The new EXAxt 450 series builds on the superior functionality of the industry leading Yokogawa EXA series by enhancing EXA's proven operation and application flexibility. The Model 450 series features a uniquely simple touch screen menu structure that offers a choice of five different languages (English, French, German, Italian or Spanish).

The ISC450 provides the best accuracy in the industry resulting from advanced temperature compensation functionality, preloaded calibration standards and online cell and analyzer diagnostics to provide verifiable results. The Model ISC450 can be programmed to display and output Conductivity, Temperature and Percent Concentration on the main display. This is possible due to predefined temperature compensation matrices and integrated concentration tables that are a standard part of the analyzer software. In addition, the EXAxt ISC450 offers full functionality including PID control on either of the two mA output(s) or on the independent contact output(s). A digital HART signal is also superimposed on mA1. The contact outputs can be selected as pulse frequency controlled or pulse length controlled contact function to control chemical metering pumps or solenoid valves. This information can be used to generate additional current and contact outputs in the HIM monitor and in maintenance optimization programs like PRM or AMS.

The EXAxt 450 series provides a truly unique Human Machine Interface. The high resolution graphical display and touch screen operation provides all information clearly visible and easily accessible to the operator. Simply select the language of choice and on screen instructions assure that the best configuration for the application is obtained.

Features
- Unique touch screen operation with menu structure in 5 languages.
- Enhanced diagnostics, process trending graphics and on-screen logbook for data storage
- Two mA-outputs and four SPDT relay contacts with display indicators
- Hart® Communications
- FM Class 1, Div.2, Group ABCD, T6 for Ta-20 to 55°C
- IP66/NEMA4X 1/2 DIN enclosure for Field Mounting and Panel Mounting
- Selectable predefined Temperature Compensation Matrices
- Percent Concentration Display
General Specifications

General specifications of EXAxt ISC450

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 : 1µS/cm (at process temp.)
Maximum : 2S/cm (at process temp.)
Temperature : -20 to +140 ºC (0 to 280 ºF).
Cable length : max. 60 metres (200 feet) 10 metres (35 feet) fixed sensor cable + 50 metres (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. Accuracy (under reference conditions):
Conductivity : \( \leq 0.5 \% \) ± 1.0 µS x C
Temperature : \( \leq 0.3^\circ C \) (0.6ºF)
Temp. compensation : \( \leq 1 \% \) for NaCl, \( \leq 3 \% \) for Matrix
mA-output circuits : \( \leq 0.02 \) mA.
Ambient temperature influence : 500 ppm/ºC ± 0.05 µS/ºC
Step response : \( \leq 4 \) seconds for 90 % (for a 2 decade step).

D) Transmission Signal
General : Two isolated outputs of 4-20 mA. DC with common negative. Maximum load 600Ω. Bidirectional HART® digital communication, superimposed on mA1 (4-20mA) signal.
Output function : Linear or 21-step table for Conductivity, concentration or temperature.
Control function : PID control.
Burn out function : Burn up (21.0mA) or burn down (3.6mA) to signal failure. 4CC. NAMUR NE43.
Parameters : Adjustable damping
Hold : The mA-outputs are frozen to the last/fixed value during calibration/ commissioning

E) Contact outputs
General : Four SPDT relay contacts with display indicators.
Switch capacity : Maximum values 100 VA, 250 VAC, 5 Amps.
Maximum values 50 Watts, 250 VDC, 5 Amps.
Fail contact : Contact S4 is configured as fail safe contact (alarm active powerdown situation)
Status : High/Low process alarms, selected from conductivity, resistivity, concentration or temperature. Configurable delay time and hysteresis. PID duty cycle or pulsed frequency control.

F) Contact Input
Contact open : Conductivity <10µS x C: Range 1
Contact closed : Conductivity <100µS x C: Range 2 (10 x Range 1)

G) Temperature compensation
Reference temp. : programmable from 0 to 100 °C or 30 - 210 °F (default 25 °C).

H) Calibration
Semi-automatic calibration using pre-configured OIML* (KCI) standard tables, with automatic stability check.
Manual adjustment to grab sample.

I) Logbook
Software record of important events and diagnostic data readily available in the display or through HART.

J) Display
Graphical Quarter VGA (320 x 240 pixels) LCD with LED backlight and touch screen. Plain language messages in English, German, French, Spanish and Italian.

K) Shipping details
Package size : 293 x 233 x 230 mm (L x W x D) (11.5 x 9.2 x 9.1 inch)
Package weight : app. 2.5 kg (5.5lbs)

L) Housing
Cast aluminium case with chemically resistant coating, cover with flexible polycarbonate window. The colour of the case and cover is silvergrey. Cable entry via six M20 polyamide glands. Cable terminals are provided for up to 2.5 mm² finished wires. Weather resistant to IP66 and NEMA4X standards. Pipe, wall or panel mounting, using optional hardware.

M) Power supply
85-265 VAC (±10%), Max 10VA, 47-63Hz 9.6-30 VDC (±10%), Max 10W

N) Regulatory compliance
EMC : Meets directive 89/336/EEC Emission conform EN 55022 class A Immunity conform IEC 61326-1
Low Voltage: Meets directive 73/23/EEC Conform IEC 61010-1, UL61010C-1 and CSA 22.2 No. 1010.1, Installation category II, Pollution degree 2 Certification for cCSAus, Kema Keur and Geprufte Sicherheit FM Class 1, Div. 2, Group AB/CD, T6 for Ta -20 to 55°C

* Organisation Internationale de Metrologie Legale, international recommendation nr. 56 standard solutions reproducing the conductivities of electrolytes, 1981.
Environment and operational conditions

Ambient temperature: -20 to +55 °C (-5 - 130°F)
Storage temperature: -30 to +70 °C (-20 - 160°F)
Humidity: Up to 90% RH at 40 °C (100°F) (non-condensing)
Data protection: EEPROM for configuration data and logbook.
Lithium cell for clock.
Watchdog timer: Checks microprocessor.
Power down: Reset to measurement.
Automatic safeguard: Auto return to measuring mode when touch screen is not touched for 10 min.

Display and Operating Interface

The Display is a backlit graphical display with QVGA resolution. Operation is done by a touch screen. Graphical keys on the right and other area’s of the touch screen respond to contact as virtual push buttons.

Main screen

The main screen displays:
- The primary variable in large font (user selectable)
- Other process variable(s) in small font
- Unit symbols
- Tag number (user programmable)
- Process description (user programmable)
- Status of contact output(s)
- Status indicator during HOLD and WASH situation
- Main Function keys

Trend screen

The trend screen displays:
- Time scale. User selectable (between 15 minutes and 2 weeks)
- PV scale. User selectable
- TAG number
- Actual PV
- Average, maximum and minimum PV in this interval

Zoom screen

The zoom screen displays an simple graphic representation of the output functions. When “next” is pressed it will give access to the logbook data.

Status screen

The Status screen gives access to diagnostic information with regards to analyser or sensors.

Maintenance screen

The maintenance screen gives access to calibration, commissioning and setup of the instrument. These levels can be protected by passwords.

Example:
Output and Alarm Functions

Output Signal

The standard ISC450 features two 4-20 mA current outputs available for registration, and indication or control functions.

The user selectable application can represent:
- the measured conductivity value
- the concentration in wt%
- the measured temperature value

In addition the following output functions are available:
- a "HOLD" function that maintains process value or a fixed value until return to normal operation
- a "BURN" function that gives a high or low output at fail status
- a programmable output function that allows the user to linearise the output(s) when used as a concentration analyser.

Two isolated mA outputs are provided, and can be set for linear or scaled output signals. Alternatively PID analogue control is available on either or both mA outputs. The transmitter or control parameter may be SC, concentration or temperature. Control settings are fully configurable.

Linearisation of output

<table>
<thead>
<tr>
<th>Conductivity (mS/cm)</th>
<th>Output in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
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<td>16</td>
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</tr>
<tr>
<td>22</td>
<td>55</td>
</tr>
<tr>
<td>24</td>
<td>60</td>
</tr>
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</table>

Code mA Conc. Example Output in %

<table>
<thead>
<tr>
<th>Code</th>
<th>mA 4-20</th>
<th>Conc.</th>
<th>Example</th>
<th>Cond.</th>
<th>Example mS/cm</th>
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<tr>
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<td>4.0</td>
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<td>5</td>
<td>4.8</td>
<td>1.25</td>
<td>1.25</td>
<td>1.25</td>
<td>27</td>
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<tr>
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<td>2.5</td>
<td>2.5</td>
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<tr>
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<td>3.75</td>
<td>3.75</td>
<td>3.75</td>
<td>40</td>
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<td>5</td>
<td>5</td>
<td>46</td>
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<td>25</td>
<td>8.0</td>
<td>6.25</td>
<td>6.25</td>
<td>6.25</td>
<td>52</td>
</tr>
<tr>
<td>30</td>
<td>8.8</td>
<td>7.5</td>
<td>7.5</td>
<td>7.5</td>
<td>58</td>
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<tr>
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<td>8.75</td>
<td>8.75</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<td>25</td>
<td>25</td>
<td>25</td>
<td>142</td>
</tr>
</tbody>
</table>

Example: 0-25% Sulfuric acid

Four SPDT relays are included as standard, and can be configured by the user as conventional process alarms, or in one of 2 control modes:

1) PID duty cycle control

In this type of control, the on/off ratio is controlled to vary the dose rate through a solenoid valve. This is a very economic way of achieving PID control.

2) PID pulse frequency control

The pulsing frequency is regulated to control electrical valve opening or pump stroke. In each case the setpoint, PB, I and D terms are all easily adjustable in the ISC450.

Configuration of contacts

<table>
<thead>
<tr>
<th>Contact</th>
<th>Normal operation</th>
<th>Alarm situation</th>
<th>Powerdown</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1, S2, S3</td>
<td>C</td>
<td>NO</td>
<td>C</td>
</tr>
<tr>
<td>S4</td>
<td>C</td>
<td>NO</td>
<td>C</td>
</tr>
</tbody>
</table>
**Measurement Principle**

Unlike 2- or 4-electrode conductivity systems, the EXA ISC450G analyses the conductivity without any contact between electrodes and process fluid. The measurement is based on inductive coupling of two ring transformers (Toroids) by the liquid. The EXA ISC450 supplies a reference voltage (V1) at a high frequency to the “drive coil”. The core of this coil is of a high permeability magnetic material, and a strong magnetic field is generated in the toroid. The liquid passes through the hole in the toroid and can be considered as a “one turn” secondary winding.

The magnetic field induces a voltage (V2) in this liquid winding. The induced current thus made to flow is proportional to this voltage and the conductance of the liquid “one turn winding” is according to Ohm’s law. The conductance (G=1/R) is proportional to the specific conductivity and a constant factor that is determined by the geometry of the sensor (length divided by surface area of the hole in the toroid) and the installation factor of the sensor.

There are two toroids mounted in the “dognut” shaped sensor. The liquid also flows through the second toroid and therefore the liquid turn can be considered as a primary winding of the second ring transformer. The current in the liquid will create a magnetic field in the second toroid. The induced voltage (V3) being the result of this magnetic field can be measured as an output. The output voltage of this “receive coil” is therefore proportional to the specific conductivity of the process liquid.

**Functional Description**

The EXA ISC450G is a real time microprocessor based conductivity analyzing system. It uses a dedicated microprocessor to control all functions necessary in such a system. The input and output functions are concentrated in the analog section of the instrument. Even these functions are operated through special interfaces designed to minimize interference with the digital functions. All functions are executed separately.

The power of the microprocessor is used for:
- Diagnostic functions to increase the dependability of the instrument.
- A self-tuning preamplifier to increase the rangeability to cover almost all conductivity applications.
- Input/output flexibility to offer the user solutions to compatibility problems and to non-linearity characteristics of some electrolytes.
- Auto zeroing to ensure long term stability
- Sophisticated temperature compensation to achieve temperature independent readings for even the most difficult processes like Sulfuric Acid and Sodium Hydroxide.

![Inductive conductivity measurement principle](image)

![Grounding](image)

**Glands to be used for cabling**
Installation and Wiring

Installation site
The converter is a rain-tight type, and can be installed inside or outside. It should, however, be installed as close as possible to the sensors to avoid long cable lengths between sensors and transmitter. Select an installation site where:
- Mechanical vibrations and shocks are negligible.
- No relay/power switches are in the direct environment.
- The transmitter is not mounted in direct sunlight and severe weather conditions.
- Maintenance activities are possible (no corrosive atmospheres).
The ambient temperature and humidity of the installation environment must be within the limits of the instrument specifications.

Mounting methods
The EXA ISC450G transmitter has universal mounting possibilities:
- Panel mounting using optional brackets.
- Surface mounting on a plate (by bolts from the back).
- Wall mounting on a bracket (e.g. thick brick wall).
- Pipe mounting using a bracket on a horizontal or vertical pipe (maximum diameter 50 mm).

Installation of the sensor
The ISC40 is a donut shaped sensor. Ideally, the process flows through the hole of the donut with the temperature compensator up-stream. For minimal obstruction of the flow and for accurate measurement without the need for calibration of the installation factor, the process should flow freely around the donut. This is effected by allowing a minimum distance of 25 mm (1 in) between donut and process piping (d).

The sensor is provided with a gasket and retaining nut. This allows "bulkhead mounting" in tank wall or standard flange through a hole of 27 mm (1.1 in) diameter (A). The insertion depth is 125 mm. Two flats are provided with wrench size 20 mm (0.8 in) to allow easy mounting and alignment of the sensor. The model identification on one flat aligns with the "up-stream" position of the sensor.

It is recommended to use Yokogawa supplied mounting options, flow fittings, immersion fittings or sub assemblies. These holders feature double O-ring seals to prevent that chemical attack of the seal will damage the sensor by ingress of process liquid in the sensor.
- For On-line mounting, adapters are available for standard 2" process connection (Gas thread, NPT, ANSI-flange, DIN-flange).
- For by-pass measurement, flow fittings are available in Polypropylene, Polyvinylidene Fluoride and Stainless Steel.
- For measurements in open ducts or vessels, an immersion fitting in CPVC is available.

For easy wiring the sensor should be located within 2 to 10m (6 or 32ft) from the transmitter using the integral sensor cabling. Up to 50 meters of WF10 extension cable may be used with a BA10 junction box. The installation factor of the ISC40 is the ratio of the measured conductivity at the sensor and the specific conductivity of the solution. The unit is cm-1 just as the cell constant of a contact electrode system. This factor is 1.88 cm-1 for the ISC40 if the sensor is installed with a minimum of 25 mm (1 in) of process fluid surrounding the donut.

- Installed in an ISC40FF-S stainless steel flow cell, the factor is 1.7 cm-1.
- Installed in an ISC40FF-P polypropylene flow cell, the factor is 1.88 cm-1.
- The factor may be estimated from table (PEEK and PFA) for actual installations not using the standard flow assemblies.
- The I.F. or cellcontact of ISC40 sensors made of TFA is 3.0/cm. This sensor comes with mounting flange DNS0/2".

![Diagram showing bulk-head mounting](image)

Dimensions and installation instructions bulk-head mounting

For PEEK and PFA

![Graph showing installation factor as a function of free distance around donut](image)
Wiring

When wiring the converter, the following guidelines should be used for cable selection, in order to ensure the correct sealing of the cable glands and the correct operation of the terminals.

- **Overall cable diameter**: 7-11 mm (9/32”-15/32”)
- **Conductor cross section**: 0.13 2 mm - 4.0 2 mm (26-12 AWG)

### Model and Suffix codes

<table>
<thead>
<tr>
<th>Model</th>
<th>Suffix Code</th>
<th>Option code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISC450G</td>
<td></td>
<td></td>
<td>Inductive/Conductivity transmitter</td>
</tr>
<tr>
<td>Power</td>
<td>- A</td>
<td></td>
<td>AC version (85…265 VAC)</td>
</tr>
<tr>
<td></td>
<td>- D</td>
<td></td>
<td>DC version (9.6…30 VDC)</td>
</tr>
<tr>
<td></td>
<td>- A</td>
<td></td>
<td>Always A</td>
</tr>
</tbody>
</table>

### Wiring Diagram

#### High Voltage Power Supply

#### Relay Contacts

#### Signal

mA Outputs

- Input contact
- Sensor Inputs

#### Wiring Diagram
Dimension and Mounting

**Wall Mounting**

- 80 mm (3.15")
- 200 mm (7.87")
- 70 mm (2.76")
- 2x ø6.5 mm (0.26")
- 4x ø10 mm (0.4")

**Pipe Mounting (Vertical)**

- 2" ND. pipe

**Pipe Mounting (Horizontal)**

- 144 mm (5.67")

OPTION /UM: Universal pipe/wall/panel mounting kit

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**Dimensions**

- Width: 144 mm (5.67")
- Height: 144 mm (5.67")
- Depth: 50 mm (1.97")

**Hole Details**

- 2x ø6.5 mm (0.26")
- 4x ø10 mm (0.4")

**Mounting Options**

- Wall Mounting
- Pipe Mounting (Vertical)
- Pipe Mounting (Horizontal)

**Technical Specifications**

- Material: Steel
- Finish: Powder-coated

**Contact Information**

- Shanghai Huiying Industrial Co., Ltd.
  - TEL: 021-60536651
  - FAX: 021-54795382
  - Email: shphying@163.com