

General Specifications

Model ISC202G(S)
2-wire Transmitter
for Inductive Conductivity

EXA
CE

Fieldbusses are based on highly reliable bi-directional communications between "smart" field devices and HOST systems. Next to a wide range of data each smart device can provide their status which is essential for adequate control and maintenance. The famous EXA sensor diagnostics will provide asset management facilities for those who operate and maintain the plant.

"The advent of Fieldbus technology had made possible a wide range of new capabilities throughout every level of the control system that had not previously been possible or fully explored."

Yokogawa has implemented three leading process Fieldbus technologies in their 202 series: HART®, Foundation Fieldbus H1 and Profibus PA. All transmitters are provided with the important and widely used Device Description files that provide information on parameters and other data in each device, as well as the ability to include algorithmic relationships such as calibrations.

The EXA ISC202G transmitter is a user programmable instrument for conductivity measurements in medium to highly conductive process liquids, using inductive measuring principles. It is used in combination with the Yokogawa model ISC40 inductive conductivity sensor, for concentration monitoring applications in the chemical industry and for various other conductivity applications in the food and pharmaceutical industry, the plating and metal finishing industry and pulp & paper industry. The robust chromated cast aluminium housing, coated with a Epoxy-polyester, makes it the ideal 2-wire transmitter for mounting directly on-site, even under tough environmental conditions. Its 2-wire concept gives low installation costs, a safe operation and easy maintenance in the field.

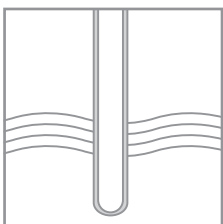
The ISC202 features user-selectable process dedicated temperature compensation for various (strong) acids and alkalis. The process linearised output function and the "%"-concentration displays contribute to a highly functional inductive conductivity based concentration analyzer.



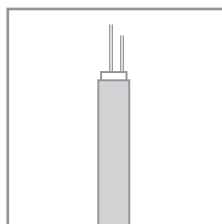
Features

- Process optimised temperature compensation to fit the instrument in any application.
- Extremely wide measuring range (> 6 decades) while maintaining a high resolution and accuracy using only one sensor type : Minimum conductivity 1.00 µS/cm
Maximum conductivity 2.00 S/cm.
- Free programmable setting of the output range, including a 21-step table to linearise the output function e.g. to weight%.
- Programmable % by weight display indication.
- Proven simple 3-level operation system using YES/NO prompts where each level can separately be protected from unwanted access by a 3-digit passcode.
- Event logbook in software

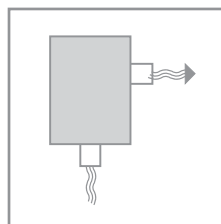
System Configuration



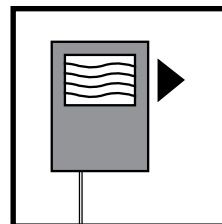
Sensors



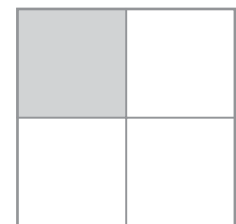
Cables



Fittings



Transmitters



Accessories

Fieldbus

Field devices in general are becoming smarter, operations more complex and hold more information about themselves and the process. Higher communication data rates are important in handling this additional information without undue delays. Fieldbuses such as Foundation Fieldbus and Profibus PA (at 31.25 kbps) provides this capability, which is also ample for measurement values such as conductivity/resistivity, concentration and temperatures. With the ISC202 it becomes possible to keep plant records up-to-date and accurate as the ISC202 keeps a logbook and will therefore provide you with all this information necessary. Calibration and validation are becoming increasingly important, both because some products, like pharmaceuticals demand it. The logbook of the ISC202 also holds invaluable information in the later investigation of production problems. Fieldbuses have brought major benefits to all aspects of process automation. The technology is now mature and well accepted by major end users in process and utilities markets. The Profibus PA and Foundation Fieldbus protocols use the European Standard EN50170. The physical layer is defined according to IEC 1158-2, which can also be used for intrinsically safe applications.

One of the features of smart field devices is their ability to detect faults, either in the device electronics or in an associated sensor. Using a fieldbus system, such faults are reported in the device status byte in every message (assuming that communication is still possible!).

For HART®, it is still useful to follow the convention of indicating fault conditions by setting the analogue output current to a value which is recognisably beyond the normal operating range (including the small amount of linear over-range commonly allowed). If it is still alive, the current output value is set to an appropriate value with the intention that a host system should be able to set alarm thresholds just outside the normal 4 to 20 mA range, to indicate measurement out-of-range, and to set further alarm thresholds to indicate a fault condition.

The ISC202 follows the NAMUR Recommendation NE43 (18.01.1994) which suggests the following:

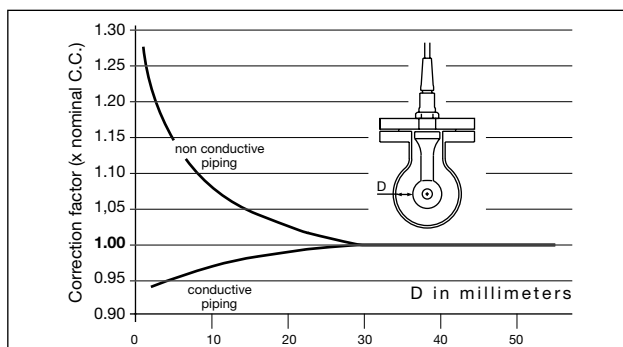
- Valid measurement range from 3.8 mA to 20.5 mA.
- Fault indicated by ≤ 3.6 mA or ≥ 21.0 mA. (burn)

DD specification and other support files

The ISC202G(S) Device Description (DD) files are available enabling communications compatible HOST devices (and HHT for HART®). Other files to support AMS, PRM and PDM are available as well. For more information contact your local Yokogawa sales offices.

Cell Constant

Since the ISC202 in combination with a ISC40 inductive conductivity sensor measures the conductivity of the "liquid winding" through the doughnut, part of this "measuring cell" is outside the doughnut. If there is little space between doughnut and process piping, in situ calibration with a sample of the process fluid is necessary to ensure accurate measurement. The relationship of the Cell Constant (CC) and the distance between the "doughnut" is shown in this picture.



GS 12D8B3-E-E

Process Dedicated Temperature Compensation

The ISC202G features optimisation of the temperature compensation for virtually any process. From neutral salt solutions to the most concentrated acids and alkalis. From tight controlled and/or very stable processes to processes that have extreme variations in both conductivity and temperature. The ISC202's temperature compensation can easily be adapted to meet the accuracy requirements for temperature compensation imposed by the process control targets.

Temperature compensation based on the IEC 746-3 table for NaCl solution can be selected for standard conductivity measurements in different processes.

For measurements requiring accuracy such as concentration applications, the temperature compensation can be tailored to the process. This is done during commissioning of the transmitter by using the actual process solution by programming a (linear) temperature coefficient: " α " (see figure 1). For processes where the temperature coefficient varies with temperature and concentration (eg Sodiumhydroxide and Sulphuric acid), matrix compensation is applied.

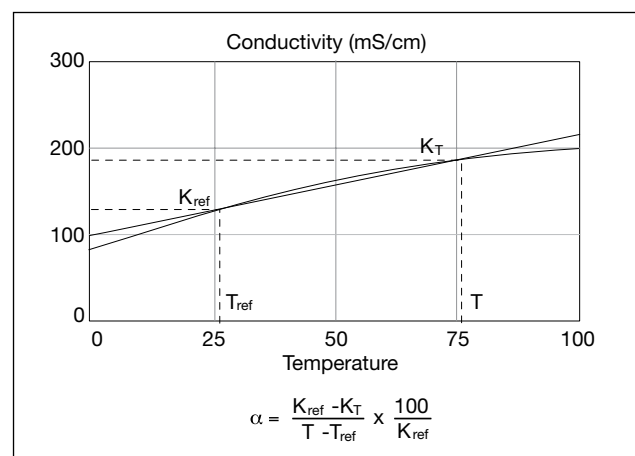
To further simplify transmitter set up, the matrices for several common process solutions are stored in memory. Any of these can be selected from the Service Menu of the transmitter.

These include:

Sulphuric Acid	H ₂ SO ₄	0.5 - 5.0 %	0 - 100 °C
Sulphuric Acid	H ₂ SO ₄	2.5 - 25.0 %	0 - 100 °C
Hydrochloric Acid	HCl	0.5 - 5.0 %	0 - 60 °C
Hydrochloric Acid	HCl	1.0 - 20.0 %	0 - 60 °C
Nitric Acid	HNO ₃	0.5 - 5.0 %	0 - 80 °C
Nitric Acid	HNO ₃	2.5 - 25.0 %	0 - 80 °C
Sodium Hydroxide	NaOH	0.5 - 5.0 %	0 - 100 °C
Sodium Hydroxide	NaOH	0.5 - 15.0 %	0 - 100 °C

If your process is not covered by one of these selectable curves, the user can create curves specific to the process. This is done by building a simple matrix table of temperature related conductivity values. Thus the accuracy of the measurement is fine-tuned to the specific process conditions.

The matrix compensation method guarantees optimal accuracy where TC dependence from conductivity and process temperature is taken into account.



Definition of temperature compensation factor (α)

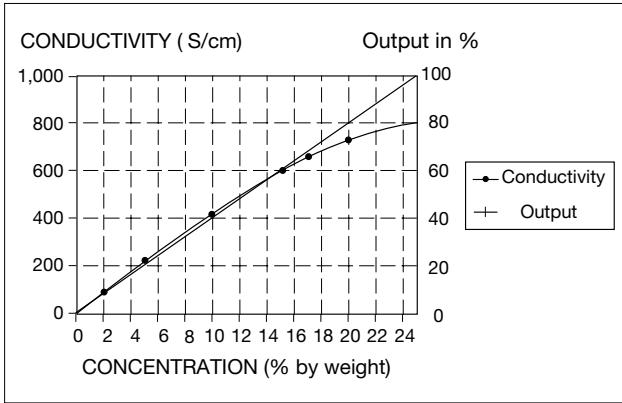
Note: The corrected Cell Constant can be obtained by multiplying the nominal Cell Constant on the label of the sensor with the installation factor found in this figure.

Converter Design

The transmitter uses advanced signal processing in order to minimize the effect of external influences such as polarization effects and cable resistance. This signal processing ensures that only changes in conductivity and temperature cause changes in the output.

Concentration Measurement

Concentrations are determined according a 21 step concentration table. The table defines all conductivity values at 25°C and the corresponding concentration levels. The conductivity values at 25°C are determined by selecting the most applicable temperature compensation method. Below an example to measure the concentration of sulphuric acid.



Linearization of output
Example: 0-25% Sulphuric acid

Code Output	mA 4-20	Conc.	Example % H2SO4	Cond.	Example mS/cm
0	4.0		0.00		0
5	4.8		1.25		60
10	5.6		2.50		113
15	6.4		3.75		180
20	7.2		5.00		211
25	8.0		6.25		290
30	8.8		7.50		335
35	9.6		8.75		383
40	10.4		10.00		424
45	11.2		11.25		466
50	12.0		12.50		515
55	12.8		13.75		555
60	13.6		15.00		590
65	14.4		16.25		625
70	15.2		17.50		655
75	16.0		18.75		685
80	16.8		20.00		718
85	17.6		21.25		735
90	18.4		22.5		755
95	19.2		23.75		775
100	20.0		25.00		791

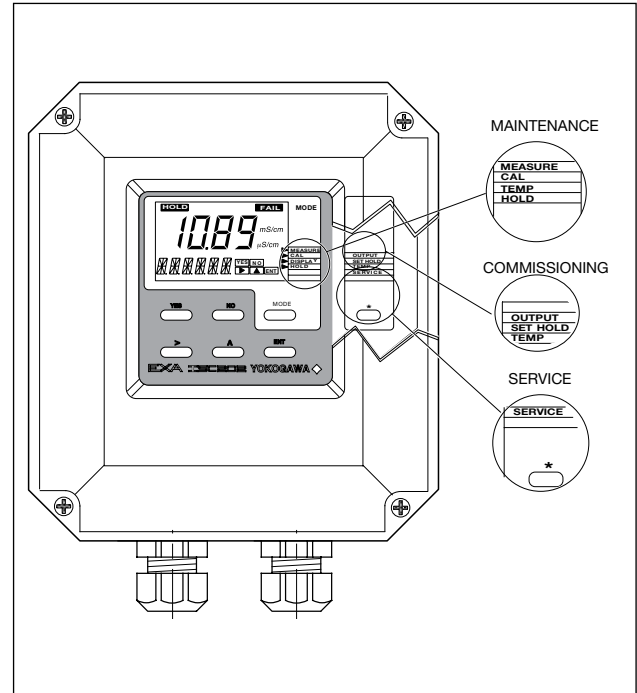
Calibration

It is maybe superfluous to say that the effect of incorrect calibrations are directly related to the measured conductivity value. Calibration of conductivity transmitters is in fact setting the slope or, the relation between the measured impedance and the Specific Conductivity (SC) value. This slope is expressed in cm^{-1} and agrees with the Cell Constant of the sensor. All Yokogawa's sensors are pre-calibrated during manufacturing according ASTM 1125-91 and this Cell Constant can be directly entered in the transmitter. Next, the transmitter offers the possibility to re-calibrate the transmitter according IEC 746-3 and OIML rec. 56 standards.

Three Level Operation

The EXA SC202G(S) converter uses a 3-level operating system to take full advantage of the microprocessor while retaining the traditional simplicity of analog converters. Advanced functions are separated from conventional operation to avoid confusion. They can be activated as required for each individual application.

1. The normal maintenance functions are accessible through the flexible window by pushing the keys underneath.
2. Functions required to commission the instrument are hidden to discourage unauthorized tampering. The front cover is removed to reveal the commissioning menu and the hidden access key (marked *).
3. Specialized functions can be adjusted via the SERVICE menu. In this case access is by using "service codes."



Three level operation

MAINTENANCE level

- Use : Normal operation and checking
- How : Simple operation by dialog through the closed front cover
- Example : Read secondary data displays

COMMISSIONING level

- Use : For normal commissioning
- How : Removal of the front cover reveals the access key and second menu
- Example : Output range setting

SERVICE level

- Use : Only for specialized functions
- How : Through special service code entries
- Example : Selecting process compensation

With this 3-level user-friendly approach, the instrument can be operated by anyone. Commissioning is straight-forward and needs no calibration equipment compared to analog instruments. Special functions available via access codes are invisible during normal operation. All three levels can be separately protected against unauthorized access by a password system using a three digit code.

General Specifications

A. Input specifications

: Compatible with the Yokogawa inductive conductivity ISC40 series with integrated temperature sensor: NTC30k or Pt1000.

B. Input range

- Conductivity : 0 to 1999 mS/cm at 25 °C (77 °F) reference temperature.
 minimum : 1 μ S/cm (at process temperature)
 maximum : 2 S/cm (at process temperature)

- Temperature : -20 to +140 °C (0 to 280 °F).

- Cable length : max. 60 meters (200 feet) 10 meters (35 feet) fixed sensor cable + 50 meters (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. Indicating range

- Main display : 0 to 1999 mS/cm (1st compensation)
 - Message display : 0 to 1999 mS/cm (2nd compensation), Temperature -20 to 140 °C (0 to 280 °F) Concentration 0 to 100.0% Temperature compensation methods NaCl, T.C., Matrix
 mA- Output (3.90 to 22.00 mA)
 Cell constant [cm⁻¹]
 Reference temperature (°C/°F)
 Software release.

E. Transmission range

- Conductivity : Minimum span 1 μ S/cm and \geq 10% of high value (20mA)
 : Maximum span 1999 mS/cm.

G. Temperature compensation

- Sensor types : 30k Ω NTC or Pt1000.
 - Automatic : between -20 to 140 °C (0 to 280 °F)
 - Algorithm : NaCl according to IEC 746-3 tables. Two T.C. settings possible between 0.00 to 3.50%/°C Matarix: user selectable/ configurable. 8 selectable for concentrated solutions, 1 free program-mable. Reference temperature adjustable between -20 to 140°C (0 to 280°F).

H. Sensor diagnostics

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

I. Calibration

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

J. Logbook

: Software record of important events and diagnostic data.

Construction

K. Display

: Custom liquid crystal display.
 - Main display : 3 $\frac{1}{2}$ 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 : μ S/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.

L. Housing

: Cast aluminum case and cover both provided with chemically resistant coating (color: case off-white; cover moss-green). Cover with flexible polycarbonate window. Weather protection: Rain and dust tight to IP65 (NEMA 4X). Two polyamide glands 1/2" NPT. Cable terminals for up to 2.5 mm².

M. Mounting

: Pipe, wall or panel.

N. Shipping details

: Package 290 x 225 x 170mm (w x h x d). Weight \pm 2.5kg.

O. Functional specification

Accuracy (under reference conditions):
 - Conductivity : \leq 0.5 % \pm 1.0 μ S/cm
 - Temperature : \leq 0.3°C (0.6°F)
 - Temp.comp. : \leq 1 % for NaCl, \leq 3 % for Matrix
 - mA-output circuits : \leq 0.02 mA.

Influence of:

- Ambient temp. : \pm 0.1% \pm 0.05 μ S/cm/°C
 - Step response : \leq 8 seconds for 90 % (for a 2 decade step).




P. Environment and operational conditions:

- Ambient temp. : -10 to +55 °C (+10 to +130 °F)
 LCD operational temperature is specified -10 to +70 °C (14 to 160 °F)
 Excursions to -30 to +70 °C will not damage the instrument.
 - Storage temp. : -30 to +70 °C (-20 to +160 °F).
 - Relative humidity : 10 to 90% Rh at 40 °C 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.




R. Regulatory compliance

- EMC : meets council directive 89/336/EEC
 - Emmission : meets EN 55022 Class A
 - Immunity : meets EN 61000-6-2

S) Intrinsic safety

- ATEX  : EEx ib [ia] IIC T4 for Ta -10 to 55 °C
EEx ib [ia] IIC T6 for Ta -10 to 40 °C
II 2 (1) G KEMA 00ATEX1191 X
- CSA  : Ex ia CL I, DIV 1, GP ABCD, T4 for Ta -10 to 55 °C T6 for Ta -10 to 40 °C
Refer to Installation Drawing ISC202S CSA
- FM  : IS CL I, DIV 1, GP ABCD T4 for Ta -10 to 55 °C T6 for Ta -10 to 40 °C HAZ
LOC per Control Drawing
FF1-ISC202S-00

T) Non-Incendive

- FM  : NI CL I, DIV 2, GP ABCD
T4 for Ta -10 to 55 °C
T6 for Ta -10 to 40 °C
HAZ LOC per Control Drawing
FF1-ISC202S-00
- CSA  : NI CL I, DIV 2, GP ABCD
T4 for Ta -10 to 55 °C
T6 for Ta -10 to 40 °C
Refer to Installation Drawing
ISC202S CSA
- ATEX  : EEx nA [L] IIC T4 for Ta -10 to 55 °C
EEx nA [L] IIC T6 for Ta -10 to 40 °C
II 3 G KEMA 00ATEX1192 X

Hart Communications

Input : Two-wire system, 4-20 mA

Power supply : Nominal 24 volt DC loop powered system.

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. (see fig. 1)

Transmission : Isolated output of 4 to 20 mA DC.

Signal : Maximum load 425 Ω. (see fig. 2)
Burn to signal failure acc. NAMUR Recommendation NE43 (18.01.1994)

Operating range : 3.6 to 21mA

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

Bus connection : Intrinsic safe EN 50020 according ATEX non incendive EN 50021

Configuration : Local with 6 keys

Software : Firmware based on Yokogawa stack.

Hardware : MH-02 HART® Modem

Hand terminal : Rosemount HHT 275

Other control systems : Yokogawa PRM, Rosemount AMS, Siemens PDM,

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.

Cable specification
- Min. cable diameter : 0.51 mm, 24 AWG
- Max. cable length : 1500 m
(Detailed information can be found at: www.hartcomm.org)

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

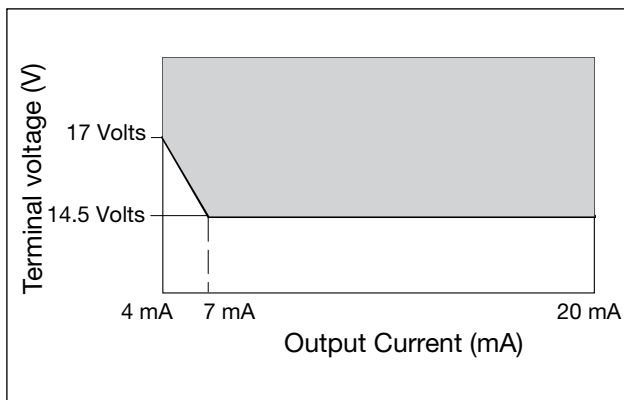


Fig. 1 minimum terminal voltage at the ISC202

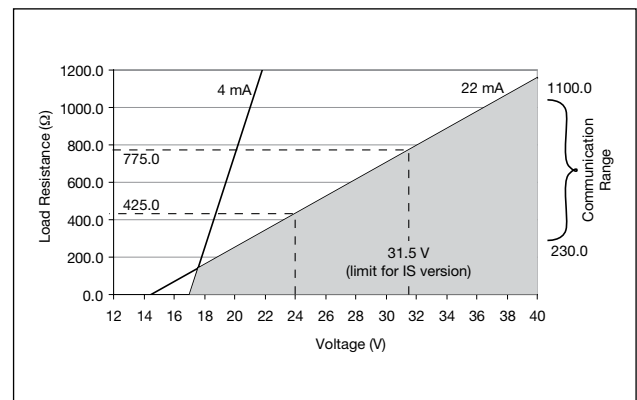


Fig. 2 HART® supply voltage/ load diagram

PROFIBUS-PA communications

Input signal	: Digital
Supply voltage	: 9 to 32 VDC
Operating current	: 24.5 mA
Operating values	: According to IEC 1158-2
Bus connection	: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
Power supply	: Power supply is achieved dependant on the application by means of segment coupler
Data transfer	: According to PROFIBUS- PA profile class B based on EN 50170 and DIN 19245 part 4
GSD file	: The actual file can be downloaded from www.profibus.com
Configuration	: Local with 6 keys
Software	: Firmware based on Siemens DPC31 stack.
Hardware	: PC- or PCMCIA-interfaces from Siemens)
Other control systems	: Siemens PDM
Electrical connection	: Terminals acc. to IEC 1158-2
Fieldbus-cable-types	: Twisted and shielded two wire cable according to recommendation based on IEC 1158-2
Cable diameter	: 6 to 12mm(0.24 to 0.47 inch)

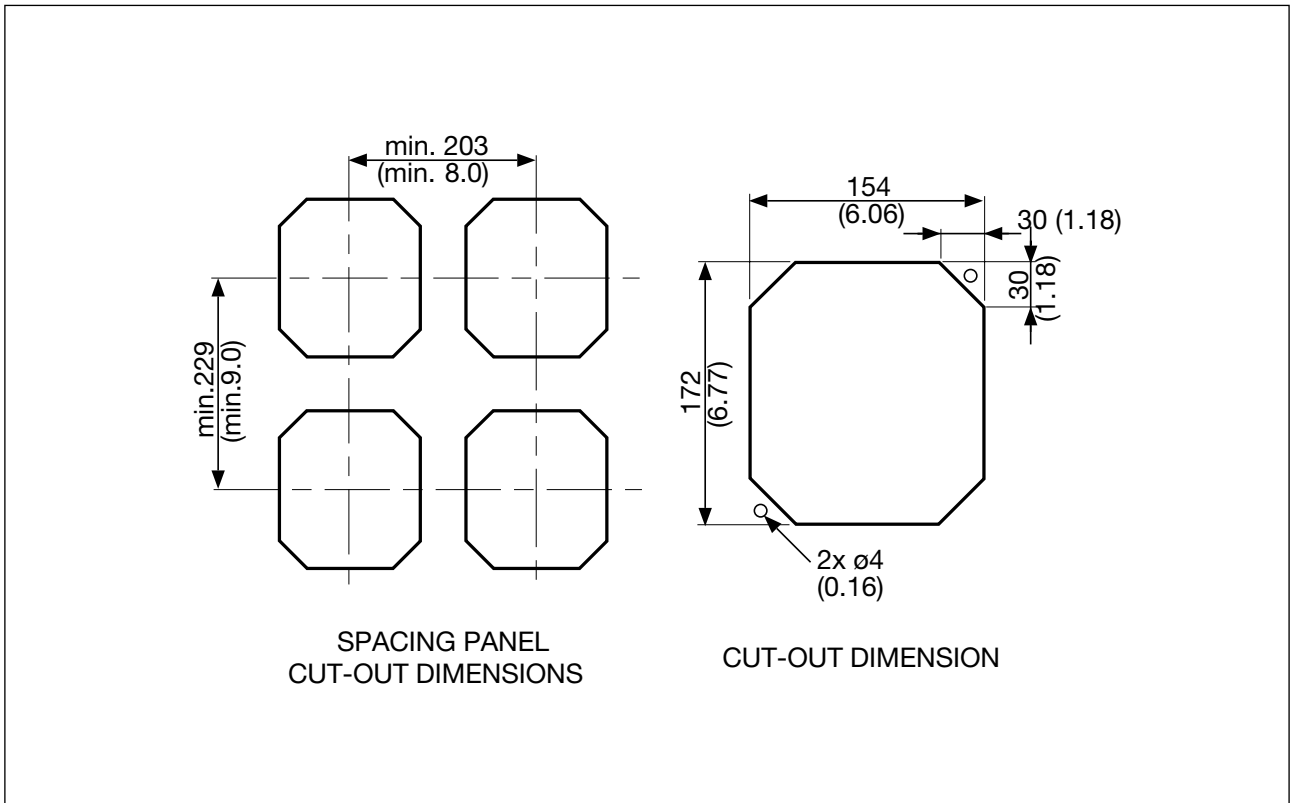
FOUNDATION Fieldbus H1 communications

Input signal	: Digital
Supply voltage	: 9 to 32 VDC
Operating current	: 24.5 mA (base current)
Operating values	: According to IEC 1158-2
Bus connection	: Fieldbus interface based on IEC 1158-2 according to FISCO-Model
Power supply	:Power supply is achieved dependant on the application by means of segment coupler
Data transfer	: FF Specification Rev. 1.4, Basic device
Function blocks	: 3xAI,Transducer,Resource
Files	: Actual file can be downloaded from our homepage
Configuration	: Local with 6 keys,
Software	: National Instruments, NI-FBUS configurator
Hardware	: FBUS-interfaces from National Instruments (AT-FBUS and PCMCIA FBUS)
Other control systems	: Yokogawa PRM, DMT

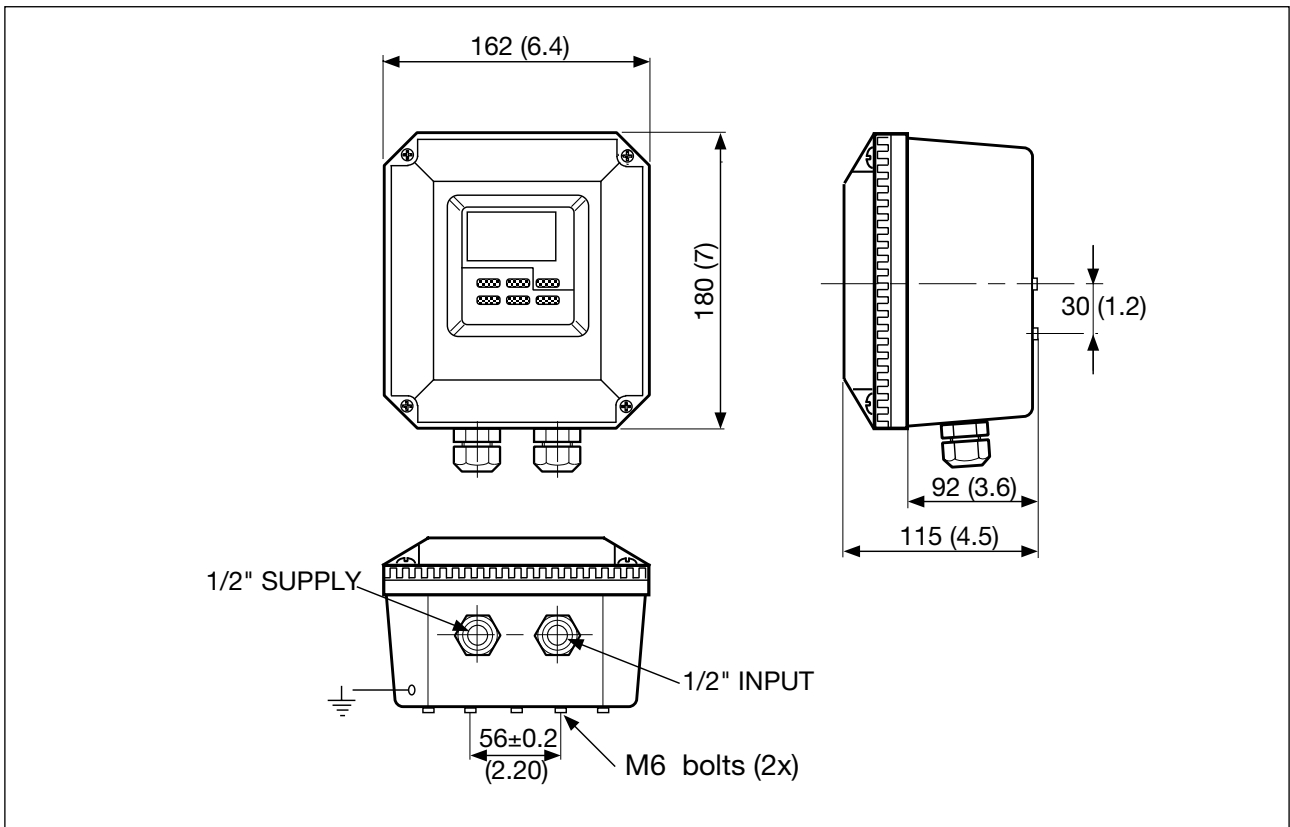
Model	Suffix Code	Option code	Description
ISC202G			Inductive conductivity transmitter, General Purpose version
Type	- A - F - P - E		Milli-amp (+HART®) version FOUNDATION ® Fieldbus version Profibus PA version Always E
Options		/H /U /SCT /Q	Hood for sun protection Pipe & Wall mounting hardware Stainless steel tagplate Calibration certificate

Model	Suffix Code	Option code	Description
ISC202S			Inductive conductivity transmitter, Intrinsic Safe version
Type	- A - F - P - N - B - D - E		Milli-amp (+HART®) version FOUNDATION ® Fieldbus version Profibus PA version Non-Incendive Milli-amp (+HART®) version Non-Incendive FOUNDATION ® Fieldbus version Non-Incendive Profibus PA version Always E
Options		/H /U /SCT /Q	Hood for sun protection Pipe & Wall mounting hardware Stainless steel tagplate Calibration certificate

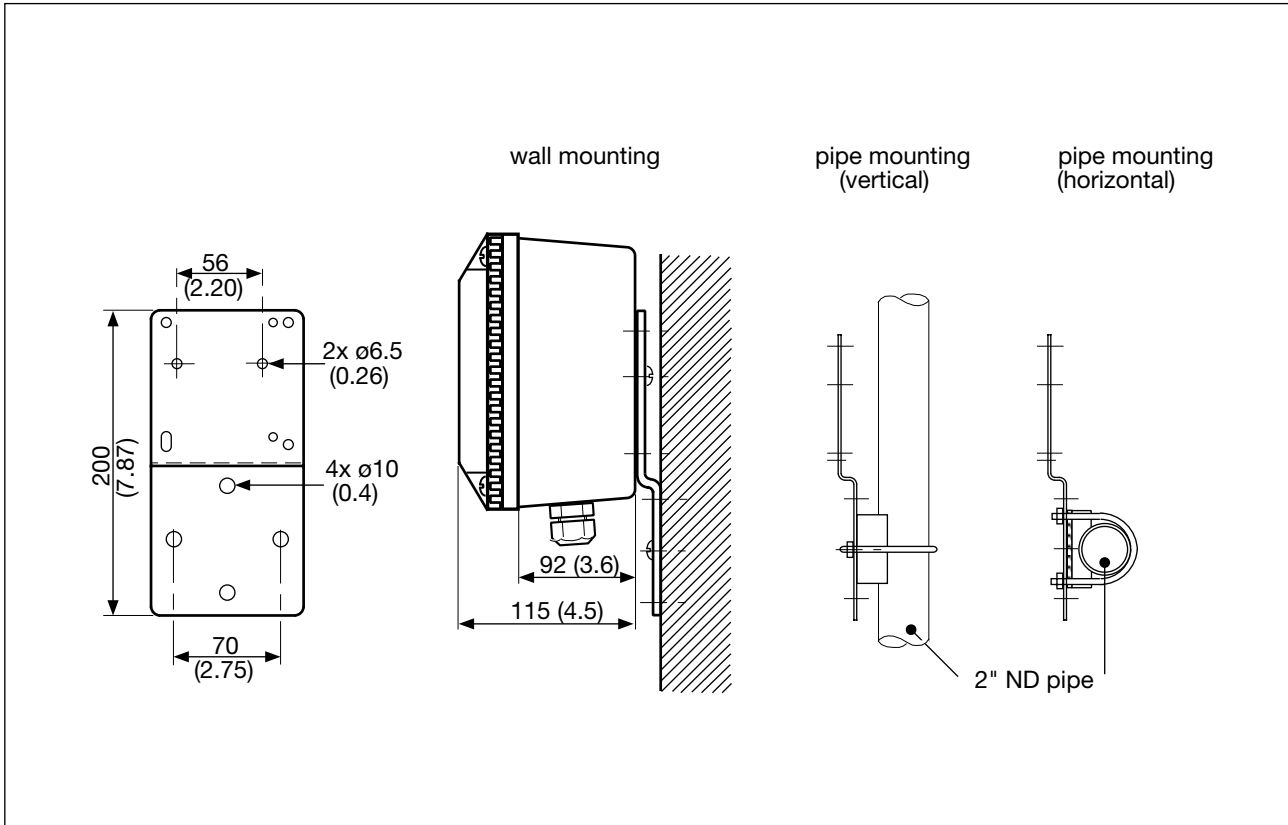
Dimensions and Mounting



Panel cut-out, spacing and mounting



Dimensions




Universal pipe/wall mounting

Spare parts ISC 202 G

Part no.	Description
K1500AU	Gland set 1/2 inch for EXA's
K1542KG	/H for EXA200/202 (hood)
K1542KW	/U pipe/wall mounting for EXA
K1544BD	Nameplate for ISC202G
K1544BM	Eprom + latest software ISC202
K1544FA	Pin-header for HART®-FF interface
K1544GG	SPR PART NAMEPLATE ISC202G-F
K1544PF	Terminals, block of 3
K1544ST	/SCT for EXA200/202
K1543WM	Sparepart HART® modem

Spare parts ISC 202 S

Part no.	Description
K1500AU	Gland set 1/2 inch for EXA's
K1542KG	/H for EXA200/202 (hood)
K1542KW	/U pipe/wall mounting for EXA
K1544BM	Eprom + latest software ISC202
K1544FA	Pin-header for HART®-FF interface
K1544PF	Terminals, block of 3
K1544ST	/SCT for EXA200/202
K1543WM	Sparepart HART® modem

<p>YOKOGAWA HEADQUARTERS 9-32, Nakacho 2-chome, Musashinoshi Tokyo 180 Japan Tel. (81)-422-52-5535 Fax (81)-422-55-1202 E-mail: webinfo@mls.yokogawa.co.jp www.yokogawa.com</p>	<p>YOKOGAWA CORPORATION OF AMERICA 2 Dart Road Newnan GA 30265 United States Tel. (1)-770-253-7000 Fax (1)-770-251-2088 E-mail: info@yca.com www.yokogawa.com/us</p>	<p>Yokogawa has an extensive sales and distribution network. Please refer to the European website (www.yokogawa.com/eu) to contact your nearest representative.</p>
<p>YOKOGAWA EUROPE B.V. Databankweg 20 3821 AL AMERSFOORT The Netherlands Tel. +31-33-4641 611 Fax +31-33-4641 610 E-mail: info@nl.yokogawa.com www.yokogawa.com/eu</p>	<p>YOKOGAWA ELECTRIC ASIA Pte. Ltd. 5 Bedok South Road Singapore 469270 Singapore Tel. (65)-241-9933 Fax (65)-241-2606 E-mail: webinfo@yas.com.sg www.yokogawa.com/sg</p>	 <p>YOKOGAWA ◆</p>