

# Transmitter CO<sub>2</sub> 5100 e

## Sensor InPro® 5000

CO<sub>2</sub> measuring systems for fermentation control

### Technical data



Transmitter CO<sub>2</sub> 5100 e



Sensor InPro 5000

#### Short description

The measuring system consisting of the CO<sub>2</sub> sensor InPro 5000 and the CO<sub>2</sub> transmitter 5100 e is specifically designed for reliable, in-line measurement in processes under sterile, hygienic conditions. The system satisfies most standard measurement requirements for fermentation processes especially in cell culture applications:

#### Transmitter features

- Display: %, mg/l and hPa
- Two 0/4 ... 20 mA current outputs
- Two limit contacts
- Alarm & wash contact
- Continuous monitoring of sensor and transmitter performance
- Sensor diagnostics
- Easy operation with help of pictographs
- PID controller
- Communication with EasyClean, the METTLER TOLEDO cleaning and calibration system for sensors

#### Sensor features

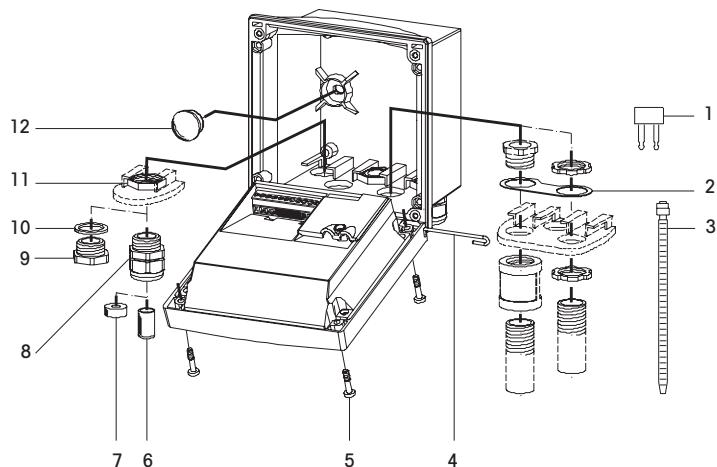
- Easy-to-replace membrane body reduces service time
- Durable and rugged sensor design for increased resistance to harsh environments
- FDA compliant materials of construction and easy-to-clean high-polished surface finish ( $R_a \leq 16 \mu \text{ inch}$ ) to satisfy stringent regulatory requirements
- Suitable for hygienic applications: EHEDG certified
- Enhanced membrane (patented) with no interference of volatile acids as found in bioprocesses

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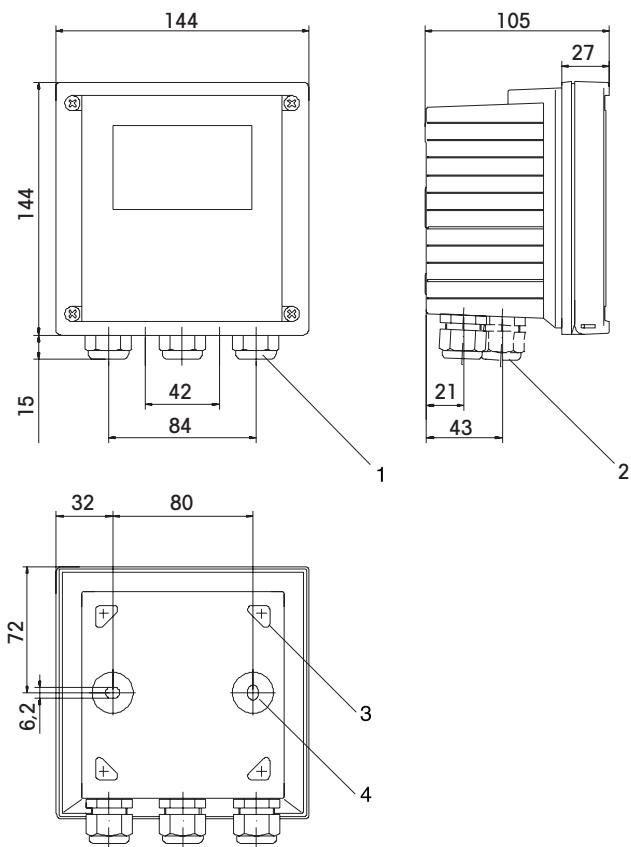
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**Assembly**



- 1 Jumper (1 piece)
- 2 Washer (1 piece)
- 3 Cable ties (3 pieces)
- 4 Hinge pin (1 piece)
- 5 Enclosure screws (4 pieces)
- 6 Pg plug (1 piece)
- 7 Rubber reducer (1 piece)
- 8 Pg cable glands (3 pieces)
- 9 Filler plugs (3 pieces)
- 10 Gaskets (3 pieces)
- 11 Hexagon nuts (5 pieces)
- 12 Sealing plugs (2 pieces)

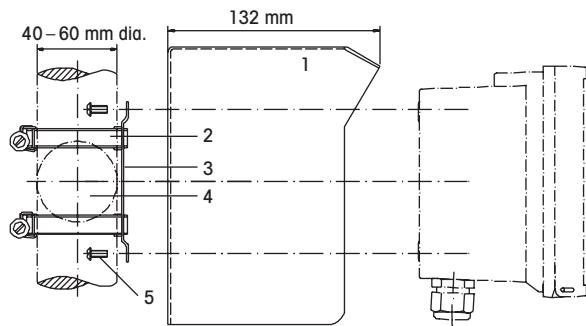
**Mounting**



- 1 Cable gland (3 pieces)
- 2 Breakthroughs for cable gland or conduit 1/2", Ø 21.5 mm (2 breakthroughs). Conduits not included!
- 3 Holes for post mounting (4 breakthroughs)
- 4 Holes for wall mounting (2 breakthroughs)

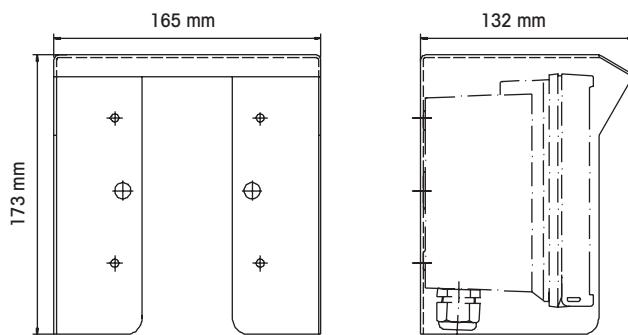
(dimensions in mm)

**Pipe mounting with ZU 0274 bracket kit**

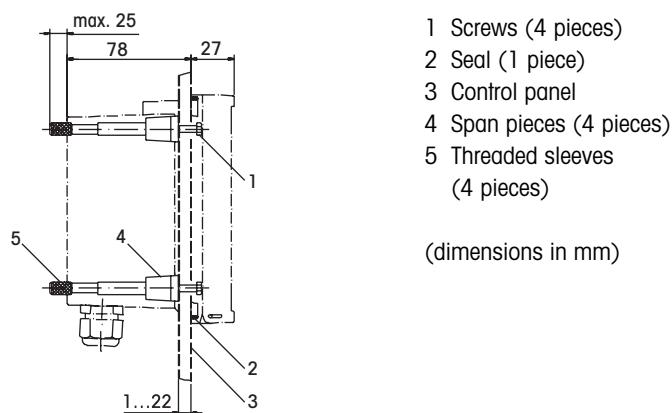


- 1 Protective hood ZU 0276  
(if required)
- 2 Hose clamps with worm gear drive to DIN 3017  
(2 pieces)
- 3 Postmounting plate (1 piece)
- 4 For vertical or horizontal post/pipe mounting
- 5 Self-tapping screws  
(4 pieces)

**Protective hood ZU 0276 for wall and pipe mounting**



**Panel mount kit ZU 0275**



- 1 Screws (4 pieces)
- 2 Seal (1 piece)
- 3 Control panel
- 4 Span pieces (4 pieces)
- 5 Threaded sleeves  
(4 pieces)

## Technical specifications

## Transmitter CO<sub>2</sub> 5100 e

<b>pH/mV input</b>	Input Input Input	Glass electrode Reference electrode Auxiliary electrode
<b>Display range CO<sub>2</sub></b>	Saturation Concentration  Partial pressure Input glass electrode <sup>1)</sup>  Input reference electrode <sup>1)</sup>  Measuring error <sup>1,2,3)</sup>  Process pressure*) Electrolytes concentration*)	0.0...200.0% (0...60°C/32...140°F) 0.0...999.9 mg/l (0...60°C/32...140°F) 0000...4000 mg/l (0...60°C/32...140°F) 0.0...999.9...2000 hPa Input resistance >0.5 x 10 <sup>12</sup> Ω Input current <2 x 10 <sup>-12</sup> A Input resistance >1 x 10 <sup>10</sup> Ω Input current <1 x 10 <sup>-10</sup> A <5 % of measured value +2 mg/l, resp. 0.2 %, resp. 2 hPa 0.000...4.000 bar 0.000...1.000 mol/l
<b>Electrode standardization pH/CO<sub>2</sub></b>	pH-calibration operating modes AUT MAN  DAT CO <sub>2</sub> -calibration Product calibration max. calibration range (asymmetry potential ±60 mV/slope)	Auto-calibration with buffer pH 7.00, 9.21 manual calibration with input individual buffer values data input of premeasured sensors (with separat Mode-Code) 80...103 % (47.5...61 mV/pH) (possibly restrictive hints by Sensoface)
<b>Cal timer</b>	0000...9999 h	
<b>Sensocheck</b>	Automatic monitoring of glass and reference electrode (can be disabled) Delay time approx. 30 s	
<b>Sensoface</b>	Provides information on the electrode condition. Evaluation of zero/slope, response, calibration interval, Sensocheck	
<b>Temperature input</b>	Pt 1000 / NTC 30 kW Measurement range Adjustment range Resolution Meas. error <sup>1,2,3)</sup>	2-wire connection, adjustable -20.0...150.0°C / -4...302°F 10 K 0.1°C/1°F <0.5 K
<b>HOLD input</b>	Galv. separated (OPTO coupler) Function Switching voltage	Switches device to HOLD mode 0...2 V (AC/DC) HOLD sinactive 10...30 V (AC/DC) HOLD active
<b>CONTROL input</b>	Galv. separated (OPTO coupler) Function Switching voltage	Control input for automatic cleaning/ calibration system 0...2 V (AC/DC) inactive 10...30 V (AC/DC) active

## Technical specifications

## Transmitter CO<sub>2</sub> 5100 e

**Output 1** 0/4 ... 20 mA, max. 10 V, floating (galv. connected to output <sup>2)</sup>

Measured variable*)	CO <sub>2</sub> value (%, mg/l, hPa)
OVERRANGE*)	22 mA in the case of error messages
Output filter*)	PT1-filter, filter time constant 0 ... 120 s
Meas. error <sup>1)</sup>	<0.3 % current value + 0.05 mA
Start / end of scale	as desired within ranges
Adm. span	2 ... 200 % / 50 ... 4000 mg/l / 50 ... 2000 hPa

**Output 2** 0/4 ... 20 mA, max. 10 V, floating (galv. connected to output <sup>1)</sup>

Measured variable	Temperature
OVERRANGE*)	22 mA in the case of error messages
Output filter*)	PT1-filter, filter time constant 0 ... 120 s
Meas. error <sup>1)</sup>	<0.3 % current value + 0.05 mA
Start / end of scale*)	as desired within ranges
Adm. span	10 ... 100 K

### Alarm contact

Relay contact, floating	
Contact ratings	AC <250 V / <3 A / <750 VA DC <30 V / <3 A / <90 W
Contact response	N/C (fail-safe type)
Alarm delay	0000 ... 0600 s

### Limit values

Output via relay contacts R1, R2 (see PID process controller)	
Contacts R1, R2 floating, but inter-connected	
Contact ratings	AC <250 V / <3 A / <750 VA DC <30 V / <3 A / <90 W
Contact response*)	N/C or N/O
Delay*)	0000 ... 9999 s
Switching points*)	as desired within range
Hysteresis*)	max. 40 % of MR floating

### PID-Process controller

Output via relay contacts R1, R2 (see limit values) (R1 base valve, R2 acid valve)	
Set point specification*)	0 ... 100.0 % / 0 ... 1999 mg/l / 0 ... 999.9 hPa
Neutral zone*)	0 ... 20.0 % / 0 ... 400 mg/l / 0 ... 200.0 hPa
P-action*) controller gaine	Kr: 0010 ... 9999 %
I-action*) reset time	Tr: 0000 ... 9999 s (0000 s = no integral action)
D-action*) derivative time	Td: 0000 ... 9999 s (0000 s = no derivative action)
Controller type*)	pulse length controller or pulse frequency controller
Pulse periode*)	0001 ... 0600 s, min. ON time 0.5 s (pulse length controller)
max. pulse frequency*)	0001 ... 0180 min <sup>-1</sup> (pulse frequency controller)

<b>Cleaning function*)</b>	Relay contact, floating for controlling a simple rinsing system or an automatic cleaning system Contact ratings Contact response*) Rinsing interval*) Cleaning interval*) Post-delay	AC <250 V / <3 A / <750 VA DC <30 V / <3 A / <90 W N/C or N/O 000.0...999.9 h (000.0 h... = cleaning function switched off) 0000...1999 s 20 s
<b>Display</b>	LC display Main display  Secondary display  Sensoface  Mode indication  Alarm indication	7-segment with icons Characters height 17 mm, unit symbols 10 mm Characters height 10 mm, unit symbols 7 mm 3 status indicators (friendly, neutral, sad smiley) 5 status bars: "meas", "cal", "alarm", "cleaning", "config" 18 further icons for configuration and messages red LED in case of alarm or HOLD, user-defined
<b>Keypad</b>	5 keys: [cal] [conf] [►] [▲] [enter]	
<b>Service functions</b>	Current source Manual controller Device self-test Display test Last error Sensor monitor Relay test	Current adjustable for output 1 and 2 (00.00 to 22.00 mA) Controller output entered directly (startup of control process) Automatic memory test (RAM, FLASH, EEPROM) Display of all segments Display of last error occurred Display of direct, uncorrected sensor signal (electrode) Manual control of the four switching contacts
<b>Parameter sets*)</b>	Two selectable parameter sets for different applications	
<b>Explosion protection</b>	NI, Class I, Div 2, Group A, B, C, D (USA/Canada)	
<b>Data retention</b>	Parameters and calibration	> 10 years (EEPROM)
<b>EMV</b>	DIN EN 61326 VDE 0843 part 20/01.98 DIN EN 61326/A1 VDE 0843 part 20/A1/05.99	
Lightning protection	DIN EN 61000-4-5, installation class 2	

## Technical specifications

## Transmitter CO<sub>2</sub> 5100 e

<b>Protection against electrical shock</b>	Protective separation of all extra-low-voltage circuits against mains by double insulation as per EN 61010-1	
<b>Power supply</b>	24 (-15 %) ... 230 (+15 %) V AC/DC ca. 2 VA AC: 45 ... 65 Hz Overvoltage category II, Class II	
<b>Nominal operating condition</b>	Ambient temperature Transport/Storage temp Relative humidity	-20 ... +55 °C (-4 ... 131 °F) -20 ... +70 °C (-4 ... 158 °F) 10 ... 95 % not condensing
<b>Enclosure</b>	<p>Molded enclosure made of PBT (polybutylene terephthalate)</p> <p>Color bluish gray RAL 7031</p> <p>Assembly</p> <ul style="list-style-type: none"><li>• Wall mounting</li><li>• Pipe mounting: dia 40 to 60 mm, dia 30 to 45 mm</li><li>• Panel mounting, cutout to DIN 43 700</li><li>Sealed against panel</li></ul> <p>Dimensions H 144 mm, W 144 mm, D 105 mm</p> <p>Ingress protection IP65/NEMA 4X</p> <p>Cable glands 3 breakthroughs for cable glands M20x1.5 2 breakthroughs for NPT 1/2" or Rigid Metallic Conduit</p> <p>Weight approx. 1 kg</p>	

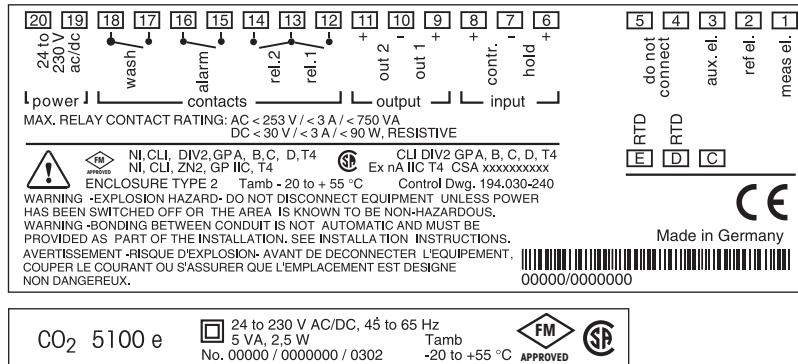
\*) User-defined

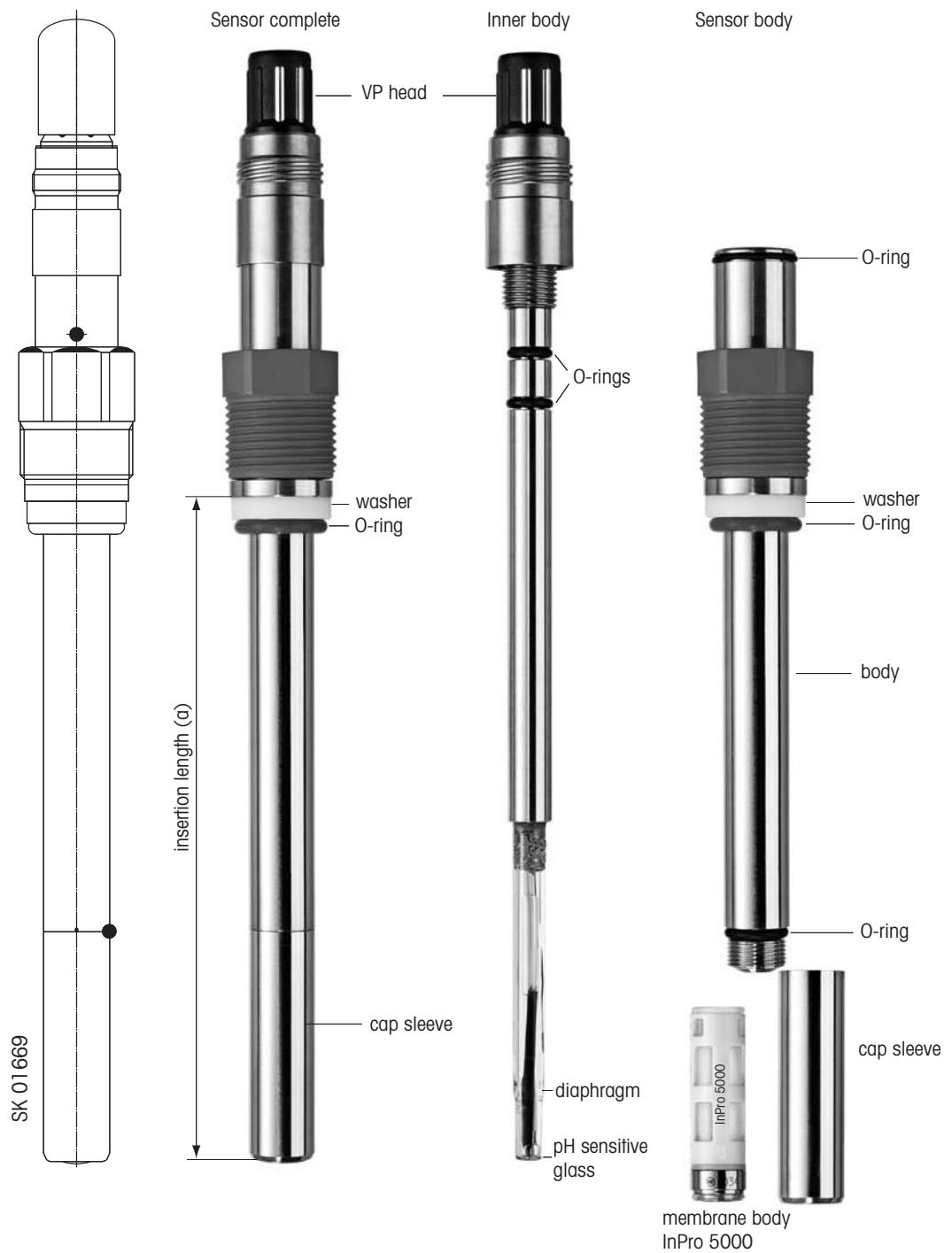
- 1) To IEC 746 Part 1, at nominal operating conditions
- 2) ± 1 count
- 3) Plus sensor error

## Terminal assignment

## Transmitter CO<sub>2</sub> 5100 e

### Transmitter CO<sub>2</sub> 5100 e



**Dimensions and modularity**

## Technical specifications

## Sensor InPro 5000

### InPro 5000

Measuring range	0 ... 1000 mbar pCO <sub>2</sub> (1 mbar = 1 hPa)
Lower detection limit	10 mbar pCO <sub>2</sub>
Accuracy	± 10% (pCO <sub>2</sub> 10 – 900 mbar) ≥ ± 10% (pCO <sub>2</sub> > 900 mbar)
Response time	90 % of final value <120 sec (at 25 °C [77 °F] from air to CO <sub>2</sub> )
Temperature range	0 ... 60 °C (32 ... 140 °F) for measurement
Sterilization temperature	≤ 130 °C (266 °F) in-situ or autoclavable
Pressure range	0.2 ... 2 bar absolute for measurement (3 ... 30 psi)
Mechanical pressure resistance max.	3 bar at 25 °C (77 °F) (max. 42 psi)
Known interferences	SO <sub>2</sub> , NH <sub>3</sub> , H <sub>2</sub> S
Measuring principle	potentiometric (Severinghaus)
Wetted metal parts	stainless steel DIN 1.4435 (similar AISI316L) surface roughness N5 Ra <0.4 µm (16 µ inch)
Membrane material	silicone reinforced
O-ring materials	Viton®, silicone, FDA compliant
Temperature sensor	Pt1000
Plug head	VarioPin (VP), Pg 13.5 thread, washer PTFE, O-ring Viton®
VP-connector	IP68, autoclavable
Certificate	3.1B for stainless steel parts EHEDG

## Ordering information

## Sensor InPro 5000 and transmitter 5100e

### Sensor InPro 5000

Description	Sensor length (a)	Order number	Suitable housing
InPro 5000/12/120	120 mm	52 206 067	InFit 761
InPro 5000/12/220	220 mm	52 206 068	InFit 761
InPro 5000/12/320	320 mm	52 206 069	InTrac 797 e, InFit 761

### Transmitter CO<sub>2</sub> 5100e

CO <sub>2</sub> 5100e	52 121 105
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### Cables

	length	
VP6-ST/3 m	3 m	52 300 108
VP6-ST/5 m	5 m	52 300 109
VP6-ST/10 m	10 m	52 300 110

### Spare parts

Membrane kit InPro 5000	4 membrane bodies, 1 O-ring set, 25 ml electrolyte	52 206 055
Interior body InPro 5000	a=120 mm	52 206 057
	a=220 mm	52 206 084
	a=320 mm	52 206 085

### Accessories

pH-Simulator 112	31 112 3003
VP-Simulator	52 120 939
Cap sleeve with protective cage, P type 1.4404	52 200 038
Cap sleeve, N type 1.4435	52 201 153
Cap sleeve, P type 1.4435	52 201 154

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Management System  
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