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JUMO CTI-500

Inductive Conductivity/Concentration and Temperature Transmitter with switch contacts

Type 202755



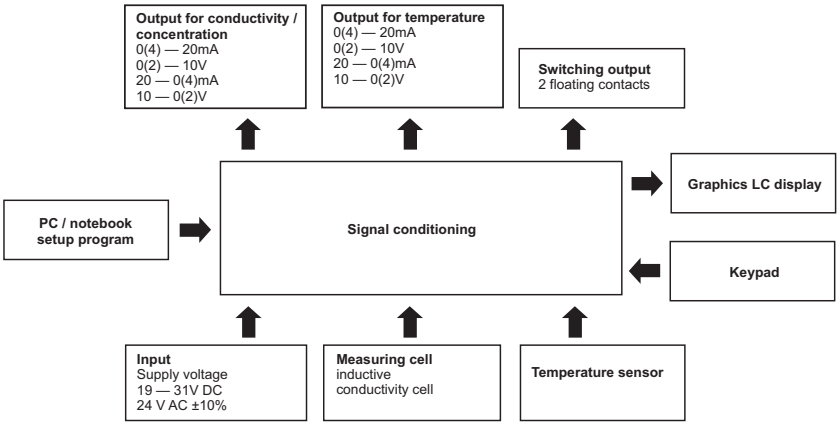
Brief description

The device is used for the measurement/control of conductivity or concentration in liquid media. It is particularly suitable for application in media where severe deposits of dirt, oil, grease or gypsum/lime precipitates are to be expected. The integrated temperature measurement enables fast and accurate temperature compensation, which is of special importance when measuring conductivity. Additional functions permit the combined changeover of measuring range and temperature coefficient.
Two built-in switching outputs can be freely programmed to monitor conductivity/concentration and/or temperature limits. It is also possible to assign alarm and control functions (dilution).
The device is operated either from the membrane keypad and plain-text graphics display (operator language can be changed over) or through the user-friendly PC setup program. The display can be read off by simply rotating the housing cover. This applies to the installation both in horizontally and vertically arranged pipes. By using the setup program, the device configuration data can be saved for plant documentation and printed out. To prevent any tampering, the device can also be supplied without keypad or display. In this case, the setup program is needed for programming.
The JUMO CTI-500 is available either as a combined unit (transmitter and measuring cell together in one unit) or as a split version (transmitter and cell connected by cable). The split version is particularly suitable for plant subjected to strong vibration and/or significant heat radiation at the measurement point, or for installation on sites that are difficult to access. Immersion models up to 2000 mm are available for application in open containers or sluices.
Typical areas of application: Freshwater and wastewater engineering, air conditioning systems and cooling tower monitoring (dilution control), rinsing baths (e.g. monitoring electroplating baths), inlet and final checks in factory water treatment plant, concentration monitoring, vehicle wash plant, etc.

Key features

- Dilution control
- Activation of up to four ranges
- Activation of up to four temperature coefficients
- Concentration measurement with
  - two predefined curves
  - one freely definable curve (through the setup program)
- Fast-response temperature sensor
- Temperature compensation
  - linear
  - natural water
  - individual characteristic (learning function)
- Operation
  - via keypad and LC display
  - through setup program
- Operator languages: English, French, German, Italian, Dutch, Spanish, Polish, Portuguese, Russian, Swedish
- By using the setup program:
  - user-friendly programming
  - plant documentation

Block diagram



Approvals/approval marks (see "Technical data")

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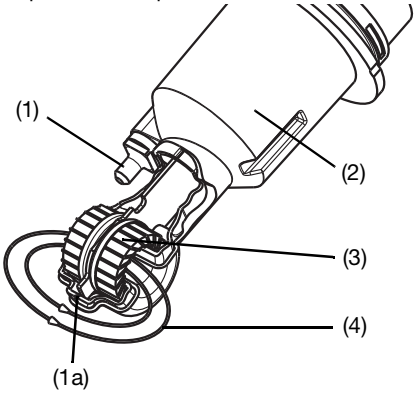
Functional description

The inductive measurement method permits largely maintenance-free acquisition of the specific conductivity, even in the toughest media conditions. As opposed to the conductive measurement method, problems such as electrode decomposition and polarization do not occur.
The conductivity is measured using an inductive probe. A sinusoidal a.c. voltage feeds the transmitting coil. Depending on the conductivity of the liquid to be measured, a current is induced in the receiver coil. The current is proportional to the conductivity of the medium.

Device description

Measuring cell

The measuring cell consists of a hermetically sealed polypropylene (PP) or polyvinyl-idenefluoride (PVDF) body inside which the two measurement coils are arranged. A bore in the measuring cell enables the medium to flow through. The measurement principle entails an inevitable electrical isolation between the sample medium and the signal output.
The measuring cell is largely unaffected by temperature and pressure variations.



(1) Temperature sensor, exposed
(1a) optionally: internal
(2) Cell body in PP
(3) Measurement coils
(4) Liquid loop

Exposed temperature sensor
The sensor (in a stainless steel sleeve) exhibits a very fast response to temperature variations. This is especially important for CIP processes (phase separation).

Internal temperature sensor
The sensor is integrated in the PP body. This construction ensures that no metal parts come into contact with the sample medium (important with corrosive media). However, temperature acquisition is somewhat slower here.

Temperature compensation

Since conductivity largely depends on the temperature of the medium, it is usually necessary to compensate for the temperature effect.
The device allows both linear and non-linear temperature compensation.
If required, temperature compensation can be switched off, for example, when the temperature conditions on the measurement site are stable or when temperature compensation is carried out in the software, in external evaluation devices (PLC or similar).

Process connections

To cover a wide variety of applications, the device can be supplied with different process connections (also as an immersion model), see dimensions.

Installation at the measurement point

The operating position is generally unrestricted. However, it is essential to ensure that there is a continuous exchange of the sample liquid in the flow channel.

Transmitter

The CTI-500 transmitter has been designed for use on site. A rugged housing protects the electronics and the electrical connections from corrosive environmental conditions (IP67).
A vent screw with a PTFE membrane prevents condensation.

Operation

The JUMO CTI-500 can be operated either from the device keys and the graphics LC display and/or through the setup program from a PC or laptop.

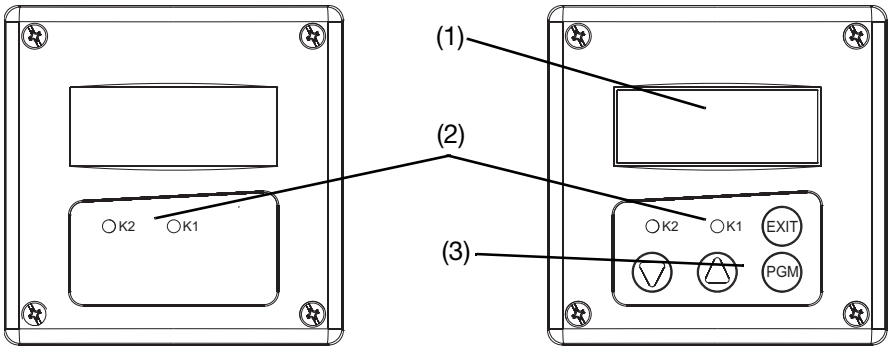
The device can be secured against unauthorized alteration by a password.

Functions of the outputs

Analog outputs

- One analog signal output for conductivity/ concentration and temperature respectively.
- The analog output signals are freely scalable (range start and end values).
- The response of the analog outputs to over/underrange or alarm can be programmed.
- Simulation of the signal output:
  The analog signal outputs can be freely set in the manual mode.
  Application: “Dry-run” start-up of the plant, trouble-shooting, servicing.

Displays and controls



Version without a display
Operation/configuration through the setup program only

Version with a display
Operation/configuration from the keys or through the setup program

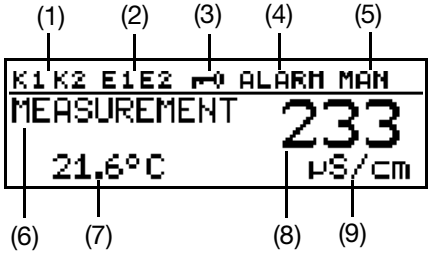
(1) Graphics LC display
(2) LEDs for the switching status indication of the outputs K1 and K2
(3) Keys

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Graphics LC display



(1) Switching output 1 or 2 is active
(2) Binary input 1 or 2 is operated
(3) Keypad is inhibited
(4) Alarm has been activated
(5) Device is in manual mode
(6) Device status
(7) Temperature of medium
(8) Conductivity measurement
(9) Unit of conductivity measurement

Switching outputs

The device features two floating switching outputs (solid-state relays) as standard.

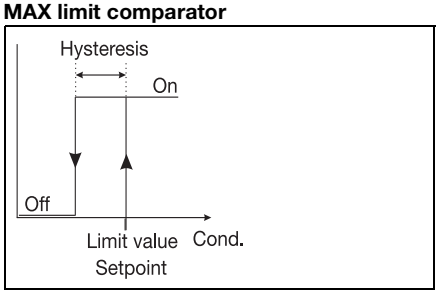
These can be used freely for monitoring the conductivity/concentration or the temperature.

The following functions can be assigned:

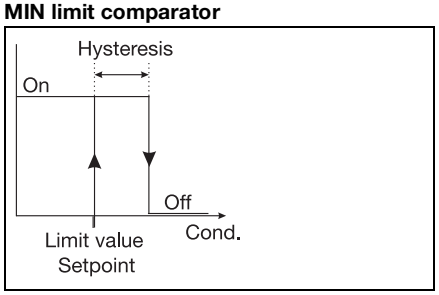
- ❏ Limit monitoring (MAX. or MIN. limit comparator) with programmable hysteresis
- ❏ Pulse function (the output switches briefly on reaching the switching point, then opens again).
- ❏ Pull-in and drop-out delay
- ❏ Inverted switching outputs
- ❏ Response to overrange/underrange or with activated measuring circuit monitoring (pull-in/drop-out).
- ❏ “Calibration timer run down" signal.

Contact functions

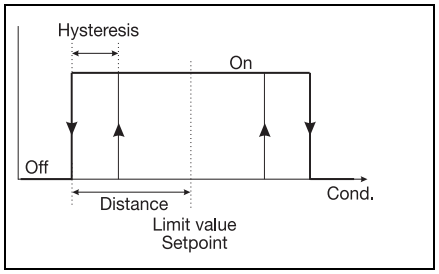
MAX limit comparator



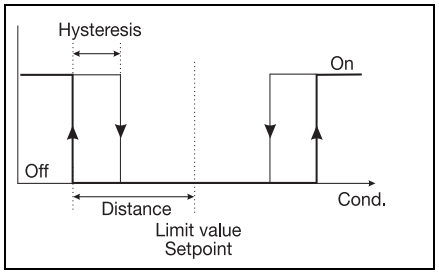
MIN limit comparator



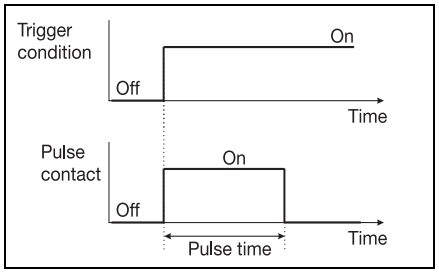
Alarm window 1



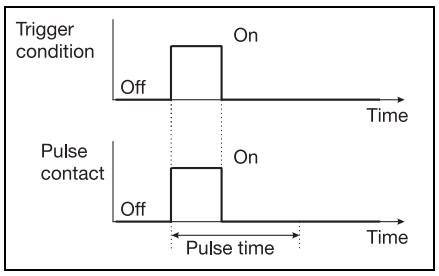
Alarm window 2



Pulse contact
Trigger conditions longer than pulse time



Pulse contact
Trigger conditions shorter than pulse time



Binary inputs

The two binary inputs serve to implement the following functions:

- Key inhibit
- HOLD mode
- 4-fold range changeover
- 4-fold temperature coefficient changeover
- Initiation of dilution function and biocide dosing

Special functions

- The learning function for the temperature coefficient enables exact measurement of media with a non-linear characteristic. During a temperature change, the device “learns” the temperature coefficient of the present medium and stores the profile. The stored values then enable the correct indication of the temperature-compensated conductivity.
- Individual characteristic for concentration indication.
  An individual characteristic with 20 interpolation points can be entered through the setup program. This function can be used to generate special characteristics for specific media (e.g. special detergents). This results in correct measurements that contribute to assuring the quality and saving costs.
- Dilution control
  Various processes that find their application in wet cooling towers are stored as sequence control (biocide dosing and subsequent inhibiting of dilution). Additional information can be found in the operating manual.
- Calibration timer
  The calibration timer draws your attention to a calibration schedule. This function is activated by entering a number of days, after which recalibration has to be carried out (plant or operator requirement).

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Function of the binary inputs

Setting parameters		Binary input 1	Binary input 2
Measuring range/ temperature coefficient changeover	Range1/TC1	open	open
	Range2/TC2	closed	open
	Range3/TC3	open	closed
	Range4/TC4	closed	closed
Key inhibit		closed	X
"Hold" function		X	closed
Start dilution function		close (edge 0 - 1)	open
Stop dilution function		open	close (edge 0 - 1)

Technical data

General

A/D converter
resolution: 15 bit
sampling time: 500 msec = 2 meas. per sec

Supply
For operation with SELV and PELV circuits.
As standard:
19 to 31 V DC (24 V DC nominal),
the device incorporates reverse-polarity protection
ripple: < 5 %
extra code 844:
24 V AC ±10 %, 50 to 60 Hz
power consumption with display: ≤ 3 W
power consumption without display: ≤ 2.6 W

Rating of the solid-state relays
U < 50 V AC/DC
I ≤ 200 mA

Electrical connection
plug-in screw terminals 2.5 mm^2 or
M12 plug/socket connectors

Display (option)
graphics LCD with background lighting; contrast is adjustable
dimensions: 62 x 23 mm

Permissible ambient temp. (transmitter)
-5 to +50 °C
max. 93 % rel. humidity, no condensation

Permissible storage temp. (transmitter)
-20 to +75 °C
max. 93 % rel. humidity, no condensation

Enclosure protection (transmitter)
IP67

Housing
polyamide (PA)

Weight
depending on version and process connection
approx. 0.3 to 2 kg

Conductivity/concentration transmitter

Concentration measurement
(implemented in the device software)
- NaOH (caustic soda)
  0 to15 % by weight or 25 to 50 % by weight
- HNO_3 (nitric acid)
  0 to25 % by weight or 36 to 82 % by weight
- customer-specific concentration curve, reely programmable through the setup program (see "special functions")

Calibration timer
adjustable: 0 to 999 days (0 = off)

Output signal for conductivity/ concentration
0 to 10 V / 10 to 0 V
2 to 10 V / 10 to 2 V
0 to 20 mA / 20 to 0 mA
4 to 20 mA / 20 to 0.4 mA
The output signal is freely scalable.

Burden
≤ 500Ω for current output
≥ 2kΩ for voltage output

Analog output with "Alarm"
Low (0 mA / 0 V / 3.4 mA / 1.4 V)
or
High (22.0 mA / 10.7 V)
or
a fixed setting

Measuring ranges
Four ranges can be selected. One of these ranges can be activated via an external switch or a PLC.

Meas. ranges Transmitter[a]	Tolerance (in % of range span)
0 to 500 µS/cm	≤0.5 %
0 to 1000 µS/cm	
0 to 2000 µS/cm	
0 to 5000 µS/cm	
0 to 10 mS/cm	
0 to 20 mS/cm	
0 to 50 mS/cm	
0 to 100 mS/cm	
0 to 200 mS/cm	
0 to 500 mS/cm	
0 to 1000 mS/cm	
0 to 2000 mS/cm[b]	

[a] Usual application range from approx. 100 µS/cm.
[b] not compensated for temperature

Note:
The overall tolerance is made up of the tolerance of the transmitter + the tolerance of the sensor.

Temperature transmitter

Temperature acquisition
manually -20 to 25.0 to 150 °C/°F
or automatically

Temperature measuring range
-20 to 150 °C/°F

Characteristic
linear

Accuracy
≤ 0.5 % of measuring range

Ambient temperature error
≤ 0.1 %/ °C

Response time
with exposed temperature sensor
t_{09} ≤ 6 sec
with internal temperature sensor
t_{09} ≤ 2 min

Output signal for temperature
0 to 10 V / 10 to 0 V
2 to 10 V / 10 to 2 V
0 to 20 mA / 20 to 0 mA
4 to 20 mA / 20 to 0.4 mA
The output signal is freely scalable within the range -20 to +200 °C.
The sensor can be applied within the range -10 to +100 °C.

Burden
≤ 500Ω for current output
≥ 2kΩ for voltage output

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Analog output for "Alarm"
Low (0 mA / 0 V / 3.4 mA / 1.4 V)
or
High (22.0 mA / 10.7 V)
or
a fixed setting

Temperature compensation

Reference temperature
15 to 30 °C, adjustable

Temperature coefficient
0.0 to 5.5 %/°C, adjustable

Compensation range
-20 to 150 °C

Function
- linear
- natural water (EN 27 888)
- non-linear (learning function, see special functions)

Sensor

Material
PP (polypropylene), suitable for foodstuffs
Note:
Temperature, pressure and sample medium affect the life of the cell!

Temperature of the sample medium

Process-connection	max. temperature
168 706	60 °C
169 607 617 690	80 °C short term 100 °C

Pressure
10 bar max. at 20 °C
6 bar max. at 60 °C

Measuring range Sensor[a]	Tolerance (in % of range span)
0 to 500 µS/cm	≤1%
0 to 1000 µS/cm	
0 to 2000 µS/cm	≤0.5%
0 to 5000 µS/cm	
0 to 10 mS/cm	
0 to 20 mS/cm	
0 to 50 mS/cm	
0 to 100 mS/cm	
0 to 200 mS/cm	
0 to 500 mS/cm	
0 to 1000 mS/cm	≤1%
0 to 2000 mS/cm[b1]	

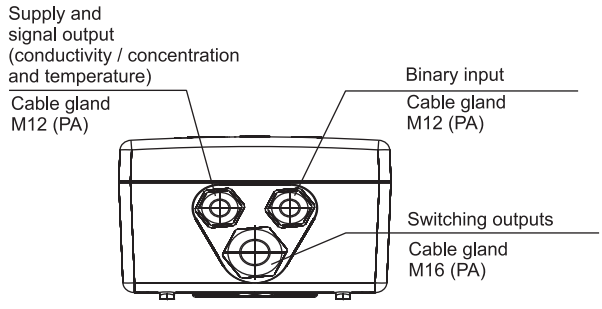
[a] Usual application range from approx. 100 µS/cm.
[b] not compensated for temperature.

Approvals/approval marks

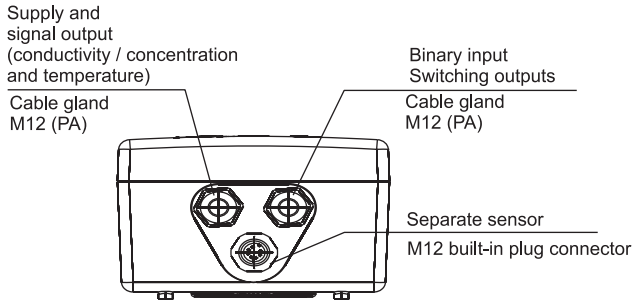
Approval mark	Testing agency	Certificate/certification number	Inspection basis	Valid for
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KR	Korean Register of Shipping	HMB39666-AE001	Rules for Classification of Steel Ships, Pt. 6, Ch 2, Art. 301	Type 202755/10 Type 202755/15

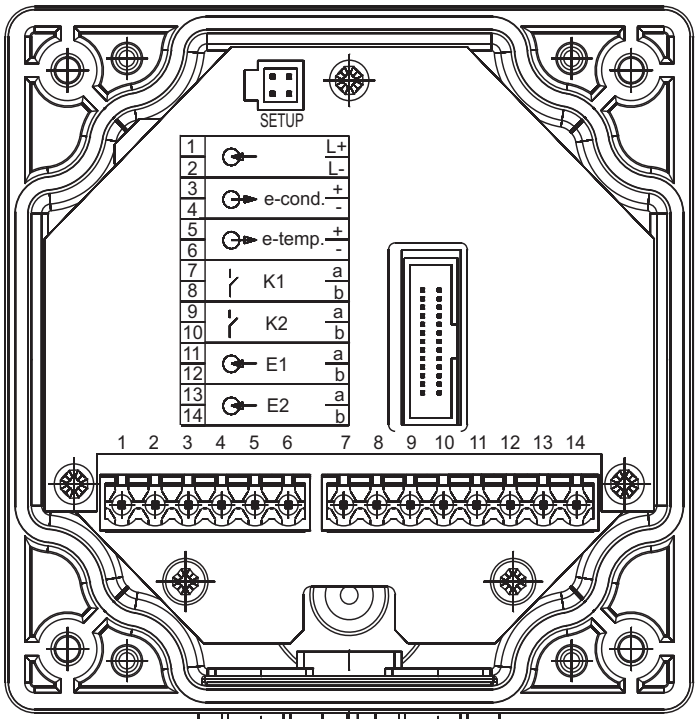
Electrical connection - head transmitter (transmitter with cable glands (-82))

Wiring recommendation - head transmitter



Wiring recommendation - with separate sensor

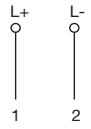


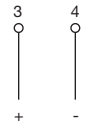
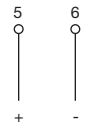
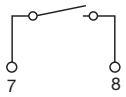
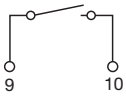


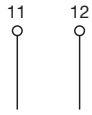
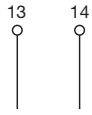
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Supply	**Terminal assignment**		**Symbol**
Supply (with reverse-polarity protection)	1 2	L + L-	

Outputs	**Terminal assignment**		**Symbol**
Analog signal output: conductivity/ concentration (electrically isolated)	3 4	+ -	
Analog signal output: temperature (electrically isolated)	5 6	+ -	
Switching output K1 (floating)	7 8		
Switching output K2 (floating)	9 10		

Binary inputs	**Terminal assignment**		**Symbol**
Binary input E1	11 12		
Binary input E2	13 14		

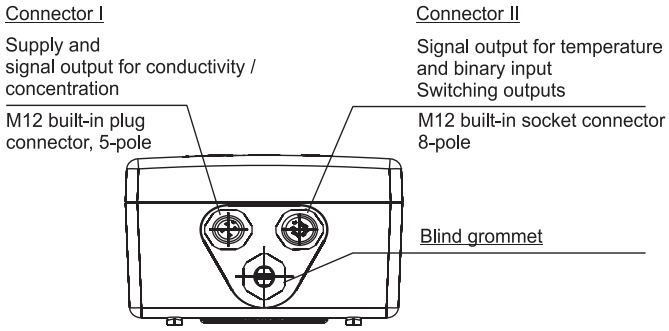
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Internet: www.jumo.net

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Phone: +44 1279 63 55 33
Fax: +44 1279 62 50 29
Email: sales@jumo.co.uk
Internet: www.jumo.co.uk

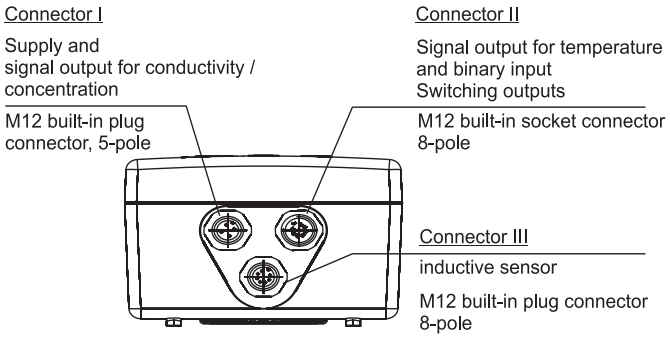
JUMO Process Control, Inc.
6733 Myers Road
East Syracuse, NY 13057, USA
Phone: +1 315 437 5866
Fax: +1 315 437 5860
Email: info.us@jumo.net
Internet: www.jumousa.com

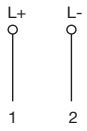
Electrical connection (transmitter with M12 connectors (-83))

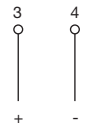
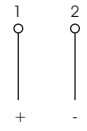
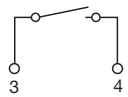
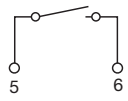
Head transmitter

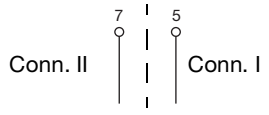
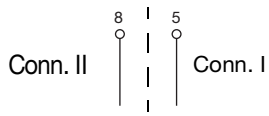


Transmitter with separate sensor



Supply	Connector	Assignment	Symbol
Supply (with reverse-polarity protection)	I	L + L-	

Outputs	Connector	Assignment	Symbol
Analog signal output: conductivity/ concentration (electrically isolated)	I		
Analog signal output: temperature (electrically isolated)	II		
Switching output K1 (floating)	II		
Switching output K2 (floating)	II		

Binary inputs	Connector	Assignment	Symbol
Binary input E1	I II		
Binary input E2	I II		

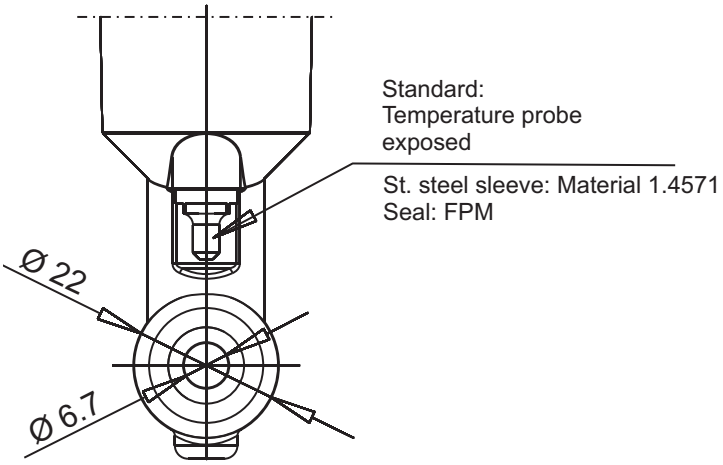
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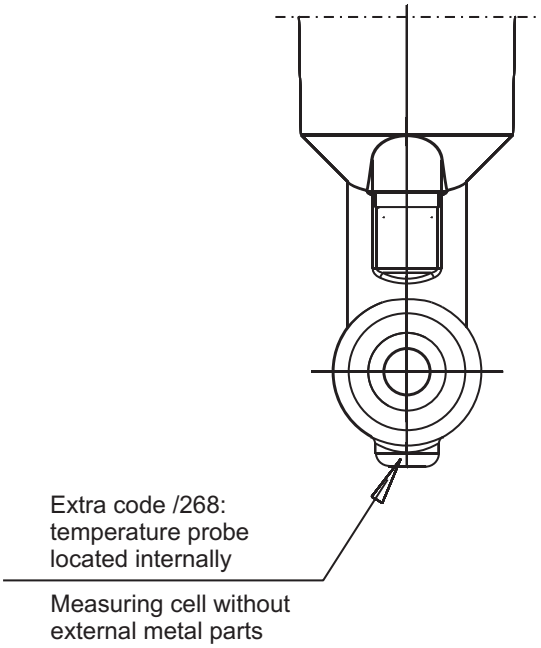
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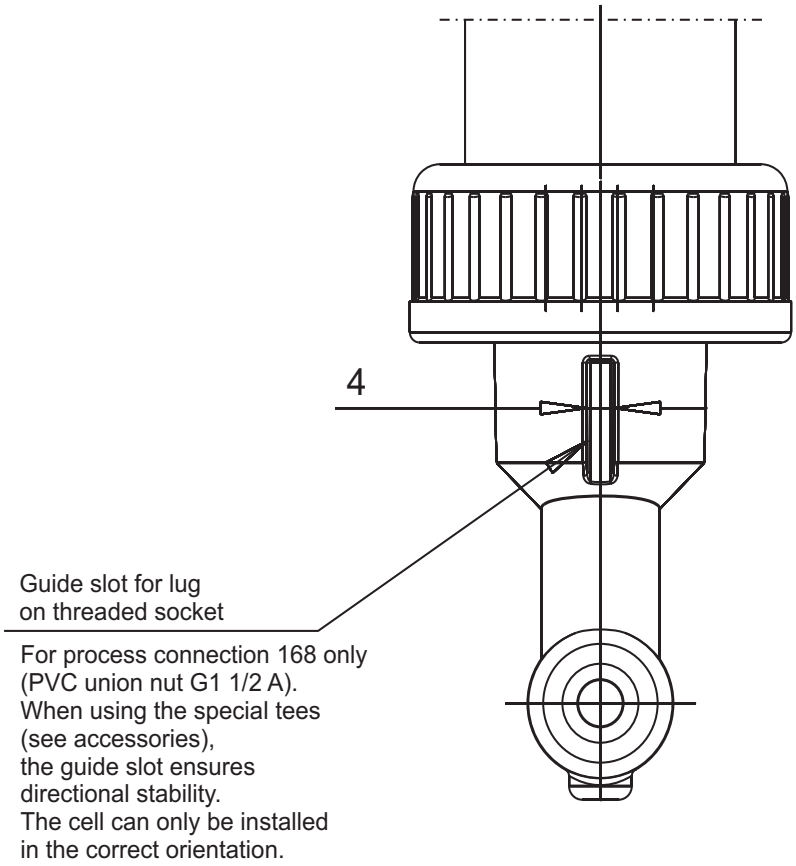
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Dimensions

Sensor (detail)







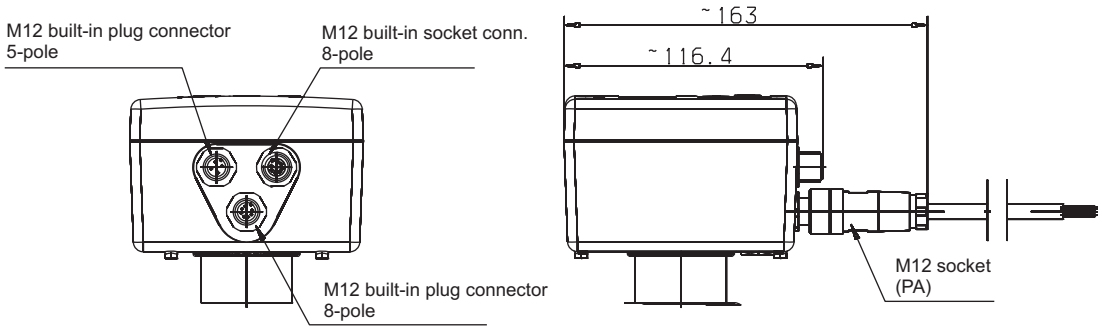
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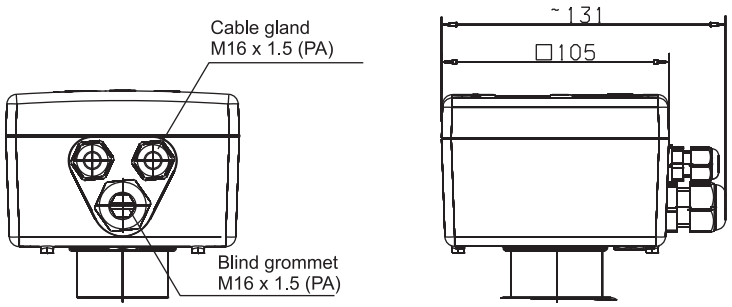
Dimensions

Transmitter with M12 plug connectors and M12 socket connectors



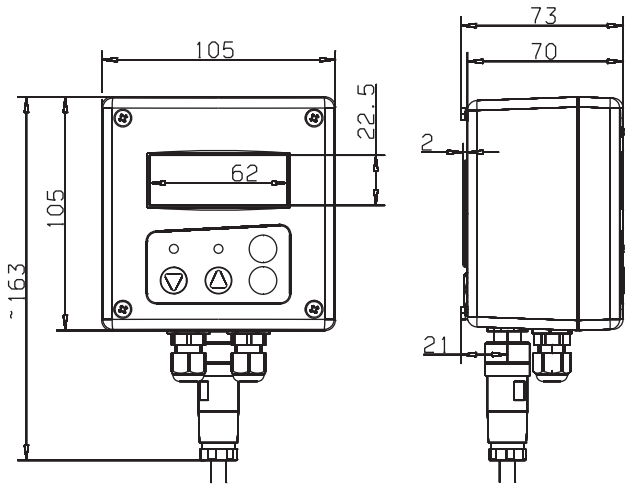
Transmitter with M16 cable gland

(only for the "head transmitter" model)

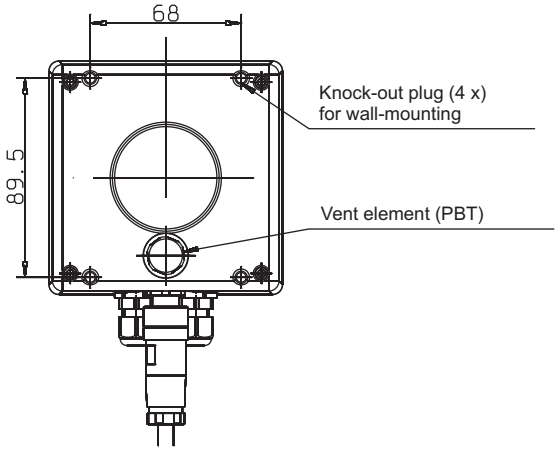


Version:
Transmitter with separate sensor (split version)

(basic type extensions /20, /25, /60 or /65)



Drilling diagram

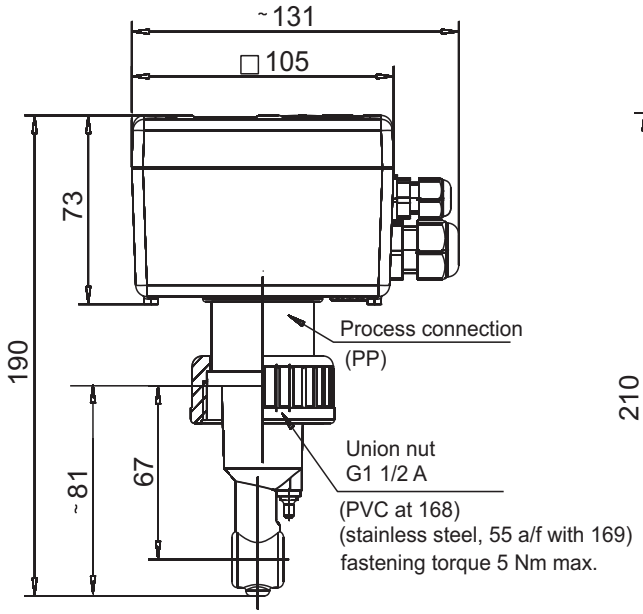


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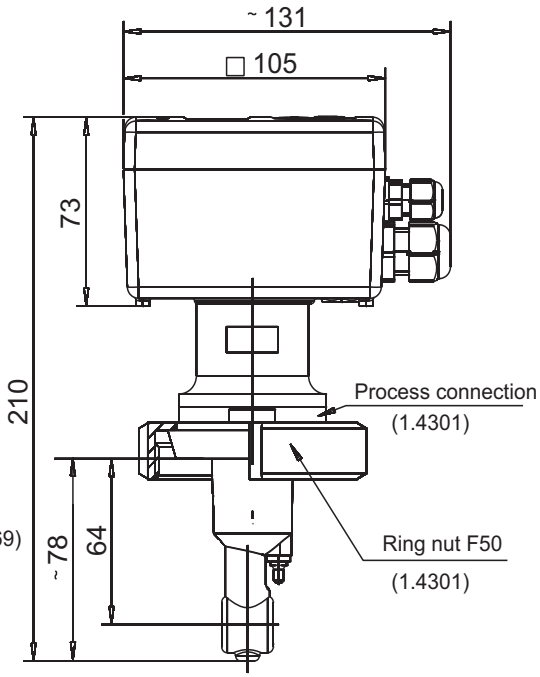
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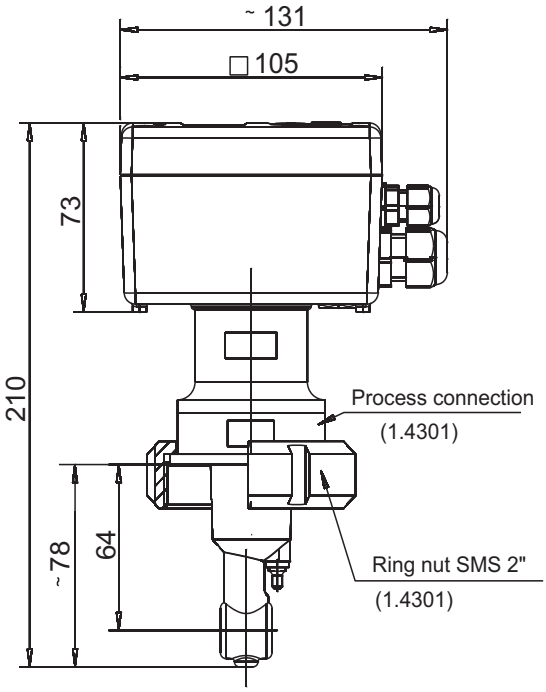
Dimensions / Process connections (head transmitter)



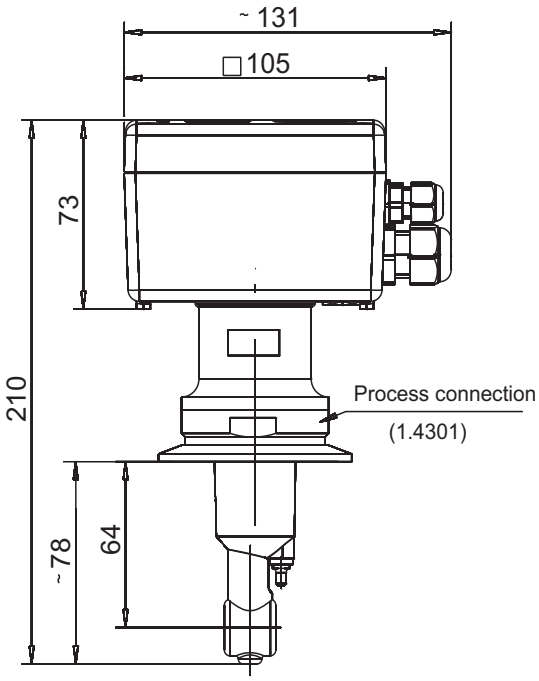
Version with
process connection 168
DN32 and DN40



Version with
process connection 607
MK DN40



Version with
process connection 690
SMS 2"



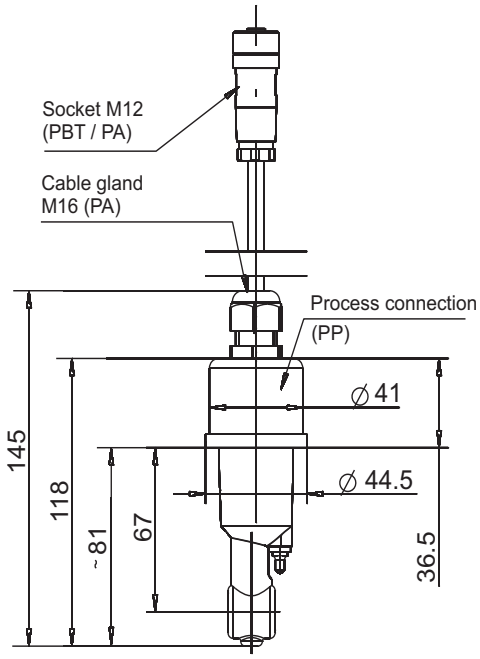
Version with
process connection 617
Clamp 2 1/2"
(retaining clip is not included
in delivery)

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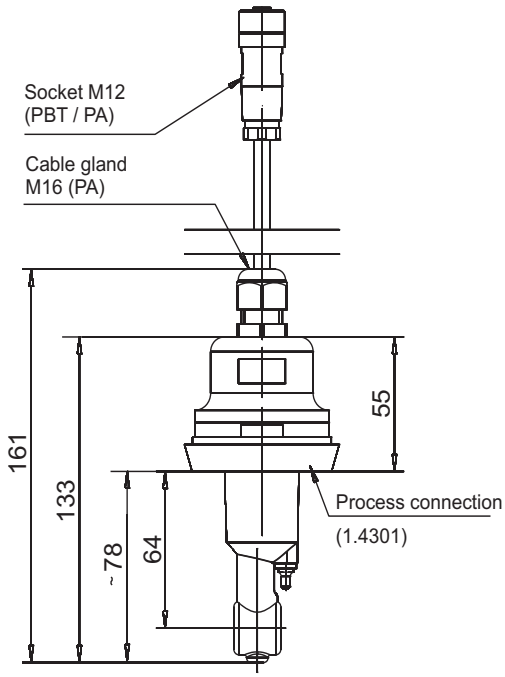
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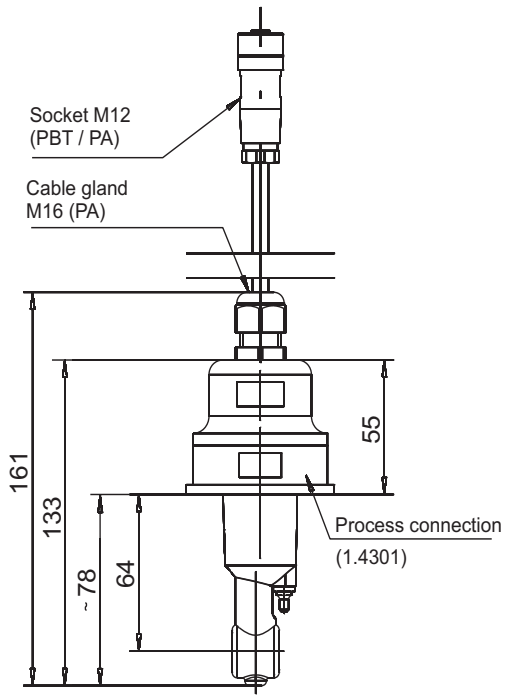
Dimensions / Process connections (separate sensor)



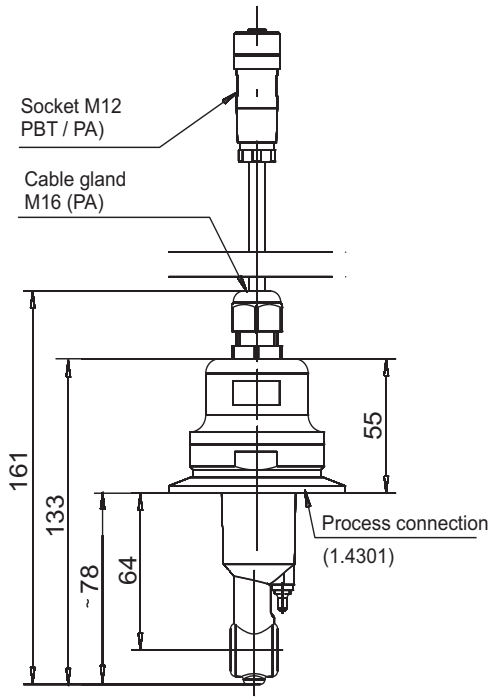
Split version
for process connection 168 and 169
DN32 and DN40
(union nut not included
in delivery)



Split version
for process connection 607
MK DN50
(union nut not included
in delivery)



Split version
for process connection 690
SMS 2"
(union nut not included
in delivery)



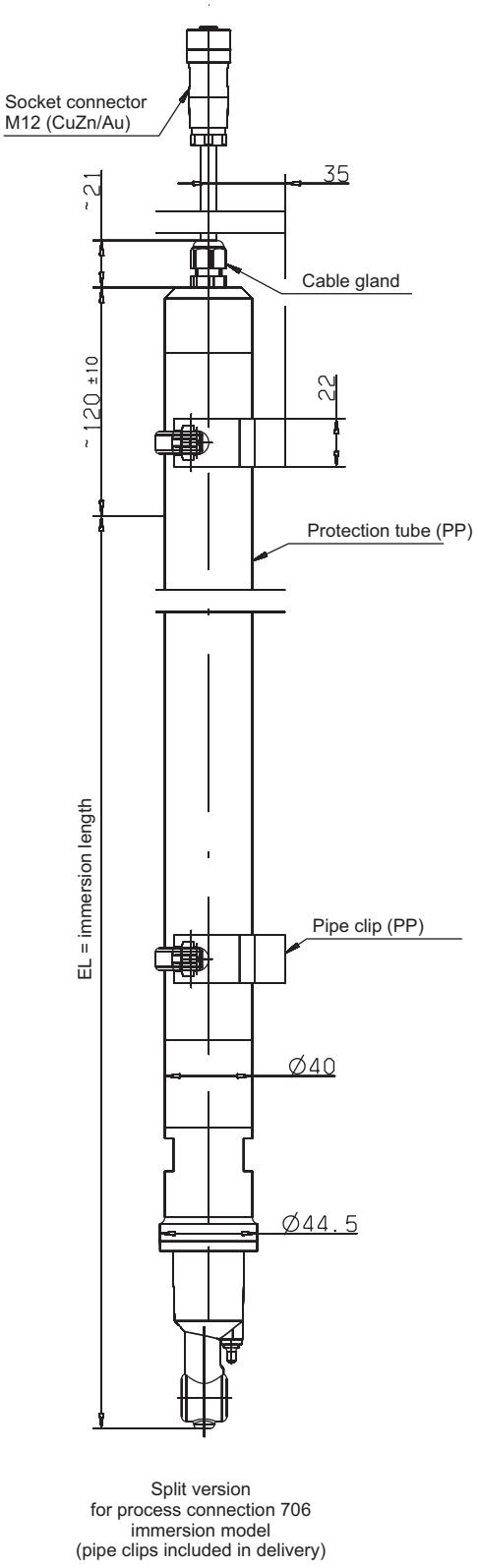
Split version
for process connection 617
Clamp 2 1/2"
(retaining clip not included
in delivery)

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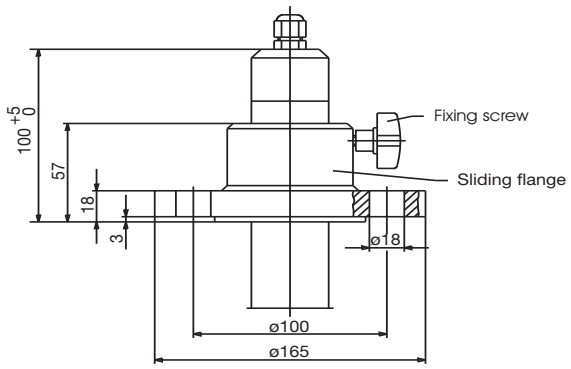
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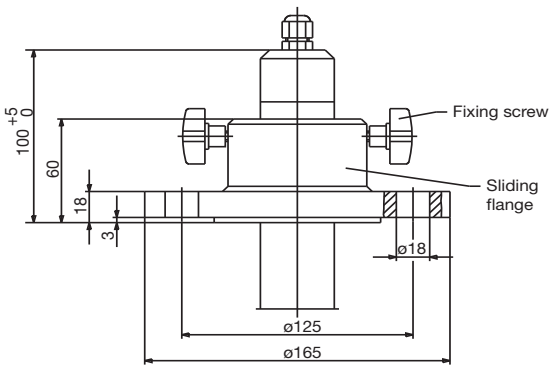
Dimensions (separate sensor as immersion model)



Split version
for process connection 706
immersion model
(pipe clips included in delivery)



Optional accessory:
flange DN32, part no. 00083375



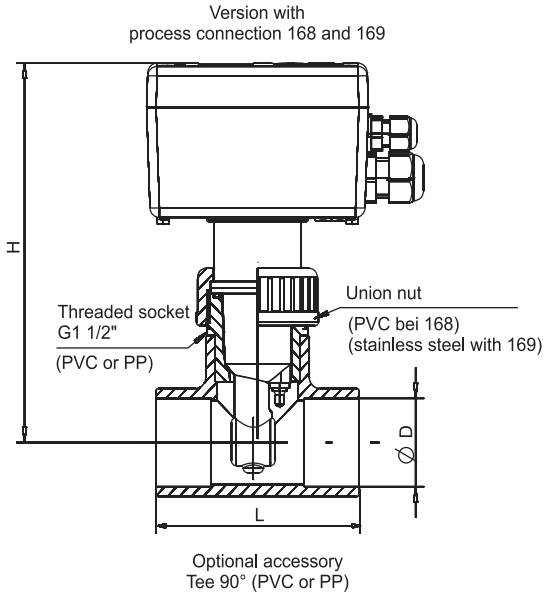
Optional accessory:
flange DN50, part no. 00083376

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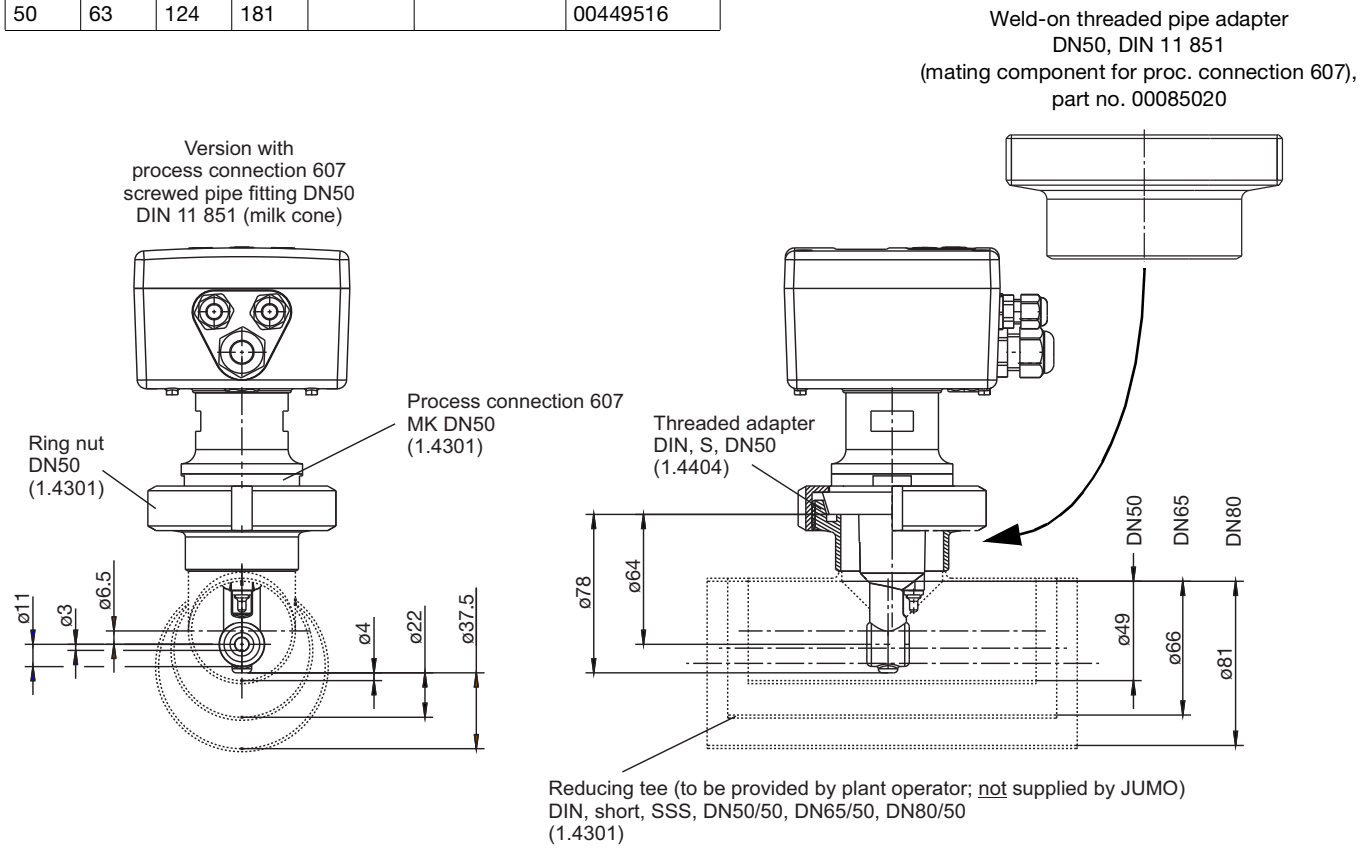
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Mounting examples



DN	ø D	L	H	Material	Maximum temperature	Part no.
32	40	98	172	PVC	+60 °C	00439247
40	50	118	177			00439249
32	40	88	179	PP	+80 °C	00449511
40	50	102	181			00449514
50	63	124	181			00449516

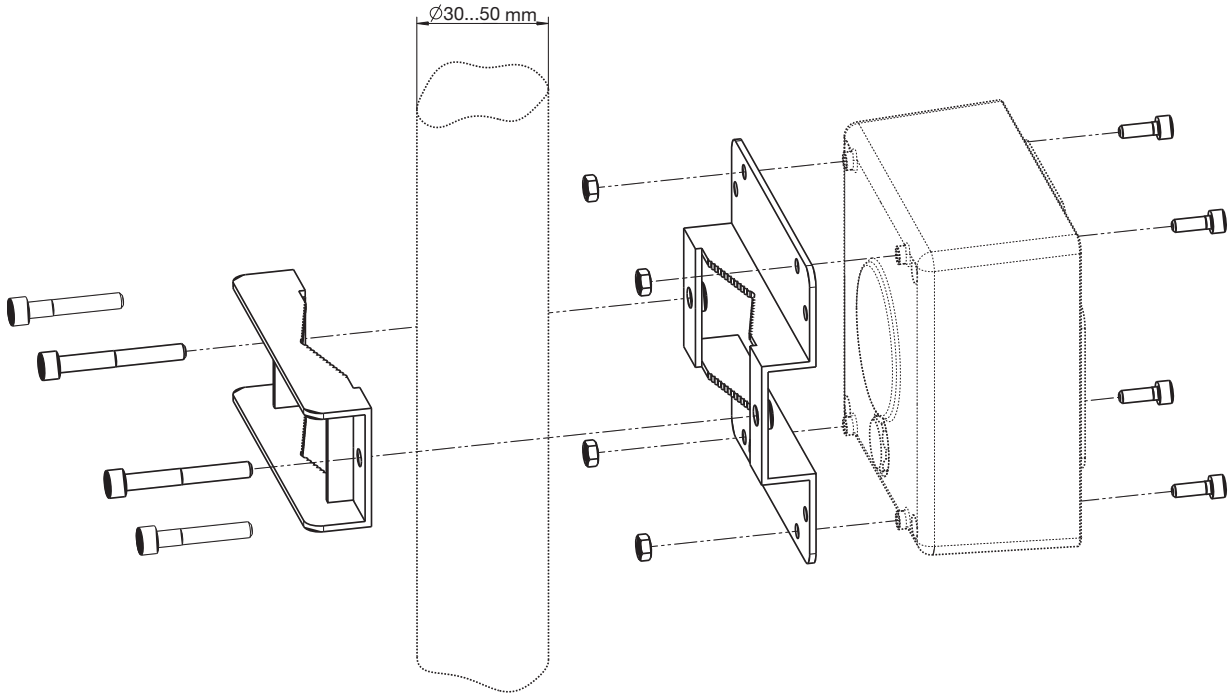


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Kit for pipe mounting



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Order details: CTI-500 as "Head transmitter"

			(1)	**Basic type**
		202755/10		JUMO CTI-500 – Inductive transmitter/switching device for conductivity/concentration and temperature as head transmitter without display/keyboard, consisting of transmitter with permanently mounted sensor[a]
		202755/15		JUMO CTI-500 – Inductive transmitter/switching device for conductivity/concentration and temperature as head transmitter with display/keyboard
			(2)	**Process connection**
x	x	168		Union nut G 1 1/2 PVC[b,c]
x	x	169		Union nut G 1 1/2 CrNi (stainless steel)[b]
x	x	607		Taper socket with union nut DN 50 DIN 11851 (dairy compression fitting)
x	x	617		Clamping socket (Clamp) 2 1/2", similar to DIN 32676[d]
x	x	690		SMS DN 2"
			(3)	**Immersion length**
x	x	0		See "Dimensions"
			(4)	**Electrical connection**
x	x	82		Cable fitting
x	x	83		M12 connector[e]
x	x	84		2 cable fittings M16 + 1 plug
			(5)	**Extra code**
x	x	000		Without extra code
x	x	062		with DNV approval[f]
x	x	077		with KR approval[f]
x	x	268		Internal temperature sensor
x	x	768		Cell material PVDF[g]
x	x	844		Voltage supply AC 24 V ±15 %

[a] The PC setup program is required for programming the device, see accessories.
[b] Special tee is not included in delivery, see accessories.
[c] Maximum temperature of medium: 60 °C.
[d] Mounting items (mounting brackets) do not come with delivery. If required, please include in your order (accessories).
[e] If required, order 1 set M12 plug / socket connectors, see accessories.
[f] Not possible in conjunction with extra code 768 and/or 844.
[g] Only with process connections 168 and 169, in combination with extra code 268.

x = Possible selection

	(1)		(2)		(3)		(4)		(5)	
Order code		-		-		-		/		, ...[a]
Order example	202755/10	-	168	-	0	-	82	/	000	

[a] List extra codes in sequence, separated by commas.

Note:
The type code is not a modular system.
If possible, choose items listed under **"stock versions"** for your orders.
We will have to technically inspect and approve a free combination of individual key features.

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Order details: CTI-500 as "Transmitter with separate sensor"

						(1)	**Basic type**
					202755/20		JUMO CTI-500 – Inductive transmitter/switching device for conductivity/concentration and temperature as transmitter without display/keypad (without sensor)[a,b]
					202755/25		JUMO CTI-500 – Inductive transmitter/switching device for conductivity/concentration and temperature as transmitter with display/keypad (without sensor)[b]
					202755/60		JUMO CTI-500 – Inductive transmitter/switching device for conductivity/concentration and temperature as transmitter without display/keypad including sensor (cable length: 10 m)[a]
					202755/65		JUMO CTI-500 – Inductive transmitter/switching device for conductivity/concentration and temperature as transmitter with display/keypad including sensor (cable length: 10 m)
					202755/80		JUMO CTI-500 – Replacement sensor with 10 m cable (without transmitter)[b,c]
						(2)	**Process connection**
		x	x	x	168		Union nut G 1 1/2 PVC[d,e]
		x	x	x	169		Union nut G 1 1/2 CrNi (stainless steel)[d]
		x	x	x	607		Taper socket with union nut DN 50 DIN 11851 (dairy compression fitting)
		x	x	x	617		Clamping socket 2 1/2", similar to DIN 32676[c]
		x	x	x	690		SMS DN 2"
		x	x	x	706		Immersion version
						(3)	**Insertion length**
x	x	x	x	x	0		not available
		x	x	x	500		500 mm immersion version
		x	x	x	1000		1000 mm immersion version
		x	x	x	1500		1500 mm immersion version
		x	x	x	2000		2000 mm immersion version
						(4)	**Electrical connection**
				x	21		Fixed cable with M12 connector
	x	x	x		82		Cable fitting
x	x	x	x		83		M12 connector[f]
		x	x		84		2 cable fittings M16 + 1 plug
						(5)	**Extra code**
x	x	x	x	x	000		without extra code
		x	x	x	268		Internal temperature sensor
		x	x	x	768		Cell material PVDF[g]
x	x	x	x		844		Voltage supply AC 24 V ±15 %

[a] The PC setup program is required for programming the device, see accessories.
[b] A calibration kit is absolutely essential for commissioning. If required, please include in your order (accessories).
[c] Mounting items (union/ring nuts, mounting brackets) do not come with delivery. If required, please include in your order (accessories).
[d] Special tee is not included in delivery.
[e] Maximum temperature of medium: 60 °C.
[f] If required, order 1 set M12 plug / socket connectors, see accessories.
[g] Only with process connections 168 and 169, in combination with extra code 268.

x = Possible selection

	(1)		(2)		(3)		(4)		(5)	
Order code		-		-		-		/		, ...[a]
Order example	202755/65	-	706	-	1000	-	21	/	000	

[a] List extra codes in sequence, separated by commas.

Note:
The type code is not a modular system.
If possible, choose items listed under **"stock versions"** for your orders.
We will have to technically inspect and approve a free combination of individual key features.

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Stock items (shipment: 3 days after receipt of order)

Type	Part no.
202755/10-168-0-82/000	00445842
202755/10-168-0-82/268	00458083
202755/15-168-0-82/000	00445843
202755/15-607-0-82/000	00445845
202755/65-706-1000-82/000	00457536

Accessories

Type		Part no.
Weld-on threaded adapter DN50, DIN 11 851 (mating component for process connection -607)		00085020
Special tee DN32, PVC[a]	including threaded socket (max. 60 °C), mating component for process connection -168	00439247
Special tee DN40, PVC[a]		00439249
Union nut G1 1/2, PVC		00439199
Union nut G1 1/2, stainless steel		00452039
Grooved union nut DN50, DIN 11 851		00343368
Grooved union nut SMS DN2"		00345162
Flange DN32, material: PP[b]		00083375
Flange DN50, material: PP[b]		00083376
Kit for pipe mounting, stainless steel		00515128
Kit for DIN rail mounting		00459903
Shackle for CTI-500 sensor and immersion fitting with diameter 40 mm		00453191
M12 socket connector, 5-pole, straight, for assembly by user	necessary for versions 202755/xx-xxx-xxxx-83/xxx	00444313
M12 plug connector, 8-pole, straight, for assembly by user		00444307
M12 socket connector, 8-pole, straight, for assembly by user	replacement part for sensor 202755/80...	00444312
PC interface cable with USB / TTL converter and two adapters (USB connection cable)		00456352
Switched-mode power supply for DIN rail mounting, Type PS5R-A24	input voltage: AC 100 to 240 V / 50 to 60 Hz output voltage: DC 24 V, 0.3 A	00374661
Cover with LC display and keypad (facilitates the programming of transmitters without display and keypad)		00443725
Special tee DN32, PP[a]	including threaded socket (max. 80 °C), mating component for process connection -169	00449511
Special tee DN40, PP[a]		00449514
Special tee DN50, PP[a]		00449516
Calibration kit (for calibrating a replacement transmitter or replacement sensor)		00459436
M12 plug/socket connectors set, suitable for electrical connection 83		00529482

Additional concentration curves for the usual acids and lyes (20 interpolation points in tabular form), for entry on the CTI-500 through the setup program.	00592816

[a] with anti-rotation lug - the cell can only be installed in the correct orientation
[b] only in conjunction with a separate sensor in the immersion version 202755/60-706-... or 202755/65-706-... or 202755/80-706-...

Software

Designation	Part no.
Setup JUMO CTI-500/-750	00447634