This is called upscale or downscale burnout, from the analogy with thermocouple failure signaling of a burned-out or open circuit sensor. The pulse burnout setting gives a 21 mA signal for the first 30 seconds of an alarm condition. After the 'pulse' the signal returns to normal. This allows a latching alarm unit to record the error. In the case of the EXA the diagnostics are extensive and cover the whole range of possible sensor faults.

Code 35 *TABLE The table function allows the configuration of an output curve by 21 steps (intervals of 5%). The following example shows how the table may be configured to linearize the output with a mA curve.

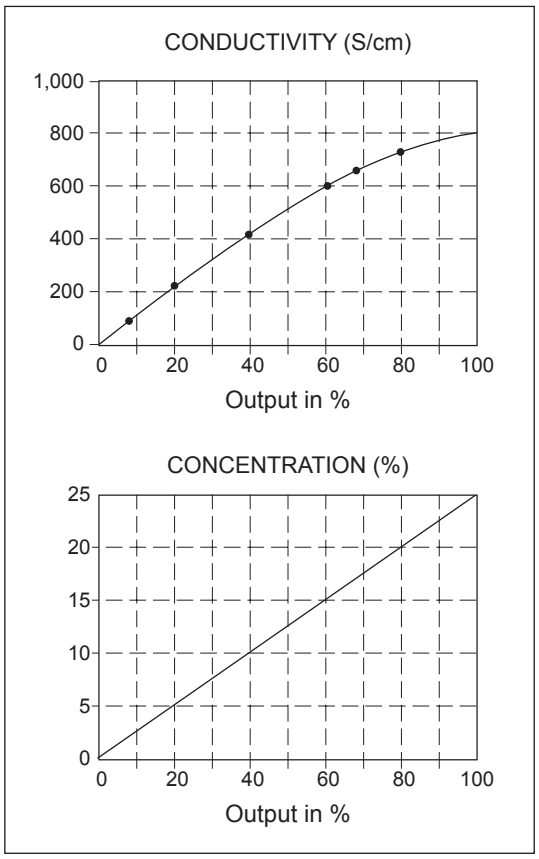


Fig. 5-1. Linearization of output
Example: 0-25% Sulfuric acid

Table 5-3.

Code Output	4-20 mA	% H_2SO_4 Service code 55	mS/cm Service code 35	Default mS/cm
0	4.0	0.00	0	0
5	4.8	1.25	60	50
10	5.6	2.50	113	100
15	6.4	3.75	180	150
20	7.2	5.00	218	200
25	8.0	6.25	290	250
30	8.8	7.50	335	300
35	9.6	8.75	383	350
40	10.4	10.00	424	400
45	11.2	11.25	466	450
50	12.0	12.50	515	500
55	12.8	13.75	555	550
60	13.6	15.00	590	600
65	14.4	16.25	625	650
70	15.2	17.50	655	700
75	16.0	18.75	685	750
80	16.8	20.00	718	800
85	17.6	21.25	735	850
90	18.4	22.50	755	900
95	19.2	23.75	775	950
100	20.0	25.00	791	1000

Concentration Output function is done in de following order:

- Set *OUTP.F. (Service Code 31) to table
- Set the Concentration range in % (Service Code 55)
- Set table values (%output and Conductivity values) in *TABLE (Service Code 35)

mA

Code	Display	Function	Function detail	X	Y	Z	Default values	
mA Outputs								
30			Not used					
31	*OUTP.F	mA output functions	Linear	0			0	Linear
			Table	1				
32	*BURN	Burn function	No burnout	0			0	No Burn.
			Burnout downscale	1				
			Burnout upscale	2				
			Pulse burnout	3				
33, 34			Not used					
35	*TABLE	Output table for mA						
	*0%		Linearisation table for mA in 5% steps.					
	*5%		The measured value is set in the main					
	*10%		display using the ▶ ▲ ENT keys, for					
	...		each of the 5% interval steps.					
	...		Where a value is not known, that value may					
	*95%		be skipped, and a linear interpolation will					
	*100%		take place.					
36-49			Not used					

5-3-5. User interface

Code 50 *RET. When Auto return is enabled, the transmitter reverts to the measuring mode from anywhere in the configuration menus, when no button is pressed during the set time interval of 10 minutes.

Code 52 *PASS Passcodes can be set on any or all of the access levels, to restrict access to the instrument configuration.

Code 53 *Err.05 to *Err.08 Error message configuration. Two different types of failure mode can be set.

Hard fail gives a steady FAIL flag in the display. A fail signal is transmitted on the mA output when enabled in code 32.

Soft fail gives a flashing FAIL flag in the display. A good example is the dry sensor for a soft fail.

Code 54 *E5.LS *E6.LIM Limits can be set for shorted and open measurement. E5 (High) is default set to 3 S and must be in the range of 0.10 S to 9.99 S. E6 (Low) is default set to 5 µS and must be in the range of 0.00 µS to 99.9 µS.

Code 55 *% Linear weight percentage. For some applications the measured parameter values may be (more or less) linear to concentration. For such applications it is not needed to enter an output table, but 0 and 100% concentration values directly can be set.

Code 56 *DISP. The display resolution is default set to autoranging for conductivity reading. If a fixed display reading is needed, a choice can be made out of 5 possibilities.

Code	Display	Function	Function detail	X	Y	Z	Default values	
User interface								
50	*RET.	Auto return	Auto return to measuring mode Off Auto return to measuring mode On	0 1			1	On
51			Not used					
52	*PASS	Passcode Note # = 0 - 9, where 1=111, 2=333, 3=777 4=888, 5=123, 6=957 7=331, 8=546, 9=847	Maintenance passcode Off Maintenance passcode On Commissioning passcode Off Commissioning passcode On Service passcode Off Service passcode On	0 # 	 0 # 	 0 #	0.0.0	Off Off Off
53	*Err.05 *Err.06 *Err.07 *Err.08	Error setting	Shorted measurement Soft/Hard Open measurement Soft/Hard Temperature sensor open Soft/Hard Temp. sensor shorted Soft/Hard	0/1 0/1 0/1 0/1			1 1 1 1	Hard Hard Hard Hard
54	*E5.L S *E6.LIM	E5 limit setting E6 limit setting	Maximum conductivity value Minimum conductivity value				3 5	S µS
55	*% *0% *100%	Display mA in w/w%	mA-range displayed in w/w% off mA-range displayed in w/w% on Set 0% output value in w/w% Set 100% output value in w/w%	0 1			0	Off
56	*DISP.	Display resolution	Auto ranging display Display fixed to XXX.X µS/cm Display fixed to X.XXX mS/cm Display fixed to XX.XX mS/cm Display fixed to XXX.X mS/cm Display fixed to XXXX mS/cm	0 3 4 5 6 7			0	Auto
57-59			Not used					

5-3-6. Communication setup

mA	Code 60	*COMM.	The settings should be adjusted to suit the communicating device connected to the output. The communication can be set to HART® or to PH 201*B distribution (see Appendix 2).
		*ADDR.	Select address 00 for point to point communication with 4-20mA transmission. Addresses 01 to 15 are used in multi-drop configuration (fixed 4mA output).
mA	Code 61	*HOUR *MINUT *SECND *YEAR *MONTH *DAY	The clock/calendar for the logbook is set for current date and time as reference.
	Code 62	*ERASE	Erase logbook function to clear the recorded data for a fresh start. This may be desirable when re-commissioning an instrument that has been out of service for a while.

5-3-7. General

	Code 70	*LOAD	The load defaults code allows the instrument to be returned to the default set up with a single operation. This can be useful when wanting to change from one application to another.

Code	Display	Function	Function detail	X	Y	Z	Default values	
Communication								
mA 60	*COMM.	Communication	Set HART® communication off	0			1.0	On
			Set HART® communication on	1				
			Set communication PH 201*B on	2				
			Communication write enable		0			write
			Communication write protect		1			enable
	*ADDR.	Network address	Set address 00 to 15				00	
mA 61	*HOUR *MINUT *SECND *YEAR *MONTH *DAY	Clock setup	Adjust to current date and time using ▶ ▲ ENT keys					
62	*ERASE	Erase logbook	Press YES to clear logbook data					
63-69			Not used					

Code	Display	Function	Function detail	X	Y	Z	Default values	
General								
70	*LOAD	Load defaults	Reset configuration to default values					
71-79			Not used					

6. CALIBRATION

6-1 When is calibration necessary?

Calibration of conductivity instruments is normally not required, since Yokogawa delivers a wide range of sensors, which are factory calibrated traceable to NIST standards. The cell constant values are normally indicated on the top of the sensor or on the integral cable. These values directly can be entered in service code 03 (section 5-3-1). If the cell has been subjected to abrasion (erosion or coating) calibration may be necessary. In the next section two examples are given. Alternatively calibration may be carried out with a simulator to check the electronics only.

NOTE:

During calibration the temperature compensation is still active. This means that the readings are refered to the reference temperature as chosen in service code 20 (section 5-3-4, default 25 °C). alibration is normally carried out by measuring a solution with a known conductivity value at a known temperature. The measured value is adjusted in the calibration mode. On the next pages the handling sequence for this action is visualised. Calibration solutions can be made up in a laboratory. An amount of salt is dissolved in water to give a precise concentration with the temperature stabilised to the adjusted reference temperature of the instrument (default 25 °C). The conductivity of the solution is taken from literature tables or the table on this page.

Alternatively the instrument may be calibrated in an unspecified solution against a standard instrument. Care should be taken to make a measurement at the reference temperature since differences in the type of temperature compensation of the instrument may cause an error.

NOTE:

The standard instrument used as a reference must be accurate and based on an identical temperature compensation algorithm. Therefore the Model SC72 Personal Conductivity Meter of Yokogawa is recommended.

Typical calibration solutions.
The table shows some typical conductivity values for sodium-chloride (NaCl) and Potassium cholide (KCl) solutions which can be made up in a laboratory.

Table 6-1. NaCl values at 25 °C (IEC 60746-3)

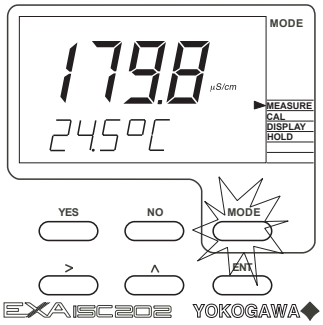
Weigth %	mg/kg	Conductivity
0.001	10	21.4 µS/cm
0.003	30	64.0 µS/cm
0.005	50	106 µS/cm
0.01	100	210 µS/cm
0.03	300	617 µS/cm
0.05	500	1.03 mS/cm
0.1	1000	1.99 mS/cm
0.3	3000	5.69 mS/cm
0.5	5000	9.48 mS/cm
1	10000	17.6 mS/cm
3	30000	48.6 mS/cm
5	50000	81.0 mS/cm
10	100000	140 mS/cm

Table 6-2. KCl values at 25 °C

Weigth %	molal (m)	mg of KCl / kg of solution	Conductivity
0.3	0.001	74.66	0.1469 mS/cm
0.5	0.002	149.32	0.2916 mS/cm
1	0.005	373.29	0.7182 mS/cm
3	0.01	745.263	1.4083 mS/cm
5	0.1	7419.13	12.852 mS/cm
10	1.0	71135.2	111.31 mS/cm

The table is derived from the Standards laid down in ‘International Recommendation No. 56 of the Organisation Internationale de Métrologie Legale’.

6-2. Calibration procedure



Press the **MODE** key

The legend **CALIB** appears,
and the **YES/NO** key prompt flags flash

Put the sensor in standard solution
Press **YES**

Set the value using the ▶ ▲ ENT key
Select the flashing digit with the ▶ key
Increase it's value by pressing the ▲ key
When the correct value is displayed,
press **ENT** to enter the change

After briefly displaying **WAIT**,
the **CAL.END** message appears
The calibration is now complete
Put the sensor back in the process and press **YES**

The cell constant is automatically updated after the calibration and the new value can be read on the dislay as described in section 5-1-2. and 5-1-3.
If the calibrated cell constant is not within the range of 0.2 - 19.99 cm^{-1}, error E3 is displayed.

7. MAINTENANCE

7-1. Periodic maintenance for the EXA 202 transmitter

The EXA transmitter requires very little periodic maintenance. The housing is sealed to IP65 (NEMA 4X) standards, and remains closed in normal operation. Users are required only to make sure the front window is kept clean in order to permit a clear view of the display and allow proper operation of the push-buttons. If the window becomes soiled, clean it using a soft damp cloth or soft tissue. To deal with more stubborn stains, a neutral detergent may be used.

NOTE:

Never used harsh chemicals or solvents. In the event that the window becomes heavily stained or scratched, refer to the parts list (Section 10) for replacement part numbers.

When you must open the front cover and/or glands, make sure that the seals are clean and correctly fitted when the unit is reassembled in order to maintain the housing's weatherproof integrity against water and water vapour. The measurement otherwise may be prone to problems caused by exposure of the circuitry to condensation.

The EXA instrument contains a lithium cell to support the clock function when the power is switched off. This cell needs to be replaced at 5 yearly intervals (or when discharged). Contact your nearest Yokogawa service centre for spare parts and instructions.

7-2. Periodic maintenance of the sensor

Maintenance advice listed here is intentionally general in nature. Sensor maintenance is highly application specific.

In general conductivity measurements do not need much periodic maintenance. If the EXA indicates an error in the measurement or in the calibration, some action may be needed (ref. Section 8 troubleshooting).

Cleaning methods

1. For normal applications hot water with domestic washing-up liquid added will be effective.
2. For lime, hydroxides, etc., a 5 ...10% solution of hydrochloric acid is recommended.
3. Organic foulings (oils, fats, etc.) can be easily removed with acetone.
4. For algae bacteria or moulds, use a solution of domestic bleach (hypochlorite).

* Never use hydrochloric acid and bleaching liquid simultaneously. The very poisonous chlorine gas will result.

8. TROUBLESHOOTING

8-1. Introduction

The EXA ISC202 microprocessor based conductivity analyser continuously monitors the condition of all key components of the measuring system to ensure that measurement is dependable. If a fault is detected this is immediatly signalled. Errors are shown on the display with a code. Table shows the errors which can be detected and gives information to help locate the fault or identify the error. Faults detected while the instrument is on line can also be signalled by a burnout (section 5-5).

8-2. Self diagnostics of the conductivity sensor

During measurement the instrument adjusts the measuring parameters to give the best conditions for the actual value being measured. At all values the instrument checks the signal from the cell to search for distortion. If there is a problem with the installation of the cell and this becomes defective this will trigger an error message on the display possibly accompanied by a by a burnout signal (section 5-5).

8-3. Self diagnostics of the temperature sensor

The temperature sensor, which is normally built into the conductivity cell, is checked to detect damage or faulty connections.

8-4. Self diagnostics of the electronics

The microprosessor opertion is checked by a watchdog which initiates an electronic reset if the normal functions suffers severe interference. During reset the instrument checks the program and all stored data.
If a fault is then detected an alarm is given.

8-5. Checking during operation

Whenever the instrument is being programmed or calibrated, data is checked and an error is shown when appropriate. Should this occur the new data is rejected and the instrument continues to work with the previuos settings.

9. ERROR MESSAGES AND EXPLANATION

Code	Error description	Possible cause	Remedy
E2	Wrong temperature coefficient	Incorrect data entry	See section 5-2-3, 5-2-4, 5-2-5
E3	Calibration out of range (>factor 10)	Wrong unit (mS vs µS) Defective sensor Standard error	See section 6-1, 6-2 Replace sensor Check standard
E4*	Impossible program for Temperature Compensation	Incorrect data in 5 x 5 Matrix in code 24-28	See section 5-3-3
E5*	Conductivity too high	Incorrect wiring Defective sensor	Check wiring Replace sensor
E6*	Conductivity too low	Sensor not submersed Sensor plugged Incorrect wiring Defective sensor	Check installation Clean sensor Check wiring Replace sensor
E7*	Temperature too high	If 30k NTC Temperature < -20° (-4°F) If Pt 1000 Temperature > 140° (284°F)	Check wiring Replace sensor
E8*	Temperature too low	If 30k NTC Temperature > 140° (284°F) If Pt 1000 Temperature < -20° (-4°F)	Check wiring Replace sensor
E9*	Impossible AIR SET	Too high ZERO	Replace sensor
E10*	EEPROM write failure	Software problem	Unplug the unit, try again call Yokogawa Service
E15	Impossible adjustment Temperature	Abnormal cable resistance	Check reference see section 5-3-2
mA E17	Outspan span too small Temperature compensation span too small	Max. zero suppression is 90% Min. temperature span is 50°C	See section 5-2-1 See section 5-2-4, 5-2-5, 5-3-3
mA E18	Impossible program for Output table	Incorrect data in code 04	See section 5-3-3
E19	Programmed values not accepted	Values exceed preset limits	Try again, read instructions
E20*	DATA LOST	Unauthorized programming Software problem	Call Yokogawa
E21	Corrupted Eprom	Software failure	Call Yokogawa

*These errors will trigger the FAIL if set to on (default is on.)

NOTE : E6 may occure if the sensor is not submerged in a solution, e.g., no sample is present or the sensor is left in the air. When E6 is displayed, first check for proper sensor installation.

10. SPARE PARTS

See Customer Maintenance Parts List.

11. APPENDIX 1

mA 11-1. User setting for non-linear output table (code 31, 35)

Output signal value

% Output	mA 4-20	%	S/cm	%	S/cm	%	S/cm
0	4.0						
5	4.8						
10	5.6						
15	6.4						
20	7.2						
25	8.0						
30	8.8						
35	9.6						
40	10.4						
45	11.2						
50	12.0						
55	12.8						
60	13.6						
65	14.4						
70	15.2						
75	16.0						
80	16.8						
85	17.6						
90	18.4						
95	19.2						
100	20.0						

11-2. User entered matrix data (code 23 to 28)

Medium:			T1 data	T2 data	T3 data	T4 data	T5 data
Code 23	Temperature	T1...T5					
Code 24	Solution 1	L1					
Code 25	Solution 2	L2					
Code 26	Solution 3	L3					
Code 27	Solution 4	L4					
Code 28	Solution 5	L5					

Medium:			T1 data	T2 data	T3 data	T4 data	T5 data
Code 23	Temperature	T1...T5					
Code 24	Solution 1	L1					
Code 25	Solution 2	L2					
Code 26	Solution 3	L3					
Code 27	Solution 4	L4					
Code 28	Solution 5	L5					

11-3. Matrix data table (user selectable in code 22)

Matrix, Solution	Temp (°C)	Data 1	Data 2	Data 3	Data 4	Data 5
1. Sulfuric acid		1 %	2 %	3 %	4 %	5 %
H_2SO_4	0	33.8 mS	63.5 mS	95.0 mS	124.5 mS	154.0 mS
0.5 – 5 %	25	47.0 mS	92.3 mS	135.3 mS	178.0 mS	218.0 mS
	50	57.5 mS	112.5 mS	166.0 mS	220.0 mS	270.0 mS
	75	63.7 mS	126.0 mS	188.5 mS	249.0 mS	307.0 mS
	100	68.0 mS	137.5 mS	206.0 mS	273.0 mS	336.0 mS
2. Sulfuric acid		5 %	10 %	15 %	20 %	25 %
H_2SO_4	0	154.0 mS	292.0 mS	398.0 mS	475.0 mS	516.0 mS
2.5 - 25%	25	218.0 mS	424.0 mS	590.0 mS	718.0 mS	791.0 mS
	50	270.0 mS	534.0 mS	749.0 mS	929.0 mS	1043.0 mS
	75	307.0 mS	612.0 mS	871.0 mS	1094.0 mS	1251.0 mS
	100	336.0 mS	673.0 mS	963.0 mS	1221.0 mS	1418.0 mS
3. Hydrochloric acid		1 %	2 %	3 %	4 %	%
HCl	0	65 mS	125 mS	179 mS	229 mS	273 mS
0.5 - 5%	15	91 mS	173 mS	248 mS	317 mS	379 mS
	30	114 mS	217 mS	313 mS	401 mS	477 mS
	45	135 mS	260 mS	370 mS	474 mS	565 mS
	60	159 mS	301 mS	430 mS	549 mS	666 mS
4. Hydrochloric acid		2 %	4 %	8 %	12 %	20 %
HCl	0	125.0 mS	229.0 mS	387.0 mS	479.0 mS	558.0 mS
1 – 20%	15	173.0 mS	317.0 mS	527.0 mS	650.0 mS	745.0 mS
	30	217.0 mS	401.0 mS	660.0 mS	820.0 mS	938.0 mS
	45	260.0 mS	474.0 mS	793.0 mS	985.0 mS	1130.0 mS
	60	301.0 mS	549.0 mS	919.0 mS	1146.0 mS	1315.0 mS
5. Nitric acid		1 %	2 %	3 %	4 %	5 %
HNO_3	0	39.5 mS	76.1 mS	113.4 mS	147.2 mS	179.5 mS
0.5 - 5%	20	57.4 mS	108.5 mS	161.4 mS	210.0 mS	258.0 mS
	40	81.4 mS	148.1 mS	215.0 mS	275.0 mS	330.0 mS
	60	99.9 mS	180.8 mS	260.0 mS	331.0 mS	397.0 mS
	80	127.8 mS	217.0 mS	299.0 mS	374.0 mS	448.0 mS
6. Nitric acid		5 %	10 %	15 %	20 %	25 %
HNO_3	0	179.5 mS	330.0 mS	448.0 mS	523.0 mS	575.0 mS
2.5 - 25%	20	258.0 mS	462.0 mS	616.0 mS	717.0 mS	794.0 mS
	40	330.0 mS	586.0 mS	778.0 mS	902.0 mS	1004.0 mS
	60	397.0 mS	696.0 mS	929.0 mS	1079.0 mS	1206.0 mS
	80	448.0 mS	795.0 mS	1075.0 mS	1263.0 mS	1426.0 mS
7. Sodium Hydroxide		1 %	2 %	3 %	4 %	5 %
NaOH	0	31.0 mS	61.0 mS	86.0 mS	105.0 mS	127.0 mS
0.5 - 5%	25	53.0 mS	101.0 mS	145.0 mS	185.0 mS	223.0 mS
	50	76.0 mS	141.0 mS	207.0 mS	268.0 mS	319.0 mS
	75	97.5 mS	182.0 mS	264.0 mS	339.0 mS	408.0 mS
	100	119.0 mS	223.0 mS	318.0 mS	410.0 mS	495.0 mS
8. Sodium Hydroxide		1 %	3 %	6 %	10 %	15 %
NaOH	0	31.0 mS	86.0 mS	146.0 mS	195.0 mS	215.0 mS
0.5 - 15%	25	53.0 mS	145.0 mS	256.0 mS	359.0 mS	412.0 mS
	50	76.0 mS	207.0 mS	368.0 mS	528.0 mS	647.0 mS
	75	97.5 mS	264.0 mS	473.0 mS	692.0 mS	897.0 mS
	100	119.0 mS	318.0 mS	575.0 mS	847.0 mS	1134.0 mS

11-4. Configuration Checklist For ISC202

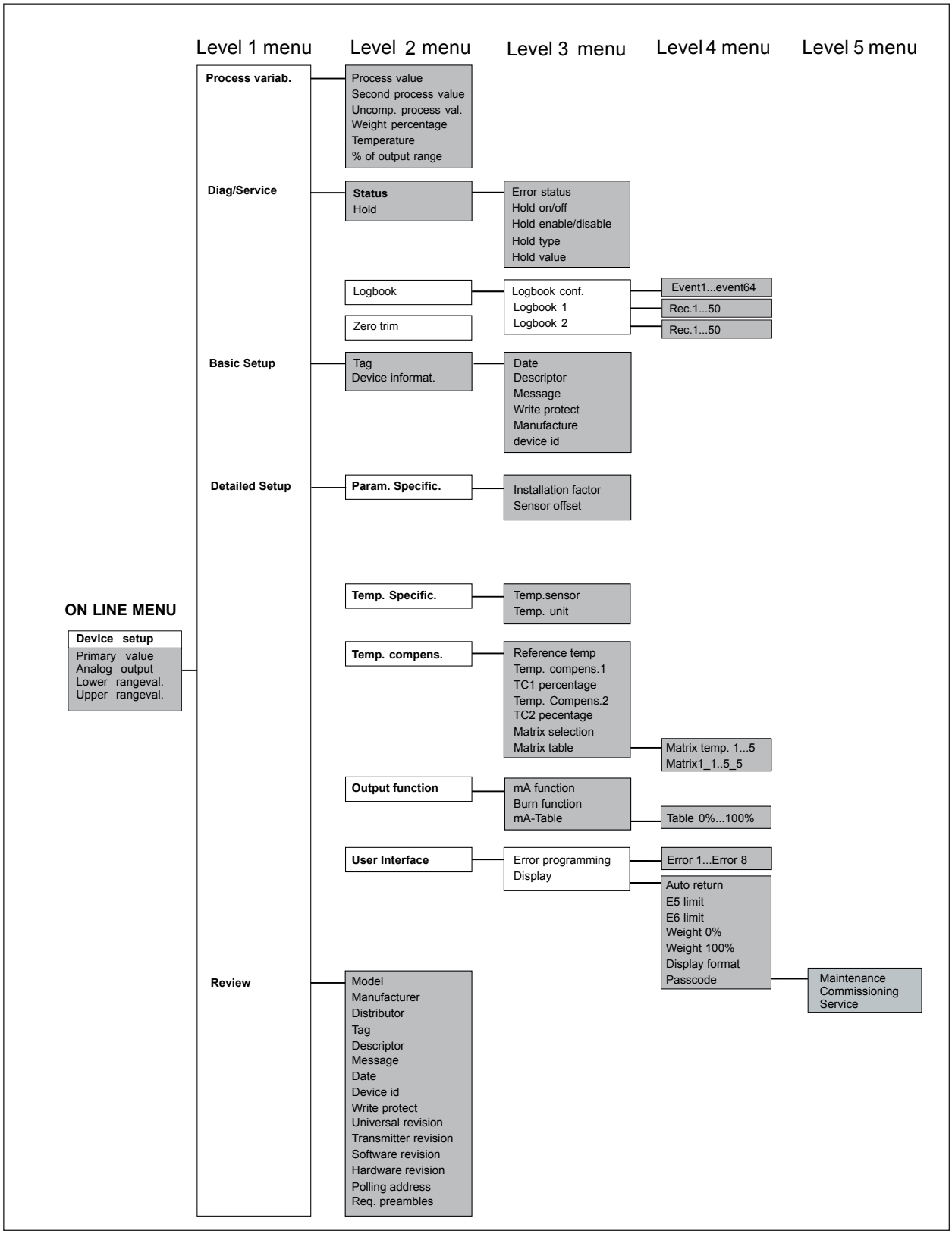
Primary choices	Defaults	Alternatives	Reference on page	Menu or Service code (SC)
Measurement	Conductivity			
1st Temp. compensation	NaCl in water	Fixed T.C., Matrix	5-2-4	'Commissioning'
2nd Temp. compensation	NaCl in water	Fixed T.C., Matrix (inactive)	5-2-5	'Commissioning'
2nd Line display	Process temp.	1st compensation method, Weight%, Output (mA), C.C., Ref. Temp., Software release, 2nd compensated Conductivity, 2nd compensation method	5-1-3/4	'Maintenance'
Range (Linear)	0-1000 mS/cm	0-1999 mS/cm	5-2-1	'Commissioning'
Temperature compensator	30k NTC	Pt 1000	5-3-2	SC 10
Temperature unit Sensor	Celsius (ºC)	Fahrenheit (ºF)	5-3-2	SC 11
Cell constant	1.88 /cm	Any value between 0.2 and 19.99 /cm	5-3-1	SC 03
Communication	HART® enabled	disable HART®, PH201*B	5-7	SC 60
Burn out	inactive	HI or LO, Pulse burnout	5-5	SC 32
HOLD during maintenance	inactive	Hold last value or fixed value	5-2-2	'Commissioning'
Calibration temperature	inactive	Adjustment +/- 15ºC	5-3-2	SC 12
AIR (zero) calibration	inactive	Adjustment +/- 15 µS/cm	5-3-1	SC 04
C.C. Calibration	inactive	0.2 and 19.99 /cm	5-1-2	'Maintenance'
Diagnostics	Hard alarm (all errors)	Hard or soft choices	5-6	SC 53
Instrument Limit: E5 (high)	3S	E5 (High) 0.10 - 9.99 S	5-6	SC 54
Instrument Limit: E6 (low)	0.5 µS	E6 (Low) 0.00 - 99.9 µS	5.6	SC 54
Password protection	inactive	(In)active password for different levels	5-6	SC 52
Output in Concentration units	inactive	Linearization of output, Weight% on LCD	5-6	SC 55

11-5. Coded service settings (default)

	Code	Display	Default Values	Setting #1	Setting #2	Setting #3
	03	*C.C.	1.88 /cm			
	10	*T.SENS	0 : 30 kNTC			
	11	*T.UNIT	0 : ºC			
	12	*T.ADJ	0 ºC			
	20	*T.R. ºC	25ºC			
	21	*T.C.1	2.1% per ºC			
		*T.C.2	2.1% per ºC			
	22	*MATRX	1 : H_2SO_4			
mA	31	*OUTP.F	0: Linear			
	32	*BURN	0: No Burnout			
	50	*RET	1: On			
	52	*PASS	0.0.0.: off.off.off			
	53	*Err. 05	1 : HARD			
		*Err. 06	1 : HARD			
		*Err. 07	1 : HARD			
		*Err. 08	1 : HARD			
	54	*E5.L	3S			
		*E6.LIM	5µS			
mA		*OUTP	0% : 0µS			
			100% : 1000mS			
mA		*HOLD	disabled			
		*TEMP.1	NaCl			
		*TEMP.2	NaCl			
mA	60	*COMM.	1.0: On, write enable			

mA **11-6. Device Description (DD) menu structure**

The Device Description (DD) is available from Yokogawa or the HART® foundation. An example is shown below of the ON LINE menu structure. This manual makes no attempt to explain the operation of the Hand Held Communicator (HHC). For detailed operating instructions, refer to the HHC instruction manual and the on-line help structure.



(Note): HART protocol DD files can be downloaded by following URL.
http://www.yokogawa.com/an/download/an-dl-fieldbus-001en.htm

12. APPENDIX 2

12-1. Preface

This appendix contains these items.

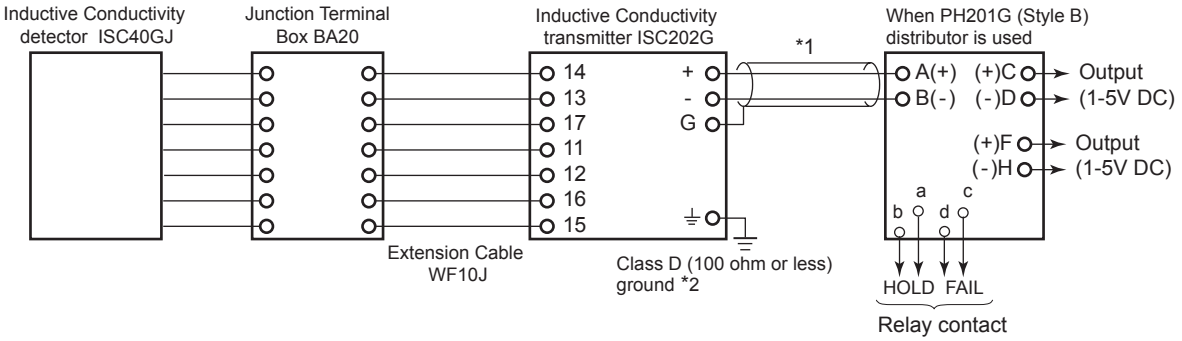
1. Method of wiring and parameter setting the following:.
   - PH201G*B Dedicated Distributor
   - BA2O Junction Terminal Box
   - WF1OJ Extension Cable
2. Quick reference for parameter setting
3. Installation factor adjustment.

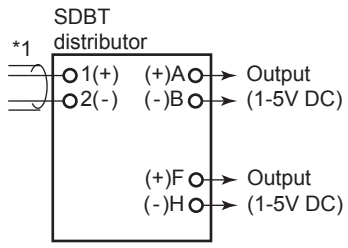
To ensure that this measurement system can be operated safely and also exhibit its full performance, be sure to read this appendix before use.

This appendix does not describe SDBT Distributor which is the component unit of the ISC2O2 two-wire inductive conductivity transmitter system. This unit comes with an instruction manual, so read the instruction manual IM 1B04T02-01E for details of the unit concerned.

12-2. Wiring diagrams

Non-explosionproof system





*1 Use two-wire cable with OD (Outside Diameter) of 6 to 12 mm
Make sure distributor voltage does not drop below minimum for ISC202G
*2 Ground ISC202G (Class D ground: 100 ohm or less)

12-3. Peripheral products
12-3-1. PH201G*B Dedicated Distributor
Model and suffix codes

Model	Suffix Code	Option Code	Description
PH201G	·····	·····	Distributor
Power Supply	-A1	·····	100V AC
	-A2	·····	220V AC
——	*B	·····	Style B
Option		/TB	Terminal for Power connection

T2.2.2E.EPS

Communication setup with PH201G (style B) distributor (service code 60)
This communication is a one-way to PH201G (Style B) distributor, a power supplier for the EXA 202 transmitters. The PH201G (Style B) receives a current signal (4-20 mA DC) and a digital signal superimposed on the DC signal. In other words, the PH201G (Style B) provides a measurement signal, a hold-contact signal and a fail-contact signal. The communication with PH201G (Style B) is set in Service code 60.

Code 60 *COM The settings should be adjusted to suit the communicating device connected to the output. The communication can be set to HART® or to PH201G (Style B) distributor.
When used with our PH201G (Style B) you can enable or disable contact outputs, namely, Fail contact and Hold contact. The PH201G (Style B) can output Hold contact and Fail contact signals. You can set Service Code 53 to “0” for “soft fail” to disable Fail contact output. When you set Service Code 53 to “1” for “hard fail”, set Service Code 60 to “2.0” to enable Fail contact output of PH201G (Style B), or set Service Code 60 to “0.1” to disable Fail contact output of PH201G (Style B).

*ADDR Select address 00 for point communication with 4-20 mA transmission. Addresses 01 to 15 are used in multi-drop configuration (fixed 4 mA output).

Code	Display	Function	Function detail	X	Y	Z	Ddefault values	
Communication								
60	*COMM	Communication (*)	Set HART®communication Off	0			1.0	
			Set HART®communication On	1				On
			communication write enable		0			write enable
			communication write protect		1			
			Set communication PH201G*B	2				
			Without half time check by setting 2.0		0			
			With half time check by setting 2.1		1			
	*ADDR	Network address	Set address 00 to 15				00	

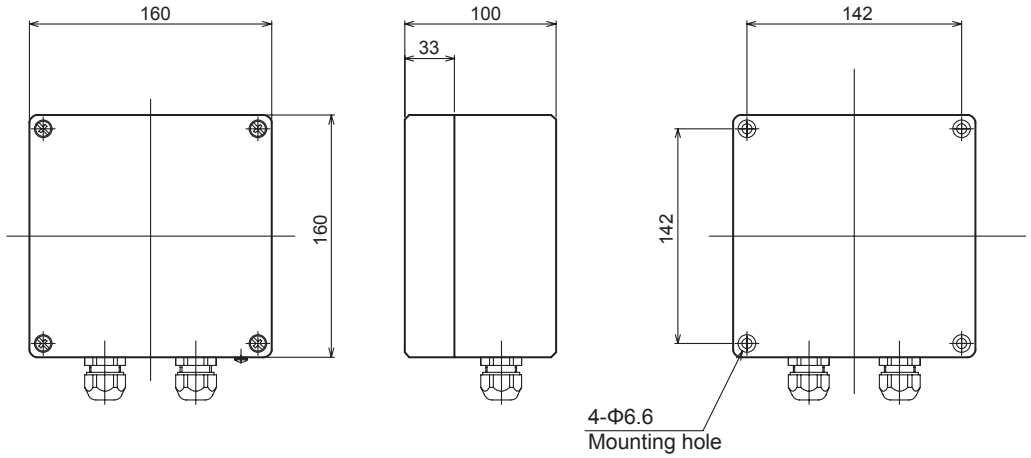
(*) In case of communication with and without distributor, set "2.0" and "0.1", respectively. T5.3.6E.eps

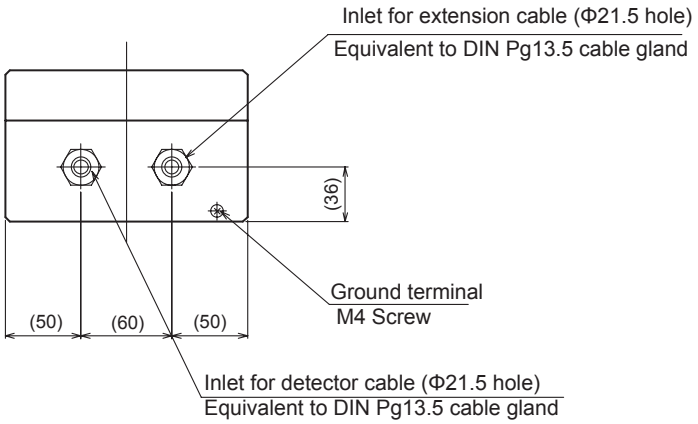
12-3-2. BA20 Junction Terminal Box
Model and suffix codes

Model	Suffix code	Option code	Description
BA20	-------	--------	Terminal box

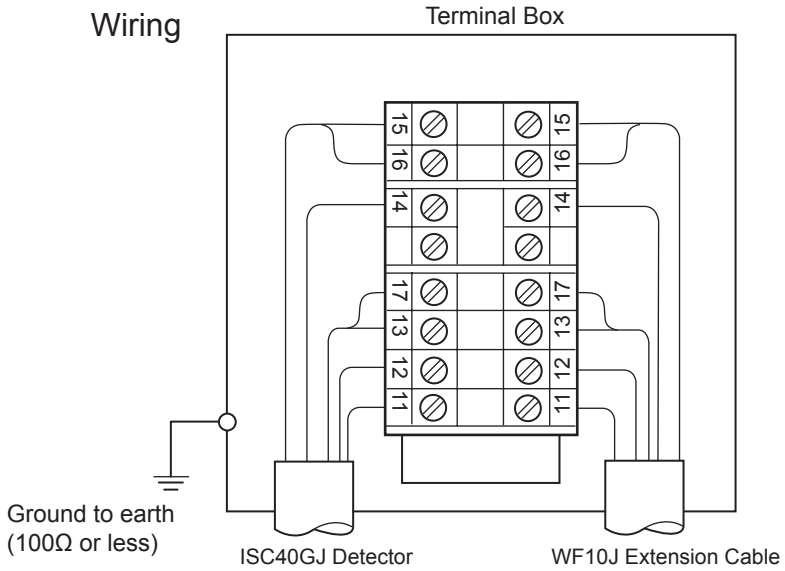
T1.3.5.eps

External Dimensions and Wiring





F2.4.13E.EPS



12-3-3. WF10J Extension Cable

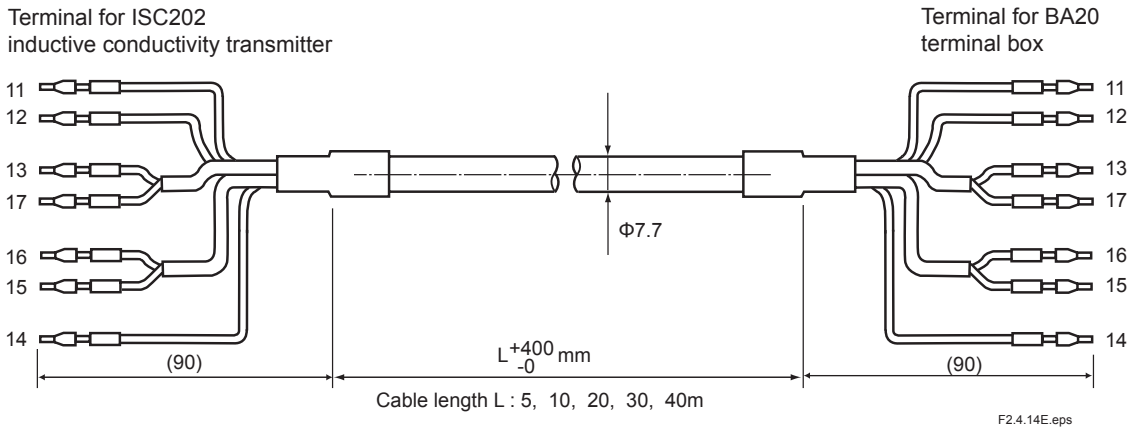
Model and suffix codes

Model	Suffix code	Option code	Description
WF10J	--------	--------	Extension cable
Cable end	-F	------	Finished ends
Cable length	-05	------	5 m
	-10	------	10 m
	-20	------	20 m
	-30	------	30 m
	-40	------	40 m

T1.3.6.eps

(Note) The maximum extension cable length is 50m including sensor cable length.

External Dimensions and Wiring



F2.4.14E.eps

12-4. Quick reference for parameter setting

Preparation for operation entails deciding maintenance-mode settings and measurement range setting-related issues. Service level (mode) settings are described in Sec. 5-3. Shipping-time measurement parameter setting defaults are shown in Table 12-1. In general there is no need to change these defaults.

Table 12-1 Default values of parameters.

Code	Corresponding Parameter	Default	When you should change	Refer to
20	Reference temperature	25°C	To use different reference temp.	Sec. 5-3-3
31	Output characteristic	Linear	For non-linear characteristic	Sec. 5-3-4
35	Output table	0 to 1000mS 0 to 100%	For non-linear characteristic	Sec. 5-3-4
3	Cell constant	1.88	When detector at least 30mm from metal pipe walls Usually corrected by calibration. Seldom nevessary to enter value by service code 37	Sec. 5-3-1
50	Auto return functions	ON(1)	To lock HOLD	Sec. 5-3-5
12	Calibrate temperature	-	To calibrate against more accurate thermometer (esp. when using one-point calibration)	Sec. 5-3-2
32	"Burnout" on fail	OFF(0)	Can set output "burnout" upscale/downscale if abnormal	Sec. 5-3-4
55	Display in Weight%	OFF	To display concentration units	Sec. 5-3-5
21	Temp. coefficient	NaCl	Temp. coefficient other than NaCl	Sec. 5.3.3
22	Matrix temp. compensation	0	Complex compensation	
23-28	Compensation matrix	-	Can be user defined	
52	Passwords	0.0.0	To protect settings	Sec. 5-3-5
70	Revert to factory defaults		To revert to factory defaults	Sec. 5-3-7

T6.1E.eps

12-4-1. Settings Performed in Maintenance Mode

12-4-1-1 Calibration with solution of known conductivity

Refer to Sec. 6 for Calibration

1. When is calibration required?

Inductive conductivity meters should be calibrated before they are first used, but should not need periodic calibration after that: the ISC202/ISC40 inductive conductivity measuring system passes a current through the measured liquid to measure its conductivity; if there is little clearance (less than 30 mm) around the sensor then this can affect the accuracy of calibration, and the sensor should be calibrated before use. Also if the sensor surface becomes corroded or contaminated, you should recalibrate it.

2. How is calibration performed

Calibration normally involves measuring a liquid of known conductivity at a known temperature, and adjusting the meter to read the correct value. Since the reading is affected by the mounting, the sensor should be calibrated on site after installation.

You can mix standard solutions of KCl or NaCl for calibration. The temperature of the standard solution should be maintained at the reference temperature. Conductivity tables for NaCl and KCl are shown in Table 6-1 and 6-2. The other conductivity tables may be found in IEC and other standards. You can also calibrate the sensor with a solution of arbitrary concentration by calibrating it against a standard conductivity meter (we recommend Yokogawa's Personal Conductivity Meter). The reference temperature of both meters should be the same, and as far as possible you should perform the calibration at the reference temperature, as there will otherwise be temperature compensation errors if the temperature compensation functions of the two meters are not exactly the same.

When calibration is performed, the cell constant ("Installation Factor") is corrected (see Sec. 5-1-2).

12-4-1-2 Selecting Items for Display

Refer to Sec. 5-1-3 and 5-1-4

1. Selecting Items for Display

You can select and display the following items on the "message" auxiliary display:

- Measured values
- Error messages
- Other messages

The shipping-time default is for temperature to be displayed.

You can change this default to any item on the list in 2. below.

2. What items can be displayed?

Temperature	:	Current value
Output	:	Current value
Weight%	:	Current value
Installation Factor	:	See Sec. 6 for Calibration, or Sec. 5-1-2 for Installation Factor adjustment
Reference Temperature	:	See Sec. 5-3-3 for Reference Temperature setting
Temperature Compensation	:	For default "standard" temperature compensation, NaCl is displayed

When manual temperature compensation is selected, "T.C. coefficient" is displayed.

When matrix temperature compensation is selected, You need to specify "reference temperature", "temperature compensation coefficient", and (non-linear) "compensation characteristic".

3. Examples

You can display output signal value (range 4 to 20 mA) on the "message" auxiliary display to check the value. For example, if :

Measurement range	: 0 to 100 µS/cm, and
Process value	: 60 µS/cm, then
Output value	: 13.6 mA is displayed.

12-4-2. Commissioning Mode Settings

12-4-2-1 Output Range Setting

Refer to Sec. 5-2-1

1. What does output range setting involve?

When linear output (linear relationship between conductivity and analog output) is selected, the measurement range corresponding to the 4 to 20 mA DC analog output range must be set.

The default measurement range is 0 to 1,000 mS/cm.

The display autoranges up to 1999 mS/cm.

Zero suppression and non-linear output characteristic may be set (see Sec. 5-2).

2. Setting zero-suppression for output range

For setting ranges with zero suppression, you must specify two points:

• Conductivity corresponding to 0% of range (4mA DC)

• Conductivity corresponding to 100% of range (20mA DC)

The conductivity value corresponding to 0% of range must be no greater than 90% of the value corresponding to 100% of range.

Example: To set range 10 to 100 mS/cm

Default 0% setting is 00.0mS/cm.

To change this to 10.0mS/cm, press the (∧) key.

Next press (>) four times until the units display is flashing to change the units.

Press the (∧) key four times until the units display changes to display 10.0 mS/cm.

Press (ENT) to confirm.

Default 100% setting is 1000 mS/cm. Press (>) four times until the units display is flashing.

Press the (∧) key until the units display changes to display 100.0 mS/cm.

Press (ENT) to confirm.

Setting non-linear output

With the ISC202 Inductive Conductivity Transmitter you can define a 21-step non-linear-characteristic (transfer function) output table — to provide an analog output proportional to concentration, for example. If you define such a table, then output range setting is disabled/invalid. Refer to Sec. 5-3-3 and 5-3-4 for 21-step-table setting details. You can also display concentration in weight% (rather than conductivity in mS/cm) as described in Sec. 5-3-5.

NOTE:

Output range 4mA and 20mA points can correspond to conductivity values in the range 0 to1999 mS/cm, but the following restrictions apply:

*1 1999 mS/cm ≤ | (0% setting) - (100% setting) | ≤ 100 µS/cm

*2 Smaller of settings ≤ 90% of larger of settings

12-4-2-2 Setting Hold Functions

Refer to Sec. 5-1-5 and 5-2-2

1. What are HOLD functions?

HOLD functions temporarily hold the output signal, and are typically used to maintain output when the sensor is removed from the measured solution, i.e. to prevent alarms and prevent disturbance to control. HOLD functions are set in Commissioning Mode.

You can set H.LST (HOLD LaST value before entering HOLD, e.g. maintenance, mode) — this is typically used when the transmitter is connected to a recorder — or H.FIX (HOLD predetermined fixed value, e.g. so that control and alarms are not adversely affected).

The default value is for HOLD to be disabled (OFF).

2. How do HOLD functions operate?

Output HOLD status is set as follows:

Under Maintenance Mode (press the MODE key), or Commissioning Mode (press the (✳) key)

Under calibration

You can also turn on HOLD manually as described in Sec. 5-2-2.

When reverting from Calibration, Commissioning, or Maintenance modes to Measurement mode, the user must select whether HOLD should be turned OFF or remain ON.

3. Examples
While washing a reactor, HOLD is turned ON to prevent interference with control. When washing finishes, and a new batch starts, HOLD is turned OFF again and the sensor reverts to conductivity measurement.

4. Auto Return
If AutoReturn functions are enabled, the instrument reverts to measurement mode after a preset time (10 min. by default) Refer to Sec. 5-3-5 User Interface.

12-4-2-3 Temperature Compensation
Refer to Sec. 5-2-3 for details.

1. Why is temperature compensation necessary?
Solution conductivity varies greatly with temperature — in general it varies by about 2%/°C. (Conductivity depends on ion mobility, i.e. on solution composition, concentration as well as temperature).
For details, refer to 5-2-3 Temperature Compensation, 5-2-4 First temperature compensation for conductivity , 5-2-5 Second temperature compensation for conductivity .

12-4-2-4 Correcting Zero Offset Error by Calibration in Air (Air Set)
Refer to Sec. 5-3 for details.

1. Why does Calibration in Air correct Zero Offset error?
It compensates for leakage resistance of sensor cable and the like.

2. When is such Calibration required?
You should correct zero offset error by calibration in air at startup time, and when the sensor is replaced.

3. What is the procedure for Correcting Zero Offset Error by Calibration in Air
Dry the sensor (conductivity of air should be effectively zero).
Ensure that the sensor is not in an electromagnetic (e.g. radio) field.
Enter Service Code 04.
When AIR is displayed, touch the YES key, and — after START is displayed — touch the YES key again. After END is displayed, touch the YES key again.

*__NOTE__: The temperature compensation of NaCl should be selected to confirm zero offset after Air Set.

12-4-3. Actual Setting Examples

WARNING

Do not enter any Service Codes other than those specified in this document.
If you enter a non-specified Service Code it may affect the program firmware or data, and adversely affect the operation of the instrument.

This section provides representative key operation flowcharts. Displays like *SERVXX, where XX is a number, represent Service Codes. Refer to Sec. 5 for details.
For other modes, refer to Sec. 6-1 and 6-2.

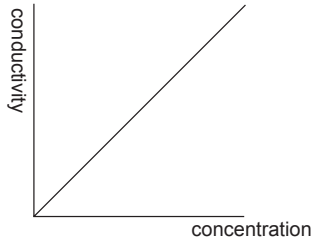
12-4-3-1 Setting Output in terms of Concentration

START

Set Reference Temperature

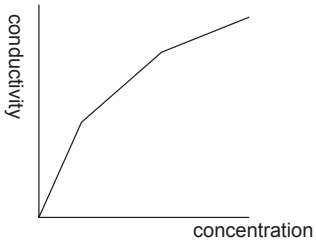
Set Measurement Range

Method 1: Linear relationship between conductivity and concentration



*OUTP
Enter conductivities corresponding to 0% and 100% output

Method 2: Line-segment modeling of non-linear relationship between conductivity and concentration



*SERV 31 select 1
*SERV 35
Enter conductivity values corresponding to concentration represented by output current

Display concentration as weight%

*SERV 55 select 1
Enter concentration values corresponding to 0% and 100% output

Set temperature compensation

Method 1: For NaCl or general solutions use NaCl compensation 2%/°C

Method 2: For other temperature compensation coefficients

Enter temperature coefficient. a=X %/°C
*SERV 21

Method 3: Existing matrix

Data corresponds to the following solution

Sulfuric acid	0 - 5% 0 - 25%	0 - 100°C
Hydrochloric acid	0 - 5% 0- 20%	0 - 60°C
Nitric acid	0 - 5% 0 - 25%	0 - 80°C
Sodium Hydroxide	0 - 5% 0 - 15%	0 - 100°C

Matrix temperature compensation (existing data)
*SERV 22

Method 4: Where present matrix data does not exist, for example, when the temperature coefficient is not constant α you can create a user matrix.

User-defined matrix temperature compensation
*SERV 23-28

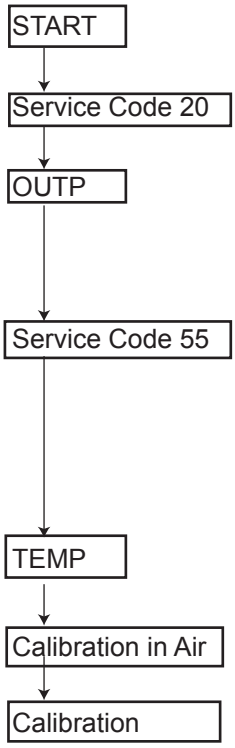
Calibration in Air (Air Set) (correct zero offset due to leakage resistance)

F6.3.1E.eps

Calibrate in actual measured solution

Sample 1
NaCl concentration

Meas. range 250-320 g/l
Reference temp. 60°C
Temp. compensation Use NaCl compensation (default)
Concentration — conductivity relationship is linear



60°C

0% out -> 404 mS/cm
100% out -> 450 mS/cm
(These conductivity values apply to reference temperature)

Select 1
0% out --> "25%" representing 250 g/l
100% out --> "32%" representing 320 g/l
(g/l display not supported, so here using % instead. Also display is XX.X%, so we display actual concentration divided by 10

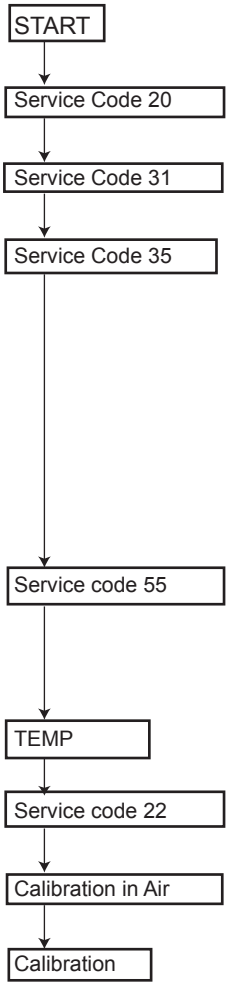
NaCl

Calibrate conductivity value using personal SC meter
(1) Set temp. compensation of both ISC202 and personal SC meter to zero.
(2) Place both ISC202 sensor and personal SC meter sensor in measured solution, wait for temperature and conductivity readings to stabilize.
(3) When stabilize, calibrate by adjusting ISC202 reading to same as personal SC meter reading.
(4) Finally revert temperature compensation to NaCl default.

Sample1E.eps

Sample 2
NaOH concentration

Meas. range 0-10%
Reference temp. 25°C Temp. compensation
Use existing (temperature, concentration) matrix



25°C (default)

Select 1

Enter conductivity values corresponding to output current values.
Existing table (below) relates output current to conductivity at 25°C

Output Current (%)	NaOH conc (%)	Conductivity (mS/cm)
0	0	0
10	1	53
30	3	145
60	6	256
100	10	359

Select 1
0% output --> 0 %
100% output --> 10%

NaCl --> NO
TC --> YES (here use [MODE] key to escape)

Matrix code 8

Calibrate conductivity value in actual operation
e.g. 3% NaOH corresponds to conductivity 145 mS/cm
(see above table)

sample2E.eps

Sample 3
Concentration of sulfuric acid mixture

Meas. range 93-97%
Reference temp. 50°C
Temp. compensation Enter temperature compensation data into a 5 x 5 matrix

START

Service code 20 — 50°C(Default)

Service code 31 — Select 1

Service code 35 — Enter conductivity values corresponding to output current values.
Existing table (below) relates output current to conductivity at 50°C

Output Current (%)	H_2SO_4 conc (%)	Conductivity (mS/cm)
0	93	227
25	94	217
50	95	204
75	96	186
100	97	162

Service code 55 — 0% output -->93%
100%output -->97%

TEMP — NaCl -->NO
TC -->YES (here use [MODE] key to escape)

Service code 22 — Matrix code 9

Service code 23 — 25 to 75°C

Service code 24 to 28

°C / (%)	25	37.5	50	62.5	75
93	133	177	227	283	344
94	128	171	217	270	328
95	122	160	204	253	306
96	110	146	186	230	288
97	95	125	162	196	238

Conductivity unit (mS/cm)

sample3E.eps

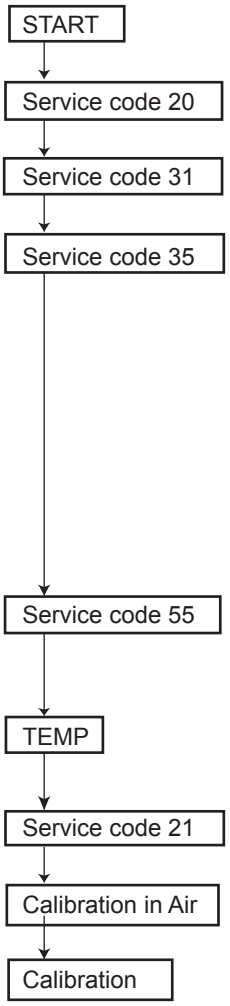
Calibration in Air

Calibration — Calibrate conductivity value in actual operation
e.g. 95% H_2SO_4 corresponds to conductivity 204 mS/cm (see above table)

Note: This application requires special sensor body material

Sample 4
Concentration of hydrochloric acid

Meas. range	30-40%
Reference temp.	35°C
Temp. compensation	Enter temperature compensation coefficient, Relate concentration to conductivity by table



Service code 20: 35 °C (Default)

Service code 31: Select 1

Service code 35: Enter conductivity values corresponding to output current values.
Table (below) relates output current to conductivity at 35°C

Output current (%)	HCl conc.(%)	Conductivity (mS/cm)
0	30	845
20	32	840
40	34	772
60	36	731
80	38	688
100	40	644

Service code 55: Select 1
0% output --> 30 %
100% output --> 40%

TEMP: NaCl --> NO
TC --> YES (here use [MODE] key to escape)

Service code 21: TC=1.24 (data from customer)

Calibration in Air:

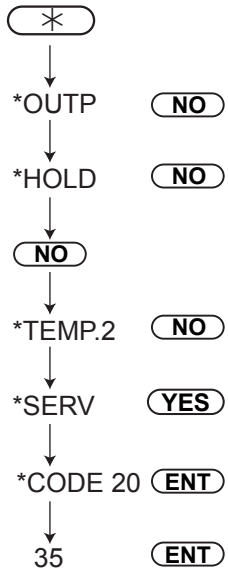
Calibration: Calibrate conductivity value in actual operation
e.g. 34% HCl corresponds to conductivity 772 mS/cm

sample4E.eps

12-4-3-2 Key Operation Procedure Examples
This uses Sample 1 above as the example

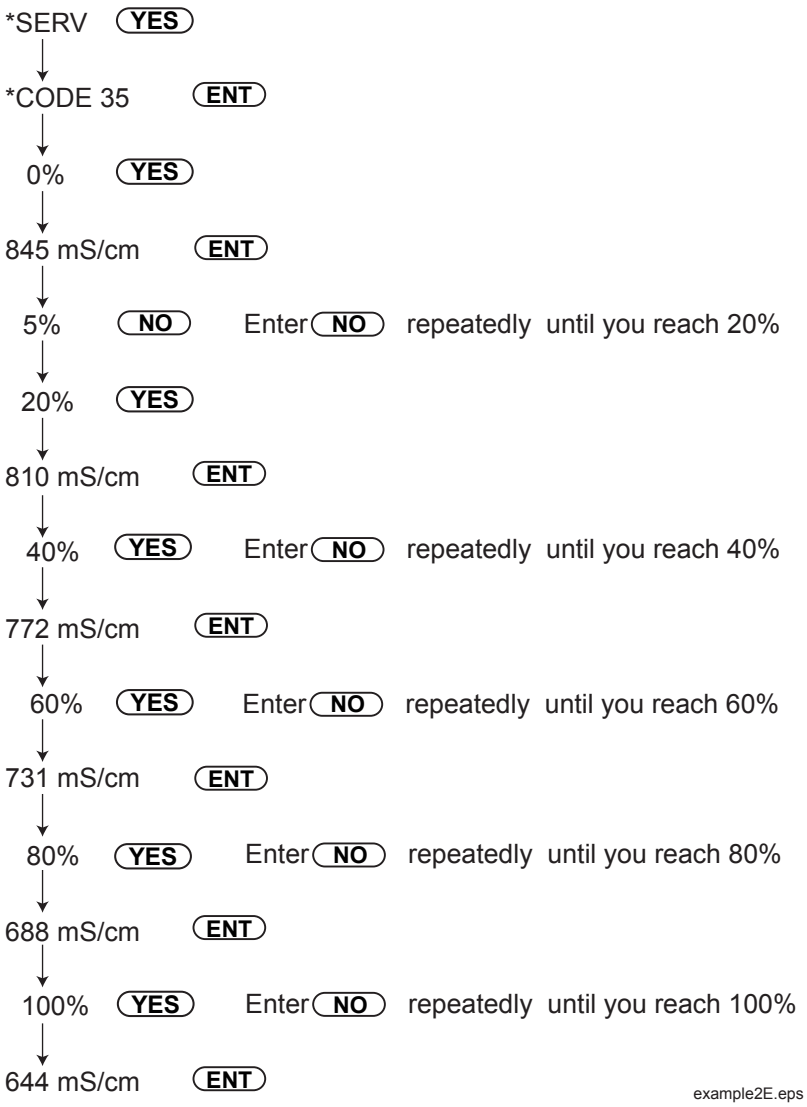
1. Reference Temperature Setting
Temperature compensation converts the measured conductivity to the equivalent at the reference temperature. The nearer the liquid temperature to the reference temperature, the lower the conversion error.

Service code 20 35°C



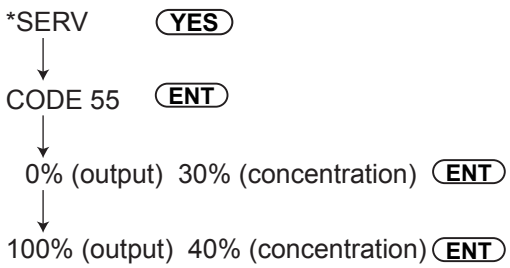
example1E.eps

2. Output Table Setting Example



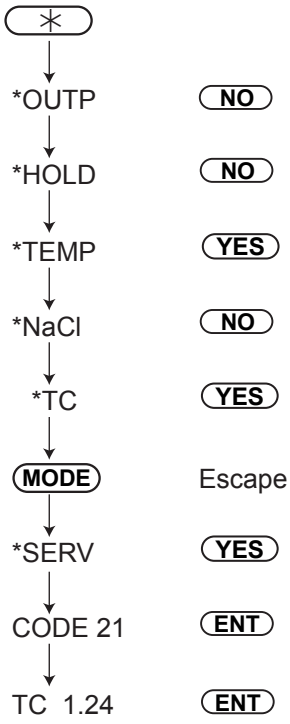
example2E.eps

3. Concentration Table Setting Example



example3E.eps

4. Temperature Compensation Coefficient Setting Example



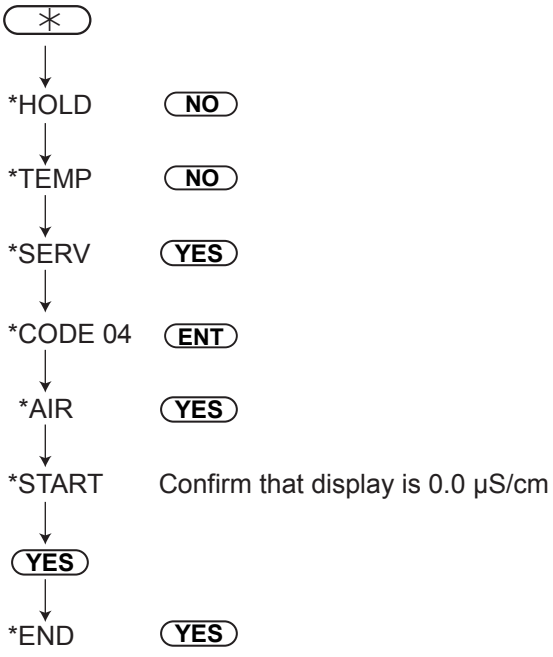
example4E.eps

The temperature compensation coefficient is calculated as follows:

$$\alpha = \frac{K_t - K_{ref}}{T - T_{ref}} \times \frac{100}{K_{ref}}$$

T = Measured temperature (°C)
Kt = Conductivity coefficient at temperature T (°C)
Tref = Reference temperature (25 °C)
Kref = Conductivity coefficient at temperature Tref

5. Calibration in Air example (Air Set)



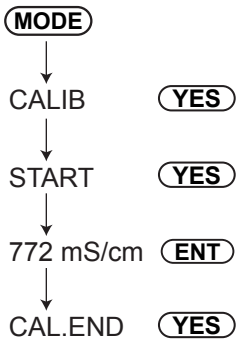
example5E.eps

6. One-point Calibration example

Normally you would do a laboratory analysis when the sensor is installed and use the resulting value to calibrate the transmitter. If the concentration at start-up time is known, then you can use concentration to conductivity tables to determine the conductivity, and use that.

For example, suppose that the concentration is known to be 34%, and the transmitter should display the corresponding conductivity which is 772mS/cm:

.



example6E.eps

12-5. Installation factor adjustment
ACCESS CODE : 03
DISPLAY : *C.C.
Adjustment:
Adjust the ratio between the measured conductance of the sensor and the specific conductivity of the solution.
Explanation:
The installation factor for the ISC40 detector is the ratio of the measured conductivity of the sensor and the specific conductivity of the solution. This factor varies depending on materials of process piping and the distance between the doughnut sensor and the process piping. If the distance is less than 30 mm, sensor calibration is required before using the ISC40. From the calibration results, the ISC202 will calculate an installation factor corresponding to the installation conditions and use it for conductivity measurement.
In case where sensor calibration is difficult to be conducted, enter the manually calculated installation factor into the ISC202 following the instructions below.

- When a sensor is installed in the standard stainless steel holder, ISC40FFJ-S, the installation factor decreases approximately 7%. Reduce the value indicated on the label of the sensor cable by 7%, and then enter the result.
- When a sensor is installed in the standard polypropylene holder, ISC40FFJ-P, the installation factor increases approximately 1%. Increase the value indicated on the label of the sensor cable by 1%, and then enter the result.
- When a sensor is installed in long piping with a distance (D) between the sensor and piping, as shown in the figure below, the installation factor for pipe mounting (reference data when the nominal value is 1.88 cm^{-1}) is shown in the graph below. Divide the value indicated on the label of the sensor cable by 1.88 and then multiply the quotient by the value obtained from the table. Enter the result.

Default: 1.88 cm^{-1}

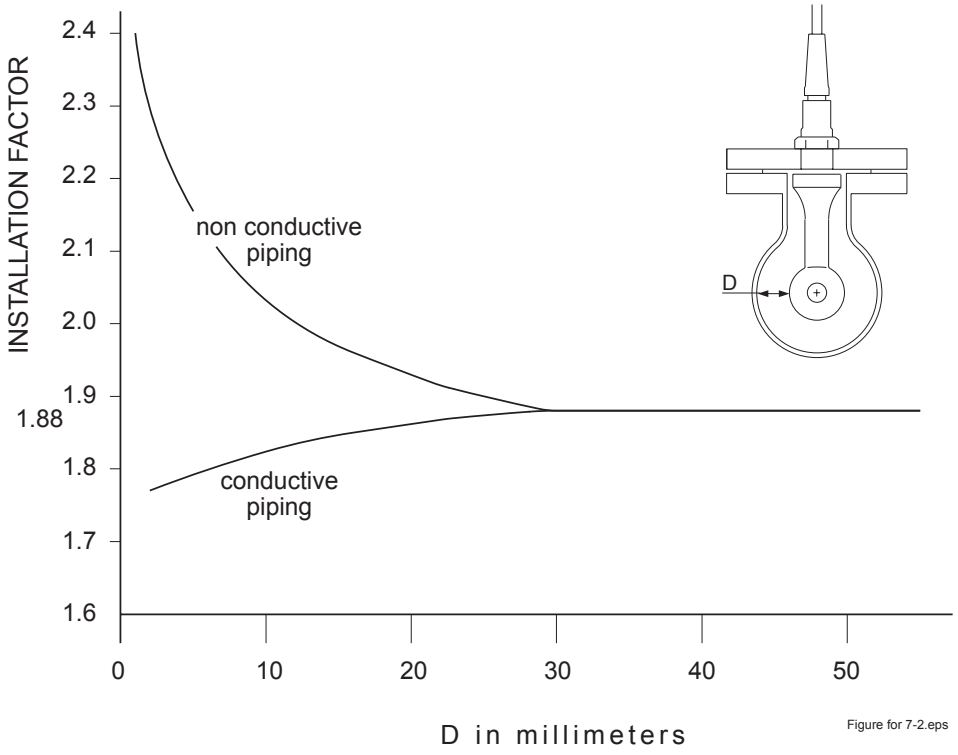


Figure 12-1. Installation factor for pipe mounting

13. APPENDIX 3 QUALITY INSPECTION

13-1. ISC202G 2-Wire Inductive Conductivity Transmitter

Quality Inspection Standards

ISC202G 2-Wire Inductive Conductivity Transmitter

1. Scope

This inspection standard applies to the ISC202G 2-Wire Inductive Conductivity Transmitter.

2. Inspection Items

2.1 Insulation resistance test
2.2 Current output test
2.3 Temperature indication check
*2.4 Resistance (conductivity) indication check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Sections 3.1.
- Use a testing circuit and test equipment shown in Figure 1, or equivalent, for the tests.
- Performance tests should be done in the inspection mode where the tests from Section 3.2 through Section 3.4 take place in sequence and cannot be retraced. If the reconfirmation of a test is needed, turn off the power to the transmitter, turn on the power again, and enter the inspection mode to restart the tests.

3.1 Insulation Resistance Test

(1) Apply 500 V DC between the power supply terminals shorted together (+ and –), input terminals shorted together (11 to 17) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

3.2 Current Output Test

<Preparation>

- Set resistance box 1 to 30 kΩ. Wind ten turns of wire onto the ISC40 sensor and set resistance box 2 to 1 kΩ.

<Test>

- Through key operations on the transmitter, enter Service Code 87, input password 070, and press the [ENT] key.
- When "∗HIF" appears, press the [YES] key.
- Press the [ENT] key. (The date in day-month-year (last 2 digits) order will appear.)
- Press the [ENT] key. (The time in hour-minute-second order will appear.)
- Press the [ENT] key.
- When the message display shows "4 mA," the output current must be within in the range shown in Table 1.
- Press the [ENT] key repeatedly until the message displays shows "12 mA." When it shows "12 mA," the output current must be within the range shown in Table 1.
  To skip the current output not needed to be checked, just press the [ENT] key.
- Press the [ENT] key repeatedly until the message displays shows "20 mA." When it shows "20 mA," the output current must be within the range shown in Table 1.
- From the above last step, proceed directly to the temperature indication check in Item 3.3.

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QIS 12D06A03-01E
1st Edition: Sep. 2004
3rd Edition: Mar. 2007

Table 1

Current Output (Indication)	Output Range
4.0 mA	4 ±0.02 mA DC
12.0 mA	12 ±0.02 mA DC
20.0 mA	20 ±0.02 mA DC

3.3 Temperature Indication Check

<Test>

- From the last step in Item 3.2, Current Output Test, press the [ENT] key repeatedly until the message display shows “PT1000.”
- Change the resistance value of the resistance box 1 (for temperature) as shown in Table 2-1 and check the temperature readings. Each temperature reading must be within the range.

Table 2-1 (PT1000)

Resistance of Resistance Box 1	Indication range
1097.3 Ω	25.0 ±0.3°C
1385.0 Ω	100.0 ±0.3°C

- Press the [ENT] key. The message display will show “30k NTC.”
- Change the resistance value of the resistance box 1 (for temperature) as shown in Table 2-2 and check the temperature readings. Each temperature reading must be within the range.

Table 2-2 (30k NTC)

Resistance of Resistance Box 1	Indication range
30 kΩ	25.0 ±0.3°C
2.069 kΩ	100.0 ±0.3°C

- From the above last step, proceed directly to the resistance (conductivity) indication check in Item 3.4.

3.4 Resistance (Conductivity) Indication Check

<Test>

- From the last step in Item 3.3, Temperature Indication Check, press the [ENT] key repeatedly until the message display shows “SEL.10.”
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.1.”
- Set resistance box 2 to the value shown in Table 3 and check the indication. The resistance indication must be within the range.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.2.” There is no need to check here, so just press the [ENT] key.
- The message display shows “∗WAIT∗” momentarily, followed by “RES.3.”
- Set resistance box 2 to the value shown in Table 3 and check the indication. The resistance indication must be within the range.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.4.” There is no need to check here, so just press the [ENT] key.
- The message display shows “∗WAIT∗” momentarily, followed by “RES.5.”

Table 3 SEL.10

Indication	Setpoint of Resistance Box 2	Indication Range
RES. 1	30.00Ω	0.300±0.002
RES. 3	800.00Ω	8.00±0.04
RES. 5	30.00kΩ	300±2

- Change the number of turns of wire onto the ISC40GJ sensor from ten to one.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.6.”
- Set resistance box 2 to the value shown in Table 4 and check the indication. The resistance indication must be within the range.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.7.” There is no need to check here, so just press the [ENT] key.
- The message display shows “∗WAIT∗” momentarily, followed by “RES.8.”
- Set resistance box 2 to the value shown in Table 4 and check the indication. The resistance indication must be within the range.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.9.”
- Set resistance box 2 to the value shown in Table 4 and check the indication. The resistance indication must be within the range.
- After the test, press the [ENT] key. The message display shows “READY.”
- Press the [ENT] key to restart the transmitter.

Table 4 SEL1

Indication	Setpoint of Resistance Box 2	Indication Range
RES. 6	300.0Ω	300±2
RES. 8	8.000kΩ	8.00±0.10k
RES. 9	80.00kΩ	80.0±6.3k

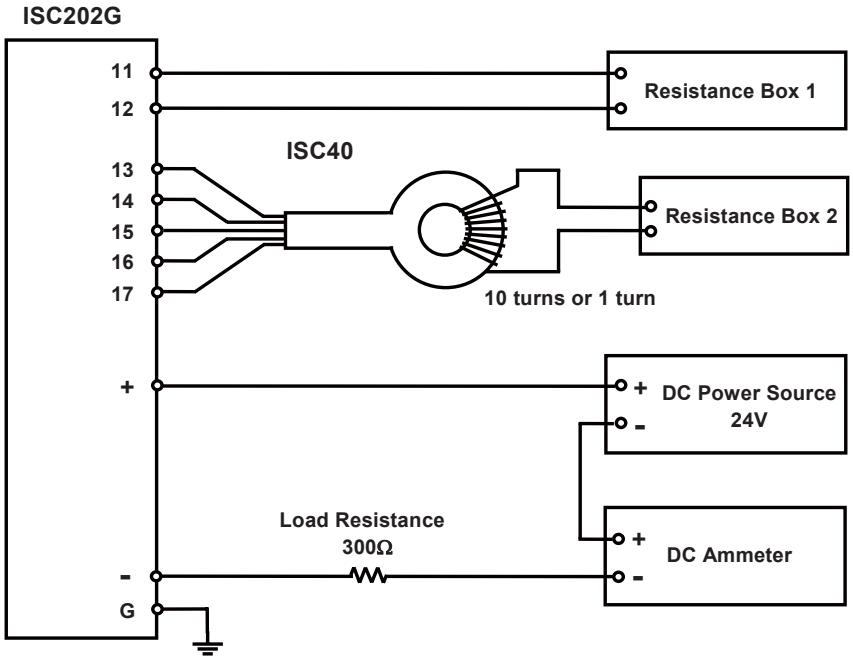

Figure 1 Testing Circuit and Test Equipment

成 績 表
TEST CERTIFICATE

製品名称 PRODUCT NAME	2線式電磁導電率伝送器 2 WIRE INDUCTIVE CONDUCTIVITY TRANSMITTER	タグNo. TAG NO.	
形名 MODEL	ISC202G		
手配No. ORDER NO.		計器番号 SERIAL NO.	

検 査 項 目　INSPECTION ITEM		結 果 RESULT
外　観 APPEARANCE		
絶縁抵抗 INSULATION RESISTANCE	電源端子(＋, －)および入力端子(11～17) 一括とアース端子(G)間 100MΩ以上 / 500V DC BETWEEN POWER SUPPLY TERMINALS(+,−), INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC	

出力電流 CURRENT OUTPUT

許容差 ACCURACY : ±0.02mA DC

表示 INDICATION (mA)	出 力 OUTPUT (mA DC)		
	基準値 REF.	実測値 ACTUAL	誤差 ERROR
4.0	4		
12.0	12		
20.0	20		

温度表示 TEMPERATURE INDICATION

PT1000

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (℃)			
	基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
1097.3	25.0	±0.3		
1385.0	100.0	±0.3		

30k NTC

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (℃)			
	基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
30k	25.0	±0.3		
2.069k	100.0	±0.3		

抵抗表示 RESISTANCE INDICATION

SEL10

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (Ω)			
	基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
30	0.300	±0.002		
800	8.00	±0.04		
30k	300	±2		

SEL1

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (Ω)			
	基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
300	300	±2		
8k	8.00k	±0.10k		
80k	80.0k	±6.3k		

NOTES

日付 DATE	室内温度・湿度 AMBIENT TEMP. & HUM. ℃ %
検査者 INSPECTOR	承認者 APPROVED BY

YOKOGAWA ◆

QIC-12D06A03-01
Ed2 Mar. 2007

13-2. ISC202S 2-Wire Inductive Conductivity Transmitter

Quality Inspection Standards

ISC202S 2-Wire Inductive Conductivity Transmitter

1. Scope

This inspection standard applies to the ISC202S 2-Wire Inductive Conductivity Transmitter.

2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Current output test
2.4 Temperature indication check
*2.5 Resistance (conductivity) indication check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Sections 3.1and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Use a testing circuit and test equipment shown in Figure 1, or equivalent, for the tests.
- Performance tests should be done in the inspection mode where the tests from Section 3.3 through Section 3.5 take place in sequence and cannot be retraced. If the reconfirmation of a test is needed, turn off the power to the transmitter, turn on the power again, and enter the inspection mode to restart the tests.

3.1 Insulation Resistance Test

- Apply 500 V DC between the power supply terminals shorted together (+ and –), input terminals shorted together (11 to 17) and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

3.2 Dielectric strength test

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

- Between the power supply terminals shorted together (+ and –) , input terminals shorted together (11 to 17) and the earth terminal (G)

3.3 Current Output Test

<Preparation>

- Set resistance box 1 to 30 kΩ. Wind ten turns of wire onto the ISC40 sensor and set resistance box 2 to 1 kΩ.

<Test>

- Through key operations on the transmitter, enter Service Code 87, input password 070, and press the [ENT] key.
- When “∗HIF” appears, press the [YES] key.
- Press the [ENT] key. (The date in day-month-year (last 2 digits) order will appear.)
- Press the [ENT] key. (The time in hour-minute-second order will appear.)
- Press the [ENT] key.

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QIS 12D06A03-21E
1st Edition: Mar. 2007

- When the message display shows “4 mA,” the output current must be within in the range shown in Table 1.
- Press the [ENT] key repeatedly until the message displays shows “12 mA.” When it shows “12 mA,” the output current must be within the range shown in Table 1.
  To skip the current output not needed to be checked, just press the [ENT] key.
- Press the [ENT] key repeatedly until the message displays shows “20 mA.” When it shows “20 mA,” the output current must be within the range shown in Table 1.
- From the above last step, proceed directly to the temperature indication check in Item 3.3.

Table 1

Current Output (Indication)	Output Range
4.0 mA	4 ±0.02 mA DC
12.0 mA	12 ±0.02 mA DC
20.0 mA	20 ±0.02 mA DC

3.4 Temperature Indication Check

<Test>

- From the last step in Item 3.3, Current Output Test, press the [ENT] key repeatedly until the message display shows “PT1000.”
- Change the resistance value of the resistance box 1 (for temperature) as shown in Table 2-1 and check the temperature readings. Each temperature reading must be within the range.

Table 2-1 (PT1000)

Resistance of Resistance Box 1	Indication range
1097.3 Ω	25.0 ±0.3°C
1385.0 Ω	100.0 ±0.3°C

- Press the [ENT] key. The message display will show “30k NTC.”
- Change the resistance value of the resistance box 1 (for temperature) as shown in Table 2-2 and check the temperature readings. Each temperature reading must be within the range.

Table 2-2 (30k NTC)

Resistance of Resistance Box 1	Indication range
30 kΩ	25.0 ±0.3°C
2.069 kΩ	100.0 ±0.3°C

- From the above last step, proceed directly to the resistance (conductivity) indication check in Item 3.5.

3.5 Resistance (Conductivity) Indication Check

<Test>

- From the last step in Item 3.4, Temperature Indication Check, press the [ENT] key repeatedly until the message display shows “SEL.10.”
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.1.”
- Set resistance box 2 to the value shown in Table 3 and check the indication. The resistance indication must be within the range.

- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.2.” There is no need to check here, so just press the [ENT] key.
- The message display shows “∗WAIT∗” momentarily, followed by “RES.3.”
- Set resistance box 2 to the value shown in Table 3 and check the indication. The resistance indication must be within the range.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.4.” There is no need to check here, so just press the [ENT] key.
- The message display shows “∗WAIT∗” momentarily, followed by “RES.5.”

Table 3 SEL.10

Indication	Setpoint of Resistance Box 2	Indication Range
RES. 1	30.00Ω	0.300±0.002
RES. 3	800.00Ω	8.00±0.04
RES. 5	30.00kΩ	300±2

- Change the number of turns of wire onto the ISC40GJ sensor from ten to one.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.6.”
- Set resistance box 2 to the value shown in Table 4 and check the indication. The resistance indication must be within the range.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.7.” There is no need to check here, so just press the [ENT] key.
- The message display shows “∗WAIT∗” momentarily, followed by “RES.8.”
- Set resistance box 2 to the value shown in Table 4 and check the indication. The resistance indication must be within the range.
- Press the [ENT] key. The message display shows “∗WAIT∗” momentarily, followed by “RES.9.”
- Set resistance box 2 to the value shown in Table 4 and check the indication. The resistance indication must be within the range.
- After the test, press the [ENT] key. The message display shows “READY.”
- Press the [ENT] key to restart the transmitter.

Table 4 SEL1

Indication	Setpoint of Resistance Box 2	Indication Range
RES. 6	300.0Ω	300±2
RES. 8	8.000kΩ	8.00±0.10k
RES. 9	80.00kΩ	80.0±6.3k

4/4

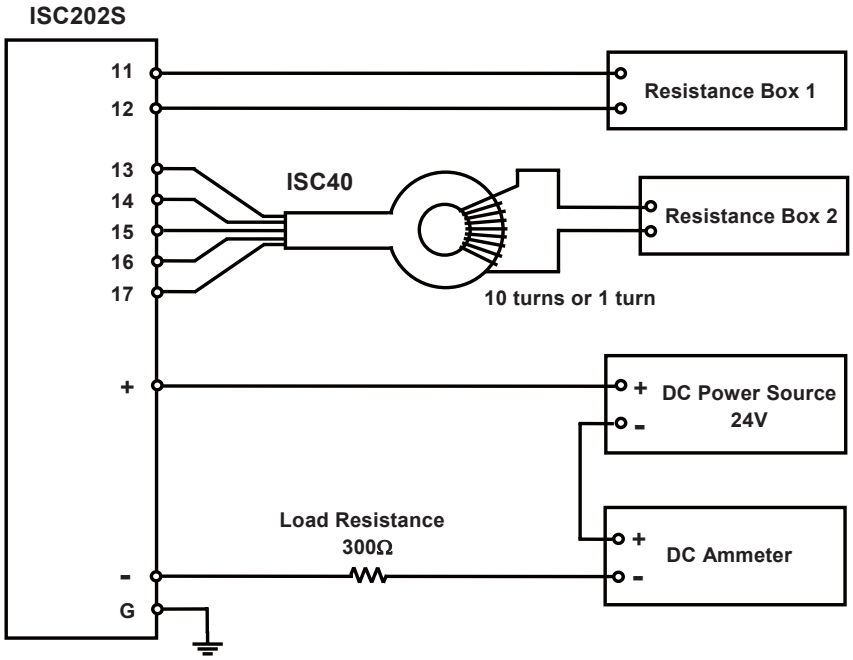

Figure 1 Testing Circuit and Test Equipment

QIS 12D06A03-21E

成 績 表
TEST CERTIFICATE

製品名称 PRODUCT NAME: 2線式電磁導電率伝送器 2 WIRE INDUCTIVE CONDUCTIVITY TRANSMITTER
タグNo. TAG NO.:
形名 MODEL: ISC202S
手配No. ORDER NO.:
計器番号 SERIAL NO.:

検 査 項 目 INSPECTION ITEM		結 果 RESULT
外 観 APPEARANCE		
絶縁抵抗 INSULATION RESISTANCE	電源端子(＋, －)および入力端子(11～17) 一括とアース端子(G)間 100MΩ以上 / 500V DC BETWEEN POWER SUPPLY TERMINALS(+,−), INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC	
耐電圧 DIELECTRIC STRENGTH	電源端子(＋, －)および入力端子(11～17) 一括とアース端子(G)間 600V AC/2 SEC BETWEEN POWER SUPPLY TERMINALS(+,−), INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 600V AC/2 SEC	

出力電流 CURRENT OUTPUT

許容差 ACCURACY : ±0.02mA DC

表示 INDICATION (mA)	出 力 OUTPUT (mA DC) 基準値 REF.	実測値 ACTUAL	誤差 ERROR
4.0	4		
12.0	12		
20.0	20		

温度表示 TEMPERATURE INDICATION

PT1000

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (℃) 基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
1097.3	25.0	±0.3		
1385.0	100.0	±0.3		

30k NTC

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (℃) 基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
30k	25.0	±0.3		
2.069k	100.0	±0.3		

抵抗表示 RESISTANCE INDICATION

SEL10

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (Ω) 基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
30	0.300	±0.002		
800	8.00	±0.04		
30k	300	±2		

SEL1

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (Ω) 基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
300	300	±2		
8k	8.00k	±0.10k		
80k	80.0k	±6.3k		

NOTES

日付 DATE:
室内温度・湿度 AMBIENT TEMP. & HUM. ℃ %
検査者 INSPECTOR:
承認者 APPROVED BY:

YOKOGAWA ◆

QIC-12D06A03-21
Ed1 Mar. 2007

13-3. ISC202G, ISC202S 2-Wire Inductive Conductivity Transmitter (Fieldbus Communication)

Quality Inspection Standards

ISC202G, ISC202S 2-Wire Inductive Conductivity Transmitter (Fieldbus Communication)

1. Scope

This inspection standard applies to the ISC202G and ISC202S 2-Wire Inductive Conductivity Transmitters (Fieldbus specification).

2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Temperature indication check
*2.4 Conductivity indication check
*2.5 Fieldbus communication functional check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Sections 3.1and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Use test equipment shown in Figure 1, or equivalent, for the tests.

3.1 Insulation Resistance Test

- Apply 500 V DC between the power supply terminals (+ and –) plus input terminals (11 to 17), shorted together, and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

3.2 Dielectric Strength Test (Required Only for ISC202S)

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

- Between the power supply terminals (+ and –) plus input terminals (11 to 17), shorted together, and the earth terminal (G)

3.3 Temperature Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.
Decade resistance box 1: 1097.3 Ω
Decade resistance box 2: 100 Ω
Set the type of temperature sensor to PT1000.
Setting Service Code 10 to 1.

a. Press the [∗] key.
b. Press the [NO] key twice. The message display will show “∗SERV.”
c. Press the [YES] key. The data display will show “00” with the first digit of 0 flashing.
d. Press the [∧] key once. The data display will show “10.”
e. Press the [ENT] key. The message display will show “∗ T.SENS.”
f. Press the [∧] key once. The data display will change from “0” to “1.”
g. Press the [ENT] key until the message display shows “∗ SERV.”
h. Press the [∗] key. The instrument returns to the measurement mode.

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QIS 12D06A03-61E
1st Edition: Apr. 2007

In this state, change the resistance value of the decade resistance box 1 as shown in Table 1. The corresponding temperature indication must be within the range.

Table 1 Temperature Indication Check (PT1000)

Reference Temperature	Resistance of Resistance Box 1	Indication Range
25 °C	1097.3 Ω	25.0 ±0.3 °C
100 °C	1385.0 Ω	100.0 ±0.3 °C

Set the type of temperature sensor to 30k NTC.

- Set Service Code 10 to 0 by following the steps for setting Service Code 10 to 1.

In this state, change the resistance value of the decade resistance box 1 as shown in Table 2. The corresponding temperature indication must be within the range.

Table 2 Temperature Indication Check (30k NTC)

Reference Temperature	Resistance of Resistance Box 1	Indication Range
25 °C	30 kΩ	25.0 ±0.3 °C
100 °C	2.069 kΩ	100.0 ±0.3 °C

3.4 Conductivity Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.

Decade resistance box 1: OPEN
Decade resistance box 2: 100 Ω

If a sensor other than the reference sensor is used, zero and span calibrations are required.

Wind ten turns of wire on the ISC40 sensor.
Change the resistance value of the decade resistance box 2 as shown in Table 3. The corresponding conductivity indication must be within the range.

Table 3 Conductivity Indication Check (Cell constant: 1.88/cm)

Reference Conductivity	Resistance of Resistance Box 2	Indication Range
1880 mS/cm	100 Ω	1880.0 ±9.4 mS/cm
188 mS/cm	1 kΩ	188.0 ±0.94 mS/cm
18.8 mS/cm	10 kΩ	18.80 ±0.094 mS/cm

Change the number of turns of wire on the ISC40 sensor to one.
Change the resistance value of the decade resistance box 2 as shown in Table 4. The corresponding conductivity indication must be within the range.

Table 4 Conductivity Indication Check (Cell constant: 1.88/cm)

Reference Conductivity	Resistance of Resistance Box 2	Indication Range
6.27 mS/cm	300 Ω	6.27 ±0.04 mS/cm
1.567 mS/cm	1.2 kΩ	1.567 ±0.009 mS/cm
376 µS/cm	5 kΩ	376 ±3.7 µS/cm

3.5 Fieldbus Communication Functional Check

Check for normal function using Fieldbus equipment specified by Yokogawa.

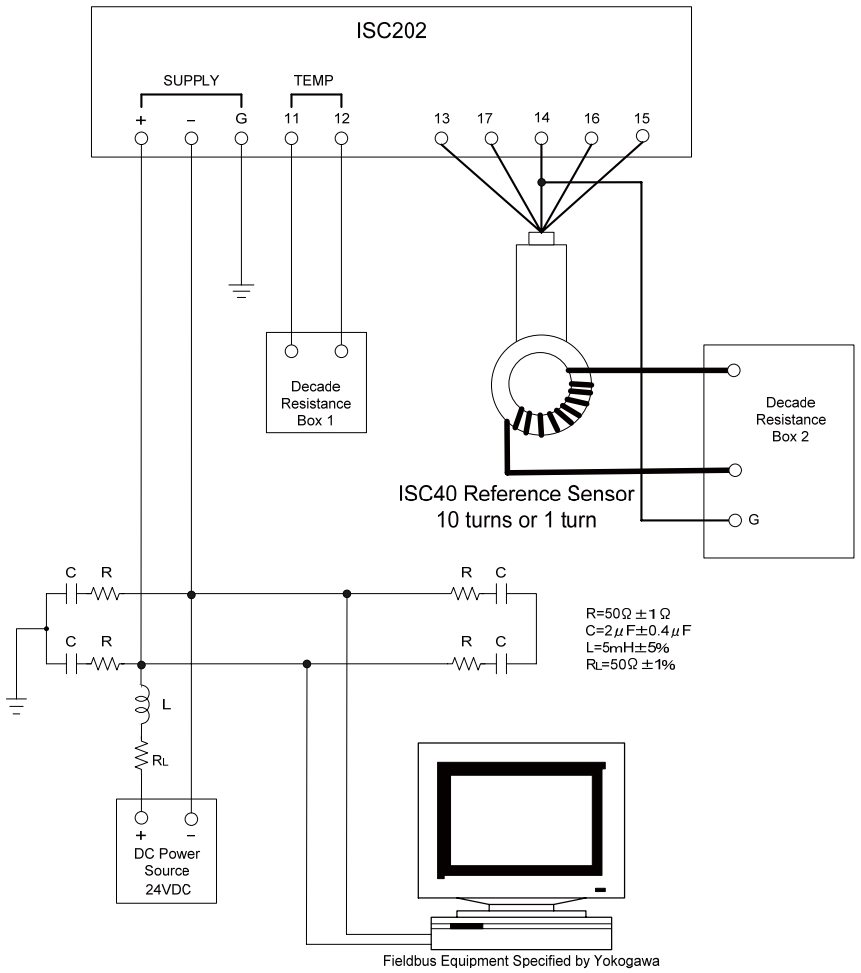

Figure 1 Testing Circuit and Test Equipment

QIS 12D06A03-61E

成 績 表
TEST CERTIFICATE

製品名称 PRODUCT NAME	2線式電磁導電率伝送器 2 WIRE INDUCTIVE CONDUCTIVITY TRANSMITTER	タグNo. TAG NO.	
形名 MODEL	ISC202		
手配No. ORDER NO.		計器番号 SERIAL NO.	

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INSULATION
RESISTANCE</td><td>電源端子(＋，－)および入力端子(11～17) 一括とアース端子(G)間
100MΩ以上 / 500V DC
BETWEEN POWER SUPPLY TERMINALS(+,−), INPUT TERMINALS(11 TO 17)
AND EARTH TERMINAL(G)
100MΩ OR MORE/500V DC</td><td></td></tr>
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DIELECTRIC
STRENGTH
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(ONLY FOR ISC202S)</td><td>電源端子(＋，－)および入力端子(11～17) 一括とアース端子(G)間
600V AC/2 秒間
BETWEEN POWER SUPPLY TERMINALS(+,−), INPUT TERMINALS(11 TO 17)
AND EARTH TERMINAL(G)
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30k NTC
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REF.</th><th>許容差
ACCURACY</th><th>実測値
ACTUAL</th><th>誤差
ERROR</th></tr>
<tr><td>300</td><td>6.27 mS/cm</td><td>±0.04 mS/cm</td><td></td><td></td></tr>
<tr><td>1.2k</td><td>1.567 mS/cm</td><td>±0.009 mS/cm</td><td></td><td></td></tr>
<tr><td>5k</td><td>376 μS/cm</td><td>±3.7 μS/cm</td><td></td><td></td></tr>
</table></td><td></td></tr>
<tr><td>フィールドバス機能
FIELDBUS
FUNCTION</td><td>フィールドバス機能確認
FIELDBUS FUNCTION CHECK</td><td></td></tr>
</table>

NOTES

日付 DATE	室内温度・湿度 AMBIENT TEMP. & HUM. ℃ %
検査者 INSPECTOR	承認者 APPROVED BY

YOKOGAWA ◆

QIC-12D06A03-61
Ed1 Apr. 2007

13-4. ISC202G, ISC202S 2-Wire Inductive Conductivity Transmitter (Profibus Communication)

Quality Inspection Standards

ISC202G, ISC202S 2-Wire Inductive Conductivity Transmitter (Profibus Communication)

1. Scope

This inspection standard applies to the ISC202G and ISC202S 2-Wire Inductive Conductivity Transmitters (Profibus specification).

2. Inspection Items

2.1 Insulation resistance test
*2.2 Dielectric strength test
2.3 Temperature indication check
*2.4 Conductivity indication check
*2.5 Profibus communication functional check

Note: Items marked with an asterisk (*) may only be confirmed by a test certificate.

3. Inspection Methods, Standards and Conditions

- Connect the testing circuit as shown in Figure 1. Allow the instrument to warm up for at least 5 minutes before conducting the tests. For the connections for the insulation resistance test, follow the instructions in Sections 3.1and for the connections for the dielectric strength test, follow the instructions in Section 3.2.
- Use test equipment shown in Figure 1, or equivalent, for the tests.

3.1 Insulation Resistance Test

- Apply 500 V DC between the power supply terminals (+ and –) plus input terminals (11 to 17), shorted together, and the earth terminal (G). The insulation resistance must be 100 MΩ or greater.

3.2 Dielectric Strength Test (Required Only for ISC202S)

Apply 600 V AC, an AC voltage of substantially sinusoidal waveform with a frequency of 50 Hz or 60 Hz, between the terminals shown below, for at least 2 seconds. The insulation must withstand this voltage. (The sensed current should be 10 mA.)

- Between the power supply terminals (+ and –) plus input terminals (11 to 17), shorted together, and the earth terminal (G)

3.3 Temperature Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.
Decade resistance box 1: 1097.3 Ω
Decade resistance box 2: 100 Ω
Set the type of temperature sensor to PT1000.
Setting Service Code 10 to 1.

a. Press the [∗] key.
b. Press the [NO] key twice. The message display will show “∗SERV.”
c. Press the [YES] key. The data display will show “00” with the first digit of 0 flashing.
d. Press the [∧] key once. The data display will show “10.”
e. Press the [ENT] key. The message display will show “∗ T.SENS.”
f. Press the [∧] key once. The data display will change from “0” to “1.”
g. Press the [ENT] key until the message display shows “∗ SERV.”
h. Press the [∗] key. The instrument returns to the measurement mode.

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QIS 12D06A03-71E
1st Edition: Sep. 2007

In this state, change the resistance value of the decade resistance box 1 as shown in Table 1. The corresponding temperature indication must be within the range.

Table 1 Temperature Indication Check (PT1000)

Reference Temperature	Resistance of Resistance Box 1	Indication Range
25 °C	1097.3 Ω	25.0 ±0.3 °C
100 °C	1385.0 Ω	100.0 ±0.3 °C

Set the type of temperature sensor to 30k NTC.

- Set Service Code 10 to 0 by following the steps for setting Service Code 10 to 1.

In this state, change the resistance value of the decade resistance box 1 as shown in Table 2. The corresponding temperature indication must be within the range.

Table 2 Temperature Indication Check (30k NTC)

Reference Temperature	Resistance of Resistance Box 1	Indication Range
25 °C	30 kΩ	25.0 ±0.3 °C
100 °C	2.069 kΩ	100.0 ±0.3 °C

3.4 Conductivity Indication Check

Connect the instruments as shown in Figure 1, and set them as follows.

Decade resistance box 1: OPEN
Decade resistance box 2: 100 Ω

If a sensor other than the reference sensor is used, zero and span calibrations are required.

Wind ten turns of wire on the ISC40 sensor.
Change the resistance value of the decade resistance box 2 as shown in Table 3. The corresponding conductivity indication must be within the range.

Table 3 Conductivity Indication Check (Cell constant: 1.88/cm)

Reference Conductivity	Resistance of Resistance Box 2	Indication Range
1880 mS/cm	100 Ω	1880.0 ±9.4 mS/cm
188 mS/cm	1 kΩ	188.0 ±0.94 mS/cm
18.8 mS/cm	10 kΩ	18.80 ±0.094 mS/cm

Change the number of turns of wire on the ISC40 sensor to one.
Change the resistance value of the decade resistance box 2 as shown in Table 4. The corresponding conductivity indication must be within the range.

Table 4 Conductivity Indication Check (Cell constant: 1.88/cm)

Reference Conductivity	Resistance of Resistance Box 2	Indication Range
6.27 mS/cm	300 Ω	6.27 ±0.04 mS/cm
1.567 mS/cm	1.2 kΩ	1.567 ±0.009 mS/cm
376 µS/cm	5 kΩ	376 ±3.7 µS/cm

3.5 Profibus Communication Functional Check

Check for normal function using Profibus equipment specified by Yokogawa.
In the tests of Item 3.3 to 3.4, check the communication function using Profibus communication.

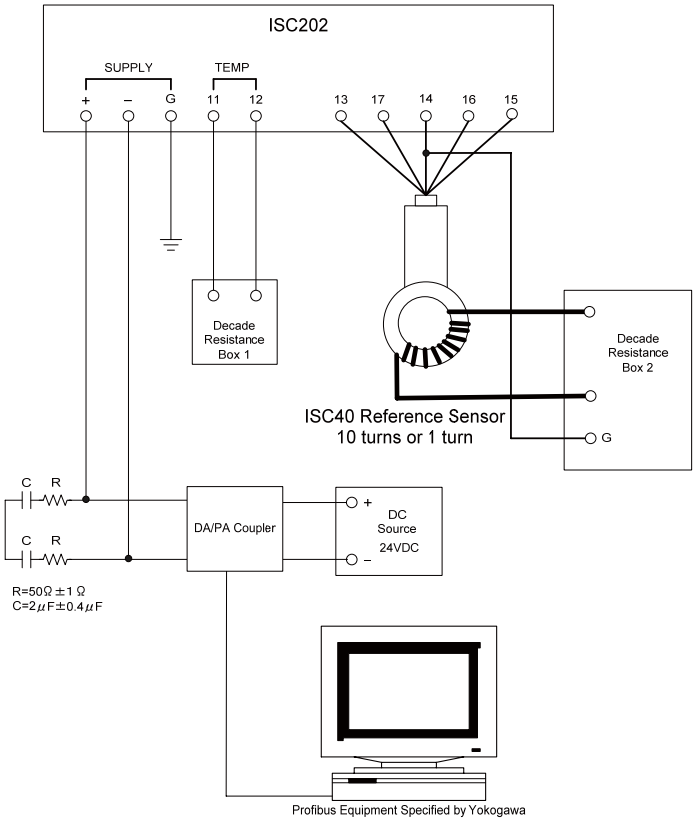


Figure 1 Testing Circuit and Test Equipment

成 績 表
TEST CERTIFICATE

製品名称 PRODUCT NAME	2線式電磁導電率伝送器 2 WIRE INDUCTIVE CONDUCTIVITY TRANSMITTER	タグNo. TAG NO.	
形名 MODEL	ISC202		
手配No. ORDER NO.		計器番号 SERIAL NO.	

検査項目 INSPECTION ITEM		結果 RESULT
外 観 APPEARANCE		
絶縁抵抗 INSULATION RESISTANCE	電源端子(＋, －)および入力端子(11～17)一括とアース端子(G)間 100MΩ以上 / 500V DC BETWEEN POWER SUPPLY TERMINALS(+,-), INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 100MΩ OR MORE/500V DC	
耐電圧 DIELECTRIC STRENGTH (ISC202Sのみ) (ONLY FOR ISC202S)	電源端子(＋, －)および入力端子(11～17)一括とアース端子(G)間 600V AC/2 秒間 BETWEEN POWER SUPPLY TERMINALS(+,-), INPUT TERMINALS(11 TO 17) AND EARTH TERMINAL(G) 600V AC/2 SEC	

温度表示 TEMPERATURE INDICATION

PT1000

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (℃) 基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
1097.3	25.0	±0.3		
1385.0	100.0	±0.3		

30k NTC

抵抗値 RESISTANCE (Ω)	表 示 INDICATION (℃) 基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
30k	25.0	±0.3		
2.069k	100.0	±0.3		

導電率表示 CONDUCTIVITY INDICATION

SEL10

抵抗値 RESISTANCE (Ω)	表 示 INDICATION 基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
100	1880 mS/cm	±9.4 mS/cm		
1k	188.0 mS/cm	±0.94 mS/cm		
10k	18.80 mS/cm	±0.094 mS/cm		

SEL1

抵抗値 RESISTANCE (Ω)	表 示 INDICATION 基準値 REF.	許容差 ACCURACY	実測値 ACTUAL	誤差 ERROR
300	6.27 mS/cm	±0.04 mS/cm		
1.2k	1.567 mS/cm	±0.009 mS/cm		
5k	376 μS/cm	±3.7 μS/cm		

プロフィバス機能 PROFIBUS FUNCTION	プロフィバス機能確認 PROFIBUS FUNCTION CHECK

NOTES

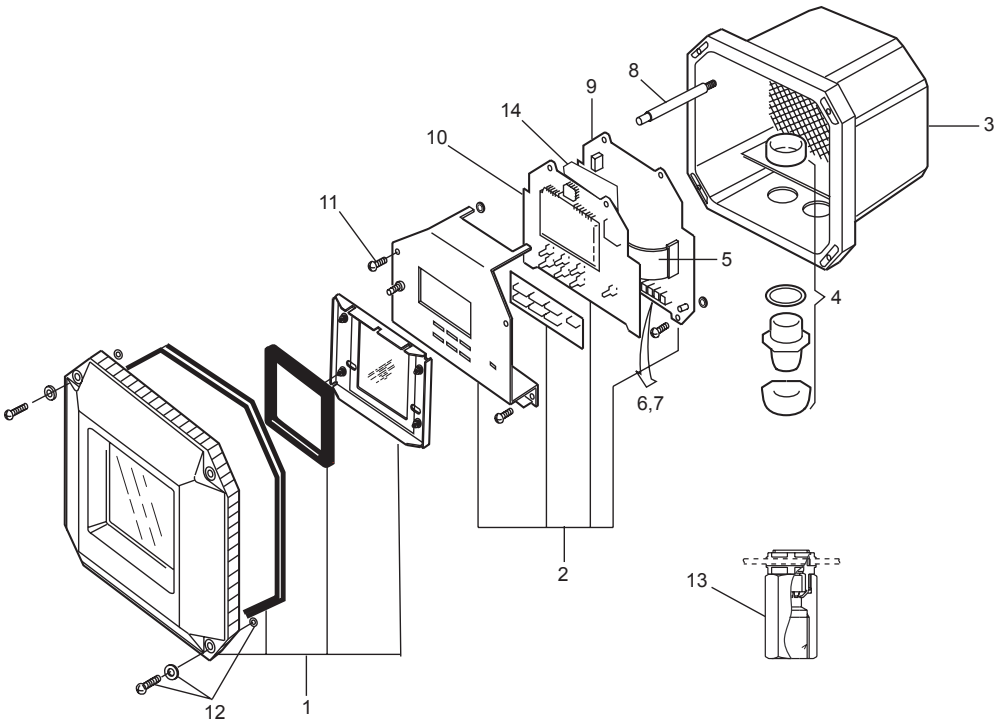
日付 DATE	室内温度・湿度 AMBIENT TEMP. & HUM. ℃ %
検査者 INSPECTOR	承認者 APPROVED BY

YOKOGAWA ◆

QIC-12D06A03-71
Ed1 Sep. 2007

Customer Maintenance Parts List

Model ISC202G [Style: S2]
Inductive Conductivity Transmitter



Item	Part No.	Qty	Description
1	—		Cover Assembly
	K9315CA	1	Polyurethane Coating
	K9315CN	1	Epoxy-polyester Coating
2	—		Internal Works Assembly with amplifier assembly
	K9661ED	1	For mA + HART
	K9661EE	1	For FF
	K9661EF	1	For Profibus
3	—		Housing Assembly
	K9661HA	1	Polyurethane Coating
	K9661HB	1	Epoxy-polyester Coating
4	L9811FV	2	Cable Gland Assembly
5	K9660AQ	1	Flat Cable
6	A1726JD	1	Pin Terminal Unit 3 terminals type
7	K9184AA	1	Screw Terminal Unit when /TB specified
8	K9661HR	2	Stud
*9	—		Analog Board Assembly
	K9661VA	1	For mA + HART
	K9661VC	1	For FF/Profibus
*10	—	1	Digital/Display Board
	K9661EV	1	For mA + HART
	K9661EW	1	For FF/Profibus
11	K9660YQ	1	Screw Assembly to fix amplifier
12	K9660YP	1	Stainless steel screw assembly to fix cover
13	—		Adapter Assembly
	K9414DH	1	For G1/2 screw when /AFTG specified (2 units).
	K9414DJ	1	For 1/2NPT screw when /ANSI specified (2 units).
*14	—		Comm. Board Assembly
	K9661ME	1	For FF
	K9661NE	1	For Profibus

* Do not exchange these parts. Call service personnel.

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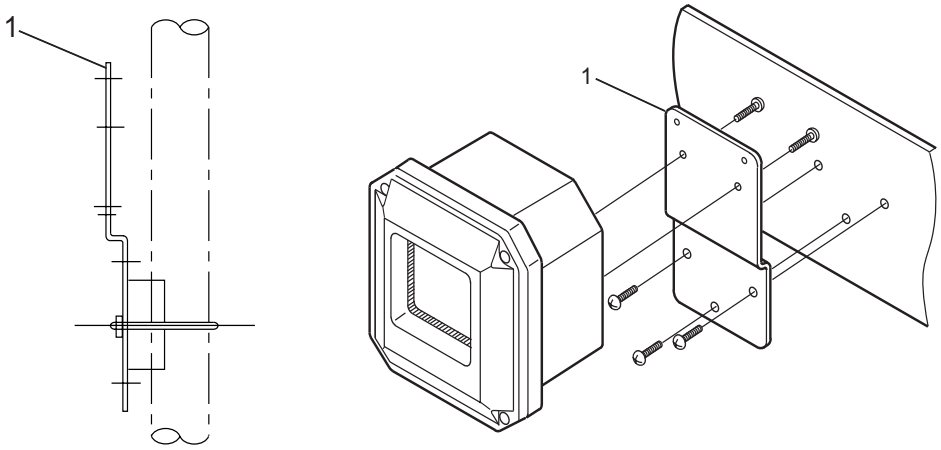
CMPL 12D06A03-02E
2nd Edition : Aug.2007 (YK)

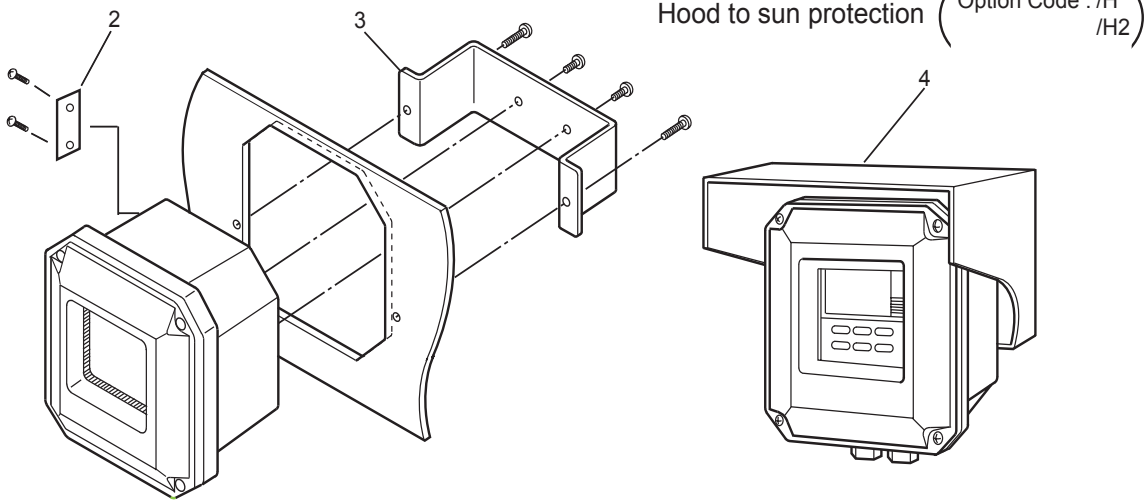
Pipe/Wall Mounting Hardware (Option Code : /U)



Panel Mounting Hardware

(Option Code : /SCT)

Hood to sun protection (Option Code : /H /H2)

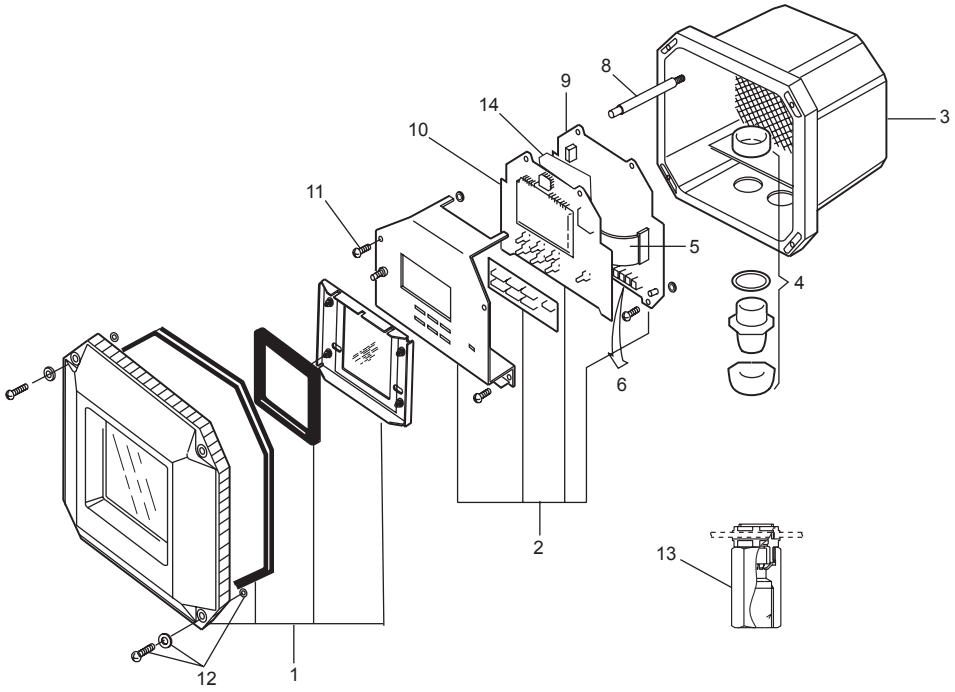


(Option Code : /PM)

Item	Parts No.	Qty	Description
1	K9171SS	1	Universal Mount Set (/U)
2	K9311BT	1	Tag Plate (/SCT)
3	K9311KA	1	Fitting Assembly (/PM)
4	K9311KG	1	Hood Assembly (/H)
	K9660JA	1	Hood Assembly (/H2)

Customer Maintenance Parts List

Model ISC202S [Style: S3]
Inductive Conductivity Transmitter



Item	Part No.	Qty	Description
1	—		Cover Assembly
	K9315CA	1	Polyurethane Coating
	K9315CN	1	Epoxy-polyester Coating
2	—		Internal Works Assembly with amplifier assembly
	—	1	For mA + HART
	—	1	For FF
	—	1	For Profibus
	—	1	For mA + HART (Non-incendive)
3	—		Housing Assembly
	—	1	Polyurethane Coating
	—	1	Epoxy-polyester Coating
4	L9811FV	2	Cable Gland Assembly
5	—	1	Flat Cable
6	—	1	Pin Terminal Unit 3 terminals type
8	—	2	Stud
9	—		Analog Board Assembly
	—	1	For mA + HART
	—	1	For FF/Profibus
	—	1	For mA + HART (Non-incendive)
10	—	1	Digital/Display Board
	—	1	For mA + HART
	—	1	For FF/Profibus
11	—	1	Screw Assembly to fix amplifier
12	K9660YP	1	Stainless steel screw asssembly to fix cover
13	—		Adapter Assembly
	K9414DH	1	For G1/2 screw when /AFTG specified (2 units).
	K9414DJ	1	For 1/2NPT screw when /ANSI specified (2 units).
14	—		Comm. Board Assembly
	—	1	For FF
	—	1	For Profibus

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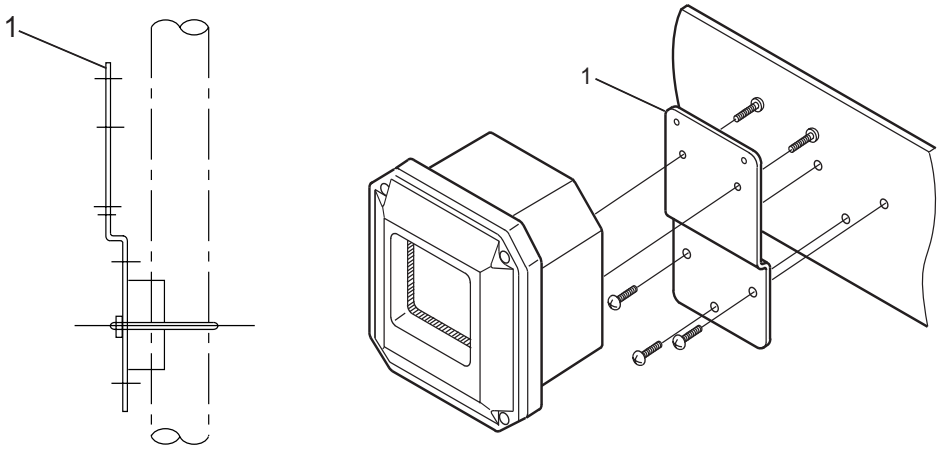
CMPL 12D06A03-23E
2nd Edition : Nov.2008 (YK)

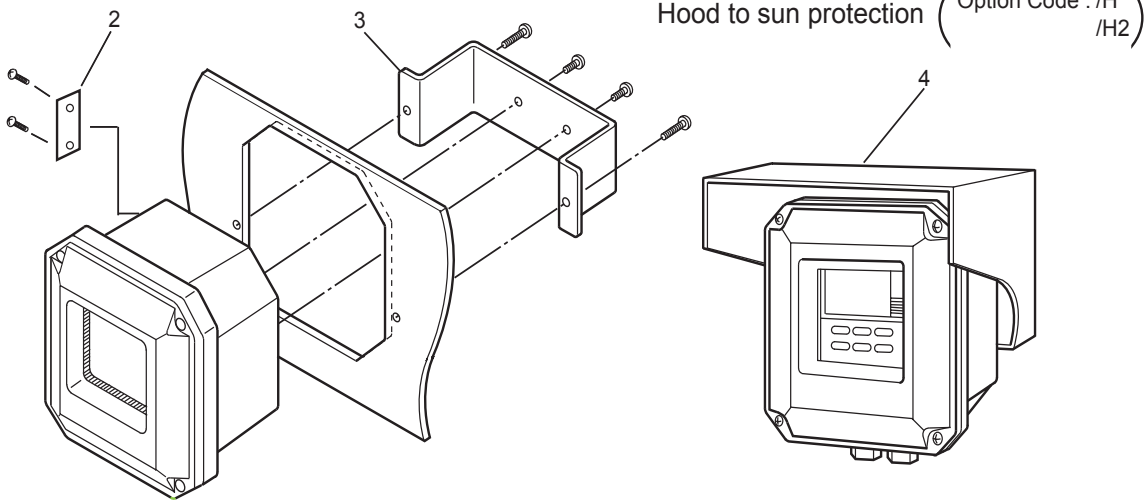
Pipe/Wall Mounting Hardware (Option Code : /U)



Panel Mounting Hardware

(Option Code : /SCT)

Hood to sun protection (Option Code : /H /H2)



(Option Code : /PM)

Item	Parts No.	Qty	Description
1	K9171SS	1	Universal Mount Set (/U)
2	K9311BT	1	Tag Plate (/SCT)
3	K9311KA	1	Fitting Assembly (/PM)
4	K9311KG	1	Hood Assembly (/H)
	K9660JA	1	Hood Assembly (/H2)

Revision Record

Manual Title : Model ISC202G [Style: S2], ISC202S [Style: S3]
2-wire Inductive Conductivity Transmitter
Manual Number : IM 12D06A03-01E

Edition	Date	Remark (s)
1st	Sep. 2004	Newly published
2nd	Sep. 2005	Revised pages are shown below. PREFACE some corrected (i page); After-sales Warranty modified (iii page). Sec. 2-1. 1. ISC202G Inductive Conductivity Transmitter; Accuracy modified (2-1 page); Transmission range modified (2-1 page); 2. ISC40G Inductive Conductivity Detector; Cable material corrected (2-5 page); 7. WF10 Extension Cable; Cable material corrected (2-6 page); Sec. 2-2 3. ISC40G Inductive Conductivity Detector; Notation modified (2-9 page); Sec. 2-3. Wiring Diagram; Corrected (2-11 page); Sec. 2-4 2. ISC40G Inductive Conductivity Detector; some weight corrected (2-14 page); Sec. 2-4 4. ISC40FF Flow-through Holder; some weight corrected (2-19, 2-20 page); CMPL 12D06A02-02E ISC40 Inductive Conductivity Detector and Holder [Style: S1]; Parts No. Corrected of item 3 on page 3; CMPL 12D06A02-03E ISC40 Inductive Conductivity Detector and Holder [Style: S2]; Parts No. Corrected of item 3 on page 3.
3rd	June 2006	Revised over all; Description for detector, holders, adapters are removed. For details of detector, holders, adapters, refer to separated IM 12D06B02-01E
4th	Mar. 2007	All over revised. Style of ISC202G, S changed to S2.
5th	Oct. 2007	PREFACE-1, Some of warning description modified; P. 1-1, Some of nameplate in Figure 1-1 changed; P. 1-2, Some of nameplate in Figure 1-2 changed; P. 2-2, EN 61000-3-3 deleted from "U) Regulatory compliance."; P. 2-3, Certificate no. of CENELEC ATEX and IECEx Scheme explosionproof added, CSA explosionproof description added; P. 2-5, Note added to Model and suffix codes; P. 2-8, Control Drawing for mA HART Specification (FM Intrinsically safe design) corrected; P. 2-9, Control Drawing for mA HART Specification (FM Non-incendive design) corrected; P. 2-10, Control Drawing for mA HART® Specification (CSA) corrected; P. 2-11, Control Drawing for FF/PB Specification (IECEx) corrected; P. 2-12, Control Drawing for FF/PB Specification (ATEX) corrected; P. 2-13, Control Drawing for FF/PB Specification (FM Intrinsically safe Entity) corrected; P. 2-15, Control Drawing for FF/PB Specification (FM Intrinsically safe FISCO) corrected; P. 2-17, Control Drawing for FF/PB Specification (FM Non-incendive Entity) corrected; P. 2-18, Control Drawing for FF/PB Specification (FM Non-incendive FNICO) corrected; P. 2-19, Control Drawing for FF/PB Specification (CSA) corrected; P. 3-2, Revision of Note in Subsection 3-2, "Preperation"; P. 5-13, Subsection 5-3, "Notes for guidance in the use of service code settings:" Added some cautions; Sec. 13 APPENDIX 3 QUALITY INSPECTION added; CMPL 12D06A03-02E, -22E revised to 2nd edition because some part no. changed.

Edition	Date	Remark (s)
6th	Apr. 2008	Style of ISC202S changed to S3 and related description changed as follows. p2-5, Style of ISC202S changed to S3 for FM approval; p3-1, Some of dimensions in Figure 3-1 corrected; p1-4 (Appendix), Note of HART protrocol DD files URL added; p2-8 (Appendix), NOTE to confirm zero offset after Air Set added to Sec. 12-4-2-4; CMPL 12D06A03-23E 1st edition added for ISC202S style S3.
7th	Oct. 2009	PREFACE, "Zone 0" added to Warning label explanation; P.1-1, Name plate of ISC202S-K (NEPSI) added to Figure 1-1; P.2-2, Some revision of U) Regulatory compliance (description for EMC revised); P.2-3, Some revision of IECEx Intrinsically safe description ("Zone 0" added); P.2-4 to 2-6, NEPSI Certification added and this page layout changed. Subsection 2-2 Model and suffix code moved to page 2-6 from 2-5, and NEPSI suffix code of "-K" added to the ISC202S MS-code; P.2-6 to 2-20, These pages layout changed, "page 2-6 to 2-19" moved to "page 2-7 to 2-20"; CMPL 12D06A03-23E of ISC202S(S3) revised to 2nd edition (some parts no. deleted).

User's Manual

Model ISC202G [Style: S2], ISC202S [Style: S3]
2-Wire Inductive Conductivity Transmitter
Supplement

Thank you for selecting our Model ISC202G [Style: S2] and/or ISC202S [Style: S3] 2-Wire Inductive Conductivity Transmitter.
User's Manual, IM 12D06A03-01E, 7th Edition, supplied with the product, some revisions/additions have been made. Please replace the corresponding pages in your copy with the attached, revised pages.

Revisions:
- PREFACE, "How to dispose the batteries" added.
- Page 2-2, Description of Profibus added to EMC conformity standard.
- Appendix 2-13, Some change of Sample 3 Concentration of sulfuric acid mixture.
- Last page, Added of KC mark.

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IM 12D06A03-01E
7th Edition

DANGER

Electric discharge

The EXA analyzer contains devices that can be damaged by electrostatic discharge. When servicing this equipment, please observe proper procedures to prevent such damage. Replacement components should be shipped in conductive packaging. Repair work should be done at grounded workstations using grounded soldering irons and wrist straps to avoid electrostatic discharge.

Installation and wiring

The EXA analyzer should only be used with equipment that meets the relevant international and regional standards. Yokogawa accepts no responsibility for the misuse of this unit.

CAUTION

The instrument is packed carefully with shock absorbing materials, nevertheless, the instrument may be damaged or broken if subjected to strong shock, such as if the instrument is dropped. Handle with care.

Although the instrument has a weatherproof construction, the transmitter can be harmed if it becomes submerged in water or becomes excessively wet.

Do not use an abrasive material or solvent when cleaning the instrument.

Do not modify the ISC202 transmitter.

WARNING

Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, e.g., rubbing with a dry cloth.

Warning label

Because the enclosure of the Dissolved Oxygen transmitter Type ISC202S-A, -P, -F are made of aluminium, if it is mounted in an area where the use of category 1 G Zone 0 apparatus is required, it must be installed such, that, even in the event of rare incidents, ignition sources due to impact and friction sparks are excluded.

Notice

- This manual should be passed on to the end user.
- The contents of this manual are subject to change without prior notice.
- The contents of this manual shall not be reproduced or copied, in part or in whole, without permission.
- This manual explains the functions contained in this product, but does not warrant that they are suitable the particular purpose of the user.
- Every effort has been made to ensure accuracy in the preparation of this manual. However, when you realize mistaken expressions or omissions, please contact the nearest Yokogawa Electric representative or sales office.
- This manual does not cover the special specifications. This manual may be left unchanged on any change of specification, construction or parts when the change does not affect the functions or performance of the product.
- If the product is not used in a manner specified in this manual, the safety of this product may be impaired.

Yokogawa is not responsible for damage to the instrument, poor performance of the instrument or losses resulting from such, if the problems are caused by:

- Improper operation by the user.
- Use of the instrument in improper applications
- Use of the instrument in an improper environment or improper utility program
- Repair or modification of the related instrument by an engineer not authorized by Yokogawa.

Safety and Modification Precautions

- Follow the safety precautions in this manual when using the product to ensure protection and safety of the human body, the product and the system containing the product.

How to dispose the batteries:

This is an explanation about the new EU Battery Directive (DIRECTIVE 2006/66/EC). This directive is only valid in the EU. Batteries are included in this product. Batteries incorporated into this product cannot be removed by yourself. Dispose them together with this product. When you dispose this product in the EU, contact your local Yokogawa Europe B.V.office. Do not dispose them as domestic household waste.

Battery type: silver oxide battery

Notice:

The symbol (see above) means they shall be sorted out and collected as ordained in ANNEX II in DIRECTIVE 2006/66/EC.

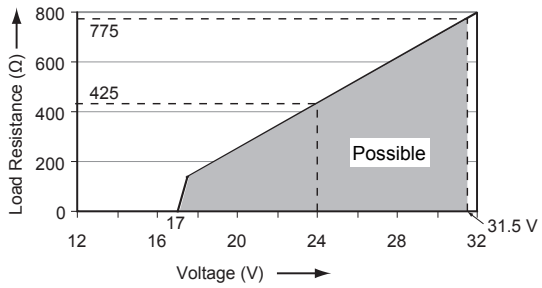

Fig.2-2 Supply voltage/ load diagram for the ISC202S

J) Temperature compensation:

- Sensor types: Pt1000Ω or 30kΩ NTC
- Automatic: -20 to 140 ºC (0 to 280 ºF)
- Algorithm: selectable as mentioned below NaCl according to IEC 60746-3 tables.
  Two T.C. setting possible between 0.00 to 3.50 %/°C
  Matrix: user selectable/ configurable. 8 selectable for concentrated solutions, 1 free programmable.

mA **K) Sensor diagnostics:**

Abnormal temperature (open, short), abnormal conductivity values (E5/E6 free programmable), e.g. dry cell, wiring problems.

L) Calibration:

Manual, calibration Input pre-measureds data (cell constant).

M) Logbook:

Software record of important events and diagnostic data.

N) Display:

Custom liquid crystal display.

- Main display: 3½ digits, 12.5 mm high, zero change included.
- Message display: 6 alphanumeric characters, 7 mm high.
- Special fields: Flags for status indication : FAIL and HOLD.
- Measuring units: µS/cm or mS/cm
- Key prompts: YES, NO, >, ^, ENT, Menu pointer
- Keys: 6 keys operated through flexible window with tactile feedback. One hidden key behind the front cover.

O) Power supply:

Power supply : Normal 24 V DC loop powered system, see Figure 2-1, 2-2.
ISC202G: 17 - 40 V DC
ISC202S: 17 - 31.5 V DC

- Input Isolation: Maximum 1000 VDC

P) Housing:

- Material : Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window.
- Color : Case : Off-white (Equivalent to Munsell 2.5Y8.4/1.2)
  Cover : Deepsea Moss green(Equivalent to Munsell 0.6GY3.1/ 2.0)
- Cable gland : 2-Pg13.5

Q) Mounting:

Pipe, Wall or Panel.

R) Shipping details:

Package size : W x H x D, 290 x 300 x 290 mm (11.5 x 11.8 x 11.5 inch).

S) Environment and operational conditions:

- Ambient temp.: -10 to 55 ºC (+10 to +130 ºF)
  LCD operational temperature is specified -10 to 70 ºC (14 to 160 ºF)
  Excursions to -30 to +70 ºC will not damage the instrument.
- Storage temp.: -30 to +70 ºC (-20 to +160 ºF).
- Relative humidity: 10 to 90% RH at 40 ºC ambient temperature, non condensing
- Data protection: EEPROM for configuration and logbook. Battery supported clock.
- Watchdog timer : Checks microprocessor.
- Automatic safeguard: Return to measurement after 10 minutes when no keystroke.

Operation protection: 3 digital pass codes (programmable).
Power down: No effect, reset to measurement.

mA **T) HART® specifications**:

Minimum cable diameter: 0.51 mm, 24 AWG.
Maximum cable length: 1500 m
Refer to standard HART® specifications for more details.
See www.hartcomm.org

U) EMC Conformity standard CE , N200

EN 61326-1 Class A, Table 2
(For use in industrial locations)
EN 61326-2-3
EN 61326-2-5 (Profibus communication may be influenced by strong electromagnetic field.)

CAUTION

This instrument is a Class A product, and it is designed for use in the industrial environment. Please use this instrument in the industrial environment only.

Sample 3
Concentration of sulfuric acid mixture

Meas. range 93-97%
Reference temp. 50°C
Temp. compensation Enter temperature compensation data into a 5 x 5 matrix

START

Service code 20 — 50°C (Default)

Service code 31 — Select 1

Service code 35 — Enter conductivity values corresponding to output current values.
Existing table (below) relates output current to conductivity at 50°C

Output Current (%)	H_2SO_4 conc. (%)	Conductivity (mS/cm)
0	93	227
25	94	217
50	95	204
75	96	186
100	97	162

Service code 55 — 0% output -->93%
100% output -->97%

TEMP — NaCl -->NO
TC -->YES (here use [MODE] key to escape)

Service code 22 — Matrix code 9

Service code 23 — 25 to 75°C

Service code 24 to 28

°C / (%)	25 (T1)	37.5 (T2)	50 (T3)	62.5 (T4)	75 (T5)
97 (L1)	95	125	162	196	238
96 (L2)	110	146	186	230	288
95 (L3)	122	160	204	253	306
94 (L4)	128	171	217	270	328
93 (L5)	133	177	227	283	344

Conductivity unit (mS/cm)
(*1)

sample3E.eps

Calibration in Air

Calibration — Calibrate conductivity value in actual operation
e.g. 95% H_2SO_4 corresponds to conductivity 204 mS/cm (see above table)

Note: This application requires special sensor body material

(*1) Error code E4 occurs when two standard solutions have identical conductivity values at the same temperature within the temperature range.

User's Manual

Model ISC202G [Style: S2], ISC202S [Style: S3]
2-Wire Inductive Conductivity Transmitter

Supplement

This is a conforming product to KC marking (Korean Certification).
Certification No.: KCC-REM-YHQ-EEN242-3

EQUIPMENT NAME	: 2-Wire Inductive Conductivity ISC202G, ISC202S
DATE OF MANUFACTURE	: See the nameplate of the product.
APPLICANT	: Yokogawa Electirc Corporation
MANUFACTURER	: Yokogawa Electirc Corporation
COUNTRY OF ORIGIN	: JAPAN

KCC-REM-
YHQ-EEN242-3

YOKOGAWA
Yokogawa Electric Corporation

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