User's Manual

TDLS8200
Probe Type
Tunable Diode Laser Spectrometer

IM 11Y01D03-01EN

YOKOGAWA
Yokogawa Electric Corporation

IM 11Y01D03-01EN
11th Edition

Introduction

Thank you for purchasing the TDLS™8200 Probe Type Tunable Diode Laser Spectrometer.

Please read the following respective documents before installing and using the TDLS8200.

When using the YH8000 HMI unit, be sure to read the dedicated instruction manual (IM 11Y01D10-01EN).

The related documents are as follows.

Contents	Document Title	Document number
General Specifications	Model TDLS8200 Probe type Tunable Diode Laser Spectrometer	GS 11Y01D03-01EN
User's Manual	TDLS8200 Probe Type Tunable Diode Laser Spectrometer	IM 11Y01D03-01EN (This manual)
	YH8000 HMI Unit	IM 11Y01D10-01EN

* the "EN" in the document number is the language code.

An exclusive User's Manual might be attached to the products whose suffix codes or option codes contain the code "Z" (made to customers' specifications). Please read it along with this manual.

In this document, the following definitions are used to explain certain specifications (Model and codes).

Probe type (Probe length: -070, -100, -150, -200)
In this document, Probe type is described as a TDLS8200 standard specification.

Flowcell type (Probe length: -EXT)
For the Flowcell type, a sampling system can be constructed by replacing the probe part with Flowcell.
If not stated explicitly, the same explanation applies as for the probe type.

Reflect type (Probe length: -REF)
In the Reflect type, the reflector and analyzer are separated and each is installed facing each other across a duct.
If not stated explicitly, the same explanation applies as for the probe type.

1 laser specification
When 2nd Gas Parameter "-NN" (None) is specified

2 laser specification
When 2nd Gas Parameter "-X1" or "-X2" is specified

Notes on Handling User's Manuals

- Please hand over the user's manuals to your end users so that they can keep the user's manuals on hand for convenient reference.
- Please read the information thoroughly before using the product.
- The purpose of these user's manuals is not to warrant that the product is well suited to any particular purpose but rather to describe the functional details of the product.
- No part of the user's manuals may be transferred or reproduced without prior written consent from YOKOGAWA.
- YOKOGAWA reserves the right to make improvements in the user's manuals and product at any time, without notice or obligation.
- If you have any questions, or you find mistakes or omissions in the user's manuals, please contact our sales representative or your local distributor.

Drawing Conventions

Some drawings may be partially emphasized, simplified, or omitted, for the convenience of description.

Some screen images depicted in the user's manual may have different display positions or character types (e.g., the upper / lower case). Also note that some of the images contained in this user's manual display examples.

Notes on Hardware

Appearance and Accessories

Check the following when you receive the product:

- Appearance
- Standard accessories

Model and Suffix Codes

The name plate on the product contains the model and suffix codes. Compare them with those in the general specification to make sure the product is the correct one. If you have any questions, contact our sales representative or your local distributor.

Safety Precautions

Safety, Protection, and Modification of the Product

- To protect the system controlled by the product and the product itself and ensure safe operation, observe the safety precautions described in this user's manual. We assume no liability for safety if users fail to observe these instructions when operating the product.
- If the product is used in a manner not specified in this user's manual, the protection provided by the product may be impaired.
- If any protection or safety circuit is required for the system controlled by the product or for the product itself, prepare it separately.
- Be sure to use the spare parts approved by Yokogawa Electric Corporation (hereafter simply referred to as YOKOGAWA) when replacing parts or consumables.
- Modification of the product is strictly prohibited.
- The following safety symbols are used on the product as well as in this manual.

WARNING

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

CAUTION

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

CAUTION

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

NOTE

This symbol indicates information that complements the present topic.

This symbol indicates Protective Ground Terminal.

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

Warning and Disclaimer

The product is provided on an "as is" basis. YOKOGAWA shall have neither liability nor responsibility to any person or entity with respect to any direct or indirect loss or damage arising from using the product or any defect of the product that YOKOGAWA cannot predict in advance.

Safety Precautions for Explosion Protected Type Instrument

Specified types of TDLS8200 is designed to protect against explosion.

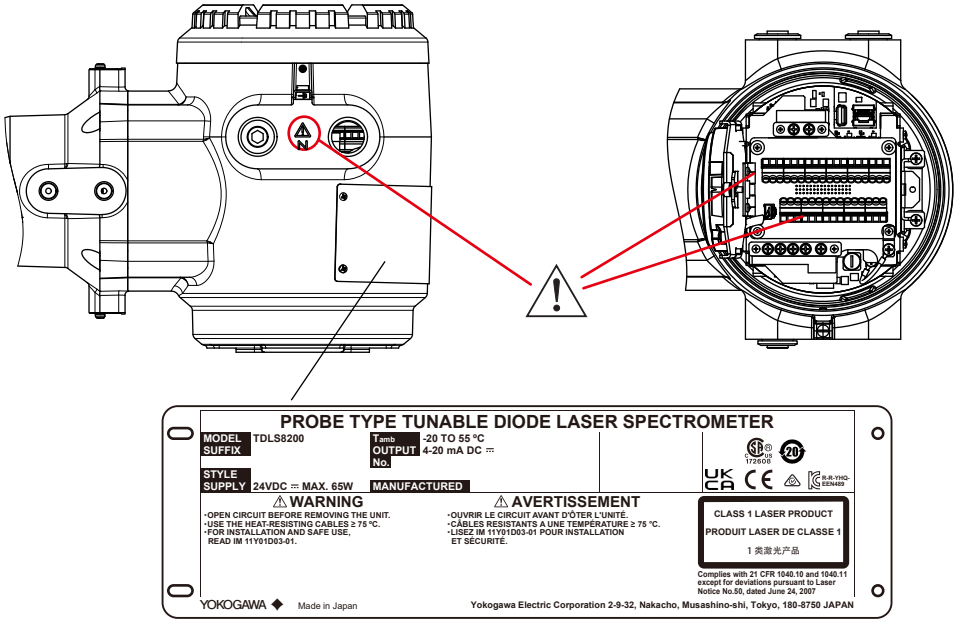
When these type instruments are used in a hazardous area, please be sure to read Appendix 5.

CAUTION

Only trained persons use TDLS8200 in industrial locations.

About the Product

There are safety symbols in the point of the figure to a product.



CAUTION

Connect the power supply wires to the correct locations. Do not reverse the polarity.

CAUTION

Use cables with a durable temperature of at least 75°C.

- Don’t install “general purpose type” instruments in the hazardous area.
- The Instrument is packed carefully with shock absorbing materials, nevertheless, the instrument may be damaged or broken if subjected to strong shock, such as if the instrument is dropped. Handle with care.
- Components that can be damaged by static electricity are used in the TDLS8200 probe type tunable diode laser spectrometer. Take protective measures against static electricity when performing maintenance and inspection and use conductive packing material for shipping replacement components.
- Do not use an abrasive or organic solvent for cleaning the TDLS8200 probe type tunable diode laser spectrometer.

CAUTION

TDLS8200 is EN61326-1 Class A product designed for use in the industrial environment. Please use the instrument in the industrial environment only.

WARNING

Depending on the specifications, toxic CO gas may be used for the offline calibration of this product. Take special care and ensure correct use when using such gas.

WARNING

Sufficiently ventilate the room to ensure the purge gas does not accumulate and there is no shortage of oxygen.

CAUTION

Do not subject the equipment to an impact. It may cause irreparable damage to the laser.

CAUTION

Sufficiently understand this user's manual and carry out the work carefully so as not to make a mistake with a pipe or wire.

CAUTION

Electrostatic discharge

The TDLS8200 contains devices that can be damaged by electrostatic discharge.

When servicing this equipment, please observe proper procedures to prevent such damage.

Replacement components should be shipped in conductive packaging. Repair work should be done at grounded workstations using grounded soldering irons and wrist straps to avoid electrostatic discharge.

CAUTION

Do not use an abrasive or organic solvent in cleaning the instrument.

CAUTION

Please turn off the power to the TDLS8200 before remove the analyzer from process flange.

Maintenance by qualified engineer

Work carried out by other than a qualified engineer may cause injury to the worker and/or severe damage to the equipment. Furthermore, if the warnings in this manual are not observed, the worker may be seriously injured and/or the equipment may be severely damaged.

Maintenance of the equipment must be performed by a qualified engineer. Qualified engineer refers to the following:

- Engineer who is familiar with how to safely handle process analyzers (or general automation technology) and has read this manual and understood its content.
- Engineer who has received training on how to start and configure equipment and has read this manual and understood its content.

Replacement of battery

The battery (CR2050 type) on the CPU board in TDLS8200 cannot be installed on site because it must be mounted at the factory. If it needs replacing, contact a Yokogawa service center.

Transportation of products containing lithium batteries

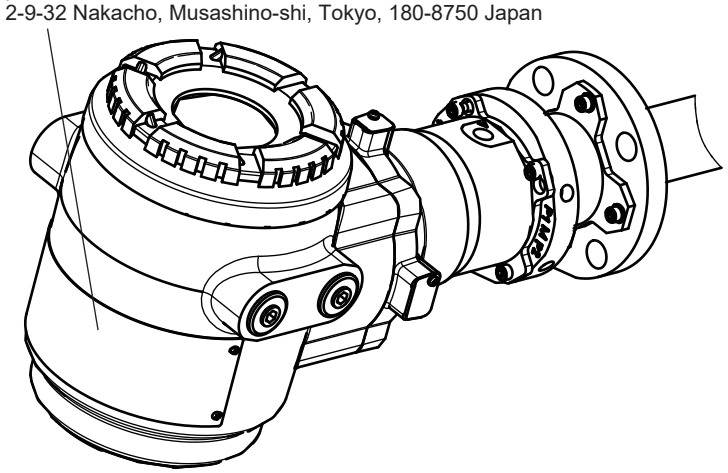
TDLS8200 contains lithium batteries. Primary lithium batteries are regulated in transportation by the U.S. Department of Transportation, and are also covered by the International Air Transport Association (IATA), the International Civil Aviation Organization (ICAO), and the European Ground Transportation of Dangerous Goods (ARD). It is the responsibility of the shipper to ensure compliance with these or any other local requirements. Please consult the current regulations and requirements regarding the transportation of lithium batteries before shipping.

Product Disposal

The instrument should be disposed of in accordance with local and national legislation/regulations.

Safety Precautions for Laser Products

TDLS8200 uses a laser light source. TDLS8200 is a Class 1 laser product as defined by IEC60825-1:2014 EN 60825-1:2014 Safety of Laser Products—Part1: Equipment Classification, Requirements and User's Guide. In addition, TDLS8200 complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No. 50, dated June 24, 2007.



CAUTION

This analyzer, a class 1 invisible laser product, is safe enough to avoid eye injury. However, do not see a light source. Laser light is emitted from the laser unit right after an analyzer is powered on. After attaching TDLS8200 unit to a process flange, power on an analyzer while laser light is not emitted outside measurement process.

Safety, EMC, and RoHS conformity standards

About standards of Explosion Protect, please see Appendix 5.

TDLS8200 probe type tunable Diode Laser Spectrometer

Safety conformity standards:

CE, UKCA	EN61010-1, EN IEC 61010-2-030
UL	UL61010-1, UL 61010-2-030
CSA	CAN/CSA-C22.2 No.61010-1, CAN/CSA-C22.2 No.61010-2-030
GB	GB30439 Part 1

Installation altitude: 2000 m or less
Installation category: I (Anticipated transient overvoltage 330V)
Measuring category: O (Other)
Pollution degree: 2, Indoor/Outdoor use

Note: Installation category, called overvoltage category, specifies impulse withstand voltage. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength.

EMC conformity standards:

CE, UKCA	EN55011 Class A Group 1 EN61326-1 Class A Table 2 (For use in industrial location), EN61326-2-3
RCM	EN55011 Class A Group 1
KC	KN11 Class A Group 1, KN61000-6-2 (Korea Electromagnetic Conformity)

한국 전자파적합성 기준

A급 기기 (업무용 방송통신기자재)
이 기기는 업무용(A급) 전자파적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

RoHS conformity standards: EN IEC 63000:2018*
*: For only TDLS8200-G1, -G2, -S1

Trademark Notices

- TDLS, FieldMate are trademarks of Yokogawa Electric Corporation.
- Ethernet is a registered trademark of XEROX Corporation.
- Modbus are registered trademarks of Schneider Electric SA.
- All other company and product names mentioned in this user's manual are trademarks or registered trademarks of their respective companies.
- We do not use TM or ® mark to indicate those trademarks or registered trademarks in this user's manual.

◆ CE/UKCA marking products

■ Authorized Representative in EEA

The Authorized Representative for this product in EEA is Yokogawa Europe B.V. (Euroweg 2, 3825 HD Amersfoort, The Netherlands).

■ Importer for This Product into the Great Britain Market

In relation to UKCA marking, the importer for this product into the Great Britain market via the YOKOGAWA sales channel is:

Yokogawa United Kingdom Limited
Stuart Road Manor Park Runcorn, WA7 1TR, United Kingdom

■ Identification Tag

This manual and the identification tag attached on a packing box are essential parts of the product. Keep them together in a safe place for future reference.

■ Users

This product is designed to be used by a person with specialized knowledge.

■ How to dispose the batteries

This is an explanation about the new EU and UK Battery Directive. This directive is only valid in the EU and UK.

Batteries are included in this product. Batteries incorporated into this product cannot be removed by yourself. Dispose them together with this product.

When you dispose this product in the EU and UK, contact your local Yokogawa office in the EU or UK.

Do not dispose them as domestic household waste.

Battery type: Manganese dioxide lithium battery.

Notice:

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

■ Information of the WEEE Directive

This product is purposely designed to be used in a large scale fixed installations only and, therefore, is out of scope of the WEEE Directive. The WEEE Directive does not apply. This product should be disposed in accordance with local and national legislation/regulations.

The WEEE Directive is only valid in the EU and UK.

■ UKCA marking compliant

UK CA 2503

TDLS8200
Probe Type
Tunable Diode Laser Spectrometer

IM 11Y01D03-01EN 11th Edition

CONTENTS

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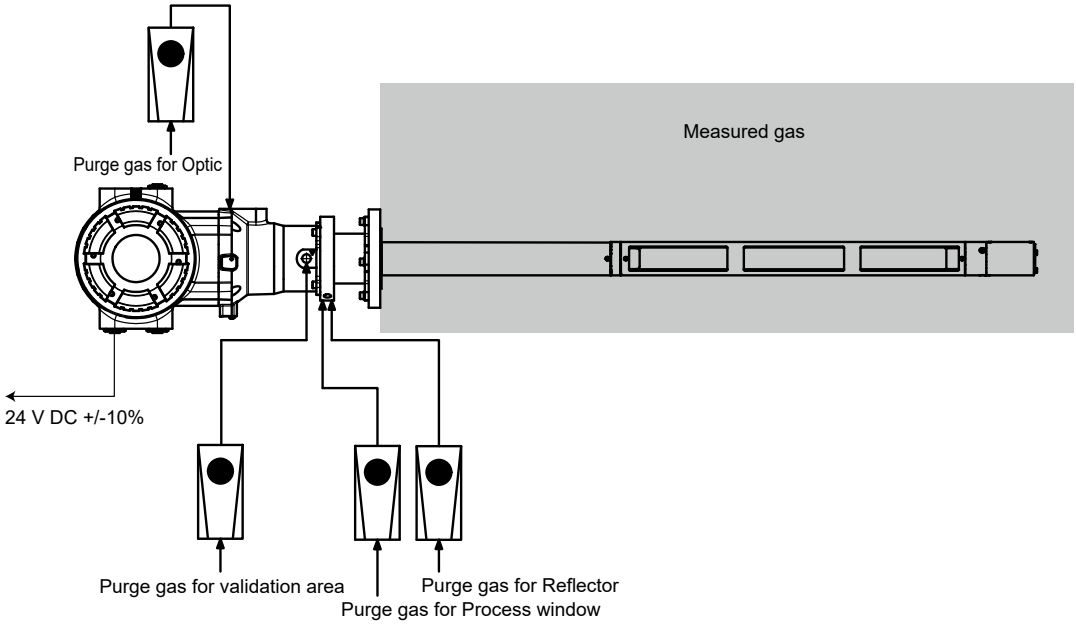
1. Overview

Yokogawa's TDLS^{TM}8200 is a laser gas analyzer that measures the concentration of gases (O_2, CO, CH_4, NH_3, HCl) in various processes such as petrochemical, power generation.

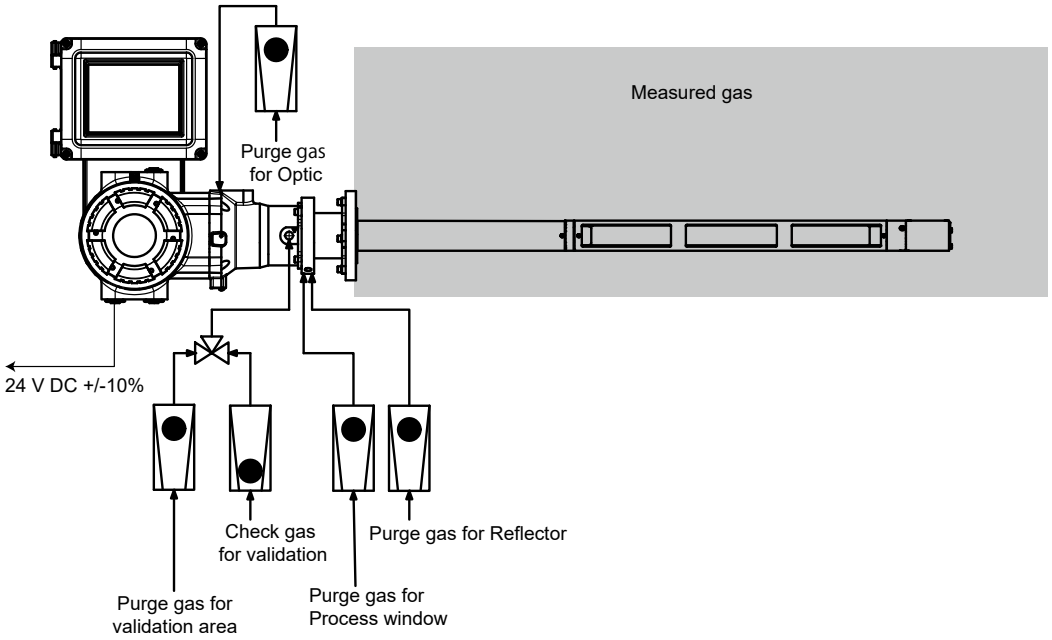
Since it can be inserted directly into the duct, the sampling equipment is unnecessary and installation cost and maintenance cost can be reduced. Moreover, it is possible to measure with high accuracy compared to other process analyzers because it is rarely affected by interference of other components in high-speed measurement.

1.1 System configuration

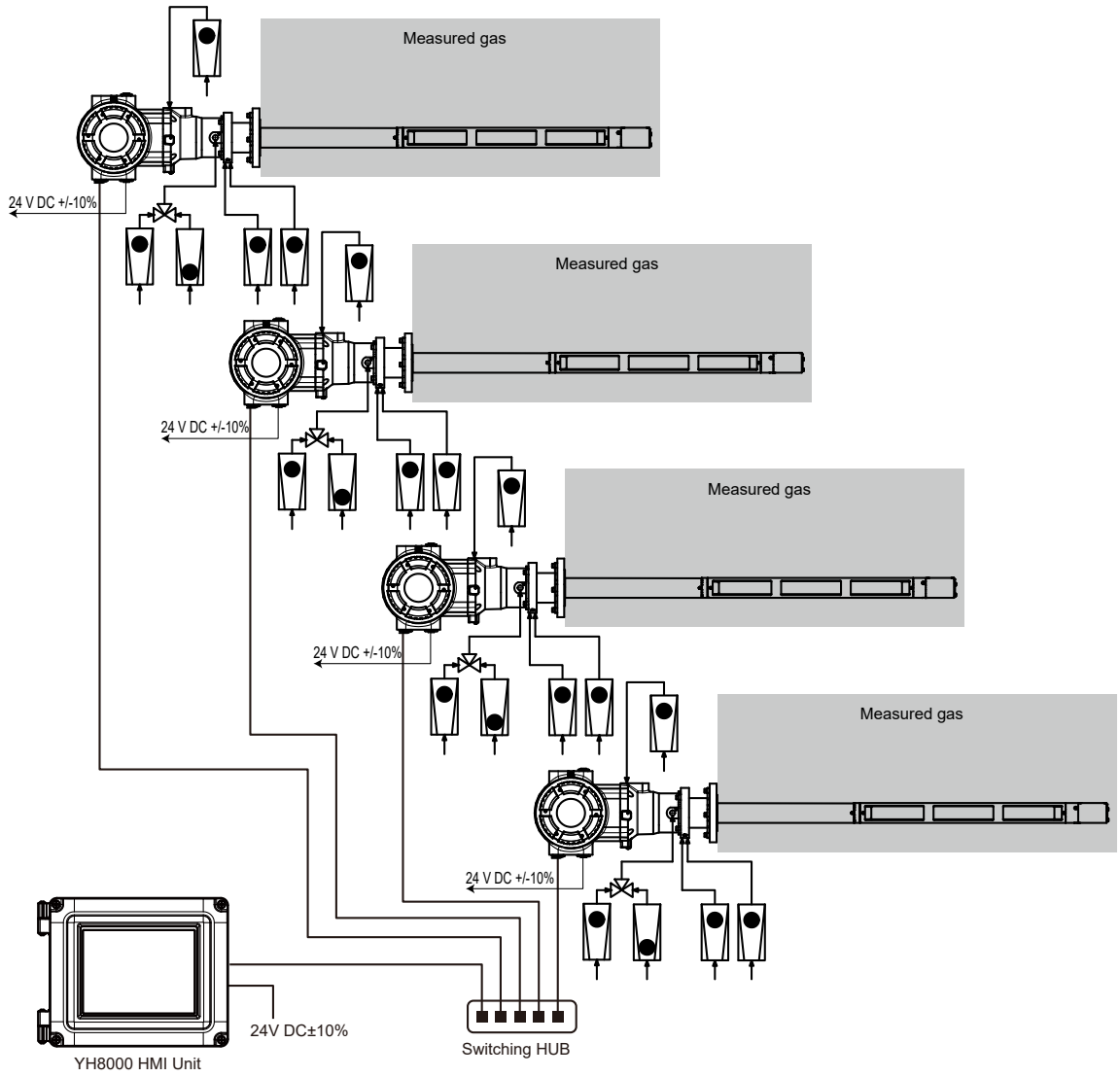
Standard System Configuration



System Configuration with YH8000 HMI Unit and Validation gas line

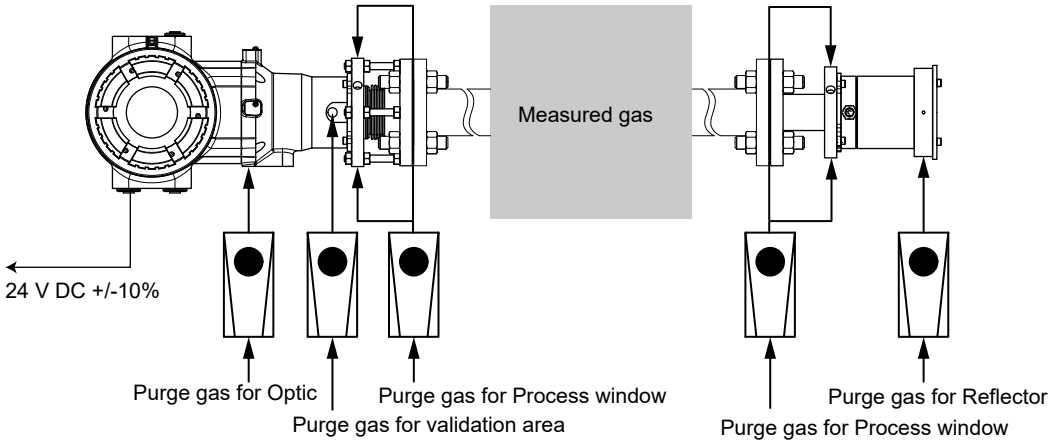


Multi Analyzer Configuration with Remote HMI, connection example of 4 analyzers



Note: If power supply is 100 to 240 V AC, power supply must be supplied by customer.

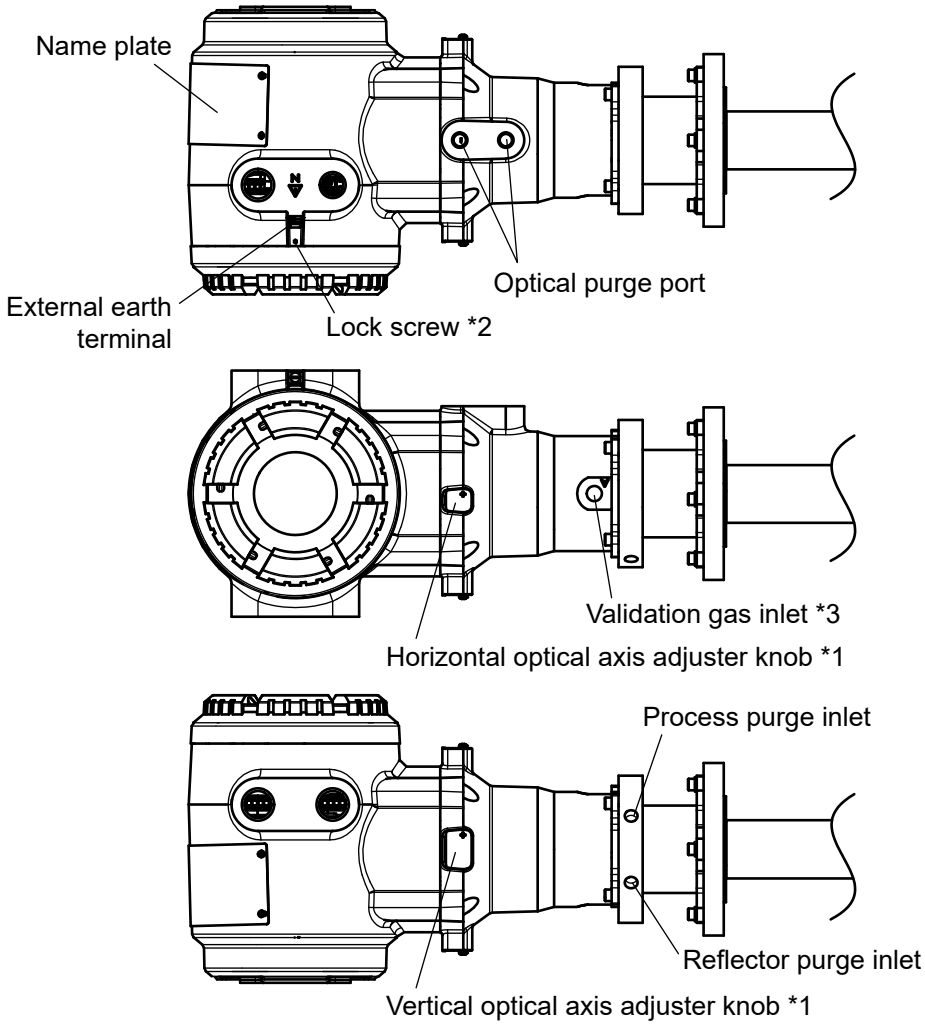
System Configuration of Reflect type (-REF)



1.2 Name and Function of Each Part

TDLS8200 is composed of analyzer part and probe part.

1.2.1 TDLS8200 analyzer part

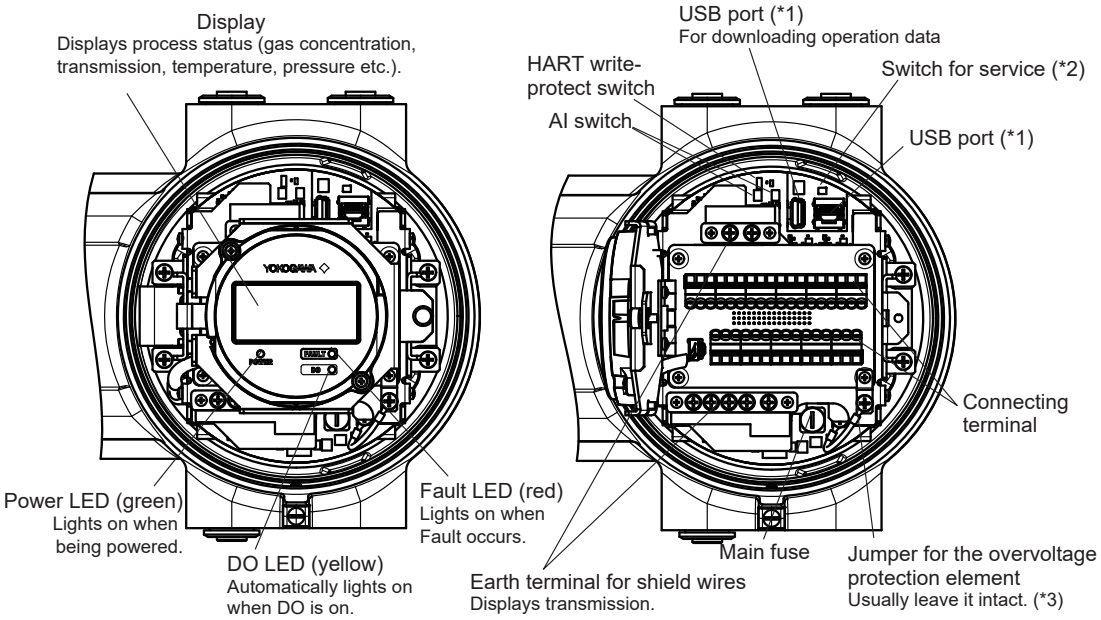


*1: Type of knob varies depending on each specification.
*2: Close the cover securely and fix it with a lock screw. Loosen the lock screw before opening the cover.
*3: Outlet is on the other side, not shown inside the figure.
NOTE
The actual positioning of each part may be different from those on the figure depending on the orientation of the connected probe.

NOTE

Do not drop or lose the lock screw when releasing it.

TDLS8200 inside analyzer part

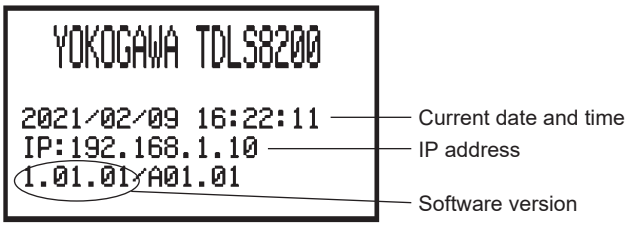


*1: On the USB port, do not plug anything except USB flash drive. For further information, see “6.13 Access to stored data in TDLS8200”.
*2: Service staff use these switches for maintenance. Leave them all OFF.
*3: The TDLS8200 is equipped with an overvoltage protection element to prevent failure caused by surges and other overvoltage. This element may hinder the correct measurement of the insulation resistance of the power line during insulation tests. To disable this element, disconnect the jumper.

Display

Starting screen

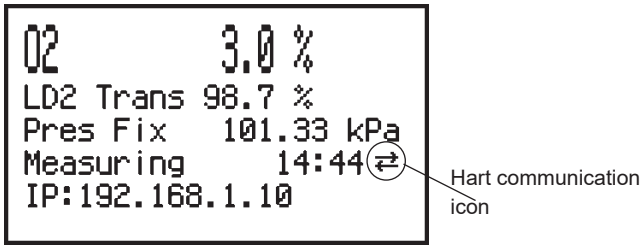
The screen below is displayed for approx. 10 seconds after power-on.



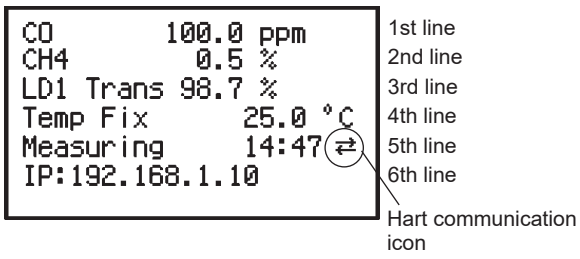
LCD starting screen

Normal screen

After the starting screen, a Warm-up screen appears and the following screen is displayed. The presentation of concentration values varies depending on the specifications of the TDLS8200.



LCD normal screen (for single-gas measuring specifications)



LCD normal screen (for double-gas measuring specifications)

NOTE

Measurements such as concentration and transmission are updated every analysis cycle. On the display, the temperature and pressure values are displayed alternately on line 4 in every analysis cycle. This means that measurement is updated whenever the content of the line 4 changes.

The details of the information displayed in each line are as follows.

<table>
<tr><th>Line</th><th colspan="2">Item</th><th>Display example</th></tr>
<tr><td>1</td><td colspan="2">Concentration of LD1 (*1) and LD2 (*1) (Display switches for each analysis cycle.) LD1 1st component gas concentration, LD2 1st component gas concentration (when measuring only the 1st component gas, use 2 lines to enlarge) (* 2)</td><td>O_2 3.0%</td></tr>
<tr><td>2</td><td colspan="2">LD1 gas concentration and LD2 gas concentration (Display switches for each analysis cycle)
LD1 2nd component gas concentration, LD2 2nd component gas concentration (in the case of 3-component measurement specifications) (*2)</td><td>CH_4 0.5%</td></tr>
<tr><td>3</td><td colspan="2">LD1 Transmission, LD2 Transmission</td><td>LD1 Trans 98.7%</td></tr>
<tr><td>4</td><td colspan="2">Temperature and pressure (displayed alternately for every analysis cycle)</td><td></td></tr>
<tr><td></td><td>1</td><td>Process pressure: Displays “pressure input mode pressure value”
<table><tr><th>Pressure input mode</th><th>Display</th></tr><tr><td>Active Input:
Input source is AI-1.
Input source is Modbus communication.</td><td>
Pres AI1
Pres COM</td></tr><tr><td>Fixed</td><td>Pres Fix</td></tr></table></td><td>PresAI1 101.32kPa</td></tr>
<tr><td></td><td>2</td><td>Process temperature: Displays “temperature input mode temperature value”
<table><tr><th>Temperature input mode</th><th>Display</th></tr><tr><td>Active Input:
Input source is AI-2.
Input source is Modbus communication.</td><td>
Temp AI2
Temp COM</td></tr><tr><td>Fixed</td><td>Temp Fix</td></tr><tr><td>Active Ambient</td><td>Temp ActA</td></tr></table></td><td>TempAI2 20.3ºC</td></tr>
<tr><td>5</td><td colspan="2">Status or alarm information
- Displays status information when there is no alarm.
- Displays alarm information when there is an alarm
*: Displays the HART communication icon at the right end when HART commands are received.</td><td></td></tr>
<tr><td></td><td>1</td><td>Status display: Displays the following equipment statuses.
<table><tr><th>Equipment status</th><th>Display example</th></tr><tr><td>During normal measurement</td><td>Measuring hh:mm</td></tr><tr><td>During warming-up</td><td>Warm-up hh:mm</td></tr><tr><td>During maintenance</td><td>Maintenance hh:mm</td></tr><tr><td>During calibration, validation, blowback</td><td>Span Cal
(for span calibration)</td></tr><tr><td>During AO loop check or calibration</td><td>AO1 Fixed=4.0mA
(for AO-1 4 mA output)</td></tr><tr><td>During AI calibration</td><td>AI-1 (Pres) Cal
(for AI-1 calibration)</td></tr></table></td><td>Measuring 12:10</td></tr>
<tr><td></td><td>2</td><td>Alarm display: Displays “[W/F(alarm number)] alarm name”
- Alternates displays every 5 seconds when multiple alarms are generated.
- [W##] means warning, [F##] means fault.
- Fault highlights characters.</td><td>[F53] Trans Lost</td></tr>
<tr><td>6</td><td colspan="2">Various setup information
Alternately displays the following items every 5 seconds.</td><td></td></tr>
<tr><td></td><td>1</td><td>IP address</td><td>IP: 192.168.1.10</td></tr>
<tr><td></td><td>2</td><td>HART address</td><td>HART ADRS: 0</td></tr>
<tr><td></td><td>3</td><td>LU temperature</td><td>LU: 34.5ºC</td></tr>
<tr><td></td><td>4</td><td>SCU temperature</td><td>SCU: 33.4ºC</td></tr>
</table>

*1: On the analyzer part of the TDLS8200, one Laser Diode is mounted when the 1 laser specification is selected. Two Laser Diodes are mounted for the 2 laser specification. Each Laser Diode hereafter is referred to as LD1 and LD2.

*2: Displays the invalid value “***” while the following alarms are generated. Example: 02 ***%

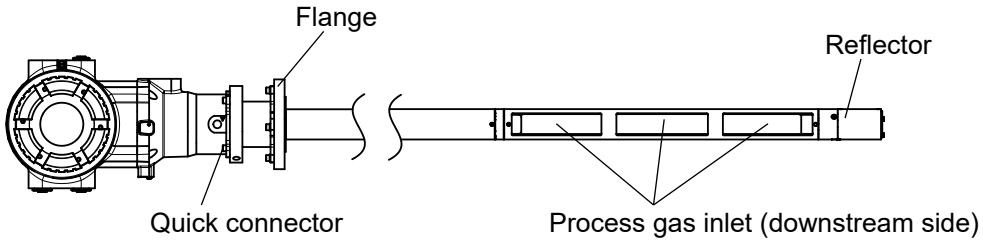
Number	Alarm
41	L1 (*1) Detector signal high
42	L2 (*2) Detector signal high
47	L1 Peak center out of range
48	L2 Peak center out of range
49	L1 Detector signal lost
50	L2 Detector signal lost

*1: The alarm related to laser 1 is referred to as L1.
*2: The alarm related to laser 2 is referred to as L2.

Spectrum screen

Absorption spectrum and detector signals can be checked. Displaying the spectrum screen requires changes in the setting of the TDLS8200. See “4.9.4 Display”.

1.2.2 TDLS8200 Probe



1.3 Specifications

■ TDLS8200 Probe type Tunable Diode Laser Spectrometer

Measurement object: O_2, CO, CO or CH_4, NH_3, HCl concentration in combustion exhaust gas and process gas. If other gas measurements are required, consult with Yokogawa.
Measurement system: Tunable diode laser spectroscopy
Light source; Near-infrared tunable diode laser
Measured components and ranges:

Measured component	Min. range	Max. range
O_2	0-1%	0-25% (*2)
CO (*1)	0-200 ppm	0-10,000 ppm
CH_4 (*1)	0-5%	
NH_3	0-30 ppm	0-5000 ppm
HCl	0-50 ppm	0-5000 ppm

*1: Please consult Yokogawa if CO and CH_4 component coexists.
*2: In the case of explosionproof type, oxygen concentration shall not exceed that found in normal air, typically 21%.

Please consult with Yokogawa if the measuring range for your measurement gas is outside of the above ranges.

Process length *1 (Reflect type): 0.25 to 0.51 m (20 inch)
Measurement optical path length *2 (Reflect type): 0.5 to 1.02 m (40 inch)

*1: The region length of the measurement gas present between the analyzer and the reflector.
*2: The distance that the measurement light passes through the measurement gas. (twice the process length)

Safety, EMC, and RoHS conformity standards:
Safety conformity standards:
CE, UKCA EN61010-1, EN IEC 61010-2-030
UL UL61010-1, UL 61010-2-030
CSA CAN/CSA-C22.2 No.61010-1,
CAN/ CSA-C22.2 No.61010-2-030
GB GB30439 Part 1
Installation altitude: 2000 m or less

Installation category: I (Anticipated transient overvoltage 330V)
Measuring category: O (Other)
Pollution degree: 2, Indoor/Outdoor use

Note: Installation category, called overvoltage category, specifies impulse withstand voltage. Pollution degree indicates the degree of existence of solid, liquid, gas or other inclusions which may reduce dielectric strength.

EMC conformity standards:
CE, UKCA EN55011 Class A Group 1
EN61326-1 Class A Table 2 (For use in industrial location),
EN61326-2-3
RCM EN55011 Class A Group 1
KC KN11 Class A Group 1, KN61000-6-2
(Korea Electromagnetic Conformity)

Laser classification: CSA E60825-1:15,
IEC 60825-1:2014, EN 60825-1:2014
GB7247.1-2012, FDA 21 CFR part 1040.10,Class 1 laser product

SIL Certification: IEC 61508:Functional safety of Electrical/electronic/programmable electronic related systems; SIL 2 capability for single analyzer use, SIL 3 capability for dual analyzer use. However, analog output (AO-4, AO-5), contact output (2 points), contact input (2 points), contact output for valve drive (2 points), digital communication (HART, Modbus/TCP) are outside the scope of the certification.

RoHS conformity standards: EN IEC 63000:2018*
*: For only TDLS8200-G1, -G2, -S1

Information of the WEEE Directive
This product is purposely designed to be used in a large scale fixed installations only and, therefore, is out of scope of the WEEE Directive. The WEEE Directive does not apply. The WEEE Directive is only valid in the EU and UK.

Display: 128 x 64 dots LCD; On Sensor Control Unit
Status LEDs; (Green: Power, Orange: DO, Red: Fault)

Display items: Gas concentration, Transmission, Process gas temperature (AI), Process gas pressure (AI), System status, Alarm information, System information (Product serial no., Laser detector module serial no., Output signal, IP address, HART address, Optical path length, Analyzer internal temperature)

Analog output: 5 points, 4 to 20 mA DC (Isolated from the power supply and ground, Max. load resistance 550 Ω)

Output types; Gas concentration, Transmission, Process gas temperature, Process gas pressure
Output range; 3.0 to 21.6 mA DC

Digital communications:
HART: On analog output signal one (AO-1)
Load resistance; 250 to 550 Ω (Include cable resistance)
Ethernet; RJ-45 connector
Protocol; Modbus/TCP
Communication speed; 100 Mbps

Digital output: 2 points, contact rating 24V DC, 1A
DO;
Function: Activate during Warning / Calibration / Validation / Warm up / Maintenance conditions
Contact Specification: Relay contact output (Isolated from the power supply and ground), C-contact (NC/NO/COM)
Fault;
Function: Activate during Fault condition or when the system power is off
Contact Specification: Relay contact output (Isolated from the power supply and ground), A-contact (NC/COM)

Valve control output: 2 points
Function; Activate calibration, validation or blowback solenoid valves for zero, span or validation gas.
Output signal; 24V DC, 500 mA Max. per terminal

Alarm:
Warning; Gas concentration low, Gas concentration high, Transmission low, Process pressure low, Process pressure high, Process temperature low, Process temperature high, Validation required, Validation failure, Zero calibration error, Span calibration error, External alarm, Detector signal high, Absorption too high
Fault; Laser module temperature low, Laser module temperature high, Laser temperature low, Laser temperature high, Peak center out of range, Reference peak height low, Transmission lost, Reference transmission low, Reference peak height high, Laser unit failure, Laser module error, File access error, E2PROM access error
Digital input: 2 points
Function; External Alarm/Calibration start/Validation start/Stream switch (Valve control)
Contact specification; Zero voltage contact input (Isolated from the power supply and ground)
Input signal; Open signal: 100 kΩ or more, Close signal: 200 Ω or less
Analog input: 2 points
Signal type; 4 to 20 mA DC (Isolated from the power supply and Ground), with selectable powered/unpowered function
Input signal range; 2.4 to 21.6 mA DC
Input types; Process gas temperature, Process gas pressure
Transmitter power supply; 15 V DC or higher (at 20 mA DC) 26 V DC or less (at 0 mA DC)

Note: This voltage is generated between the AI terminals of TDLS8200. When calculating the minimum operating voltage for transmitters, consider allowing margins for voltage drop in external wiring.

Self-diagnostics: Laser detector Unit temperature, Laser temperature, Detector signal level, Memory read/write function, Peak locking condition
Calibration: Calibration method; Zero/Span calibration
Calibration mode; Manual
Validation: Validation method; Up to 2 points
Validation mode; Manual, Auto (Time initiated, Remote initiate (DI/Modbus)), Semi-Auto (YH8000)
Power supply: 24V DC +/-10%
Power consumption: Max. 25W; TDLS8200 only
Max. 65W; TDLS8200 with YH8000 and 2 solenoid valves
Protection degree: IP66, Type 4X
Material: Case; Aluminum alloy
Wetted materials: Fused silica, 316 SS (Eq.),BK-7 glass, Teflon encapsulated FKM, ASE wool, Alloy 800 (or equivalent, only for Mid temp.), Alloy 800H/HT (or equivalent, only for Mid temp.), PEEK (only for Flowcell type)
Paint color: Mint green (RAL 190 30 15 or equivalent)
Weight (approx.): Probe part (Standard); 0.7 m 2.7 kg, 1 m 4.3 kg, 1.5 m 7.0 kg, 2 m 9.8 kg
Probe part (High temp); 1 m 20.0 kg, 1.5 m 25.0 kg
Flowcell part; 11 kg
Reflector unit (Reflect type);

ANSI Class 150-2-RF (Eq.)	9 kg/pc
ANSI Class 150-3-RF (Eq.)	11 kg/pc
ANSI Class 150-4-RF (Eq.)	14 kg/pc
DIN PN16-DN50-D (Eq.)	9 kg/pc
DIN PN16-DN80-D (Eq.)	11 kg/pc
JIS 10K-50-FF (Eq.)	9 kg/pc
JIS 10K-80-FF (Eq.)	10 kg/pc

Alignment flange part (Reflect type)

ANSI Class 150-2-RF (Eq.)	5 kg/pc
ANSI Class 150-3-RF (Eq.)	7 kg/pc
ANSI Class 150-4-RF (Eq.)	9 kg/pc
DIN PN16-DN50-D (Eq.)	5 kg/pc
DIN PN16-DN80-D (Eq.)	6 kg/pc
JIS 10K-50-FF (Eq.)	5 kg/pc
JIS 10K-80-FF (Eq.)	6 kg/pc

Analyzer part; explosion proof; Approx. 16.5 kg
general purpose; 15.6 kg (Not include flange)

Process gas condition: Process gas temperature; Max. 850ºC, Application dependent, 150°C or less for Flowcell type
Process gas pressure; Max.500 kPa abs., Min. 90 kPa abs., Application dependent
Process gas velocity; over 1m/s (recommendation over 5 m/s) over 0m/s for Reflect type
Dust in process gas; When the process dust load is high, please consult with Yokogawa.

Note: When using TDLS8200 as CE, UKCA marking compliance product, it has following limitation.
General purpose model (-G1, -G2):
The upper limit of the measurement gas pressure is 50kPa in gauge pressure.
The unstable gas defined by following cannot be measured. An unstable gas in this context is a gas liable to transform itself spontaneously, producing a sudden pressure increase. Such transformation as an example can result from a relatively small variation of an operating parameter (e.g. pressure, temperature, presence of catalyzing material) in a confined volume. This includes gases that are classified as chemically unstable gases according to CLP Regulation (EC) No 1272/2008 as amended. Typical examples of unstable gases: acetylene (UN 1001), methyl acetylene (UN 1060), vinyl fluoride (UN 1860),ozone and dinitrogen oxide (UN 1067). For further examples, see Table 35.1 of the UN Manual of Tests and Criteria.

Warm-up time: 5 min.

Installation condition:

Ambient operating temperature; -20 to 55ºC
Storage temperature; -30 to 70ºC
Humidity; 0 to 95%RH at 40ºC (Non-condensing)
Mounting flange type; ASME B16.5, DIN, JIS
Gas connections; 1/4NPT or Rc1/4
Cable entries; 1/2NPT or M20x1.5mm, one hole. 3/4NPT or M25x1.5mm, three holes

Purge gas connections; 1/4NPT or Rc1/4
If other gas connections are required, please consult with Yokogawa.

Purge gas; Theoretically, instrument air could be used as a purge gas for all the below applications except for oxygen measurement. Choosing between using nitrogen or instrument air or purge gas will ultimately depend upon further application details and the desired precision of the measurement. All gasses should be clean and dry.

Recommended purge gasses:
O_2 analyzer: N_2 (99.99% or greater, application dependent)
CO, CO or CH_4, NH_3, HCl analyzer: N_2 (99.99% or greater, application dependent) or Instrument air (dew point; less than -20ºC/no dust/no oil mist)

Purge gas flow rates; Optic: 2 to 20L/min (Application dependent)
100 to 200mL/min (explosionproof)
* Not more than 10 kPa at the inlet for explosionproof.
Process window/Reflector: 0.5 to 100 L/min (Application dependent)

PERFORMANCE

Repeatability / Linearity:

Measured gas		Repeatability	Linearity
O_2		+/- 1% reading or +/- 0.01% O_2, whichever is greater	+/- 1% F.S.
CO (ppm)		+/- 2% reading or +/- 1 ppm CO, whichever is greater	+/- 1% F.S.
CO or CH_4	CO	+/- 2% reading or +/- 1 ppm CO, whichever is greater	+/- 2% F.S.
	CH_4	+/- 4% reading or +/- 0.02% CH_4, whichever is greater	+/- 4% F.S.
NH_3		+/- 2% reading or +/- 1 ppm NH_3, whichever is greater	+/- 2% F.S
HCl		+/- 1% reading or +/- 2.5 ppm HCl, whichever is greater	+/- 2% F.S

Measurement conditions: Gas temperature; 25 ºC, Gas pressure; 0.1 MPa, Optical path length; 1 m

Data Update

Cycle: Approx. 2 seconds (Response time may increase for non-standard applications) If less than 2 seconds response is required, please consult with Yokogawa

Influences on the Measurement - Application dependent

A. Temperature: The temperature of the measured gas should be taken into account by the analyzer so that the reading can be corrected on a real time basis. The effect is specific to each different measurement gas.

a. If the gas temperature is constant at the desired measurement condition, then a fixed gas temperature may be programmed into the analyzer. This fixed value can be used in real time by the analyzer to provide a temperature compensated reading.
b. If the gas temperature is relatively equal to the ambient temperature, then an integral sensor value may be utilized by the analyzer. This active ambient value is used real time by the analyzer to provide a temperature compensated reading.
c. If the gas temperature is variable, then an external sensor value may be utilized by the analyzer. This active input value can be used in real time by the analyzer to provide a temperature compensated reading.

B. Pressure: The pressure of the measured gas must be taken into account by the analyzer so that the reading can be corrected on a real time basis. The effect is specific to each different measurement gas.

a. If the gas pressure is constant at the desired measurement condition, then a fixed gas pressure may be programmed to the analyzer. This fixed value can be used in real time by the analyzer to provide a pressure compensated reading.
b. If the gas pressure is variable, then an external sensor value may be utilized by the analyzer. This active input value can be used in real time by the analyzer to provide a pressure.

Hazardous area classifications:

Division 1, Zone 1: Explosionproof

TDLS8200-D1 (FM Approval for US)
Division system:
Type pf protection:
Explosion proof; Class I, Division 1, Groups A, B, C, D, T6
Dust-Ignitionproof; Class II/III, Division 1, Groups E, F, G T6
Enclosure rating: Type4X
Applicable standards: FM Class 3600: 2018, FM Class 3615: 2018, FM Class 3616: 2011, FM Class 3810: 2018, NEMA 250: 2014, ANSI/UL 50E:2015, ANSI/UL 61010-1:2012, ANSI/UL 61010-2-30:2012, ANSI/ISA-12.27.01: 2011

Zone system:
Type of protection:
Class I, Zone 1, AEx db [op is Ga] IIC T6 Gb
Zone21, AEx tb [op is Da] IIIC T85°C Db
Enclosure rating: IP66
Applicable standards:
ANSI/UL 60079-0:2013, ANSI/UL 60079-1: 2015, ANSI/UL 60079-28:2017, ANSI/UL 60079-31: 2015, ANSI/IEC 60529:2004, ANSI/UL 61010-1:2012, ANSI/UL 61010-2-30:2012, ANSI/ISA-12.27.01: 2011

TDLS8200-C1 (FM Approval for Canada)
Type of protection:
Ex db [op is Ga] IIC T6 Gb
Ex tb [op is Da] IIIC T85°C Db
Enclosure rating: IP66, Type4X
Applicable standards: CSA C22.2 No.94.2-15:2015, CAN/CSA C22.2 No.60079-0: 2015, CAN/CSA C22.2 No.60079-1: 2016, CAN/CSA C22.2 No.60079-28: 2016, CAN/CSA C22.2 No.60079-31: 2015, CAN/CSA C22.2 No.60529: 2016, CAN/CSA-C22.2 No. 61010-1-12:2012, CAN/CSA-C22.2 No. 61010-2-030-12:2016, ANSI/ISA-12.27.01: 2011

TDLS8200-E1 (IECEx)
Type of protection: Ex db [op is Ga] IIC T6 Gb
Ex tb [op is Da] IIIC T85ºC Db
Enclosure rating: IP66 (In Accordance with IEC 60529)

Applicable standards: IEC 60079-0:2017, IEC 60079-1:2014,
IEC 60079-28:2015, IEC 60079-31:2013

TDLS8200-S1 (ATEX,UKEX)
Type of protection: II 2(1) G Ex db [op is Ga] IIC T6 Gb
II 2(1) D Ex tb [op is Da] IIIC T85ºC Db
Enclosure rating: IP66 (In Accordance with EN 60529)
Applicable standards: EN IEC 60079-0:2018, EN 60079-1:2014,
EN 60079-28:2015, EN 60079-31:2014

TDLS8200-K1 (Korea Ex)
Type of protection: Ex db IIC T6 Gb
Ex tb IIIC T85ºC Db
Enclosure rating: IP66 (In Accordance with IEC 60529)
Applicable standards: Notice of Ministry of Labor No. 2021-22
Harmonized with IEC 60079-0: 2017, IEC 60079-1: 2014,
IEC 60079-31: 2013

TDLS8200-N1 (NEPSI)
Type of protection: Ex db [op is Ga] IIC T6 Gb
Ex tb [op is Da] IIIC T85ºC Db
Enclosure rating: IP66 (in accordance with GB/T 4208-2017)
Applicable standards: GB/T 3836.1-2021
GB/T 3836.2-2021
GB/T 3836.22-2017
GB/T 3836.31-2021

TDLS8200-J1 (Japan Ex)
Type of protection: Ex db [op is Ga] IIC T6 Gb
Ex tb [op is Da] IIIC T85ºC Db
Enclosure rating: IP66 (In Accordance with IEC 60529)
Applicable standards: JNIOSH-TR-46-1:2020
JNIOSH-TR-46-2:2018
JNIOSH-TR-46-9:2018
JNIOSH-TR-46-11:2020

Calibration Cell

Used for off-line calibrations and validations.

Specification

Optical Path Length: 500 mm
Material: 316 SS (eq.), Aluminum, BK-7, FKM
Part No.: K9777ZA (for O_2, CO)
K9777ZK (for NH_3),
K9777ZL (for HCl)
Weight: Approx. 4.6 kg

1.4 Model and Codes

Model	Suffix Code	Option Code	Description
TDLS8200	.....	.....	Probe type Tunable Diode Laser Spectrometer
Structure	**-G1**	.....	General Purpose, cable entry/piping: NPT
	-G2	.....	General Purpose, cable entry: Metric thread, piping:Rc
	-D1	.....	FM (US) explosionproof, cable entry/piping: NPT
	-C1	.....	FM (Canada) explosionproof, cable entry/piping: NPT
	-E1	.....	IECEx explosionproof, cable entry:Metric thread, piping:Rc
	-S1	.....	ATEX,UKEX explosionproof, cable entry:Metric thread, piping:Rc
	-K1	.....	Korea explosionproof: cable entry:Metric thread, piping: Rc
	-N1	.....	NEPSI explosionproof: cable entry:Metric thread, piping: Rc
	-J1	.....	Japan Ex explosionproof: cable entry:Metric thread, piping:Rc (*1)
Temperature	**-L**	.....	Standard < 600 °C (*2) (*3)
	-M	.....	Mid temperature < 850°C (*4)
1st Gas Parameter	**-C2**	.....	Carbon Monoxide ppm <500°C (*5)
	-C3	.....	Carbon Monoxide ppm <850 °C (*2)(*5)(*6)
	-C4	.....	CO ppm <850 °C or CH4 0-5%, combustion (*2)(*5)(*6)
	-X1	.....	Oxygen < 600°C, 0-25% (*7)
	-X2	.....	Oxygen <850°C, 0-25%
	-A1	.....	NH_3 up to 0-5,000 ppm, < 450°C DeNOx (*8)
	-L1	.....	HCl 0-50 ppm/0-5,000 ppm, < 500°C (*8)
2nd Gas Parameter	**-NN**	.....	None (*8)
	-X1	.....	Oxygen < 600°C, 0-25% (*7)
	-X2	.....	Oxygen <850°C, 0-25%
Probe length	**-070**	.....	0.7m
	-100	.....	1m
	-150	.....	1.5m
	-200	.....	2m
	-REF	.....	Reflect type (*9)
	-EXT	.....	Flowcell type (*10)
Probe material	**-S**	.....	316SS
	-A	.....	Alloy 800, Mid temperature
Flange	**-U2**	.....	ANSI CLASS150-2-RF(Eq.)
	-U3	.....	ANSI CLASS150-3-RF(Eq.)
	-U4	.....	ANSI CLASS150-4-RF(Eq.)
	-D5	.....	DIN PN16-DN50-D(Eq.)
	-D8	.....	DIN PN16-DN80-D(Eq.)
	-D1	.....	DIN PN16-DN100-A (Eq.)
	-J5	.....	JIS 10K-50-FF(Eq.)
	-J8	.....	JIS 10K-80-FF(Eq.)
	-J1	.....	JIS 10K-100-FF (Eq.)
	-J6	.....	JIS 10K-65-FF (Eq.)
	-P4	.....	JPI Class 150 4 RF(Eq.)
	-P3	.....	JPI Class 150 3 RF(Eq.)
	-NN	.....	None (*11)
I/O interface	**-A1**	.....	Analog with HART + Modbus Ethernet
SI Unit	**-J**	.....	Only SI unit
	-N	.....	SI unit or non SI unit (*12)
—	**-N**	.....	Always -N
Option		**/RX**	Reference Cell for O_2 (*13)
		/RC	Reference Cell for CO (*6)
		/SCT	Stainless Steel Tag Plate
		/SIL	with IEC61508 SIL2 (SC3)
		/W	Wall bracket for Flowcell type (*11)
		/JA1	Cable gland for Japan Ex (Cable O.D. 8-12mm, G1/2) 1pc, for local HMI
		/JB1	Cable gland for Japan Ex (Cable O.D. 10-16mm, G3/4) 1 pcs
		/JB2	Cable gland for Japan Ex (Cable O.D. 10-16mm, G3/4) 2 pcs
		/JB3	Cable gland for Japan Ex (Cable O.D. 10-16mm, G3/4) 3 pcs

*1: For Japan Ex model (TDLS8200-J1), specified cable glands shall be attached to each cable entry for wiring. Select one cable gland out of three types: (/JB1, /JB2, or /JB3). If you need, specify (/JA1) as well. For detailed information, refer to Japanese General Specifications.
*2: When Temperature "-L" is selected, the temperature specification of "-C3" or "-C4" is 600°C or below.
*3: When Temperature "-L" is selected, select codes as follows:

1st/2nd Gas Parameter: other than “-X2”
Probe material: “-S”

*4: When Temperature “-M” is selected, only the following specifications (a) or (b) can be selected.
(a) TDLS8200-**-M-aa-bb-ccc-A-dd-A1-*-N (Option)
-aa (1st Gas Parameter): “-C3”, “-C4”, “-X2”
-bb (2nd Gas Parameter,): “-X2” (1st Gas Parameter “-C3” or “-C4” is selected),“-NN”
-ccc (Probe length): “-100”, “-150”
-dd (Flange): all except “-U2”, “-D5”, “-J5”, and “-NN”
(b) TDLS8200-**-M-ee-ff-REF-S-gg-A1-*-N (Option)
-ee (1st Gas Parameter): “-C3”, “-C4”, “-X2”
-ff (2nd Gas Parameter): “-X2” (1st Gas Parameter “-C3” or “-C4” is selected)
“-NN” (1st Gas Parameter “-X2” is selected)
-gg (Flange): “-U2”, “-U3”, “-U4”, “-D5”, “-D8”, “-J5”, “-J8”

*5: When CO and CH_4 component coexist, please contact YOKOGAWA.

*6: When 1st Gas Parameter “-C3” or “-C4” is specified, Option “/RC” must be selected . “/RC” can be selected when “-C2”, “-C3”, or “-C4” is specified for 1st Gas Parameter.

*7: When the process gas pressure is out of 90 to 130 kPa (abs.), or the process gas contains $CO_2 \geq 40$ % or $H_2 \geq 20$ % as coexisting gas components, please contact YOKOGAWA.

*8: When 1st Gas Parameter “-A1” or “-L1” is specified, only “-NN” can be selected for 2nd Gas Parameter.

*9: When Probe length “-REF” (Reflect type) is specified, for Flange only “-U2”,“-U3”,“-U4”,“-D5”,“-D8”,“-J5”,“-J8” can be selected. Also, specify 1st Gas Parameter and 2nd Gas Parameter from the following.
1st Gas Parameter: “-X1”, “-X2”, “-C2”, “-C3”, “-C4”
2nd Gas Parameter: “-X1”, “-X2”, “-NN” (1st Gas Parameter “-X1”, “-X2” is selected)

*10: When Probe length “-EXT” (Flowcell type) is specified, select codes as follows:
Temperature: “-L”
1st Gas Parameter: “-X1”, “-C2”,
2nd Gas Parameter: “-X1”, “-NN” (1st Gas Parameter “-X1” is selected)
Probe material: “-S”
Flange: “-NN”
Note when “-EXT” (Flowcell type) is specified, measurement gas temperature must be below 150°C.

*11: Available only when Probe length “-EXT” (Flowcell type) is specified.

*12: Available only to an end user located outside of Japan

*13: The Option “/RX” can be selected when 1st/2nd Gas Parameter “-X1” “-X2” is selected.

Accessories

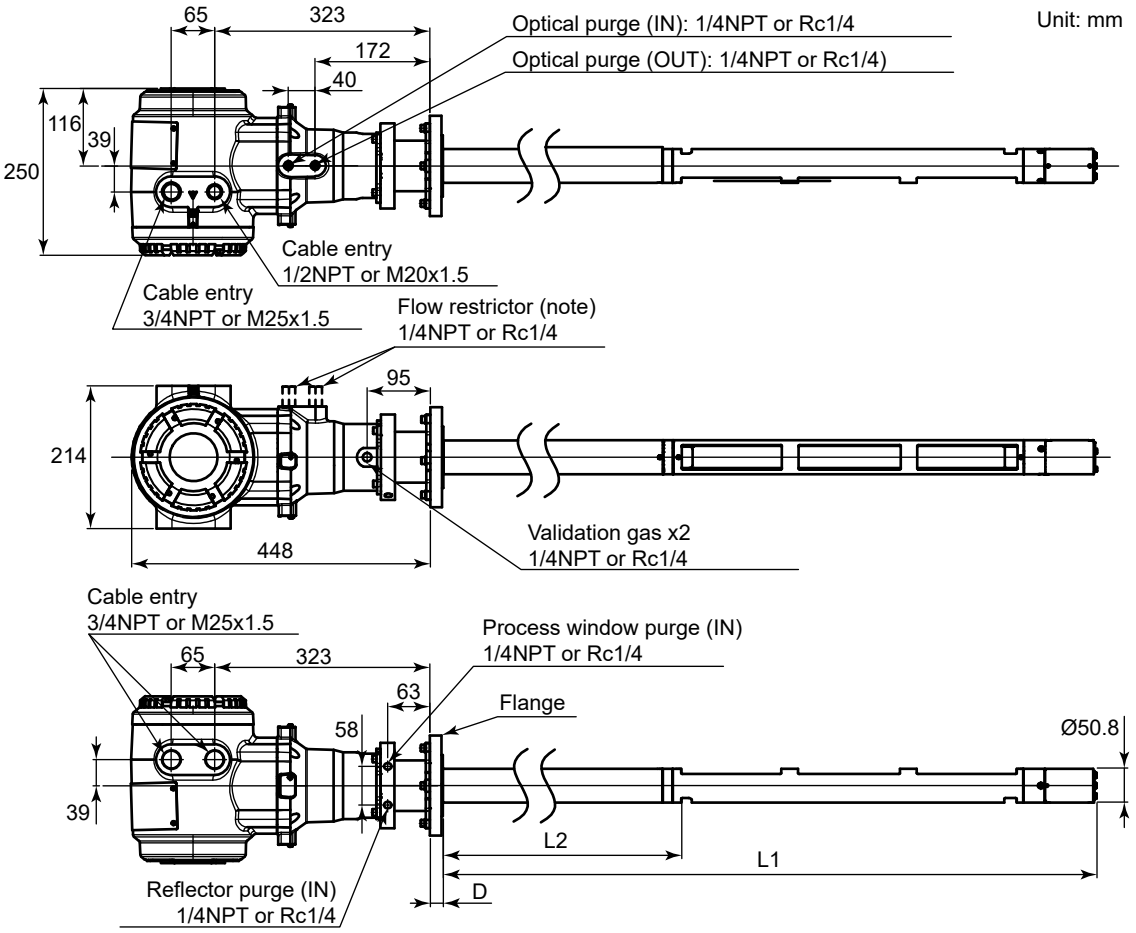
Parts name	Parts number	QTY	Remarks
Hex wrench	L9827AC	1	For lock screw
Fuse	A1624EF	1	250V/3.15A

1.5 External Dimensions

TDLS8200 Probe type Tunable Diode Laser Spectrometer, Standard (Temperature: "-L")

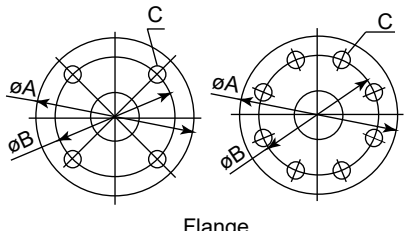
See page 1-19 for Reflect type, page 1-21 for Flowcell type.

Unit: mm



Flange	A	B	C	D
ANSI Class150-2-RF	150	120.7	4-Ø19	20
ANSI Class150-3-RF	190	152.4	4-Ø19	24
ANSI Class150-4-RF	230	190.5	8-Ø19	24
DIN PN16-DN50-D	165	125	4-Ø18	20
DIN PN16-DN80-D	200	160	8-Ø18	20
JIS 10K-50-FF	155	120	4-Ø19	16
JIS 10K-80-FF	185	150	8-Ø19	18

L1	700	1000	1500	2000
L2	78	378	878	1378

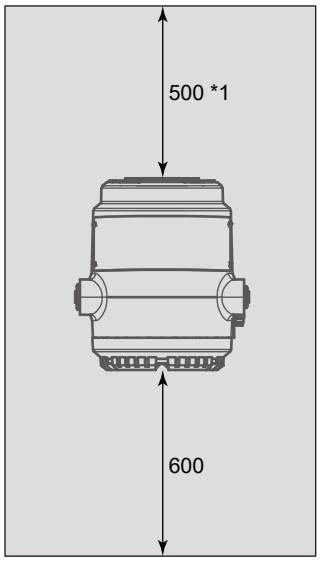


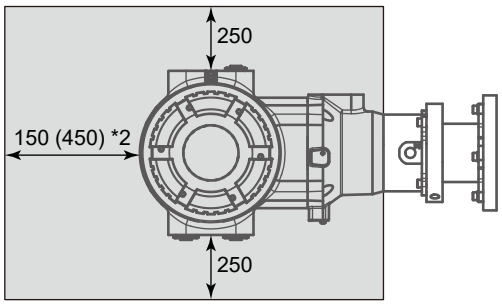
Flange

(note) The flow restrictors are attached in the case of type -C1, -D1, -E1, -S1, -K1, -N1, -J1

Maintenance space

Unit: mm



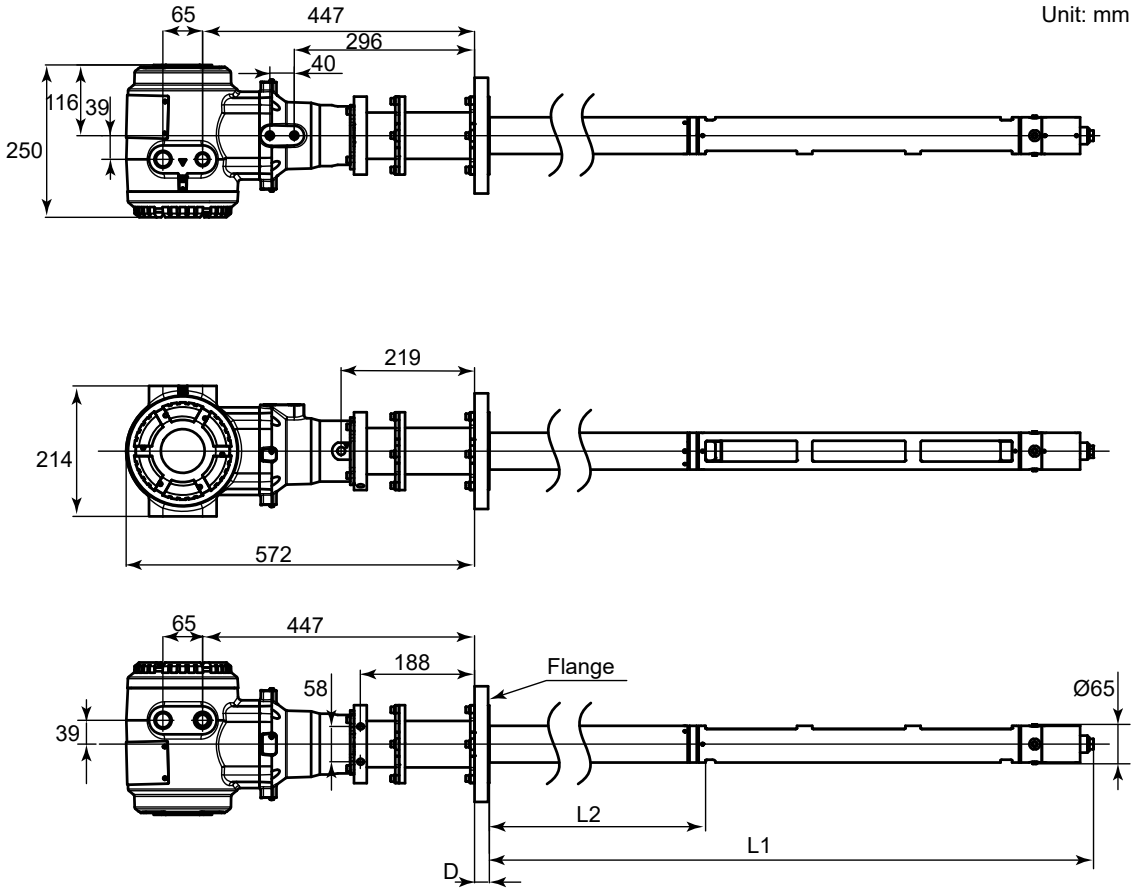


*1: When installing YH8000 on TDLS8200 with /M, it is necessary to secure this space.
*2: When connecting the calibration cell, it is necessary to secure this space. If install or uninstall of probe, need the additional space depend on probe length.

TDLS8200 Probe type Tunable Diode Laser Spectrometer Mid temperature, (Temperature: "-M")

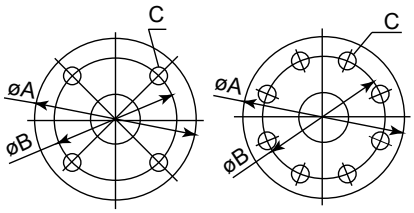
See page 1-19 for Reflect type.

Unit: mm



Flange	A	B	C	D
ANSI Class150-3-RF	190	152.4	4-Ø19	24
ANSI Class150-4-RF	230	190.5	8-Ø19	24
DIN PN16-DN80-D	200	160	8-Ø18	20
DIN PN16-DN100-A	220	180	8-Ø18	22
JIS 10K-65-FF	175	140	4-Ø19	18
JIS 10K-80-FF	185	150	8-Ø19	18
JIS 10K-100-FF	210	175	8-Ø19	18

L1	1000	1500
L2	363	863



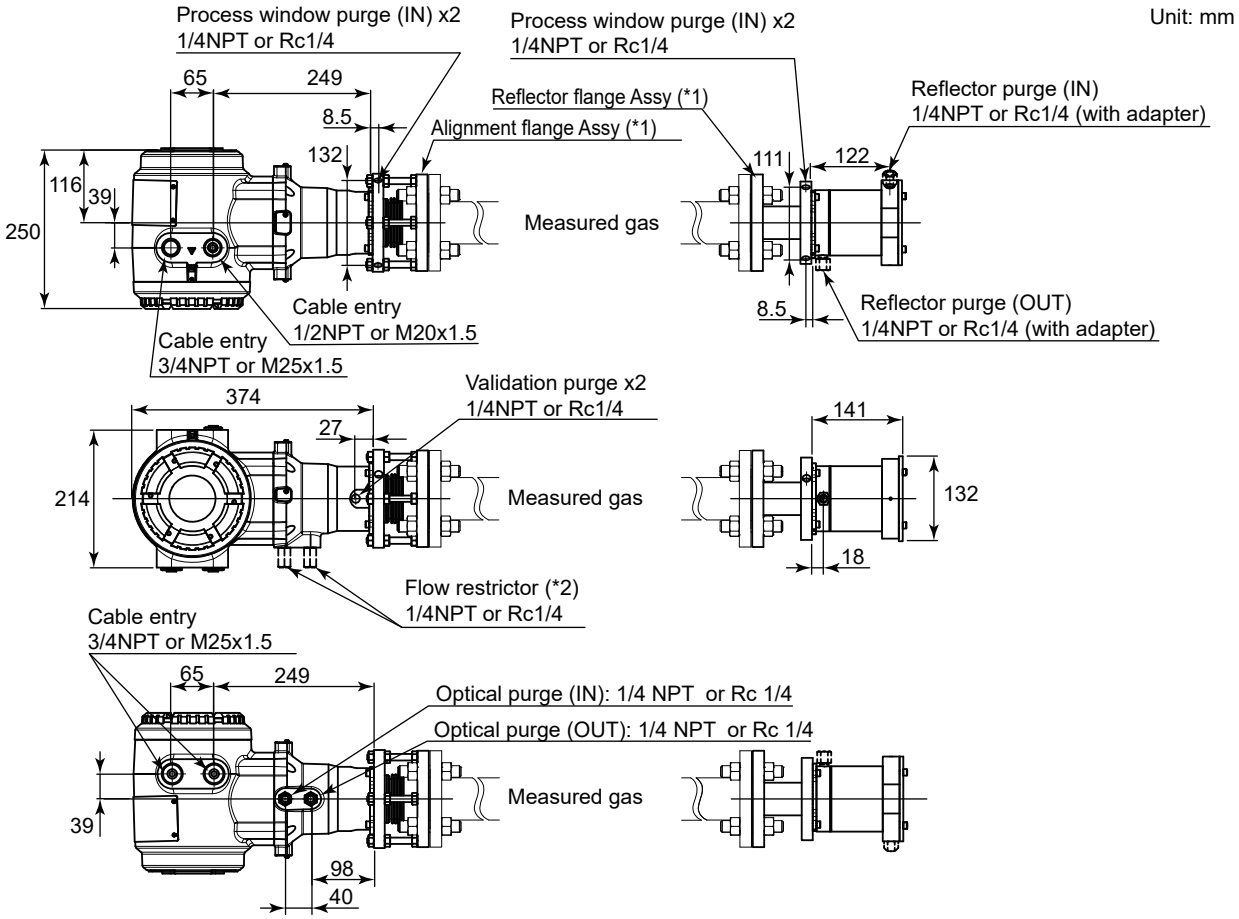
Flange

Maintenance space

Same as the standard probe on page 1-17 .

TDLS8200 Probe type Tunable Diode Laser Spectrometer, Reflect type (Probe length: “-REF”)

Unit: mm

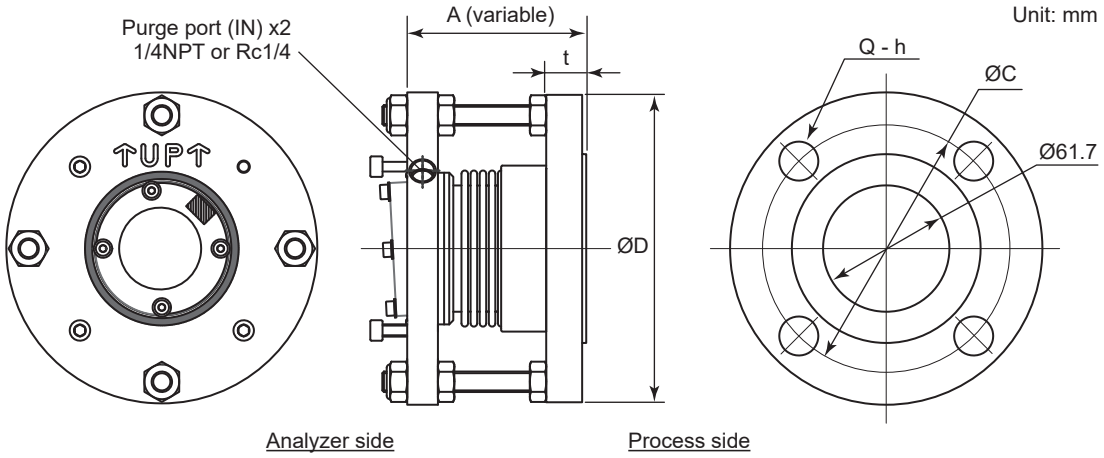


(*1) The alignment flange and the reflector flange varies according to specifications.
(*2) The flow restrictors are attached in the case of type -C1, -D1, -E1, -S1, -K1, -N1, -J1.

Maintenance space

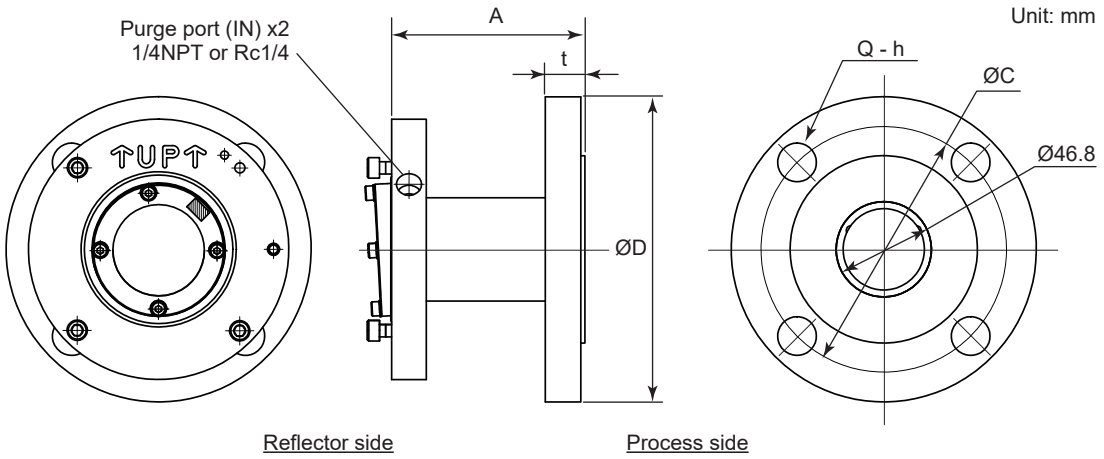
Same as the standard probe on page 1-17 .

Alignment Flange



Flange code		Hole QTY Q	Hole h	Hole P.C.D C	Thickness t	Outside dia. D	Distance A	Purge port
-U2	ANSI CLASS150-2-RF (Eq.)	4	19	120.7	19.5	150	87	1/4NPT
-U3	ANSI CLASS150-3-RF (Eq.)	4	19	152.4	24.3	190	92	1/4NPT
-U4	ANSI CLASS150-4-RF (Eq.)	8	19	190.5	23.9	228.6	92	1/4NPT
-D5	DIN PN16-DN50-D (Eq.)	4	18	125	18	165	86	Rc1/4
-D8	DIN PN16-DN80-D (Eq.)	8	18	160	20	200	88	Rc1/4
-J5	JIS 10K-50-FF (Eq.)	4	19	120	16	155	84	Rc1/4
-J8	JIS 10K-80-FF (Eq.)	8	19	150	18	185	86	Rc1/4

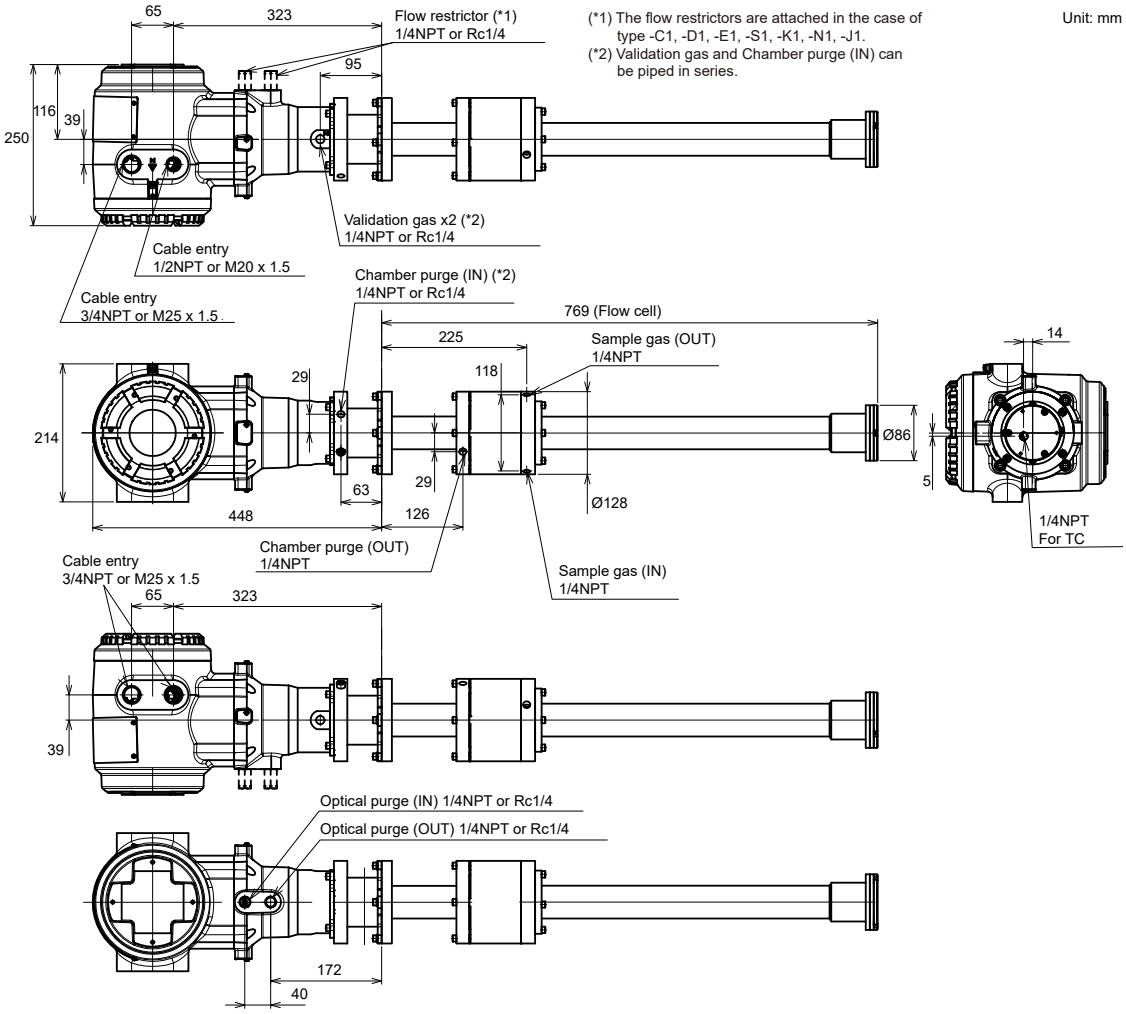
Reflector Flange



Flange code		Hole QTY Q	Hole h	Hole P.C.D C	Thickness t	Outside dia. D	Distance A	Purge port
-U2	ANSI CLASS150-2-RF (Eq.)	4	19	120.7	19.5	150	95	1/4NPT
-U3	ANSI CLASS150-3-RF (Eq.)	4	19	152.4	24.3	190	100	1/4NPT
-U4	ANSI CLASS150-4-RF (Eq.)	8	19	190.5	23.9	228.6	100	1/4NPT
-D5	DIN PN16-DN50-D (Eq.)	4	18	125	18	165	94	Rc1/4
-D8	DIN PN16-DN80-D (Eq.)	8	18	160	20	200	96	Rc1/4
-J5	JIS 10K-50-FF (Eq.)	4	19	120	16	155	92	Rc1/4
-J8	JIS 10K-80-FF (Eq.)	8	19	150	18	185	94	Rc1/4

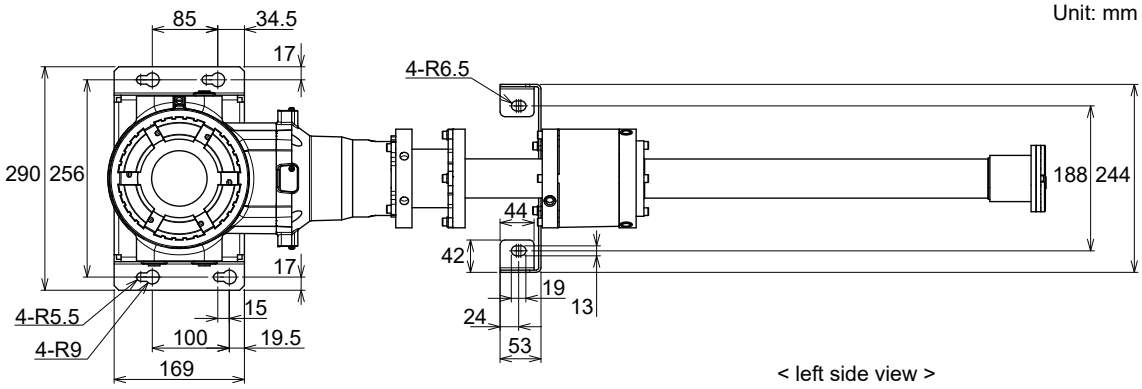
TDLS8200 Probe type Tunable Diode Laser Spectrometer, Flowcell type (Probe length: “-EXT”)

For applications where the TDLS8000, TDLS8100 or TDLS8200 could not be installed or inserted due to the process size, etc., a sampling system can be constructed by replacing the probe part of the TDLS8200 with a flowcell part.

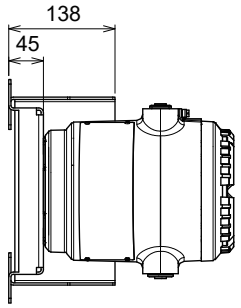


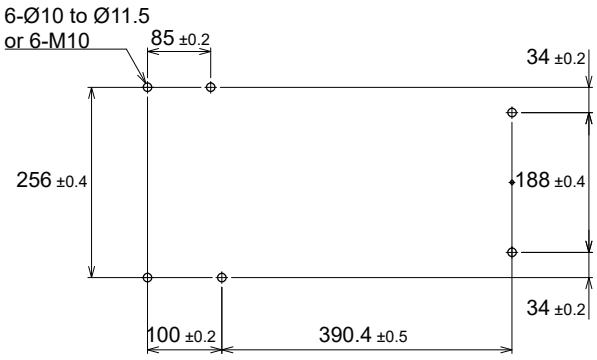
Wall bracket for Flowcell type (Option code: /W)

Unit: mm



< left side view >





< Hole dimensions for wall mounting >

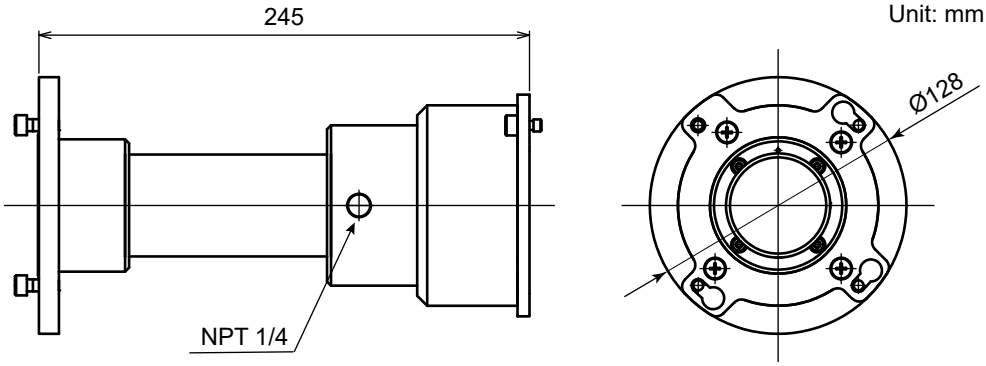
Maintenance space

Same as the standard probe on page 1-17 .

Calibration Cell

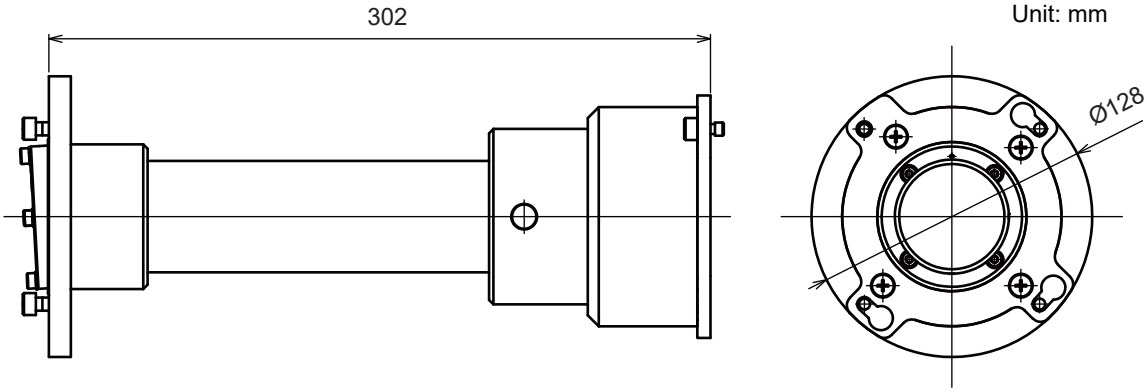
Part number: K9777ZA

Unit: mm



Part number: K9777ZK, K9777ZL

Unit: mm



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2. Installation, Wiring, Optical Axis Adjustment, and Piping

This chapter describes installation, wiring, optical axis adjustment, and purge gas piping in the order they need be performed.
If you use the YH8000, install it after you complete the procedures in this chapter.
For Reflect types, the work procedure is slightly different. See Section 2.5 for a summary.

2.1 Installation

CAUTION

For the safety, POWER OFF the equipment before starting this operation.

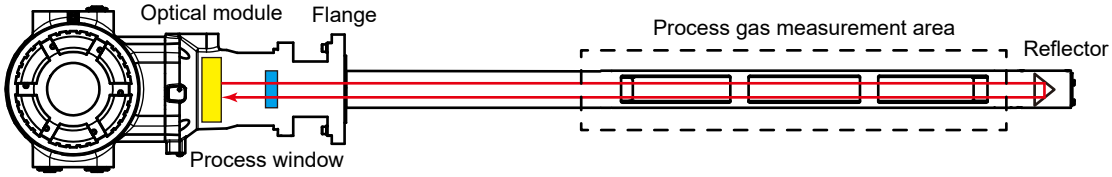
The TDLS8200 uses laser beam.

The laser beam, being emitted from the light source of the analyzer part, reflects at the tip-of-the probe reflector and enters the detector element of the analyzer part.

The optical axis of the laser beam is adjusted to the optimum condition at the factory, but the optical axis may deviate during the installation on to the process.

After the installation, confirm the intensity (transmittance) of the received light signal. Adjust the optical axis as necessary.

Install TDLS8200 in a location with sufficiently wide work area.



CAUTION

During installation, be careful not to drop the product, damage the display.

Refer to “1.1 System configuration” and “1.5 External Dimensions” to install the product.
Reserve enough maintenance space where you can adjust the optical axis.

NOTE

For Reflect type (-REF), use a process isolation valve with an opening whose diameter is at least 40 mm so that you can sufficiently adjust the optical axis of the laser beam after installation. See Figure 2.1.

Flange alignment and installation are important. A proper flange installation ensures accurate optical axis adjustment of the laser beam.

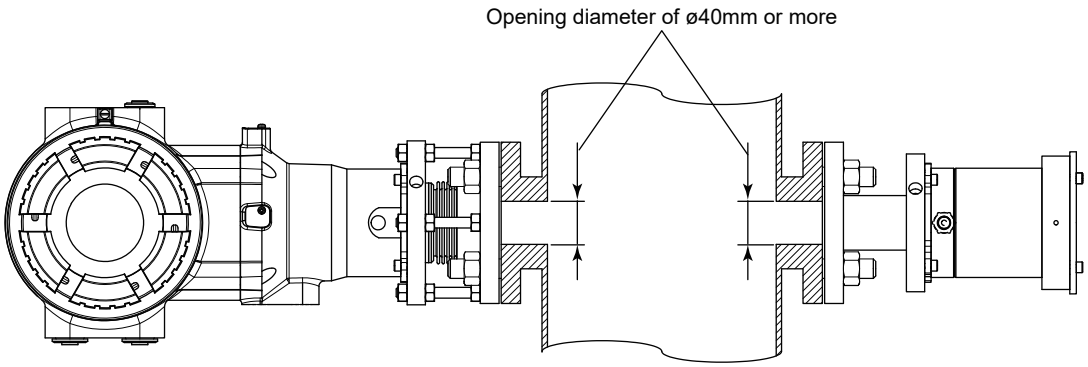


Figure 2.1 Reflect type installation

● Installation conditions

Install the product in a location that meets the conditions indicated in “1.3 Specifications”.

Note the following points.

- Process window purge protects the TDLS8200 from the heat, dust, and corrosive elements of the process gas. Be sure to run the process window purge gas during processing. The process window purge gas flow rate varies depending on the process gas conditions.

  Temperature: Set the purge gas flow rate so that the temperature of the process window area and inside of the purge block does not exceed 55 °C.

  Dust: Set the purge gas flow rate so that the transmission can be maintained. If the transmission decreases over time, the purge flow rate must be increased.

  Corrosion: If the process includes corrosive elements, sufficient purge flow rate is necessary. If the sealant of the TDLS8200’s process window corrodes, the inside of the TDLS8200 will also corrode, causing the TDLS8200 to malfunction. Set the purge gas flow rate appropriately to keep corrosive gas from entering the process window area or inside the purge block.

  Flow rate: Set the purge gas flow rate according to the process gas flow rate. Refer to page 2-28 “■ Purge Gas”.

2.1.1 Measurement Point Selection (Probe type, Reflect type)

Take the following process conditions into consideration when selecting the measurement point.

● Process gas flow rate conditions

Set the measurement point to a location where the concentration distribution of the streamline flow is uniform.

In the case of a duct or flue with a circular cross section, a typical measurement point is where the distance from the end of a curved process area is at least three times the diameter (D) of the duct or flue and where there is nothing that would interfere with measurements.

In the case of a duct or flue with a rectangular cross section, the equivalent diameter (D) can be determined from the following equation.

Diameter (D) = 4 × duct cross sectional area/duct circumference

If such point is not available or if setting a measurement point at such point is not possible, the measurement point is a location two-thirds of the length away from the duct inlet end or one-third from the outlet end.

Once the measurement point is determined, double-check that it is at the appropriate location.

Process gas temperature

Install the TDLS8200 in a location with minimal process gas temperature fluctuations.

If the gas temperature fluctuation where the TDLS8200 is installed exceeds ±10 °C, connect an external thermometer to the TDLS8200 temperature input terminal and enter the actual measured gas temperature to obtain correct measurements (for details, see “4.1.3 Process Temperature”).

Check that a thermometer suitable for the maximum process gas temperature is being used.

In general, the lower the gas temperature, the better the measurement.

Process gas pressure

Install the TDLS8200 in a location with minimal pressure fluctuations.

If the gas pressure fluctuation where the TDLS8200 is installed exceeds ±5 kPa, enter the pressure signal from a separately applied process pressure meter to obtain correct measurements (for details, see “4.1.2 Process Pressure”).

Check that a pressure meter suitable for the maximum process gas pressure is being used.

Check that the process window interfacing the process gas is suitable for the maximum preset gas pressure.

In general, the lower the gas pressure, the better the measurement.

Process dust/particulate concentration

Install the TDLS8200 in a location with minimal dust concentration.

If the installation needs to be implemented in highly dusty condition, utilize blaster equipment and others alike to protect the analyzer from build-up dust. For further information, consult our service.

Process flow rate

Install TDLS8200 at a location with a flow rate of 1 m/s or above. Flow rate of 5 m/sec. or above secures more stable measurement.

Install TDLS8200 at a location with minimum fluctuation of flow rate, otherwise it may result in the deviation of the measurement result.

Process gas flow and probe orientation

Install TDLS8200 so that the probe side with wider opens can face downstream of process gas flow.

2.1.2 Constructing Process Flanges (Probe type, Reflect type)

Process flanges must be provided by the customer.

Process Flange Reinforcing Plate

If the duct or the wall of flue that the process flanges will be attached to is thin or may bend, weld large reinforcing plates around the area where the flanges will be attached. Figure 2.2 and Figure 2.3 show examples of welding reinforcing plates. Secure the necessary strength for installing the TDLS8200 at the customers' own risk.

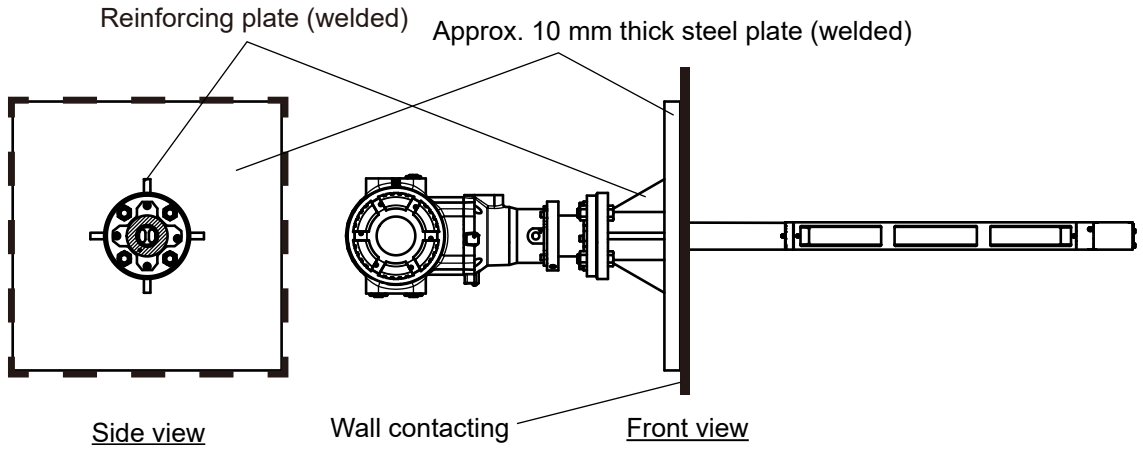


Figure 2.2 Reinforcing plate for process flange (Probe type)

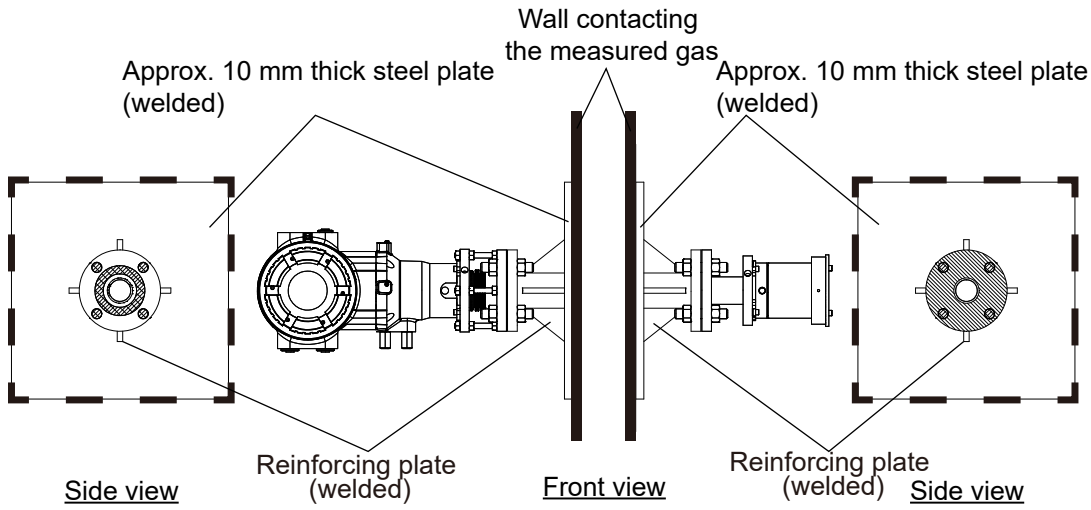


Figure 2.3 Reinforcing plate for process flange (Reflect type)

● Process flange reinforcement construction in a heating furnace (example)

Weld one side of the L-angle, as shown below, to the process nozzle, vertically and horizontally, and weld the other side to the heater frame that is constructed on the furnace.
This prevents deflection of the furnace wall. The tip of the process nozzle should be about 25 mm deep into the process inside the furnace.

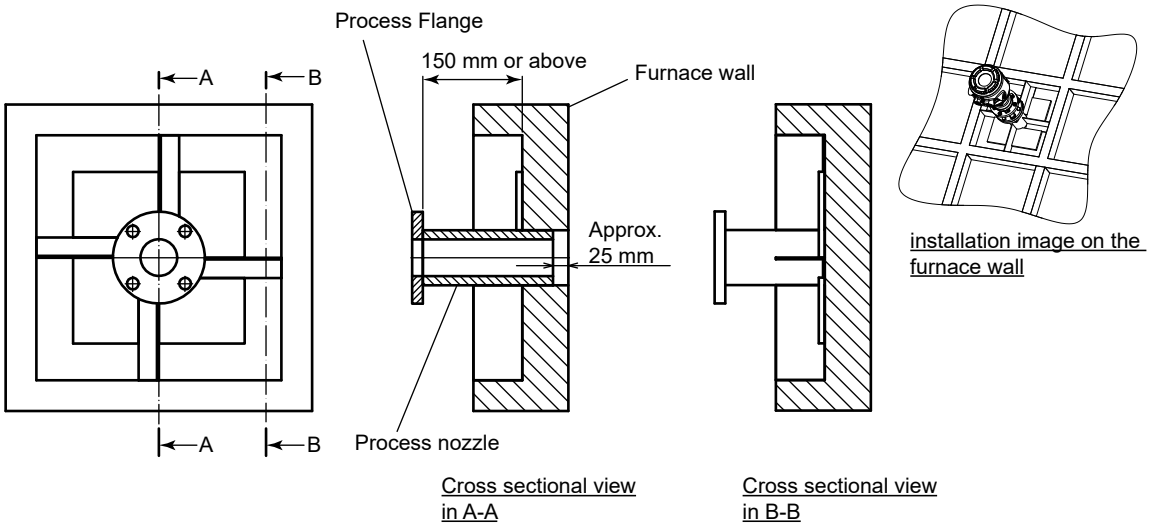
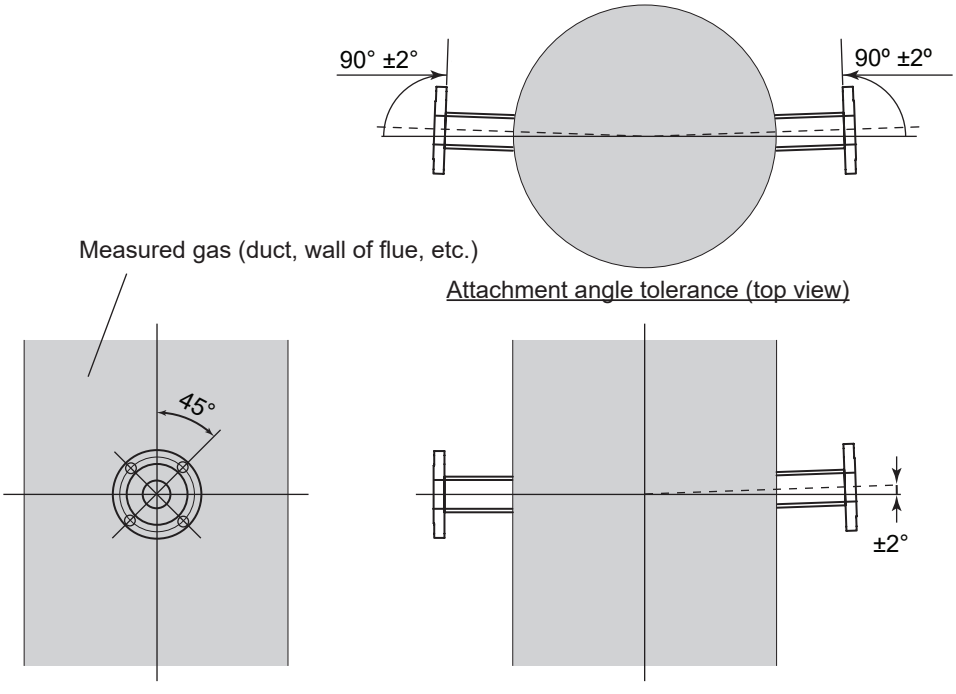


Figure 2.4 Process flange reinforcement construction in a heating furnace (example)

■ Alignment angle tolerance (Reflect type)

The Reflect type (-REF) has an alignment mechanism that allows the laser beam direction to be manually adjusted in a vertical or horizontal plane. Make sure to keep the process flange within the angular tolerances shown in Figure 2.5.



Mount the analyzer unit and reflector unit so that they are mounted in the proper orientation, positioning the flange mounting bolt holes as shown in the figure above.

Mount the flange nozzles on both sides of the analyzer unit and reflector unit so that the overall angular misalignment is within ±2° in any direction.

Figure 2.5 Alignment angle tolerance to the flange

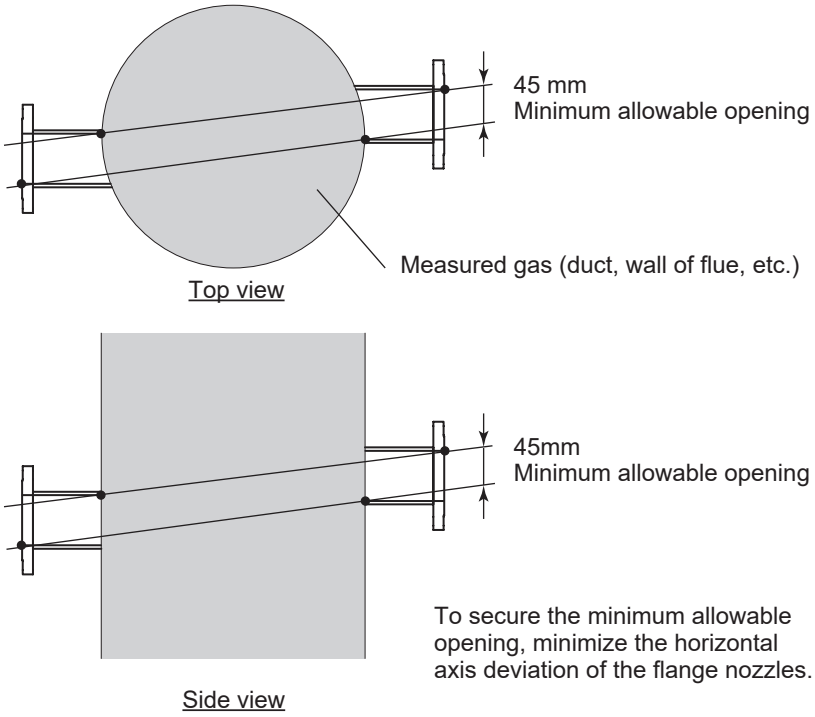


Figure 2.6 Minimum allowable opening

2.1.3 Probe direction (only Probe type)

To introduce process gas to TDLS8200 probe, install TDLS8200 so that the probe openings can face downstream of process gas flow.

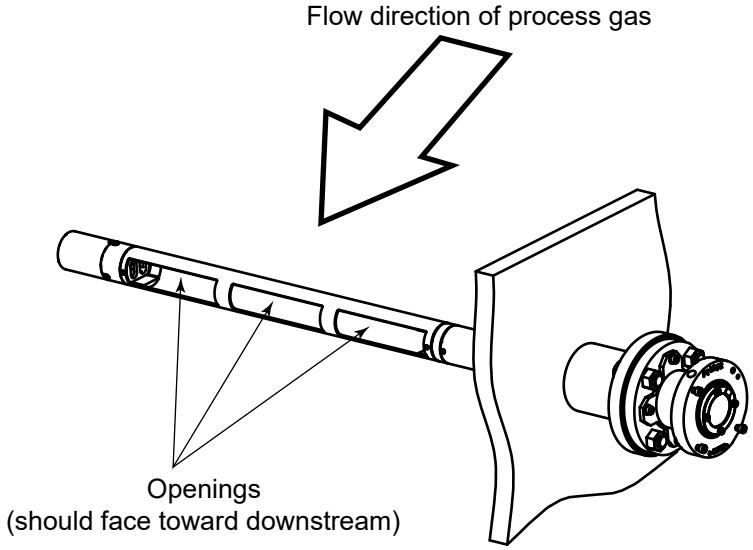


Figure 2.7 Probe opening orientation

TDLS8200 indicator or probe are assembled according to each customer's specification. If you need to change the orientation of the indicator or probe opening, consult Yokogawa service.

2.1.4 Installation of TDLS8200 to the process flange

This section explains how to mount TDLS8200 in the pre-shipping condition directly on process flange.

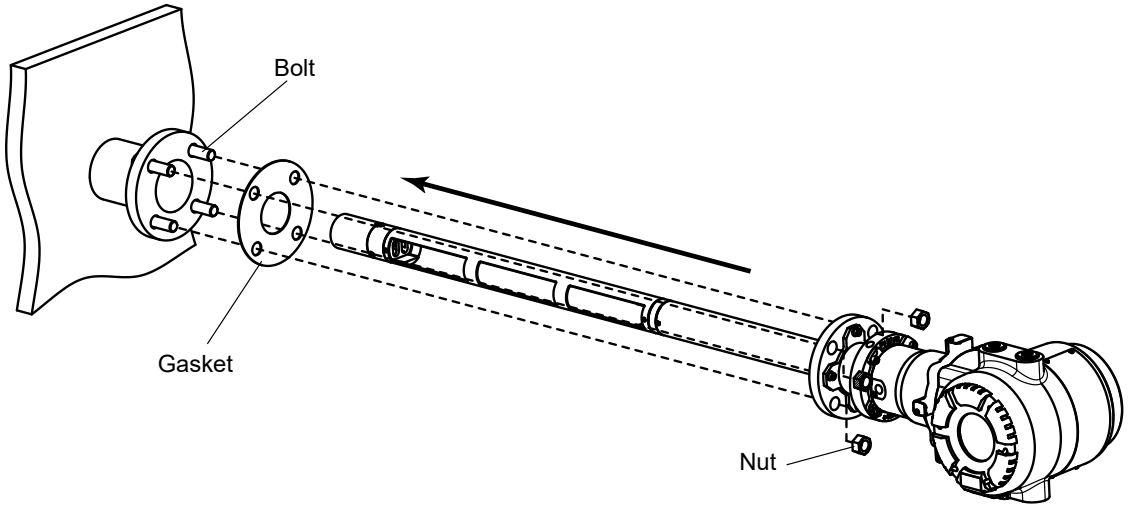


Figure 2.8 Installation TDLS8200 to process flange

Install the TDLS8200 probe on to the process flange in the following steps.

1: Insert a gasket between the process flange and the probe flange.

2: Put bolts through holes on the probe flange and tighten it on to the process flange with nuts. Avoid any loosen part or lost.

CAUTION

- When connecting the probe to the process flange, reserve work area wide enough to the length of the probe.
- Probe must be installed in the proper orientation. Mount the probe so that the side with wider openings can face in the same direction as the flow direction of the process gas. Handle the equipment with care during the installation.

2.1.5 Installation of Analyzer part and probe on to the process flange (only Probe type)

TDLS8200 analyzer part and probe can be separated and be installed on to the process flange in the following steps.

For further information on each part, see “1.1 System configuration” and “1.5 External Dimensions”.

CAUTION

- When connecting the probe to the process flange, reserve work area wide enough to the length of the probe.
- Probe must be installed in the proper orientation. Mount the probe so that the side with wider openings can face in the same direction as the flow of the process gas. Handle the equipment with care during the installation.

Detaching probe and analyzer part

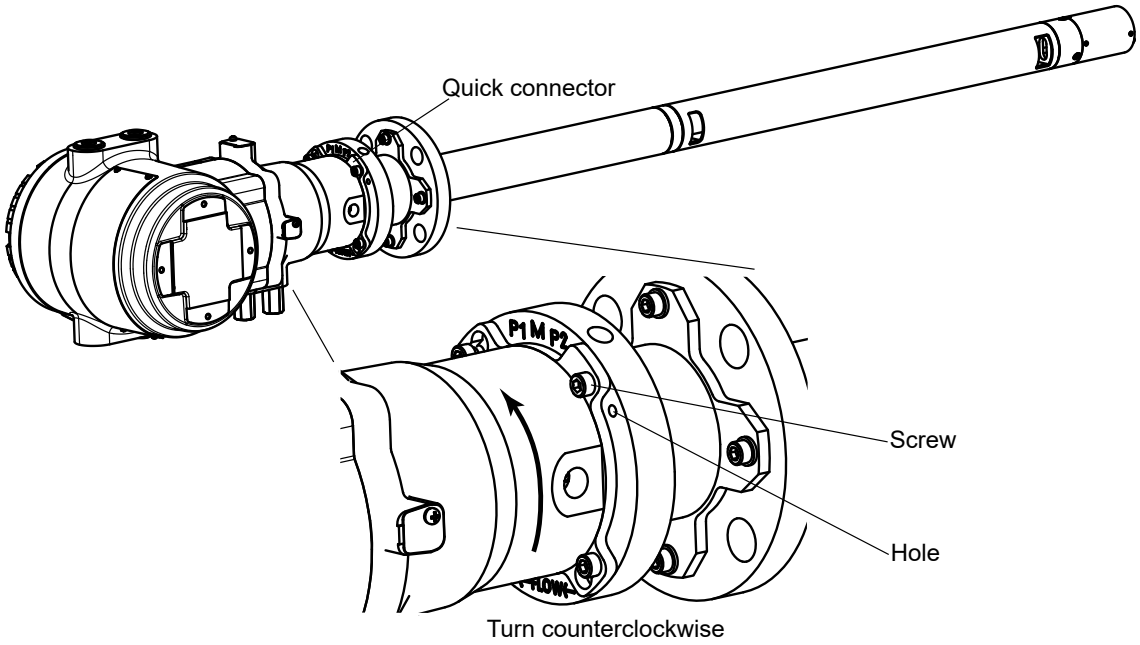


Figure 2.9 Detaching probe from analyzer part

1: Remove a screw on Quick connector as shown in the figure completely from the probe. The screws are stoppers to prevent the equipment from falling.
2: Loosen the rest of the three screws. Don't detach any screw from the process flange.
3: Rotate slowly the analyzer counterclockwise to take it off from the probe.

CAUTION

There is an O-ring between the probe and the analyzer . Be careful not to lose or damage the O-ring when detaching them.

Mounting probe part on to the process flange

TDLS8200 analyzer part and probe part can be detached and be mounted separately onto the process flange. See "1.1 System configuration" and "1.5 External Dimensions".

Attaching probe part to the Process Flange

(1) Insert a gasket between the process flange and flange on the probe part.
(2) Pass the bolts through holes on the probe flange. Fasten the bolts with nuts onto the process flange. Make sure that the nuts are securely fastened so that they do not fall off.

CAUTION

- Probe must be installed in the proper orientation. Mount the probe part so that the side with wider openings can face toward downstream of the process gas. Handle the equipment with care during the installation.
- The process window is where the laser beam passes through. Be careful not to damage or stain the window during installation.

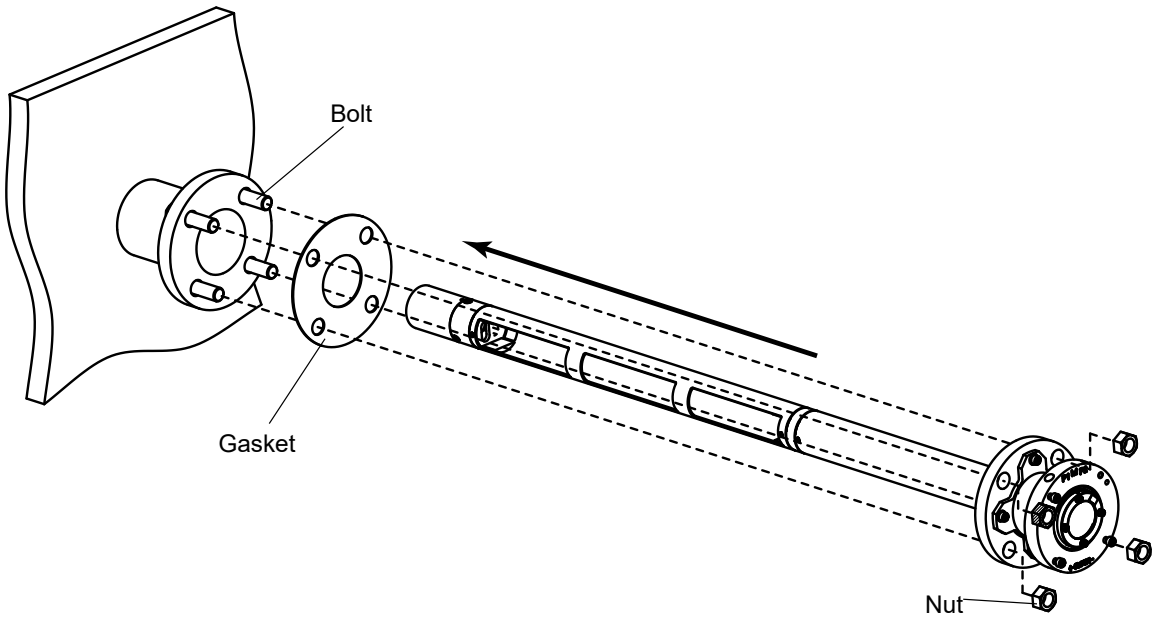


Figure 2.10 Installation of probe part

Installation of the analyzer part

CAUTION

The process window is where the laser beam passes through. Be careful not to damage or stain the window during installation.

After mounting a probe part to the process flange, install the analyzer part according to the following procedure.

(1) First confirm that there are three screws left loosen on the probe part flange after removing the analyzer part. Leave about 8 mm gap from the flange surface. Do not fasten the screw in the upper right hole as viewed from the front. The upper right screw is attached on the analyzer part.

(2) Insert the alignment flange screws that you fastened in (1) in the holes on the mounting surface (quick connectors) of the laser unit (or sensor control unit), and then rotate the unit clockwise.

(3) Temporarily fasten the upper right screw, and then tighten all screws evenly.

CAUTION

Be careful not to damage O-ring or drop it while mounting the analyzer part.

CAUTION

Anti-seizing grease is applied to the screw areas. Keep dust or the like from adhering. If they adhere to the areas, remove them and reapply the anti-seizing grease.

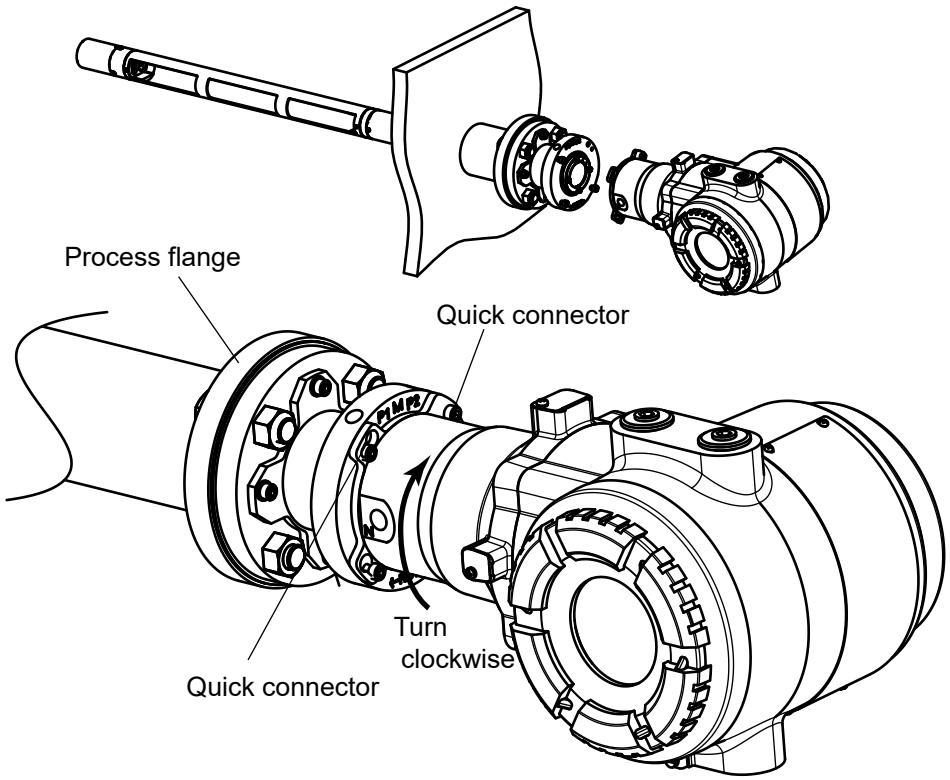


Figure 2.11 How to mount analyzer part

2.1.6 Installation of Flowcell type

Installation of the TDLS8200 Flowcell type (-EXT) is basically wall mounting. Mount it on the wall using the bracket on the analyzer side and the bracket on the Flowcell side. See “1.5 External Dimensions” for wall mounting hole dimensions.

Wall Mounting Bracket Installation

Install the wall mount bracket (/W) according to the following procedure.

(1) Fasten the analyzer side bracket to the analyzer with washers and analyzer mounting bolts (M6 x 10 mm with hexagonal holes).

(2) Secure the Flowcell-side bracket to the Flowcell with the mounting bolt (M6 x 16 mm with hexagonal hole), while holding the bracket between two washers.

In both steps (1) and (2), tighten to a torque of approx. 5 to 6 N•m.

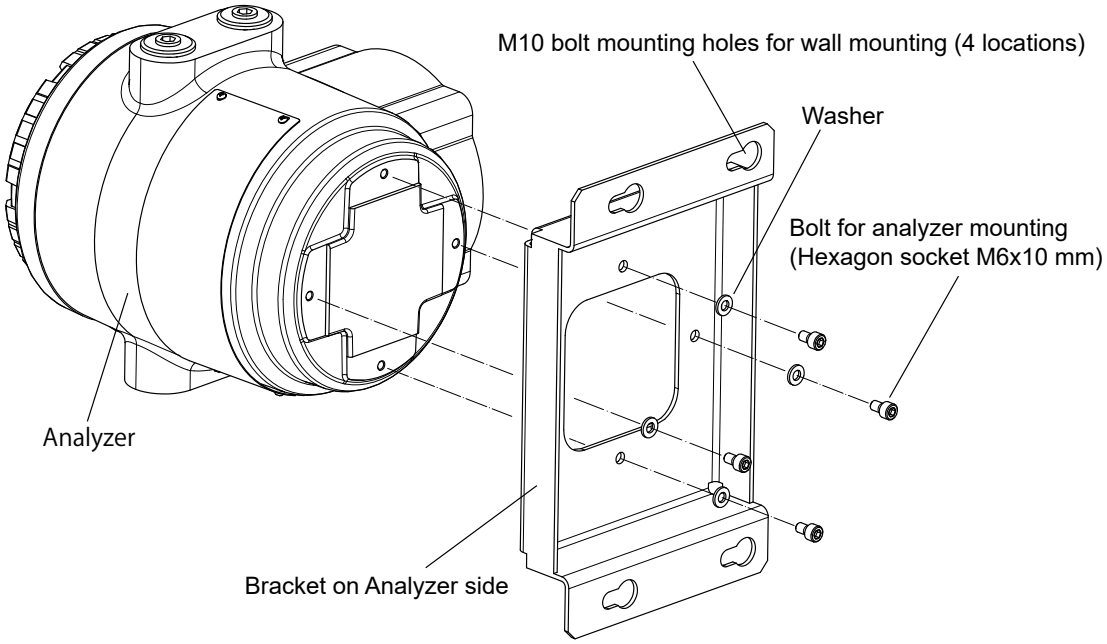


Figure 2.12 Analyzer side

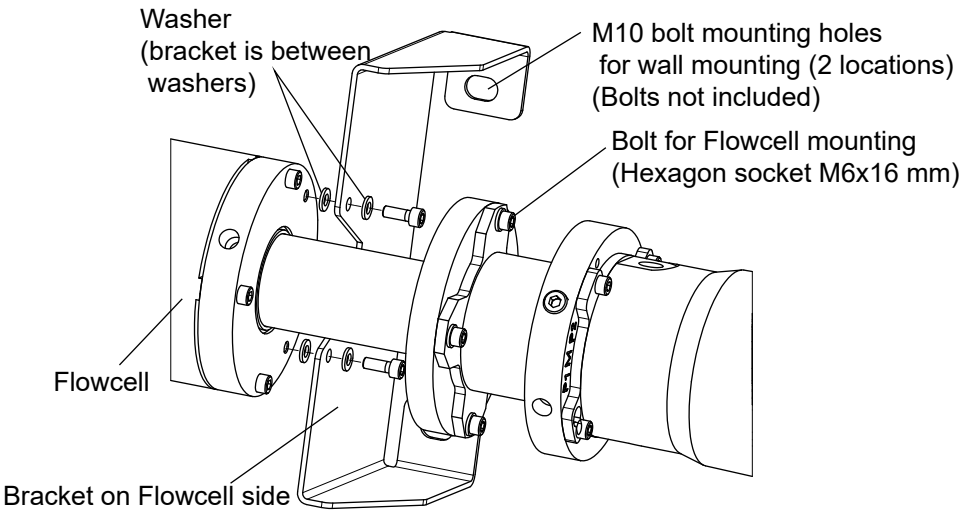


Figure 2.13 Flowcell side

CAUTION

When attaching a thermocouple to the flow cell, the insertion length of the thermocouple should be 32 to 37 mm (see Figure 2.14). Out of this dimension, the thermocouple may contact the retro-reflector and damage it.

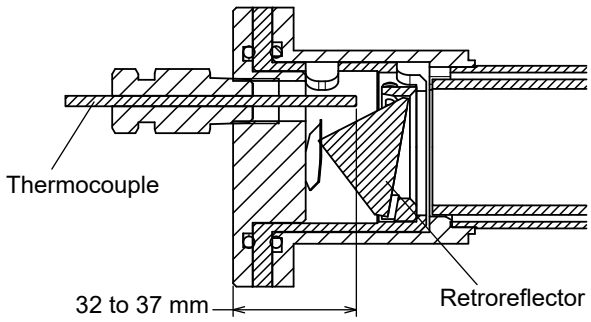


Figure 2.14 Thermocouple insertion length

2.2 Wiring

When the installation is complete, wire the TDLS8200 and external devices.

For wiring of the YH8000, read the YH8000 user's manual (IM 11Y01D10-01EN).

Wiring Precautions

To open the covers, turn the lock screw counterclockwise with the supplied hex wrench to loosen the screw.

After closing the cover, turn the lock screw clockwise to tighten.

CAUTION

- Turning the cover without loosening the lock screw can damage the case or cover. Note that the lock screw is in a loosened state when the TDLS8200 is shipped from the factory.
- If sand or foreign substance adheres to the screw area of the cover or case, wipe it off to prevent it from damaging the screw threads and prevent it from entering the inside of the device.
- Rotate the cover slowly and carefully to remove or install the cover.

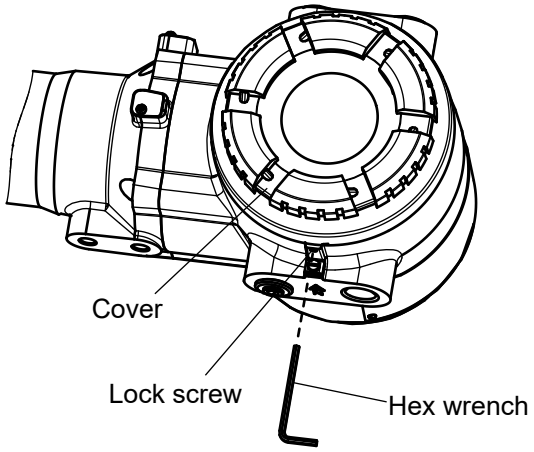


Figure 2.15 Open/Close of cover

CAUTION

Never turn on the power to the TDLS8200 or the devices connected to the TDLS8200 until all wiring is complete.

Wiring procedure

Construct signal cables and power supply cables according to the following conditions.

(1) Be sure to connect the shield to the functional ground terminal for the shielded wire inside the TDLS8200.
(2) Strip the necessary minimum length of outer most covering of signal cables and power supply cables.
(3) When using conduit tubes, do not run power cables in the same conduit as signal cables. Doing so can cause noise interference on signals. Ground metal conduits.
(4) Attach the supplied blind plugs to unused cable glands.
(5) For the cables you need to use, see 2-16 "■ Types of Wiring and Cabling".
(6) When you complete all wiring, close the terminal cover, and fasten with the lock screw.

Cable Entries

Symbols are inscribed near the cable entries for identifying the thread specifications.

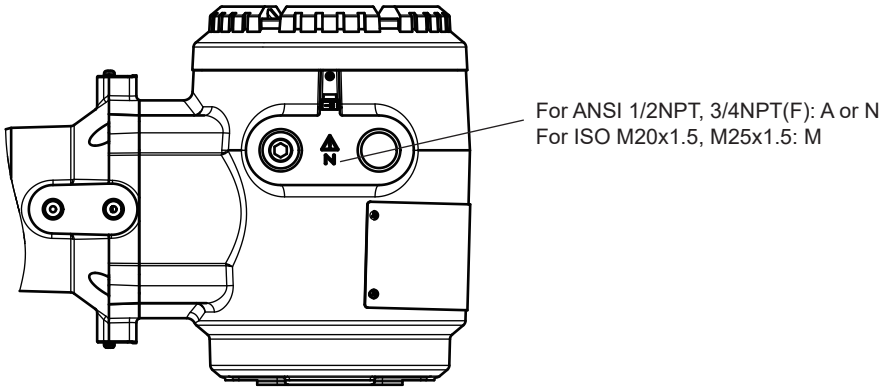


Figure 2.16 Inscribed thread identification

Attach conduits and cable glands with the appropriate screw size to the TDLS8200 cable entries.

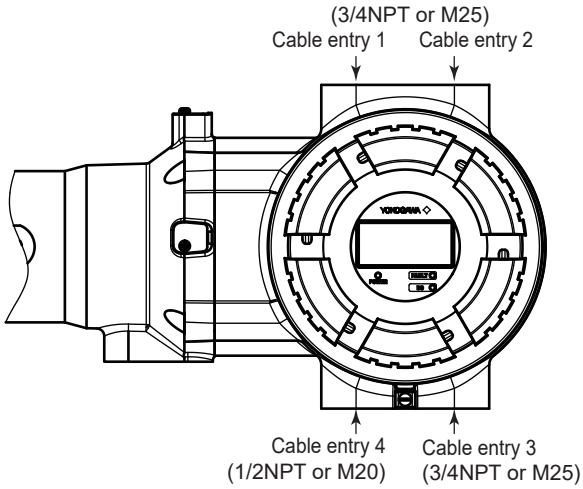


Figure 2.17 Cable entries

Cable entry 1 to 3: Cable entry for power cable or I/O signal cables
Cable entry 4: Cable entry for a cable connecting to the YH8000 or Ethernet cable

TDLS8200 Wiring Terminals

CAUTION

Be careful not to connect the power supply wires to the incorrect locations or reverse the polarity.

In particular, incorrectly connecting the power supply terminals (PWR, VO[HMI]) or solenoid valve control output terminals (SV-1, 2) can damage the TDLS8200 or the devices connected to the TDLS8200.

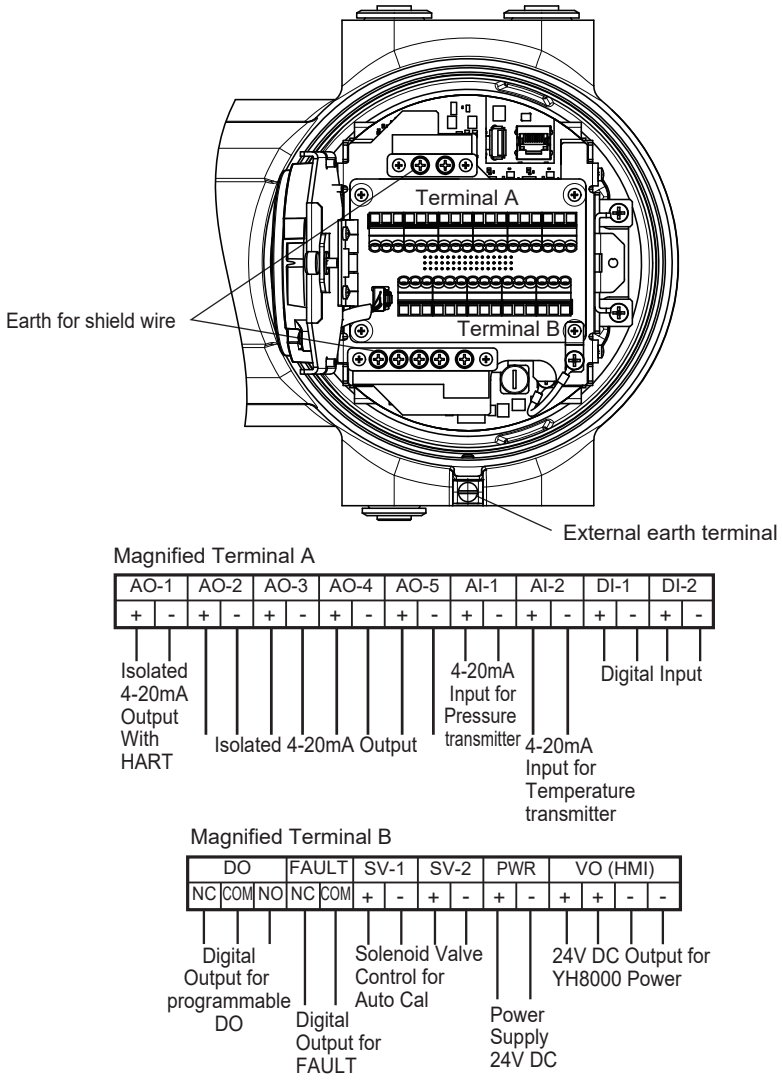


Figure 2.18 TDLS8200 wiring

Table 2.1 Terminals and functions

Terminal block	Terminal name	Function
A	AO-1+	Analog output 1 (4-20 mA)/HART communication port
	AO-1-	
	AO-2+	Analog output 2 (4-20 mA)
	AO-2-	
	AO-3+	Analog output 3 (4-20 mA)
	AO-3-	
	AO-4+	Analog output 4 (4-20 mA)
	AO-4-	
	AO-5+	Analog output 5 (4-20 mA)
	AO-5-	
	AI-1+	Analog pressure signal input (4-20 mA). Connect to a pressure transmitter.
	AI-1-	
	AI-2+	Analog temperature signal input (4-20 mA). Connect to a temperature transmitter.
	AI-2-	
	DI-1+	Digital input 1 Voltage-free digital input terminal. Open: 100 kΩ or more, Closed: 200 Ω or less (including wiring resistance)
	DI-1-	
	DI-2+	Digital input 2 Voltage-free digital input terminal. Open: 100 kΩ or more, Closed: 200 Ω or less (including wiring resistance)
	DI-2-	
	DO NC	Programmable digital output Between NC and COM: Closed when the specified operating condition is met Between NO and COM: Open when the specified operating condition is met
	DO COM	
	DO NO	
	FAULT NC	FAULT signal digital output Closed when the device is operating normally; open when a fault occurs or when the power is off
	FAULT COM	
	SV-1+	Solenoid valve control output 1. Output rating: 24 V DC, 0.5 A max.
	SV-1-	
	SV-2+	Solenoid valve control output 2. Output rating: 24 V DC, 0.5 A max.
	SV-2-	
	PWR+	Power supply. 24 V DC ± 10%
	PWR-	
	VO[HMI]+	Power supply terminal for the YH8000. 24 V DC
	VO[HMI]-	

Types of Wiring and Cabling

CAUTION

Use cables with a durable temperature of at least 75 °C.

CAUTION

Use cables that are appropriate for the environment that the product is installed in. Use cables with an outer diameter that matches the cable gland that you are using.

Table 2.2 Types of wiring

Cable entry	Cable type	Nominal cross sectional area, conditions	Shield	Terminal	Withstand voltage, flame resistance	Section
1, 2, 3	Power supply	AWG18 to AWG14 Two-core or three-core (when using the functional ground terminal inside the device)	Required	Wire: (Note) Shield: M4 screw crimp-on terminal	500 V or more VW1	2.2.1
	I/O cable	Multi-core cable Up to 21 cores A terminal box or the like is required when branching the signals externally.	Required	Wire: (Note) Shield: M4 screw crimp-on terminal	500 V or more VW-1 or more	2.2.2 to 2.2.6
4	YH8000 connection cable	Special cable (YH8000 option) AWG24 4 pairs Covering outer diameter approx. 8.4 mm	Required	Shield: M4 screw crimp-on terminal	500 V or more FT-4	YH8000 User's manual (IM 11Y01D10-01EN)
	Ethernet cable	CAT.5e AWG24 4 pairs 100 m max.	Required	Shield: M4 screw crimp-on terminal	VW-1 or more	2.2.7
Functional ground terminal (external)	Functional grounding	AWG16 or more	Not required	M5 screw crimp-on terminal		2.2.1

Note: Use cables with outer diameters that match the conduits or cable glands that you are using. The following terminals are recommended depending on the specifications of the terminal block you are using.
Single: H05(07)V-U, Stranded: H05(07)V-R, Thin stranded: H05(07)V-K,
Sleeve without insulating cover: DIN46228/1, Sleeve with insulating cover: DIN46228/4

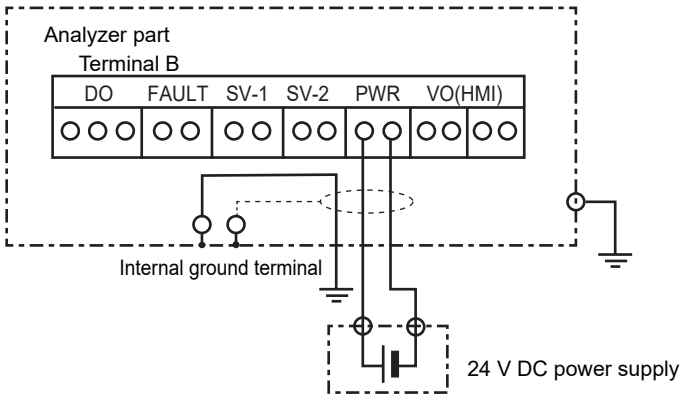
2.2.1 Connecting the Power Cable and Grounding

CAUTION

Connect the power supply wires to the correct locations and don't reverse polarity.
Incorrectly connecting "PWR" the power supply can cause the TDLS8200 to malfunction.

Use two-core or three-core shielded cable to wire the power supply.

For ground wiring, use the internal ground terminal or external ground terminal. If you want to use the internal ground terminal, use a three-core power cable. Be sure to ground the cable shield on the both TDLS8200 side and on the other side.



2.2.2 Connecting to Temperature and Pressure Transmitters

This section explains the wiring for receiving current signals (4 to 20 mA DC) from a temperature and pressure transmitters. Connect AI-1 to a pressure transmitter and AI-2 to a temperature transmitter.

For analog input settings, see “4.3 Analog Input Settings”.

Connection Preparation

To supply power to the transmitters from the TDLS8200, set the switch inside the analyzer part to Active AI. To supply power externally, set to Passive AI. If you want to connect to a 4-wire system pressure meter or thermometer, set to Passive AI.

The factory default setting is Passive AI.

	Switch state		
	Applicable switch	External power supply	Power supply from the TDLS8200
AI-1 (pressure signal)	SW1	Passive AI	Active AI
AI-2 (temperature signal)	SW2	Passive AI	Active AI

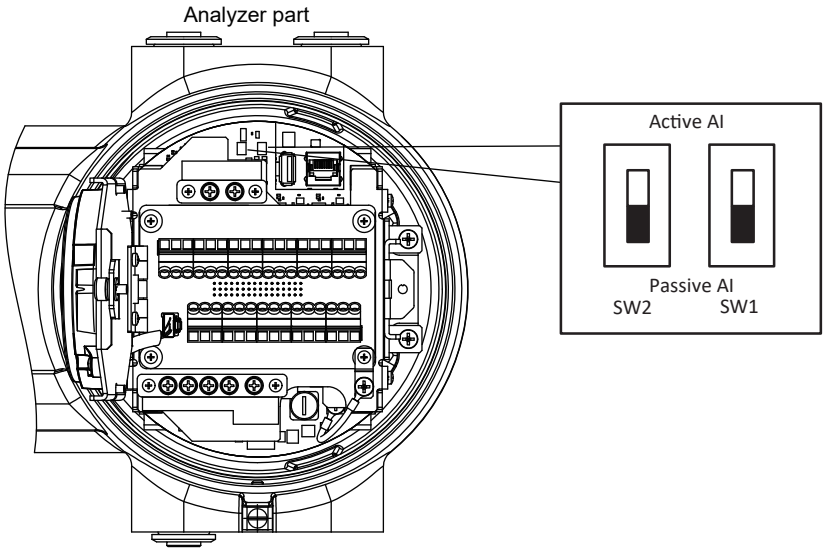


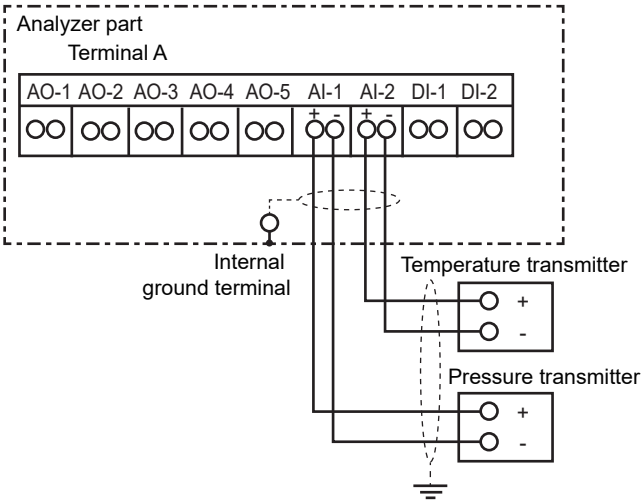
Figure 2.19 SW1 and SW2 settings

CAUTION

To avoid damages on devices, be sure to check that the TDLS8200 is turned off before setting SW1 or SW2.

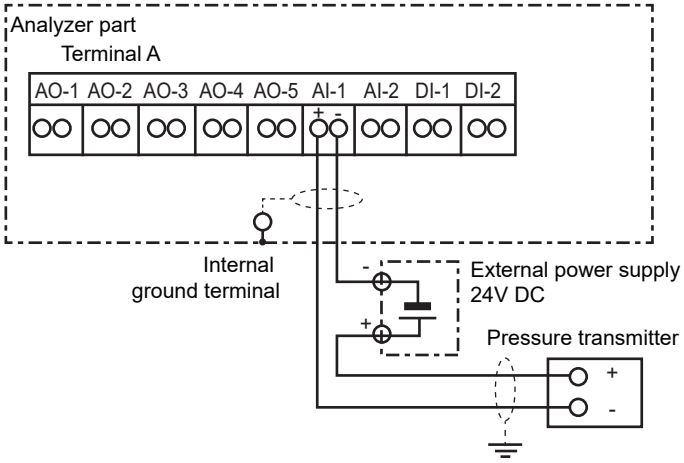
■ Connecting a Pressure Meter and Thermometer

Connect the analog output terminals of the transmitters as follows. The terminal polarity is the same for Passive AI and Active AI.



■ When Connecting an External Power Supply Such as a Distributor

If you need to connect an external power supply such as a distributor to a 2-wire system transmitter, connect it as follows. Set the switch to Passive AI.



● Wiring procedure

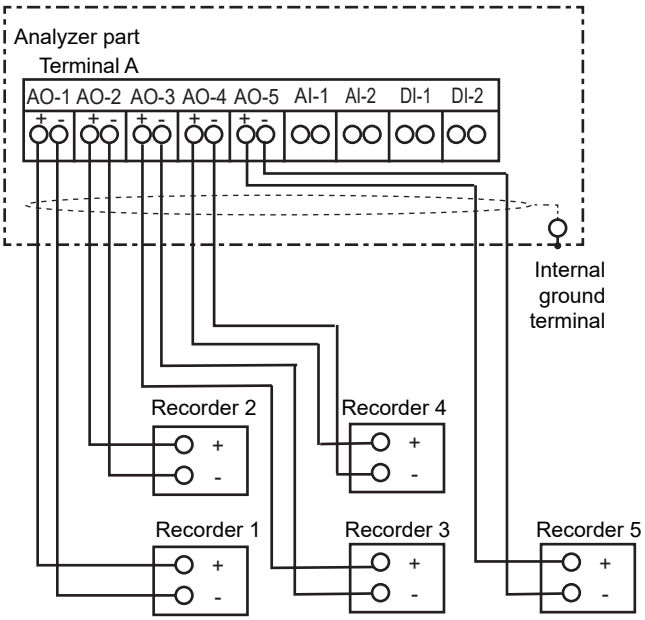
- For the cable type to use, see page 2-16 “■ Types of Wiring and Cabling”.
- Be sure to ground the cable shield on the TDLS8200 side and on the other side.
- When supplying power to the transmitters from the TDLS8200, take into account the drop in the transmitter supply voltage due to wiring resistance and the like.

CAUTION

Do not apply current exceeding the allowable value to AI. Doing so can cause a malfunction.

2.2.3 Wiring Analog Outputs (AO)

This section explains the wiring for transmitting concentration, transmission, and other analog outputs to a recorder or other device. Only AO-1 supports HART communication. For analog output settings, see “4.4 Analog Output Settings”.



Wiring procedure

- For the cable type to use, see page 2-16 “■ Types of Wiring and Cabling”.
- Be sure to ground the cable shield on the TDLS8200 side.
- For each output, keep the load resistance including the wiring resistance 550 Ω or less.
- During HART communication, keep the load resistance including the wiring resistance within the allowable load resistance range specified by the HART communication specifications, which is 250 to 550 Ω. (AO-1 only)

CAUTION

Be careful not to reverse the polarity when wiring. Doing so can cause a malfunction.

2.2.4 Wiring Digital Outputs

The following digital outputs are available. Both contacts are voltage-free dry outputs (mechanical relay digital outputs). The contact rating is 24 V DC 1 A for both contacts.

For digital output settings, see “4.5 Digital Output Settings”.

● DO digital output (DO)

A user-defined function can be assigned to this contact through configuration. It is a C-contact (transfer contact) consisting of three terminals: COM, NC, and NO. It is always de-energized and cannot be changed. The NC and NO markings on the terminals indicate the de-energized state.

<DO>

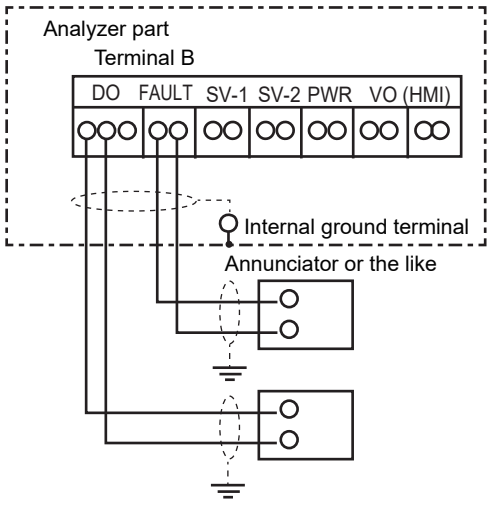
Contact state	State between the NO and COM terminals	State between the NC and COM terminals
Power off	Open	Closed
Output on	Closed	Open
Output off	Open	Closed

● FAULT digital output (FAULT)

This contact transmits a signal when a fault occurs. It is an A-contact (make contact) consisting of two terminals: COM and NC. It is always energized and cannot be changed. The NC marking on the terminal indicates the energized state.

<FAULT>

Contact state	State between the NC and COM terminals
Power off	Open
Output on	Open
Output off	Closed



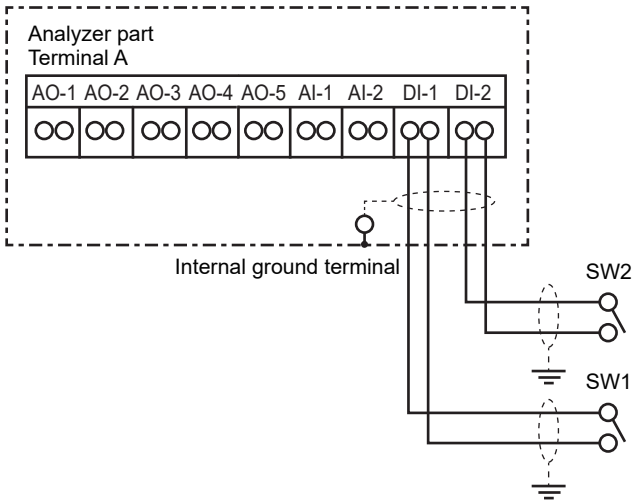
● Wiring procedure

- For the cable type to use, see page 2-16 “■ Types of Wiring and Cabling”
- Be sure to ground the cable shield on the TDLS8200 side and on the other side.
- The contact rating is 24 V DC 1 A. Connect a load (e.g., indicator lamp, annunciator) that will not cause these values to be exceeded.
- For the DO digital output, select whether to wire NC or NO depending on your application.

2.2.5 Wiring Digital Inputs

The TDLS8200 executes specified functions when it receives contact signals. There are two inputs. Apply voltage-free contact signals. The digital input terminal outputs 5 V DC.

For digital input settings, see “4.7 Digital Input Settings”.



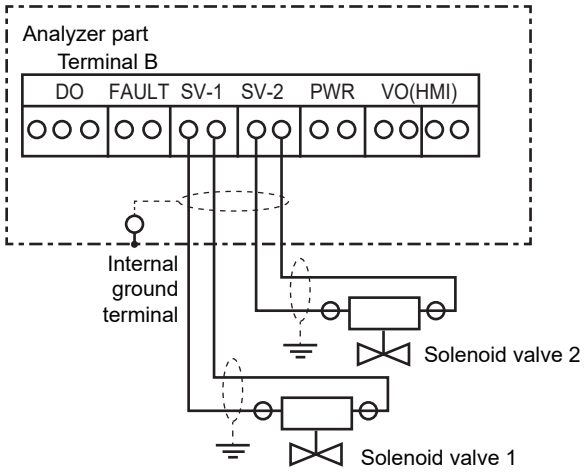
● Wiring procedure

- For the cable type to use, see page 2-16 “■ Types of Wiring and Cabling”.
- Be sure to ground the cable shield on the TDLS8200 side and on the other side.
- The open and closed levels of the digital inputs are identified by the resistance seen from the TDLS8200 side. Wire the digital inputs to meet the following conditions. Note that wiring resistance is included.
  If the DI terminals are shorted, about 2 mA of current will flow.

	Closed	Open
Resistance	200Ω or less	100 kΩ or more

2.2.6 Wiring Solenoid Valve Control Outputs

These outputs control the solenoid valves that are used during calibration and the like. There are two outputs. Each can supply 24 V DC 500 mA max.



Wiring procedure

- For the cable type to use, page 2-16 “■ Types of Wiring and Cabling”.
- Be sure to ground the cable shield on the TDLS8200 side and on the other side.

CAUTION

- The output rating is +24 V DC 500 mA max. Check that the solenoid valves that you want to use do not exceed these values before connecting them.
- Do not short the SV terminals when the solenoid valve control output is on. Doing so will cause the internal protection fuse to melt, preventing output. If this happens, the component needs to be replaced.

2.2.7 Connecting an Ethernet Cable

NOTE

Reception of numerous invalid packets may affect the TDLS8200 functionality.
When connecting the TDLS8200 to a network, manage the network appropriately.

If you want to connect the TDLS8200 to an YH8000 (HMI unit) through an Ethernet hub or to an external device through Modbus/TCP communication, you will need to use an Ethernet cable.

The Ethernet cable connector must be crimped during the TDLS8200 installation.

NOTE

- Before crimping the Ethernet connector, pass the cable through cable gland. After crimping the Ethernet connector, the connector cannot be passed through the cable glands.
- Be careful of the cable gland orientation. The end with the screw section of the cable gland is the connector end.

- Use an eight-core CAT 5e shielded cable for the Ethernet cable.
  Use a braided wire type shield. If the shield is a metallic foil type, the shield may not be properly grounded.
  Use a cable with straight wiring.
- Use a cable gland with a cable diameter specification that matches the outer diameter of the Ethernet cable.

● Processing method for Ethernet cables

• Required parts and tools

RJ45 modular plug, RJ45 modular plug crimp tool, LAN cable tester,
Wire cutter, Wire stripper

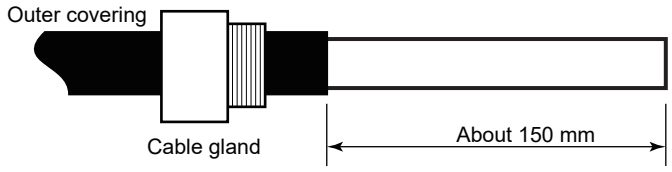
Round crimp-on terminal (for shielded wires) *1, Crimp tool for round crimp-on terminals,
Heat shrink tube *2, Heating gun (for shrinking heat shrink tubes)

*1: For M4 screw. Use the appropriate crimp-on terminals for the Ethernet cable that you are using.
Crimp-on terminal example:
For M4 screws, nominal cross sectional area of wire 2 mm^2
FV2-4 by J.S.T. Mfg. Co.,Ltd. or 170782-1 by TE Connectivity, or equivalent

*2: Used to cover the shielded parts of the Ethernet cable.
Use the appropriate heat shrink tube for the Ethernet cable that you are using.
Heat shrink tube example:
For shielded wires: inner diameter 4 mm, length about 140 mm
For external cable covering: inner diameter 10 mm, length about 30 mm

(1) Pass the Ethernet cable through the cable gland.

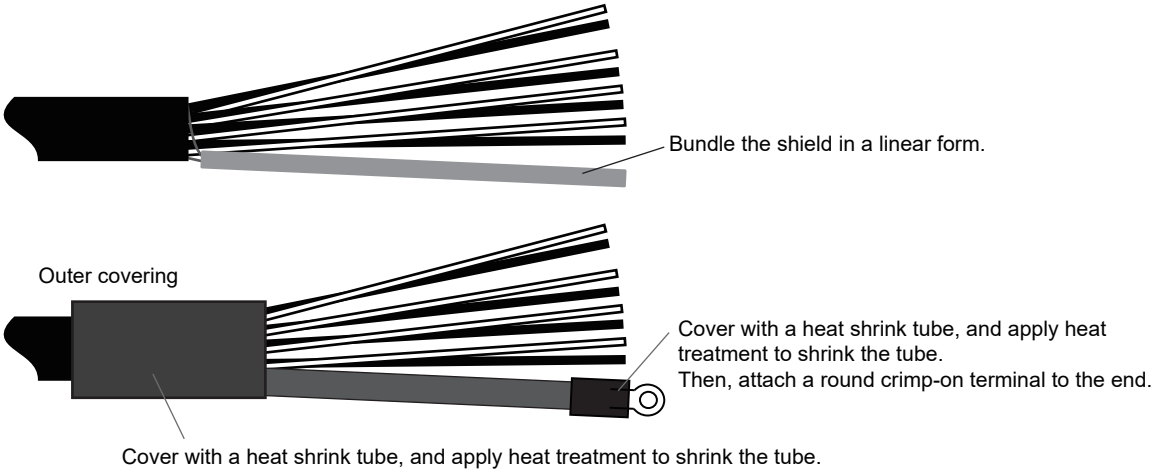
(2) Remove about 150 mm of covering from the shielded Ethernet cable.
Be careful not to cut off the shield.



(3) Bundle the shield in a linear form, cover it with a heat shrink tube, and apply heat treatment to shrink the tube.

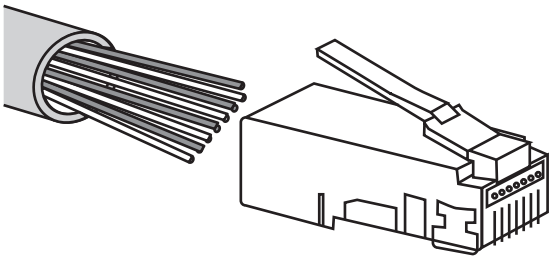
Then, attach a round crimp-on terminal to the end of the shield.

Cover with a heat shrink tube the section of the cable where the covering was removed, and apply heat treatment to shrink the tube.



(4) Crimp an RJ45 modular plug onto the end of the Ethernet cable.

Pin No.	Wire color
1	White-orange
2	Orange
3	White-green
4	Blue
5	White-blue
6	Green
7	White-brown
8	Brown



Insert the wires in the correct arrangement into the RJ45 modular plug, check that the wires are firmly inserted, and then crimp the plug with a RJ45 modular plug crimp tool.

Finally, check that the plug has been crimped on properly by testing the connection with a LAN cable tester.

(5) Insert the RJ45 connector into the TDLS8200 Ethernet port and the round crimp-on terminal at the end of the shielded wire to the functional ground terminal (M4 screw) inside.

2.3 Optical Axis Adjustment

When wiring is complete, turn on the power, and adjust the optical axis as necessary.

CAUTION

The TDLS8200 is a Class 1 laser product. As such, the laser level of the product is safe to the eyes, but do not intentionally look at the laser light source. The TDLS8200 laser unit emits laser beam from the analyzer part as soon as the power is turned on. Turn the power on after installing TDLS8200 probe or calibration cell in a condition where the laser beam is not irradiated outside the process.

TDLS8200 optical axis is adjusted at factory to optimum level and shipped with 100% transmission.

However, the optical axis may deviate after disassemble or reassemble of probe or during the TDLS8200 installation at site. If the transmission falls below 70%, check again that the installation according to “2.1 Installation” had any problem.

If the transmission level still stays low, take the following measures.

When the TDLS8200 is turned on, transmission is indicated on the display as “Trans **.*%.”.

Use the optical axis adjustment knob so that this transmission is maximized. (See Figure 2.16.)

The transmission display is updated every analysis period. The standard analysis period is 2 to 5 seconds. For details on the analysis period, see “Appendix 1 What is an Analysis Period?”

While adjusting the optical axis, check the updated display showing the most recent transmission. Note that it is possible to determine when the transmission is updated by the way each display changes its displayed content.

For details, see “1.2 Name and Function of Each Part”.

Optical Axis Adjustment

As shown in Figure 2.20, there are some optical axis adjustment knobs on TDLS8200. Their position varies depending on the specification of each equipment. Unused knobs are sealed with stickers.

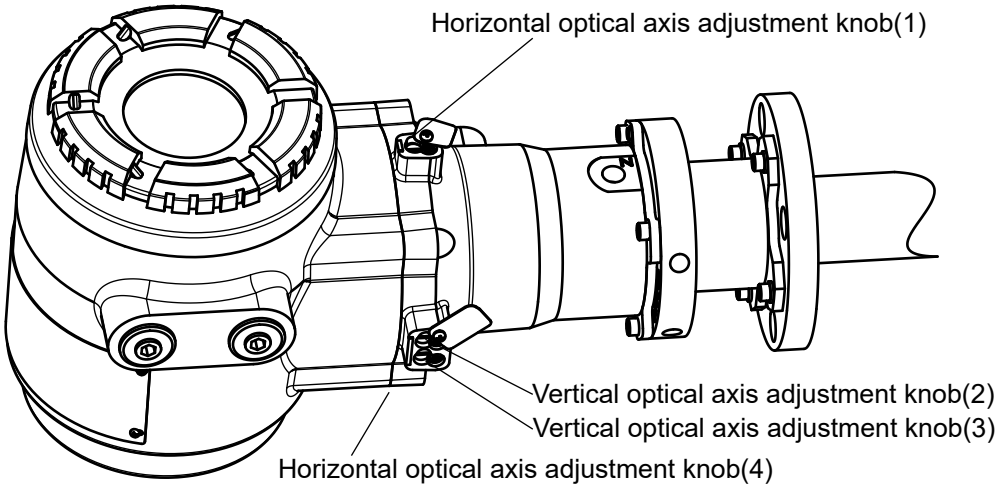


Figure 2.20 Optical axis adjustment

To adjust optical axis, use specific adjustment knobs to each measured component as below.

Adjustment knob (number)	Measured component
(1)	CO, CO+CH4, NH3, HCl (-C2, -C3, -C4, -A1, -L1)
(2)	CO, CO+CH4, NH3, HCl (-C2, -C3, -C4, -A1, -L1)
(3)	O_2 (-X1, -X2)
(4)	O_2 (-X1, -X2)

(1) Loosen the threads on the cover of Vertical/Horizontal axis optical adjustment knobs.

(2) Rotate the knobs to make the transmission maximized. Wait to check the transmission on the display until the display is updated more than two times. The transmission is susceptible to the knob's rotation. Rotate the adjustment knobs little by little to find the maximum level of the transmission. The optical axis adjustment can be implemented in vertical/horizontal both direction.

(3) Seat the knob cover.

(4) Transmission calibration

After the optical axis adjustment described above is complete, perform transmission calibration by assuming the maximum transmission value that was obtained to be 100%. (“6.1.1 Transmission Calibration”).

CAUTION

- Move the optical axis adjustment knob in small increments. If you move the optical axis adjustment knob in large increments, the beam may move so much that the transmittance may be lost.
- Do not overtighten the optical axis adjustment knob.

2.4 Piping

After wiring and optical axis adjustment are complete, connect the pipes for the purge gas.

After piping is complete, to keep the TDLS8200 process window area clean, we recommend that you let the purge gas flow until the beginning of operation.

CAUTION

To maintain the dust proof and waterproof performance of the TDLS8200, attach pipes or plugs to all ports.

For the piping thread specifications, check the inscriptions near the ports (Rc1/4: M, 1/4NPT: A or N).

Piping Parts

Refer to the following table, and check that all the necessary piping parts are available.

Device	Piping location	Piping parts	Remarks
TDLS8200 (Probe type, Reflect type)	Optical Purge port	Tube joint	Rc1/4 or 1/4NPT, off-the-shelf product
	Validation purge port	Tube joint	Rc1/4 or 1/4NPT, off-the-shelf product
	Process purge port	Tube joint	Rc1/4 or 1/4NPT, off-the-shelf product
	Reflector purge port	Tube joint	Rc1/4 or 1/4NPT, off-the-shelf product
TDLS8200 (Flowcell type)	Optical Purge port	Tube joint	Rc1/4 or 1/4NPT, off-the-shelf product
	Validation purge port	Tube joint	Rc1/4 or 1/4NPT, off-the-shelf product
	Chamber purge (IN)	Tube joint	Rc1/4 or 1/4NPT, off-the-shelf product
	Chamber purge (OUT)	Tube joint	1/4 NPT only
	Sample gas port	Tube joint	1/4 NPT only
	Thermocouple inlet	—	1/4 NPT only
Calibration cell	Piping port	Tube joint	1/4NPT, off-the-shelf product

Purge Gas

Refer to the information provided in the specifications of “1.3 Specifications”.

(1) Purge gas type

Normally, nitrogen (N_2) is used for the purge gas, but depending on the application, instrumental air may suffice.

Use nitrogen gas or instrumental air that meets the following conditions.

- Use clean one. Dust particle diameter is less than 0.5 µm.
- Gas does not contain oil.
- Nitrogen gas with 99.99% or higher purity when measuring O_2.
- Instrument air should be dehumidified to a dew point of -20°C or less.

(2) Areas that needs to be purged

The TDLS8200 needs to be purged with nitrogen gas for the following two purposes.

First is to prevent open-air oxygen and moisture from entering the measurement optical path during process gas concentration measurements. This purge uses nitrogen gas and runs continuously, called *analyzer internal purge*. Within the analyzer, the purge area is divided into two, optical module area and validation area.

When validation is performed, the purge gas in the validation area is temporarily switched to check gas.

The second purpose is to keep clean the reflector at the tip of probe, or process window contacting process gas and prevent process dust from adhering to them. This purge runs continuously and is called *process purge* or *reflector purge*.

Purge inlets are located on different positions between process window purge and reflector purge.

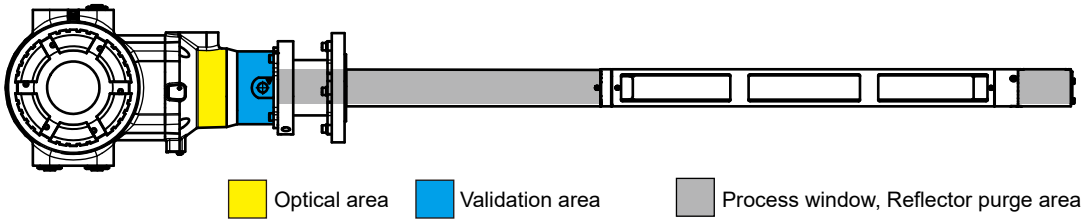


Figure 2.21 Purge position (Probe type)

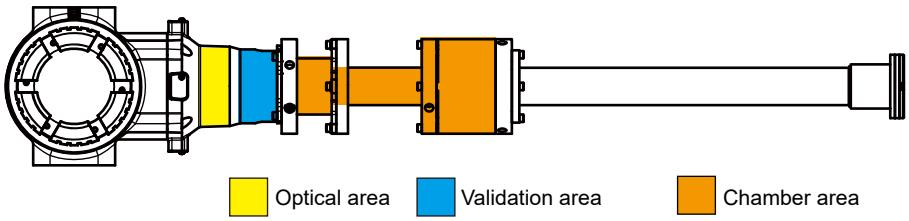


Figure 2.22 Purge position (Flowcell type)

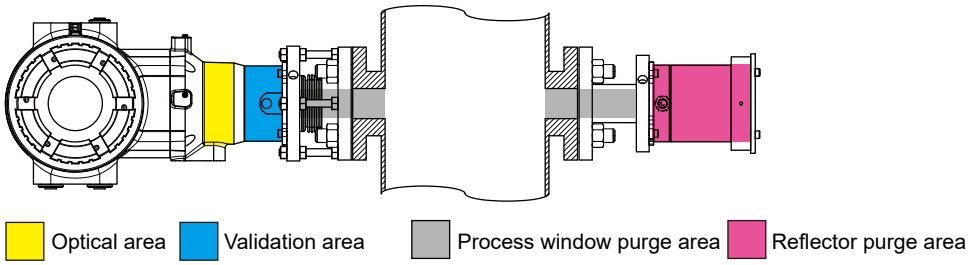


Figure 2.23 Purge position (Reflect type)

CAUTION

To protect the analyzer from humidity and ambient conditions, always supply an “Analyzer internal purge” while the analyzer is powered on. If purge gas supply is not available, be sure to turn off the analyzer.

When the power is turned off and the purge gas supply is shut off, shut off the gas with a valve or the like so that the gas does not flow into the analyzer from the piping port.

(3) Purge gas flow rates

Feed purge gases with the following purge flow rates.

- Optical module area:
  general purpose: 2 to 20L/min (Application dependent)
  Explosionproof: 100 to 200mL/min (not exceeding 10 kPa at the inlet)
  * Not more than 10 kPa at the inlet for explosionproof.
- Validation area:
  10 to 20 L/min (Application dependent)
- Other area:
  [Probe type]
  Process window purge area, Reflector purge area:
  See the next table and configure the purge rate according to the process gas temperature and its flow rate. The table shows each flow rate of process window purge and reflector purge.

Process gas flow (m/s)	Purge gas flow rate (L/min) @ process temp. RT-300 ºC	Purge gas flow rate (L/min) @ process temp. 300-600 ºC	Purge gas flow rate (L/min) @ process temp. 600-850 ºC
1 to 5	15 to 25	5 to 15	0.5 to 5
5 to 10	25 to 45	5 to 25	1 to 5
10 to 20	40 to 60	20 to 40	5 to 20
2o to 30	45 to 80	20 to 45	10 to 30

Purge gas flow rate shown in the table above applies to the purge for both process window and reflector.

Info. Higher process temperature leads to lower flow rate of purge gas. The relationship is linear between process temperature and purge flow rate.

[Flowcell type]
Chamber area: 2 to 20L/min (Application dependent)
[Reflect type]
Process window purge area: 5 to 30 L/min (Application dependent)
0 L/min (only when neither process gas flow nor dust is present.)
Reflector purge area: 2 to 30 L/min (Application dependent)

(4) Exhausting purge gas

Purge gas exhaust is as follows.

- Analyzer internal purge:
  Connect pipes to outlet ports if necessary, to exhaust the purge gas to an appropriate location. Construct them so that rainwater and the like do not enter the ports.
  If you are using hazardous gas (e.g., CO gas) for check gas, exhaust it inside the process or in an appropriate manner.
- Process window purge, Reflector purge:
  The gas is exhausted inside the process. However, the reflector purge of the Reflect type is exhausted outside the process, so the purge gas should be exhausted to an appropriate location.

2.4.1 Purge Gas Piping

Purge Gas Piping for Probe type

(1) When not using the online validation function

If the installation into the process is in situ and the validation function is not used, connect the piping as shown in Figure 2.24.

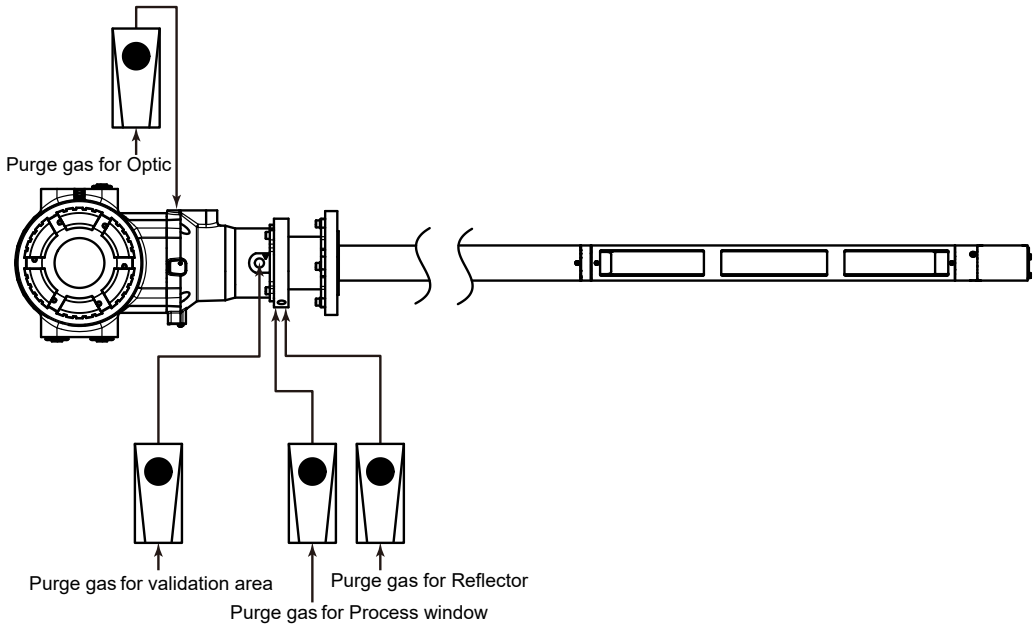


Figure 2.24 Piping when not using the online validation function/process in situ

(2) When using the online validation function

Connect the piping as shown in Figure 2.25.
Check gas is fed during the validation. Connect the piping with a three-way valve so that the gas can be switched between purge gas and check gas.

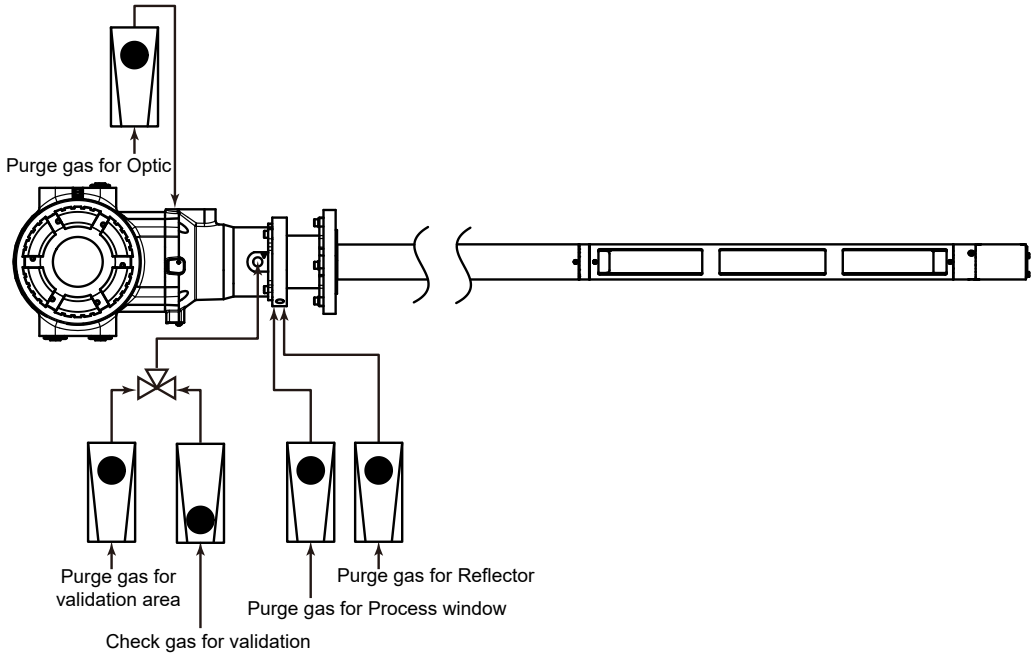


Figure 2.25 Piping when using online validation function

Purge Gas Piping (Sampling) for Flowcell type (-EXT)

(1) When not using the online validation function

For applications that use Flowcell types and do not use the online validation function, pipe as shown in Figure 2.26.

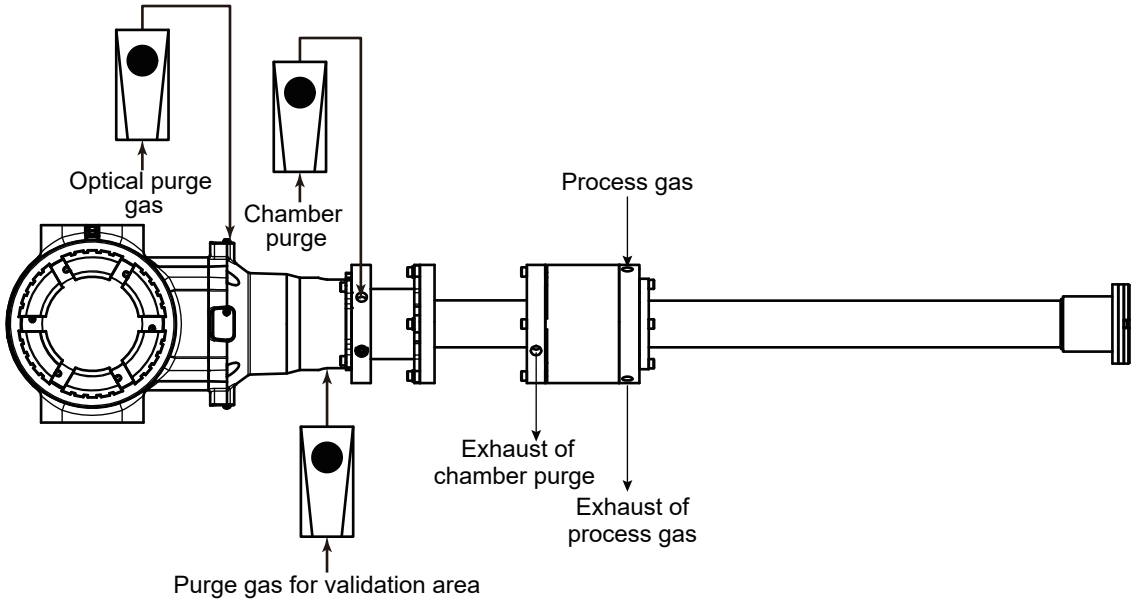


Figure 2.26 Piping when not using the online validation function

(2) When using the online validation function

For an application that uses a Flowcell and the online validation function, pipe as shown in Figure 2.27.
When measuring process gases by sampling, nitrogen gas is introduced in the validation area. During validation, the piping can be switched to supply nitrogen gas and check gas by a three-way valve in order to flow the check gas to the validation area.

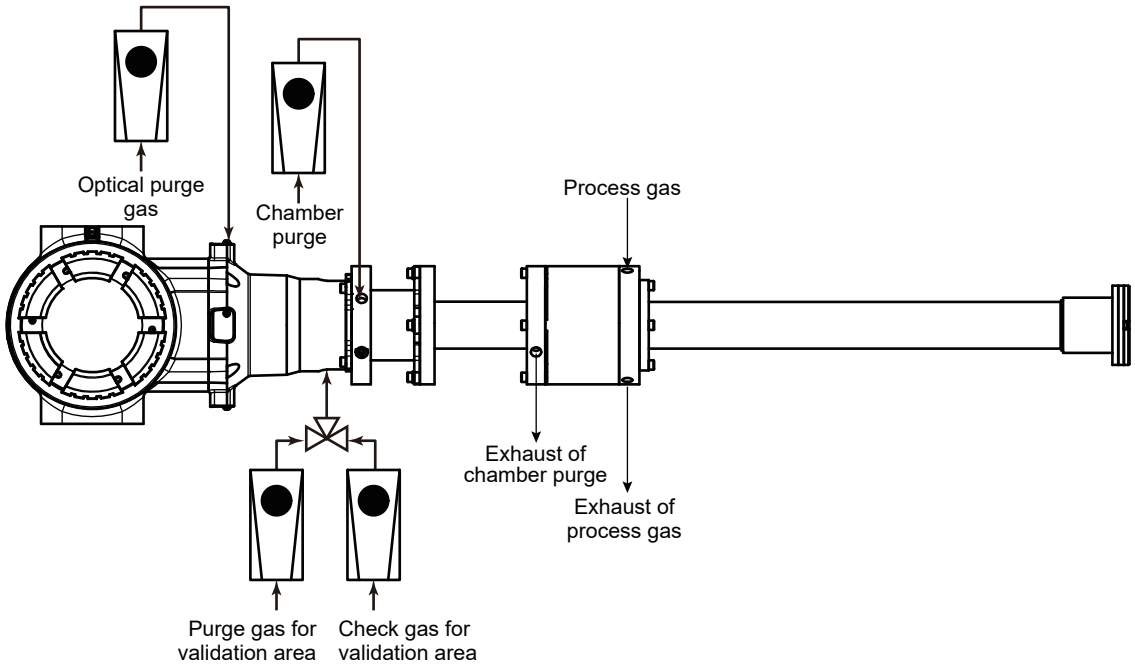


Figure 2.27 Piping when using the online validation function

2.4.2 Optical Area Purge of Zone 1/Div. 1/Flameproof “d”

TDLS8200 Flameproof has flow restrictors on optical purge gas inlet and outlet. Connect piping of purge gas to the flow restrictors. Set the flow rate of the purge gas to 100 to 200 mL/min. Excess flow rate causes high resistance by flow restrictor and increases the case internal pressure, thus may harm the internal component parts, failing to meet the flameproof requirements.

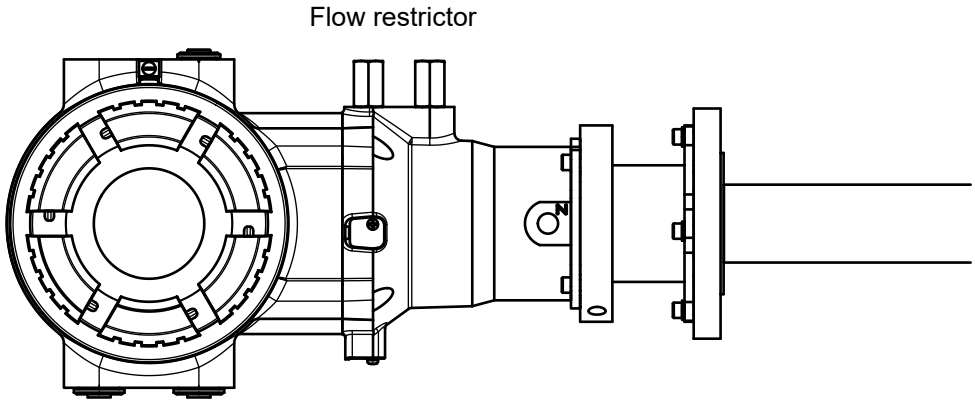


Figure 2.28 Optical purge gas inlet and outlet of Zone 1/Div.1/Flameproof “d”

CAUTION

For TDLS8200 flameproof, excess flow rate for optical area may cause damages on internal optical components.

WARNING

For TDLS8200 flameproof, pressure at the inlet for optical area shall not exceed 10 kPa.

2.5 Procedure for using a Reflect type

The following describes the installation, optical axis adjustment, wiring, and purge gas piping for Reflect type (-REF) in the order of work.

First, complete the first part of “2.1 Installation” through section 2.1.2 before proceeding with the work in this section.

2.5.1 Installation (Step 1)

Attach the alignment flange and reflector flange to the process flange according to the following procedure.

■ Separation of analyzer and alignment flange

(1) Before attaching the alignment flange to the process flange, loosen the quick connector screws to separate the analyzer from the alignment flange. First, loosen the anti-loose screw shown in Figure 2.29.

(2) Loosen the remaining 3 screws (M6) on the flange. Do not completely remove the three screws from the flange at this time.

(3) Rotate the analyzer counterclockwise and remove the analyzer from the alignment flange.

Follow the same procedure to separate the reflector from the reflector flange.

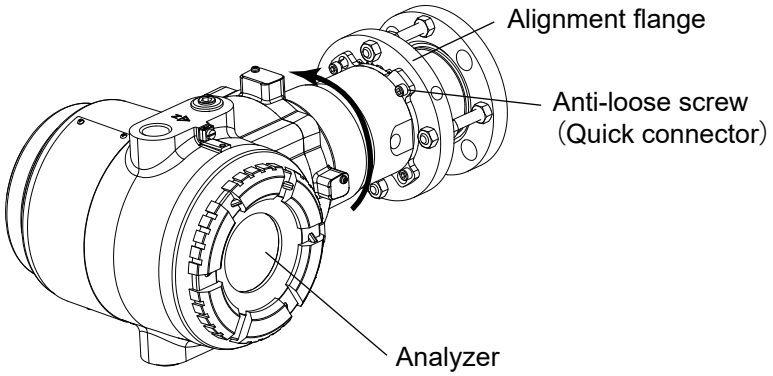


Figure 2.29 Separation the analyzer and the alignment flange

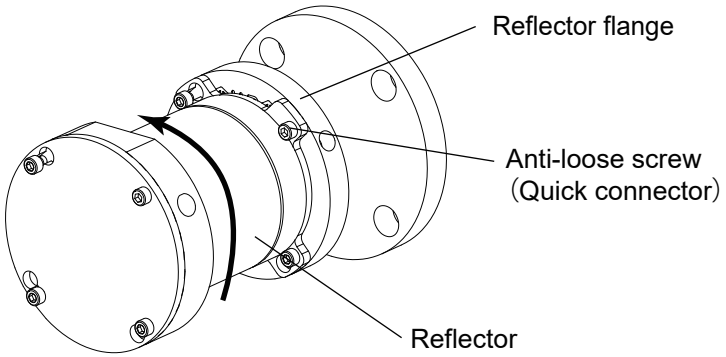


Figure 2.30 Separation of reflector and reflector flange

Installation of alignment flange on process flange

(1) Insert a gasket between the alignment flange and the process flange.
(2) Pass the mounting bolts through the mounting holes of the alignment flange and attach them to the process flange with nuts. (At this time, ensure that they do not loosen or fall off.)

Follow the same procedure to separate the reflector from the reflector flange.

CAUTION

- Alignment flange and reflector flange have installation orientation. The “UP” arrow must point upward.
- A laser beam passes through the process window. Do not scratch or contaminate the process window area while working on it.
- If the alignment service tool is not used, install the analyzer unit and reflector unit directly on the process flange.

CAUTION

- A laser beam passes through the process window. Do not scratch or contaminate the process window area while working on it.
- The anti-seizing agent is applied to the threads. Avoid adhesion of dust and other contaminants. If dust or other foreign matter adheres to the threads, remove them and reapply the anti-seizing agent.
- Carefully install the analyzer section, avoiding damage to the O-ring or falling off during assembly.

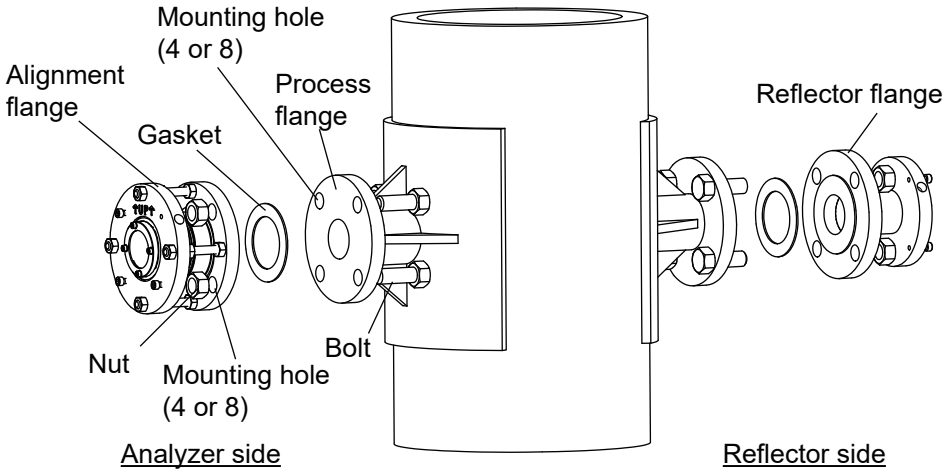


Figure 2.31 Installation of alignment flange and reflector flange

2.5.2 Optical axis adjustment using alignment service tool (initial adjustment)

Adjust the optical axis with the angle adjustment nut on the alignment flange so that the flanges installed opposite each other are parallel. Follow the procedure described below. If you do not use the alignment service tool, proceed to “2.2 Wiring”.

Installation of alignment service tool

(1) Three screws (M6) are preinstalled on the alignment flange. Ensure that the screw has a clearance of approximately 8 mm from the flange surface. The screw (M6) is not visible in the upper right hole when viewed from the front. The screw in the upper right is provided on the alignment service tool side.

(2) Align the holes of the quick connector on the alignment service tool with the three M6 screws (1), insert the quick connector, and rotate it clockwise.

(3) After temporarily fastening the top right screw, tighten the other three screws evenly.

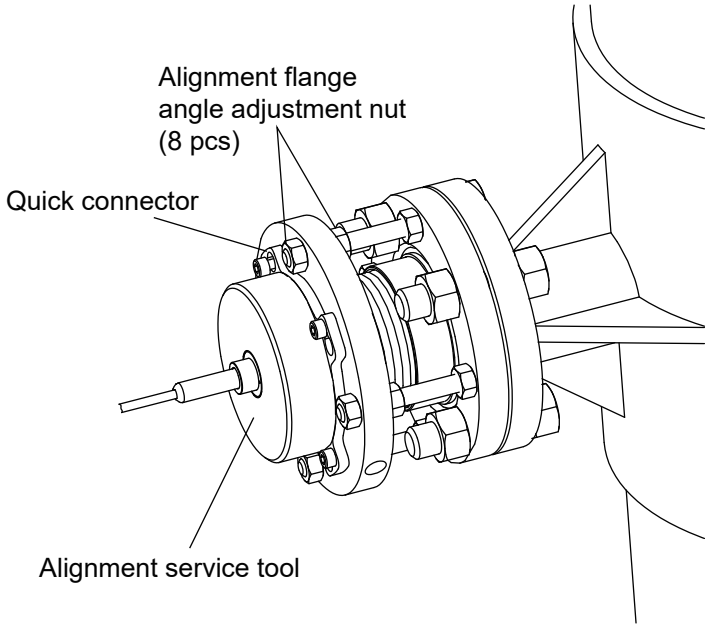


Figure 2.32 Installation of alignment service tool

Optical axis adjustment with alignment flange

(1) Power on the alignment service tool and make sure that the visible laser is near the center of the process window from the reflector side. Do not look directly at the laser beam with your eyes. Always check through a piece of paper.

WARNING

- Never look directly into the laser beam of the alignment service tool.
- Do not use alignment service tools in hazardous locations.

(2) Adjust the optical axis so that the visible laser is positioned in the center of the process window by using the angle adjustment nut on the alignment flange.

Removal of alignment service tool

After the optical axis adjustment is completed, remove the alignment service tool in the reverse order of installation.

NOTE

Contact YOKOGAWA for the alignment service tools.

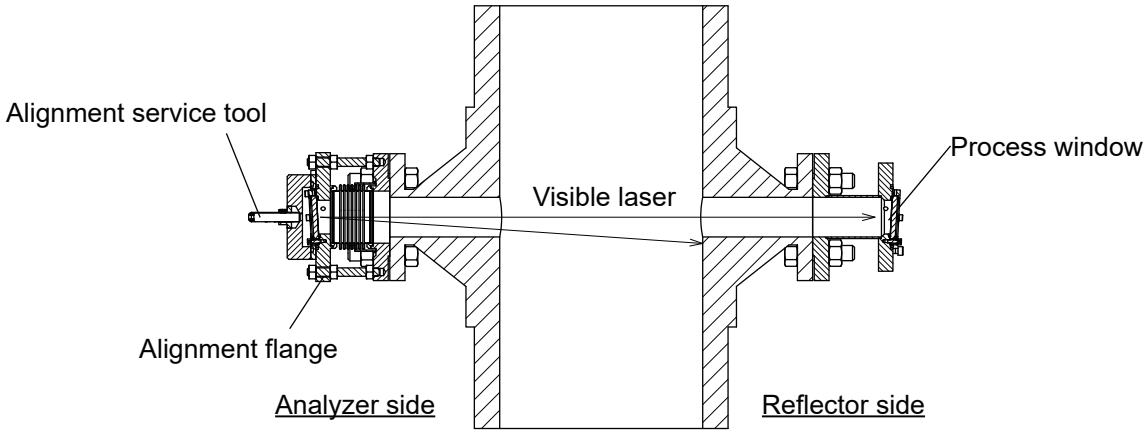


Figure 2.33 Optical axis adjustment using alignment service tool

2.5.3 Installation (Step 2)

Install the analyzer following the same procedure as for the alignment service tool.

(1) Three screws (M6) are preinstalled on the alignment flange. Ensure that the screw has a clearance of approximately 8 mm from the flange surface. The screw (M6) is not visible in the upper right hole when viewed from the front. The screw in the upper right is provided on the analyzer side.

(2) Align the holes of the quick connector on the alignment service tool with the three M6 screws (1), insert the quick connector, and rotate it clockwise.

(3) After temporarily fastening the top right screw, tighten the other three screws evenly.

Follow the same procedure to attach the reflector to the reflector flange.

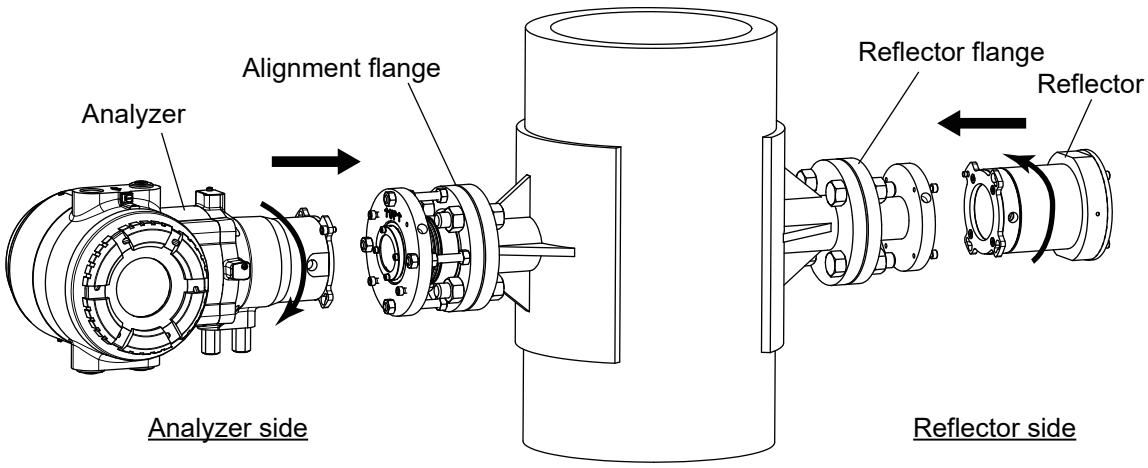


Figure 2.34 Installation of analyzer and reflector

CAUTION

- A laser beam passes through the process window. Do not scratch or contaminate the process window area while working on it.
- The anti-seizing agent is applied to the threads. Avoid adhesion of dust and other contaminants. If dust or other foreign matter adheres to the threads, remove them and reapply the anti-seizing agent.
- Carefully install the analyzer section, avoiding damage to the O-ring or falling off during assembly.

2.5.4 Wiring

After installation is complete, wire the TDLS8200 to the external equipment. Wire according to “2.2 Wiring”.

2.5.5 Optical axis adjustment (final adjustment)

After the wiring is complete, turn on the power and adjust the optical axis.

CAUTION

Before starting the adjustment, record the initial positions of the optical axis adjustment knobs for the X and Y axes so that you do not lose track of how far you have moved the optical axis adjustment knobs.

CAUTION

For /SIL with IEC61508 SIL2 (SC3), disable the Safety mode only when adjusting the optical axis. For details, see ”4.9.8 Safety Mode”.

After turning on the power, check the transmittance of LD1 and LD2 (only LD1 for 1 laser specification) .
Fine-tune the optical axis using the optical axis adjustment knob on the TDLS8200 to maximize transmittance according to “2.3 Optical Axis Adjustment”.

After the optical axis adjustment is completed, calibrate the transmittance so that the result is set to 100%. See “6.1.1 Transmission Calibration” for details on how to perform the calibration. However, if the transmittance is close to 0% as a result of optical axis adjustment, follow the procedure below to adjust the optical axis.

Optical axis adjustment when transmittance is close to 0%

If transmittance cannot be secured due to optical axis misalignment for Reflect type, follow the procedure below to adjust the transmittance.

When transmittance is secured, end the optical axis adjustment. Calibrate the transmittance so that the result is set to 100%. See “6.1.1 Transmission Calibration” for details on how to perform the calibration.

(1) Step 1: Adjustment in X-axis direction

- **Adjustment in X-axis direction (1 to 1.5 turns clockwise)**

  While checking the transmittance, rotate the X-axis optical axis adjustment knob slightly to adjust it.
  Specifically, rotate the optical axis adjustment knob of X-axis slightly (about 1/8 turn) and then check the transmittance.

  Then rotate the optical axis adjustment knob of X-axis slightly again (about 1/8 turn) and check the transmittance again.
  Repeat this procedure to adjust clockwise 1 to 1.5 turns.
  Finally, return the optical axis adjustment knob to its initial position.

- **Adjustment in X-axis direction (1 to 1.5 turns counterclockwise)**

  Follow the same procedure to check the transmittance while rotating counterclockwise 1 to 1.5 turns.
  Finally, return the optical axis adjustment knob to its initial position.

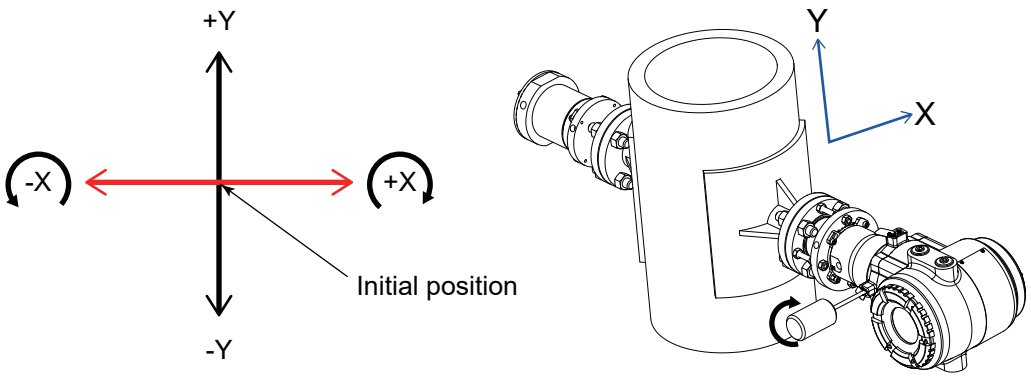


Figure 2.35 Adjustment in X-axis direction

(2) Step 2: Adjustment in Y-axis direction (1 to 1.5 turns clockwise and counterclockwise)

See step (1) and check the transmittance while rotating the Y-axis clockwise 1 to 1.5 turns instead of the X-axis. Also, adjust counterclockwise in the same way Finally, return the optical axis adjustment knob to its initial position.

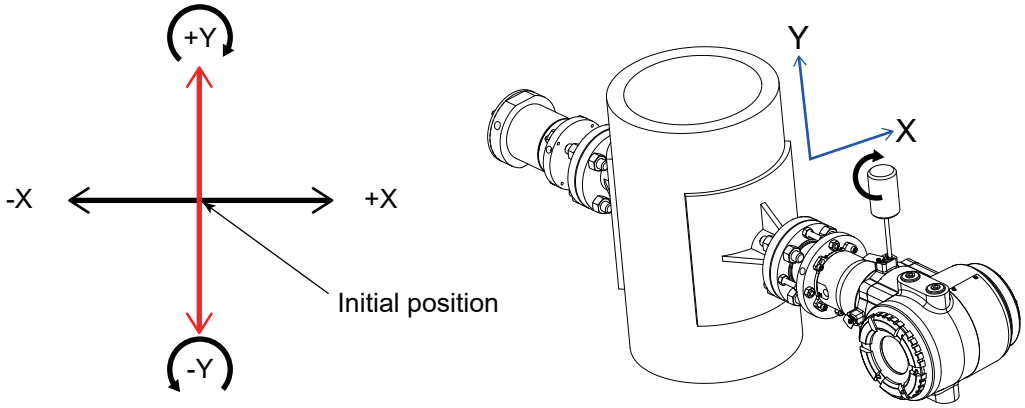


Figure 2.36 Adjustment in Y-axis direction

(3) Step 3: Final adjustment

If sufficient transmittance has not been obtained at this point, follow the procedure described below.

Adjust the optical axis outside the range of steps 1 and 2 to check the transmittance.

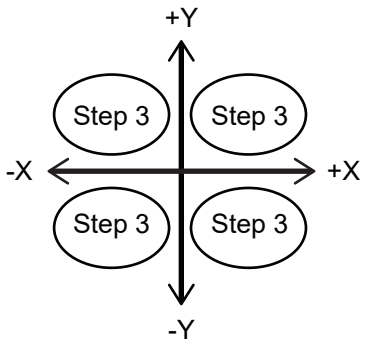


Figure 2.37 Step 3: Final adjustments

- **Adjustment of Y-axis direction (fine adjustment clockwise), X-axis direction (1 to 1.5 turns clockwise and counterclockwise)**

  From the initial position, turn the Y-axis optical axis adjustment knob slightly clockwise (approx. 1/8 turn). Next, check the transmittance while adjusting the X-axis optical axis adjustment knob as before.
  Repeat this procedure until the Y-axis has made 1 to 1.5 rotations clockwise. Finally, return the optical axis adjustment knob to its initial position.

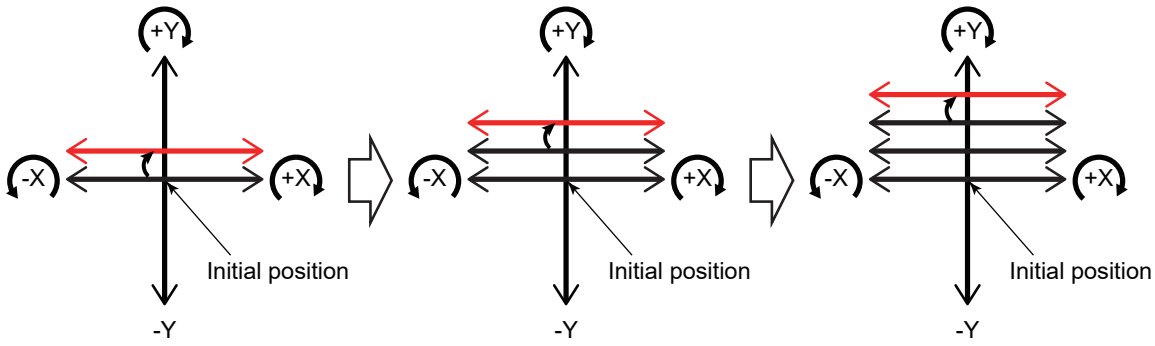


Figure 2.38 Final adjustment (Y-axis clockwise fine adjustment)

- **Adjustment of Y-axis (fine adjustment counterclockwise), X-axis adjustment (1 to 1.5 turns clockwise and counterclockwise)**

  From the initial position, turn the optical axis adjustment knob on the Y-axis slightly counterclockwise (approx. 1/8 turn). Next, check the transmittance while adjusting the optical axis adjustment knob for the X axis using the same procedure as before. Repeat this procedure until the Y-axis has made 1 to 1.5 counterclockwise turns.

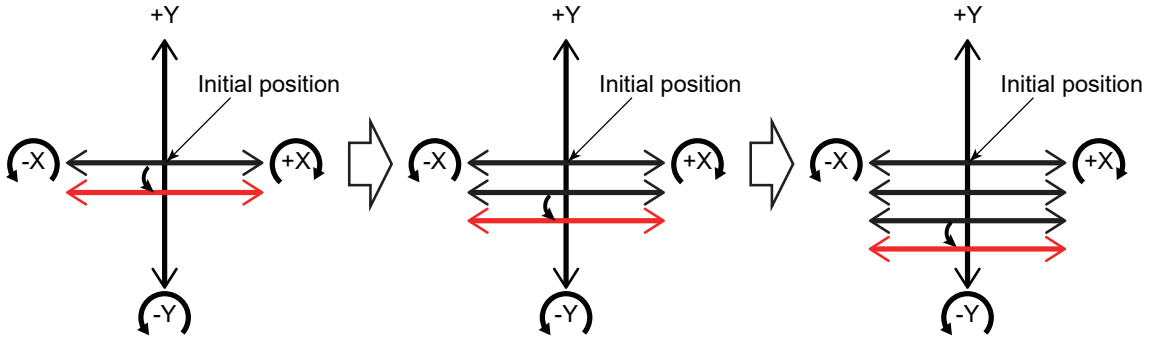


Figure 2.39 Final adjustment (Y-axis counterclockwise fine adjustment)

NOTE

If transmittance ultimately fails to improve, contact YOKOGAWA.

2.5.6 Piping

After optical axis adjustment is completed, perform piping for purge gas according to “2.4 Piping”.

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3. Startup

Refer to “2.2 Wiring” and “2.4 Piping”, and verify that the system has been constructed correctly. Perform the startup procedure with the optical axis adjustment completed.

Run optical area purge gas, process window purge gas and reflector purge gas at the appropriate flow rates.

Supply power to the TDLS8200.

The LCD display shows a screen indicated in “1.2 Name and Function of Each Part”.

NOTE

Even in an application that requires the system to be regularly run and suspended repeatedly, we recommend that you continuously supply power, process window purge gas, and reflector purge gas to the TDLS8200. This is to prevent unnecessary temperature changes and unnecessary load on the laser device and sensor.

3.1 Connecting the HART Configuration Tool

This section explains how to connect the HART configuration tool and provides a brief overview of the menu tree shown on the tool. For details on the menu tree and HART communication function, see “5. HART Communication” and “Appendix 3 General View of HART DD”.

3.1.1 Installing a DD File

Before using the HART configuration tool, the TDLS8200 DD (Device Description) must be installed in the configuration tool. If you use FieldMate for the configuration tool, obtain the latest Device Files, and install a DTM. For details, see the FieldMate instruction manual.

The following table shows the relation between DD and Device Files.

Software Revision	HART Device Revision	DD Revision	Device Files Revision
1.02.01 or later	01	01	3.09.21 or later

If you want to connect your own configuration tool, download the DD file from the YOKOGAWA website and install it.

https://www.yokogawa.com/library/search/#/t=742&p=29

*: The URL is subject to change without notice. If you cannot access the URL, contact our sales representative or your local distributor.

3.1.2 Connection Procedure

Connect the configuration tool in parallel with the load resistance connected to the analog output AO-1 terminal. There is no polarity. For details on connecting the load resistance, see “2.2 Wiring”.” Figure 3.1 shows a wiring example. TDLS8200 can be connected to any relaying terminal in a transmission loop. Only one master device such as FieldMate can be used in a transmission loop.

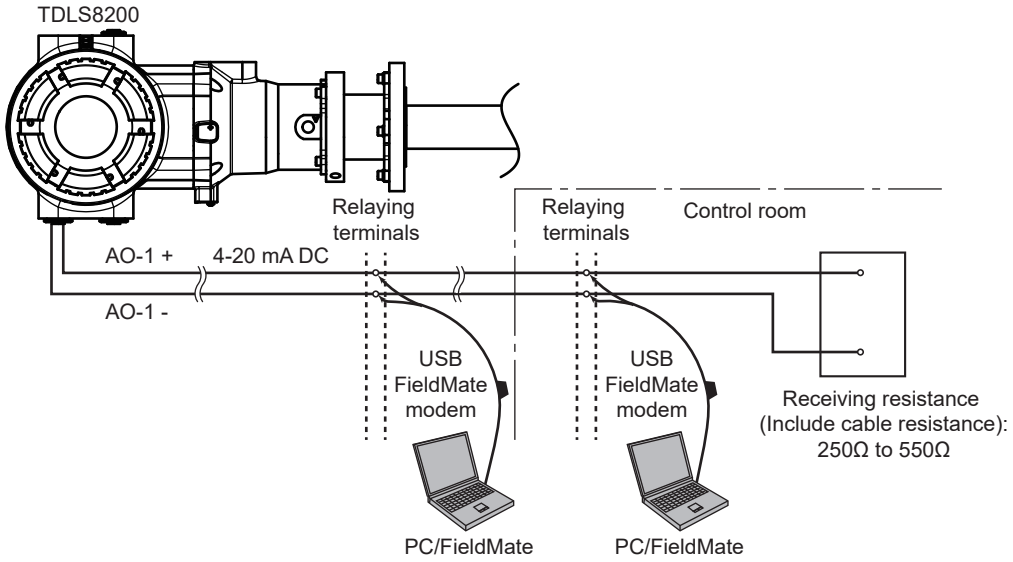


Figure 3.1 HART configuration tool wiring example

3.1.3 Basic Menu Configuration

The root menu of the menu tree displayed in the HART configuration tool is described below. For the entire menu including parameter names, see “Appendix 3 General View of HART DD”

Root menu	Description
Process variables	Displays the most recent PV-QV and measured values. Sets PV-QV, AO output ranges.
Diagnostics	Checks alarm status. Executes calibration, validation, loop checks, Piezo Proof Test.
Device Settings	Sets TDLS8200-specific parameters
Maintenance	Displays product information

NOTE

Update-Failure may appear on the factory default settings of the TDLS8200 depending on your HART configuration tools. This is a notification that the same measured value was read multiple times within the same analysis period. This is not a problem with the TDLS8200 operation. The analysis period is a fixed adjustment value assigned to each TDLS8200 and cannot be changed.

You can mask Update Failure if you don’t want it to appear. See “5.5.3 Update Failure mask” for details.

3.2 Setting Basic Parameters

This section explains how to set the basic parameters necessary to start measurements by showing examples from YH8000 operation.

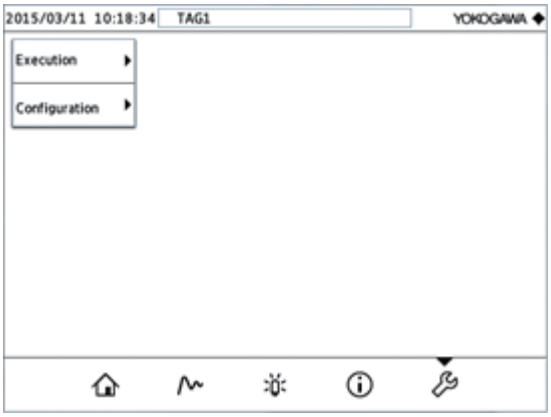
3.2.1 Setting the Date and Time

Set the current date and time on the TDLS8200. The date and time will be retained through battery power even when the power is turned off.

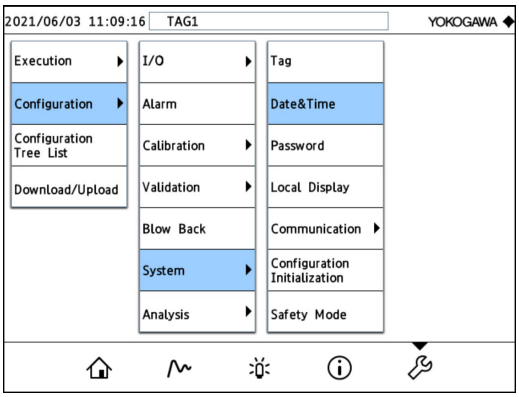
● Setup procedure using YH8000

(1) Tap  to switch to the analyzer selection screen. Select a tag name of the analyzer you want to connect to, and then tap OK.

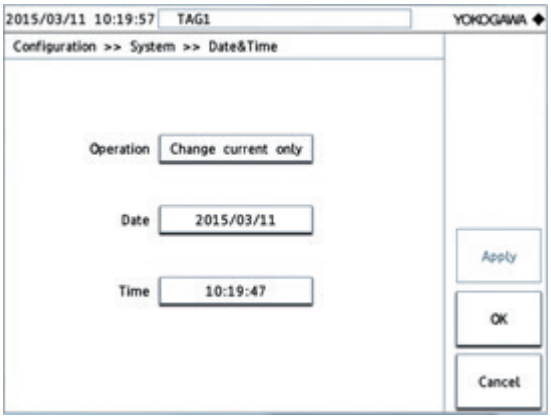
(2) A password input screen will appear. Enter the password and tap Enter. A configuration screen will appear.



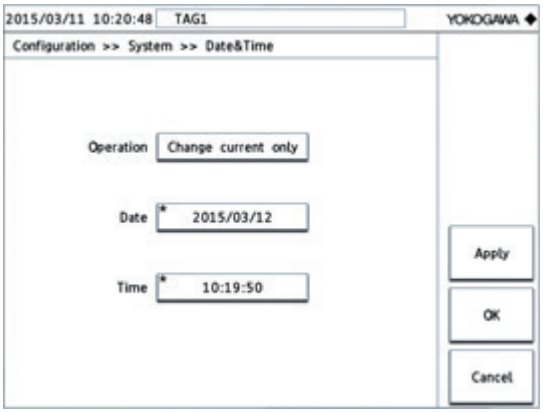
(3) Select “Configuration>>System>>Date&Time” as shown in the following figure.



(4) Select “Date” and “Time,” and enter the date and time you want to apply.



(5) The items that you change will show an asterisk in the upper left as shown in the following figure. Tap OK to reflect the date and time in the analyzer.



3.2.2 Setting the Process Optical Path Length

■ Probe type

Process optical path length is the distance the laser beam travels when it goes through measurement gas.

The process optical path length of TDLS8200 is twice the length of insertion length of the process gas into the probe.

Process gas insertion length is 100 cm or approximately twice the width of probe entry (50 cm). However, optical path length may need to be adjusted because the contact position where process gas and purge gas mix each other moves, depending on their flow rate.

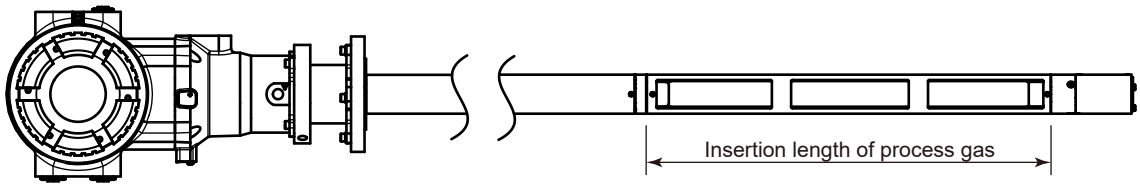


Figure 3.2 Process optical path length definition

Reflect type

For the Reflect type, the process length (L) is the distance between the analyzer part and the reflector part, as shown in Figure 3.3.

Enter twice the process length (L) as the process optical path length.
Process optical path length = Process length (L) x 2

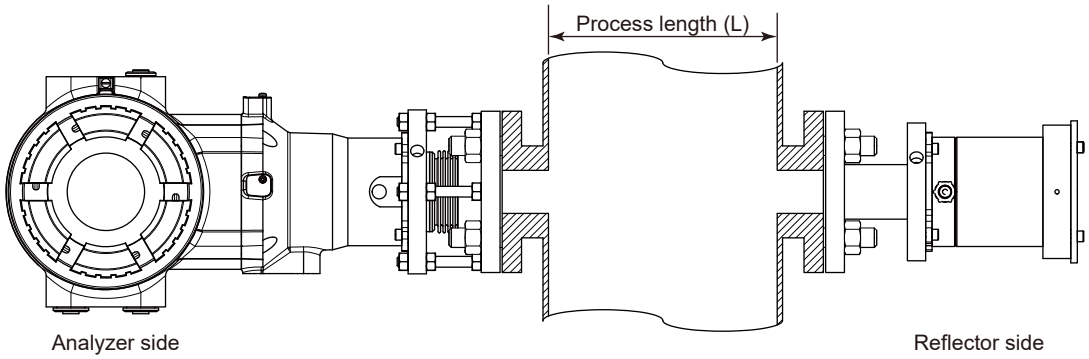


Figure 3.3 Definition of process optical path length (Reflect type)

Setup procedure using YH8000

Configuration menu path:

[YH8000]“ >>Select analyzer >> Configuration >>Analysis>>Process Parameters >>Path Length”

NOTE

If you cannot use nitrogen purge gas, contact Yokogawa service.

3.2.3 Setting the Process Pressure

This section explains the pressure value of the measurement process when the input mode is an analog input (AI-1). When using other input modes, see “4.1.2 Process Pressure”.

Configuration menu path:

[YH8000] “ >> Select analyzer >> Configuration >>Analysis >>Process Parameters>>Pressure”

(1) Set Mode (pressure input mode) to Active input.

(2) Set Active type (pressure input source) to AI-1.

(3) Select Backup mode (pressure value backup when the analog input is outside the range) from the following options.

If you select Disable, the analog input is converted as-is into a pressure value without backing up.

If you select the Backup value, the pressure value is fixed to the value specified by the Backup set value. Set Backup set value to a value of your choice.

If you select Hold, the pressure value is held at the previous value within the proper range.

(4) Set the analog input range. Set the pressure values corresponding to 4 mA and 20 mA.

Configuration menu path:

[YH8000]“ >> Select analyzer >> Configuration >> I/O >> Analog Input>>AI-1(Pressure)”

3.2.4 Setting the Process Temperature

This section explains the temperature value of the measurement process when the input mode is analog input (AI-2). When using other input modes, see “4.1.3 Process Temperature” .

Configuration menu path:

[YH8000] “ >> Select analyzer >> Configuration >> Analysis >>Process Parameters>>Temperature”

(1) Set Mode (temperature input mode) to Active input.

(2) Set Active type (temperature input source) to AI-2.

(3) Select Backup mode (temperature value backup when the analog input is outside the range) from the following options.

If you select Disable, the analog input is converted as-is into a temperature value without backing up.

If you select Backup value, the pressure value is fixed to the value specified by Backup set value. Set Backup set value to a value of your choice.

If you select Hold, the pressure value is held at the previous value within the proper range.

(4) Set the analog input range. Set the temperature values corresponding to 4 mA and 20 mA.

Configuration menu path:

[YH8000] “ >>Select analyzer >>Configuration>>I/O>>Analog Input >>AI-2(Temperature)”

3.2.5 Setting the Output Range

This section explains how to assign an item to the 4 to 20 mA analog output. For details on the analog output hold function, see “4.4.2 Output Hold”.

Configuration menu path:

[HART] “Device Settings >>Basic setup>>Set process vars”

[YH8000]“ >> Select analyzer >> Configuration >>I/O>>Analog output”

(1) Select the output item for each channel.

On HART, the AO-1 output item is displayed as “PV is”. AO-2 and the subsequent output items are displayed, starting with “AO-2 is”, in such a corresponding consecutive number.

On YH8000, it is displayed as “Item.” You can assign the following items to the analog output.

Output item	Name displayed on HART	Name displayed on YH8000
LD1 Component 1 gas concentration	LD1-SubGas1	(*2)
LD1 Component 2 gas concentration (*1)	LD1-SubGas2	(*2)
LD2 Component 1 gas concentration (*4)	LD2-SubGas1	(*2)
LD1 Transmission	LD1 Transmission	LD1 Transmission
LD2 Transmission (*4)	LD2 Transmission	LD2 Transmission
Temperature	Temperature	Temperature
Pressure	Pressure	Pressure
Off (*3)	Off	Off

*1: Selectable only for two-component measurement per LD.
*2: Displays the name of the gas component being measured.
*3: Selectable only for channel 2 to 5.
*4; Selectable only for the 2 laser specification.

(2) Set the measurement item values that correspond to the minimum point (4 mA) and maximum point (20 mA). On HART, the minimum and maximum points are displayed as “PV LRV” and “PV URV,” respectively.

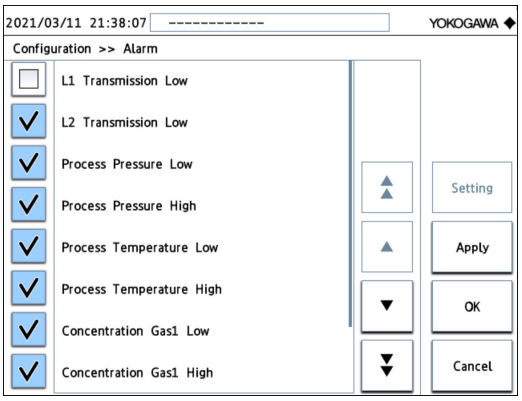
3.2.6 Setting Process Alarms

You can set threshold values of the high/low limit alarm (warning) for process measurement values. The following table shows the types of warnings that you can specify. For each type of warning, you can set the threshold values and select whether to enable the detection. For details on warnings, see “7.2 Warning Display and Handling” described later.

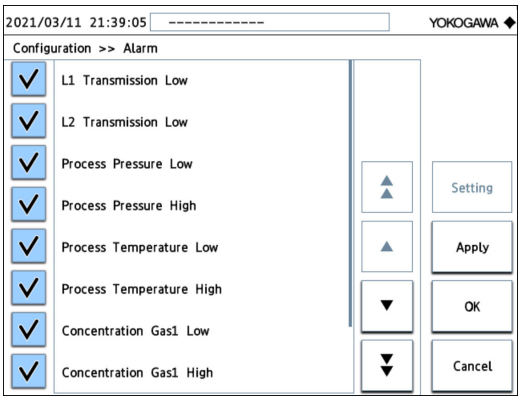
Alarm number	Warning name
1	L1 Transmission Low
2	L2 Transmission Low
3	Process Pressure Low
4	Process Pressure High
5	Process Temperature Low
6	Process Temperature High
7	Concentration Gas1 Low
8	Concentration Gas1 High
9	Concentration Gas2 Low (only with two-gas measurement)
10	Concentration Gas2 High (only with two-gas measurement)
11	Concentration Gas3 Low
12	Concentration Gas3 High

● Setup procedure using YH8000

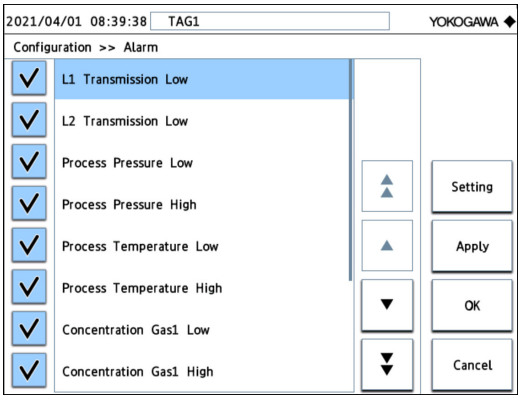
(1) From the menu, select [YH8000]“ >>Select analyzer >>Configuration>>Alarm” to display the following screen.



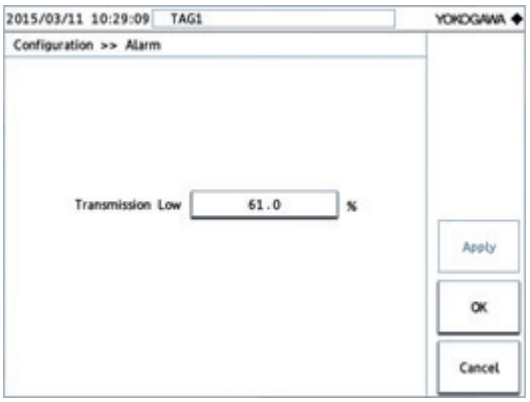
(2) You can enable or disable each warning by tapping the check mark on the left side. In the following example, the “L1 Transmission Low” check box is selected to enable the L1 transmission low limit alarm. Touch Apply to apply the settings to the TDLS8200.



(3) Change the threshold values of each warning. In the following example, to set the threshold value of the L1 transmission low limit alarm, select “L1 Transmission Low,” and tap Setting on the right side.



(4) The following screen will appear. Select the value box, enter the threshold value, and touch OK to apply the value to the TDLS8200.



3.3 Loop Check (Simulation output)

You can force the analog output, digital output, and valve control output to a given state. This section explains how to do this. You can use this function to check the operation after wiring.

3.3.1 Executing a Loop Check

This section explains the loop check setup procedure for each output type separately. A loop check can be executed simultaneously on all terminals of all types.

Execution menu path:

[HART] “Diagnostics>>Loop check”

[YH8000] “  >>Execution>>Loop Check”

NOTE

If you turn off the TDLS8200 while performing a loop check, loop check will be cleared.

- **Analog output**

Open the Analog output menu, and set Loop check mode to Enable to output the specified simulated current (“check output”).

NOTE

If multi-drop mode is set on HART, loop checking of AO-1 via HART is not possible. In this case, “Input Loop Check” of the FieldMate is not supported.

- **Digital output**

Open the Digital output menu, and set Loop check mode to Enable to output the specified simulated state (“check output”).

- **Valve control output (SV)**

Open the Valve output menu, and set Loop check mode to Enable to output the specified simulated state (“check output”).

3.3.2 Auto Release Function

The auto release function automatically clears loop checking on all terminals and restores normal output after the specified time elapses. The auto release counter starts when any of the loop check is enabled. The counter restarts whenever a loop check setting is changed. When the counter expires, all loop checking is disabled.

To set the auto release time, set Auto release time in the Loop check menu. If you select Disable, the auto release function is disabled, and the simulated output is maintained until you manually clear the loop check mode. The set Auto release time value is retained even after the power is turned off.

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4. Configuration

This chapter provides details of all the setting items and shows the locations of the setting menus of the TDLS8200. However, the setting items related to calibration and validation are described in “6. Inspection and Maintenance”.

4.1 Process Parameter Settings

Process parameters indicate the measurement conditions related to measurement process gas. Set the process optical path length, process pressure, and process temperature of the process gas correctly because they directly affect the measurement values.

NOTE

If nitrogen purge gas cannot be used, contact Yokogawa.

4.1.1 Process Optical Path Length

Set the process optical path length of the process to be measured. For a definition of the process optical path length, see “3.2.2 Setting the Process Optical Path Length” Setup menu path:

[YH8000] >> Select analyzer >> Configuration >>Analysis>>Process Parameters>>Path Length”

4.1.2 Process Pressure

Set the process pressure of the process to be measured. When you select the input source, set the action for error input as described in the procedure below.

Setup menu path:

[YH8000] >> Select analyzer >> Configuration>>Analysis>>Process Parameters>>Pressure”

(1) Select “Mode” (pressure input mode).

When “Fixed” is selected, set the pressure value as an arbitrary fixed value.

When “Active input” is selected, input the pressure value via a 4-20 mA analog input (AI-1) or Modbus. The TDLS8200 acquires a pressure value sent from the input source at every measurement value analysis cycle and uses it for the concentration calculation.

(2) Configure the settings below according to the pressure input mode.

When "Fixed" is selected

Enter a fixed pressure value for "Fixed mode value." The other parameters do not need to be set.

When "Active input" is selected

Set each of the following parameters.

- Active type: Setting of pressure input source

  "AI-1" is analog input.

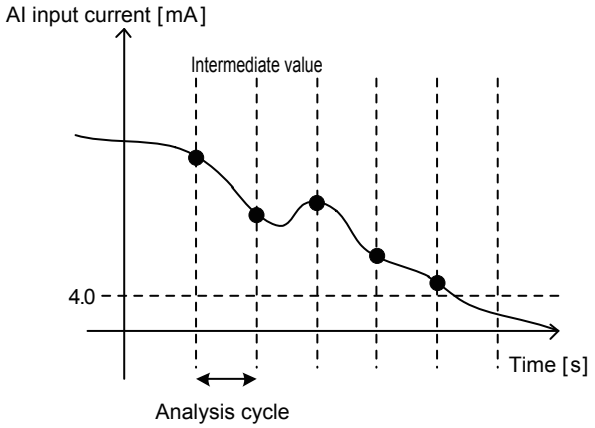
  "Field Communication" is Modbus input. For details on the Modbus function, see "8. Modbus".
- Backup mode: When "Active input" is selected, set the pressure value to use for the concentration calculation when an input value from the sensor is out of range.

  With "Disable," backup is disabled and the input is used as is for the pressure value.

  With "Backup value," the value set in "Backup set value" is used for the pressure value.

  With "Hold," the intermediate value of the input values of five cycles that were within the range immediately before an input value from the sensor became out of range is used for the pressure value. The following figure shows the example of when the analog input falls below the lower limit of 4 mA.

  A ● in the figure indicates the point of acquisition of an AI input value, and a value is acquired every analysis cycle. The second ● of the five cycles immediately before falling below the lower limit is the intermediate value of the current values so the pressure value of this time is held. If the analog input immediately after turning on the power of the TDLS8200 is out of range while "Hold" is selected, a pressure value corresponding to 4 mA is held.



In order to input via Modbus network, take notice how the Modbus network should correspond to the backup function as below.

When backup operation starts (the system starts restoring data)	When backup function stops
Modbus is off	First pressure value is input via Modbus network.

NOTE

Maintain Modbus network connected when the backup function is activated. If you want to shut down the Modbus network regularly, set the backup mode “Disable”.

- If you select “Disable” in the backup mode, the last pressure value you enter remains valid i.e. in the same status as “Hold”.
- After the power of TDLS8200 turns on, the backup function keeps active until the first pressure value is received. During this period, when you select “Hold”, or “Disable” in the backup mode, the pressure values will be on hold at the equivalent of the one obtained within the Analog input range mentioned below (3) with 4mA.
- Backup set value: Backup pressure value when “Backup mode” is “Backup value”

(3) Configure the analog input range setting only when “AI-1” is selected in “Active type.”

Enter the pressure value corresponding to each of 4 mA and 20 mA.

Setup menu path:

[YH8000]  >>Select analyzer >>Configuration >>I/O>>Analog Input>>AI-1 (Pressure)”

4.1.3 Process Temperature

Set the process temperature of the process to be measured. When you select the input source, set the action for error input as described in the procedure below.

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>Analysis >>Process Parameters>>Temperature”

(1) Select “Mode” (temperature input mode).

When “Fixed” is selected, set the temperature value as an arbitrary fixed value.

When “Active input” is selected, input the temperature value via a 4-20 mA analog input (AI-2) or Modbus. The TDLS8200 acquires a temperature value sent from the input source at every measurement value analysis cycle and uses it for the concentration calculation.

When “Active ambient” is selected, the value of the temperature sensor mounted near the laser device in the TDLS8200 is used as the process temperature.

(2) Configure each of the settings below according to the temperature input mode.

When “Fixed” is selected

Enter a fixed temperature value for “Fixed mode value.” The other parameters do not need to be set.

When “Active input” is selected

The setting items are the same as those in section 4.1.2. Read “pressure” as “temperature” and “AI-1” as “AI-2” when configuring the settings.

When “Active ambient” is selected

Set the Offset value in “Temp act amb ofst” (“Offset value” on the YH8000).

The temperature sensor value is the temperature in the vicinity of the laser device, and is not exactly equal to the process temperature so set a difference as an offset.

(3) Configure the analog input range setting only when “AI-2” is selected in “Active type.”

Enter the temperature value corresponding to each of 4 mA and 20 mA.

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>I/O>>Analog Input>>AI-2 (Temperature)”

4.2 Unit Settings

Set the units for physical quantities related to concentration measurement. The physical quantities for which units can be set are “Optical path length,” “Pressure,” and “Temperature,”. You can select from the following units for each of them.

When Only SI unit (-J) is specified, only SI unit can be selected.

Item	SI	
Optical path length	m, cm	inch, feet
Pressure	barA, kPa, atm	psi, torr
Temperature	°C, K	°F

Setup menu path:

[YH8000] >>Select analyzer >>Configuration>>Analysis>>Units”

4.3 Analog Input Settings

Analog input is used for the purpose of calculating a pressure value and temperature value from analog input within the 4-20 mA range. Set the pressure value and temperature value ranges here which will correspond to 4 mA and 20 mA.

Setup menu path to A1-1 (pressure input):

[YH8000] >>Select analyzer >>Configuration >>I/O>>Analog Input>>AI-1(Pressure)”

Setup menu path to A1-2 (temperature input):

[YH8000] >>Select analyzer >>Configuration >>I/O>>Analog Input>>AI-2(Temperature)”

NOTE

For how to set the pressure values and temperature values for analog input, see and “4.1.2 Process Pressure” and “4.1.3 Process Temperature”.

4.4 Analog Output Settings

This section describes how to set the process measurement values for analog output and the function to hold output in accordance with the status of the TDLS8200.

4.4.1 Normal Range Output

This section describes how to set 4-20 mA analog output and the detailed operation.

Setup menu path:

[HART] “Device Settings >> Basic setup >> Set process vars >> PV range or AO2~5 range”

[YH8000] >>Select analyzer >>Configuration >>I/O>>Analog Output>>AO-1 to AO-5>>range”

Output items and range settings

(1) Select the measurement item to assign to analog output.

Output item	HART Display Name	Name displayed on YH8000
LD1 Component 1 gas concentration	LD1-SubGas1	(*2)
LD1 Component 2 gas concentration (*1)	LD1-SubGas2	(*2)
LD2 Component 1 gas concentration (*4)	LD2-SubGas1	(*2)
LD1 Transmission	LD1 transmission	LD1 Transmission
LD2 Transmission (*4)	LD2 transmission	LD2 Transmission
Temperature	Temperature	Temperature
Pressure	Pressure	Pressure
Off (*3)	Off	Off

*1: Selectable only for two-component measurement per LD.
*2: Displays the name of the gas component being measured.
*3: Selectable only for channel 2 to 5.
*4: Selectable only for the 2 laser specification.

(2) Enter the values for the measurement items corresponding to the lower range value (4 mA) and upper range value (20 mA). In the case of HART, each of the lower range value (LRV) and upper range value (URV) is displayed.

Output value at startup

The analog output value is fixed to 4.0 mA during the period from after turning on the power of the TDLS8200 until the first measurement result is updated. However, if output hold is set for the warming-up state, the value is in accordance with that setting.

Analog output range

Measurement values within the range from 3.8 mA to 20.5 mA are output (NAMUR NE43 compliant).

4.4.2 Output Hold

Output hold is a function to fix (hold) analog output to a set value when the TDLS8200 is in the following specific states.

Setup menu path:

[HART] “Device Settings >> I/O condition >> Analog output >> AO-1 to AO-5 >>Hold menu for each specific state”

[YH8000] >>Select analyzer >>Configuration >>I/O>>Analog Output>> AO-1 to AO-5>>Hold Mode”

Definitions of specific states

Set output hold individually for each of the following states.

During fault occurrence	State when any fault is occurring
During warning occurrence	State when any warning is occurring
During calibration, validation, Blow Back	State when calibration/ validation/ Blow Back/ function is being executed
During maintenance	State in which the password for maintenance has been entered from the YH8000 and changing of the settings is enabled
During warm-up	State up until the temperature of the laser device stabilizes and measurement becomes possible after turning on the power of the TDLS8200.

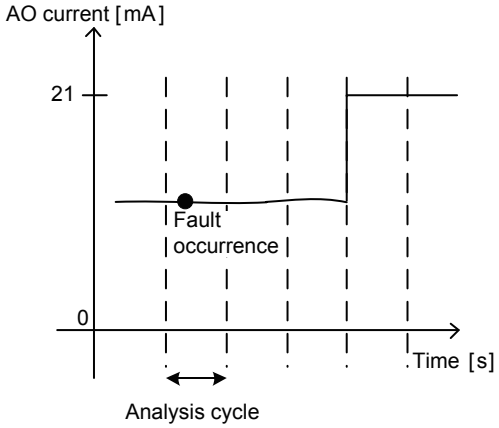
Output hold mode

One of the following modes can be selected for output hold.

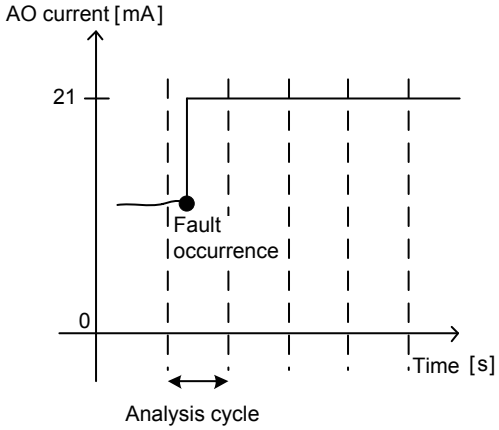
Setting Mode	Description
Preset hold	Holds output to any output value within 3.8 to 20.5 mA. * Any value within 3.0 to 21.6 mA can be set for during warning occurrence and during fault occurrence. Furthermore, the holding of output to any value can be delayed for a period of up to five analysis cycles (*1). Analog output during this delay is held to the value immediately before just as with the Hold mode.
Non-hold	Analog output is not held. Measurement values continue to be output.
Hold	Holds output to the normal output value immediately before.

*1: The analysis cycle differs depending on the type of analyzer used. For details on the analysis cycle, see “Appendix 1 What is an Analysis Period?”.

(Example 1) Figure showing the analog output action when Preset hold is set to 21.0 mA and the number of delays is set to 2 for during fault occurrence



(Example 2) Figure showing the analog output action when Preset hold is set to 21.0 mA and the number of delays is set to 0 for during fault occurrence



Output hold priority

When multiple specific states occur at the same time and multiple holds are enabled (when multiple Preset holds or Hold modes are enabled), the output hold is determined according to the following priority order.

Priority High
↑ During fault occurrence
During warning occurrence
During calibration • validation • blowback
During maintenance
During warm-up

(Example) When during warning occurrence = Non-hold, during maintenance = Preset hold, and during calibration and validation execution = Hold, and all three of the aforementioned states occurred at the same time, output hold becomes the Hold mode.

NOTE

Be sure to enable the Safety Mode when using TDLS8200 for a safety instrumented system. See “Appendix 4 Safety Instrumented System Installation” for details.

4.5 Digital Output Settings

This function is for turning on digital output when the TDLS8200 enters the following specific states.

4.5.1 DO Contact (DO-1)

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>I/O>>Digital Output>>DO-1(DO)”

Definitions of specific states

When any of the following specific states occurs, the contact turns on. Enabling or disabling of digital output can be set separately for each specific state. For an explanation of each state, see “4.4.2 Output Hold”.

- During warning occurrence
- During Calibration, validation, Blow Back
- During maintenance
- During warm-up

Output delay

A delay of up to 100 analysis cycles can be set for the period from when a specific state occurs until when the contact actually turns on. When the number of delays is set to zero, the contact turns on immediately after a state occurs.

The analysis cycle differs depending on the application and is set to the optimum value at the time of shipment. For details, see “Appendix 1 What is an Analysis Period?”.

4.5.2 Fault Contact (DO-2)

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>I/O>>Digital Output>>DO-2(Fault)”

- **Definitions of specific states**

When a fault occurs, the contact turns on. This contact is specifically for fault notification and cannot be disabled.

- **Output delay**

A delay of up to 100 analysis cycles can be set for the period from when a fault occurs until when the contact actually turns on. When the number of delays is set to zero, the contact turns on immediately after a fault occurs.

The analysis cycle differs depending on the application and is set to the optimum value at the time of shipment. For details, see “Appendix 1 What is an Analysis Period?”.

4.6 Process Alarm Settings

Of the alarms of the TDLS8200, the threshold value and enable and disable can be set arbitrarily only for the following warnings related to the measurement process status. For details on each alarm, see “7.2 Warning Display and Handling”.

Alarm No.	Alarm Name
1	L1 Transmission Low
2	L2 Transmission Low
3	Process Pressure Low
4	Process Pressure High
5	Process Temperature Low
6	Process Temperature High
7	Concentration Gas1 Low
8	Concentration Gas1 High
9	Concentration Gas2 Low (2-component meas. by Laser1)
10	Concentration Gas2 High (2-component meas. by Laser1)
11	Concentration Gas3 Low
12	Concentration Gas3 High

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>Alarm”

For details on the setting procedure, see “3.2.6 Setting Process Alarms”.

4.7 Digital Input Settings

A specific function can be executed depending on the digital input (DI-1, DI-2). Also, the function to execute can be set for each channel. There are two types of digital input methods, edge input and status input, and the input method differs depending on the function.

- Edge input
  Execute a function when the digital input changes from “open” to “closed.”
- Status input
  Execute and continue executing a function while the digital input is closed.

Setup menu path:
[YH8000] >>Select analyzer >>Configuration >>I/O>>Digital Input>>DI-1 or DI-2”

● Functions that can be executed

The following shows the functions that can be executed.

Function Name	Action	Input Method
External Alarm	Generates the “External Alarm” warning.	Status
Online Validation 1	Executes automatic online validation 1.	Edge
Online Validation 2	Executes automatic online validation 2.	Edge
Blow Back	Executes Blow Back.	Edge

Note: The items of the above selection options that have been disabled by the “Valve usage setting” are not displayed. For details, see “4.8.2 Valve Usage Setting”

● Filter time

A cutoff time can be set to prevent wrong operation due to chattering. A digital input change within the specified time will be ignored.

4.8 Valve Stream Settings

This section describes the procedure to automatically control multiple process gas streams according to the TDLS8200 valve control output (SV terminal). Up to three streams can be switched.

4.8.1 Definitions of Stream Numbers

Implement the valve operation of the TDLS8200 using stream numbers defined for the statuses of the two valves connected to the valve control outputs (SV-1 and SV-2). Do not perform valve operation independently but specify stream numbers (independent operation is possible only when performing a loop check).

The following shows the stream numbers to define for the TDLS8200 and the corresponding status of each valve.

Stream No.	Valve 1 (SV-1) Status	Valve 2 (SV-2) Status
Stream 1	OFF	OFF
Stream 2	ON	OFF
Stream 3	ON	ON

The process gases can be switched as shown in Figure 4.1 by switching the streams.

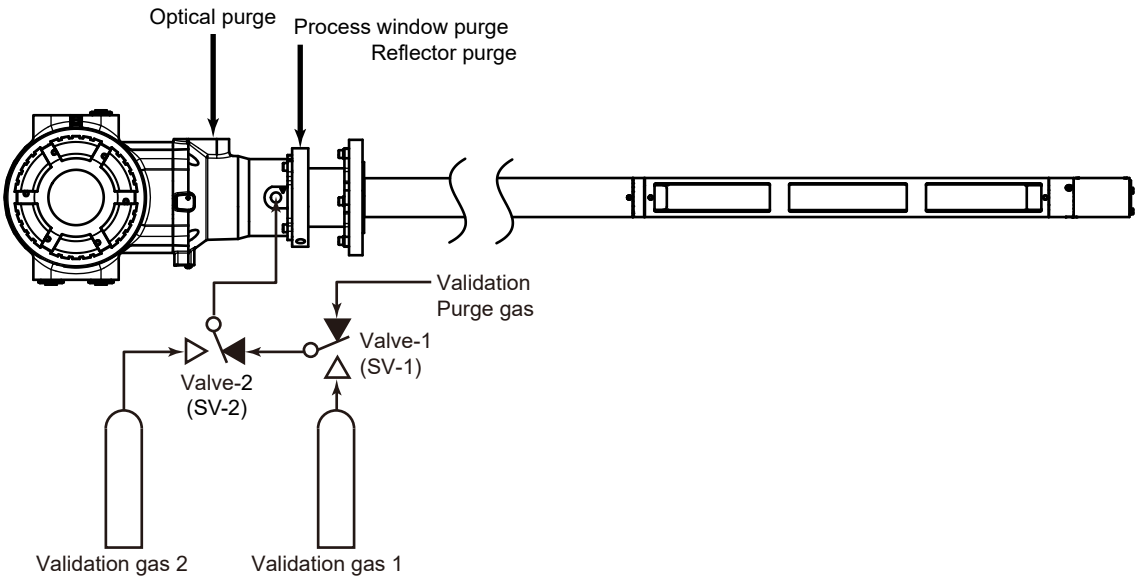


Figure 4.1 Piping diagram for switching streams

4.8.2 Valve Usage Setting

Set the valve usage purpose for automatically controlling the valves according to the SV terminal.

Online Validation or Blow Back can be selected.

Setup menu path to Valve usage:

[YH8000] >>Select analyzer >>Configuration >>I/O>>Valve Control>>Valve Usage”

NOTE

The items of OnlineValidation or Blow Back that can be executed according to the TDLS8200 valve control output (SV terminal) are limited depending on the “Valve usage” setting.

- Online validation

  Stream switching cannot be used because all streams are used for automatic validation. When validation is not executed, the stream is fixed to Stream 1.
- Blow Back

  Sets only Stream 3 to be used for Blow Back.

If valve usage is changed, the following setting values are initialized.

- The time execution setting (Time initiate) of all automatic validation, Blow Back is set to “Disable.”
- If remote execution of automatic validation, Blow Back is set for digital input, it is set to “Disable.”

4.9 Other Settings

This section describes various settings other than measurement process settings and the I/O and alarm settings.

4.9.1 Tag

This is a tag of up to 32 ASCII characters for identifying individual TDLS8200. It is displayed when you connect to the TDLS8200 from the YH8000. Furthermore, the long tag defined as standard in HART communication is the same as this tag.

From YH8000, Latin-1 character cannot be inputted on tag.

Setup menu path:

[HART] “Device Settings >> Basic setup >> Long tag”

[YH8000] >>Select analyzer >>Configuration >>System>>Tag”

4.9.2 Date and Time

Set the current date and time. For a detailed description of the setting screen, read “3.2.1 Setting the Date and Time”. Furthermore, it is possible to set the time simultaneously for multiple connected TDLS8000 series only when setting them from the YH8000. For details, see YH8000 user’s manual (IM 11Y01D10-01EN).

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>System>>Date&Time”

4.9.3 User Password Setting

Change the user password for when entering the setting screen from the YH8000. Enter the current password and then enter a new password twice for confirmation. The factory default password is “1234”.

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>System>>Password”

4.9.4 Display

Configure settings related to the LU display and SCU display.

- **Brightness adjustment**

Adjust backlight brightness and contrast to any of 11 levels.

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>System>>Local Display>>SCU”

Spectrum display of LCD display

Set whether or not to display the spectrum screen.

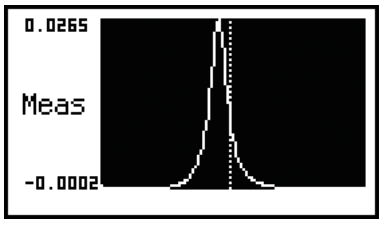
Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>System>>Local Display>>SCU”

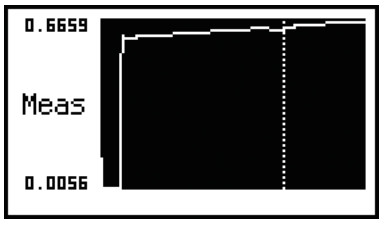
Selection Option (HART Display Name)	Description
Hide	A spectrum is not displayed.
During alarm mode	• Measurement spectrum When any of the following alarms occur, the received optical signal and absorption spectrum of the measured gas are displayed alternately in a 3-second cycle. No. / Alarm 41 fault: L1 detector signal high 42 fault: L2 detector signal high 47 fault: L1 peak center out of range 48 fault: L2 peak center out of range 49 fault: L1 detector signal los 50 fault: L2 detector signal lost 53 fault: L1 laser unit failure 54 fault: L2 laser unit failure • Reference cell spectrum When any of the following alarms occur, the received optical signal and absorption spectrum of the reference cell are displayed alternately in a 3-second cycle. (If the reference cell is disabled, the received optical signal and absorption spectrum of the measured gas are displayed.) No. / Alarm 51 fault: L1 ref signal out of range 52 fault: L2 ref signal out of range
Periodically	After the display item on the 6th line of the screen is complete, the measurement spectrum of LD1/LD2 are displayed for 4 seconds each.
Each measurement spectrum	The received optical signal and absorption spectrum of the LD1/LD2 measured gas are always displayed alternately in a 4-second cycle. (*1)
Each reference spectrum	The received optical signal and absorption spectrum of the LD1/LD2 reference cell are always displayed alternately in a 4-second cycle. (*1)

*1: When the 1 laser specification is selected, only the spectrum of LD1 is displayed.

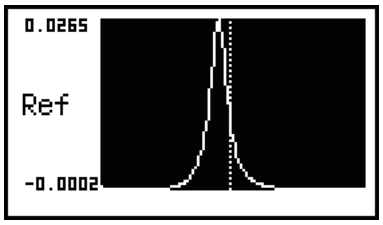
The following shows the display image of each spectrum screen.



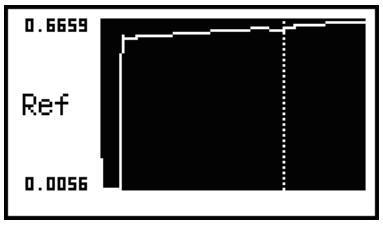
Measurement absorption spectrum



Measurement received optical signal



Reference cell absorption spectrum



Reference cell received optical signal

4.9.5 Communication Address Setting

Configure the address settings for TDLS8200 and HART communication.

- **IP address setting of TDLS8200**

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>System>>Communication>>TCP/IP”

NOTE

When the IP address is changed, the TDLS8200 restarts automatically.

NOTE

When the IP address of the TDLS8200 is changed via the YH8000, the YH8000 connection settings need to be configured again. For details, see YH8000 user’s manual (IM 11Y01D10-01EN).

- **HART address setting**

Setup menu path:

[HART] “Device Settings >> System >> Communication >> HART output”

[YH8000] “Configuration>>System>>Communication>>HART”

“Loop current mode” is a setting related to multi-drop mode. For details on multi-drop mode, see “5.5.1 Multidrop Mode”.

4.9.6 Moving Average Count for Analysis Values

Configure the setting for how many analysis cycles of spectrum data to take the moving average. Increasing this value enables a more stable analysis result to be obtained but the response time will increase. For explanations on the analysis cycle and average count, see “Appendix 1 What is an Analysis Period?”

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>Analysis>>Average”

4.9.7 Concentration Offset

It is possible to display the value resulting from adding a fixed offset value to the calculated concentration value as the final reading. For the two-gas measurement specification, you can set an offset for each of the first component gas concentration and second component gas concentration.

Setup menu path:

[YH8000] >>Select analyzer >>Configuration >>Analysis>>Zero Offset”

4.9.8 Safety Mode

Safety mode is for more reliable fault detection of the instrument. The following table shows how configuration of Safety Mode affects the operation.

Setup menu path:

[HART] “Device Settings >> System >> Safety mode”

[YH8000] >>Select analyzer >>Configuration >>System >>Safety Mode”

Effect on \ Safety mode	Enable (*1)	Disable (*2)
Condition of fault clearance	Fault stays until the system reboots.	Once the problem is solved, the fault is cleared.
Threshold of Fault: L1 detector signal lost	Detector sensitivity becomes high	Detector sensitivity becomes standard.
Threshold of Fault: L2 detector signal lost	Detector sensitivity becomes high	Detector sensitivity becomes standard
Feedback error AO-1, AO-2, AO-3	AO feedback check becomes enabled. An error of AO output value is detected. When the error is detected, the value becomes =0 mA (no output).	AO feedback check becomes disabled.
Analog output on the following conditions: ● AI-1 <= 3.6 mA, or AI-1 >= 21.0 mA ● Process pressure input mode is “Active Input” and “Input source is “A1-1”.	Follow the Output Hold setting for Fault	Follow the Output Hold setting for Warning. (Warning appears when analog input is less than or equal to 4 mA or greater than or equal to 20 mA.)
Analog output on the following conditions: ● AI-2 <= 3.6 mA , or AI-2 >= 21.0 mA ● Process temperature input mode is “Active Input” and “Input source is “A1-2”.		
Analog output after WDT reset	=0 mA	normal operation
Analog output during Fault diagnosis (*3)	Hold the previous output value.	Output the measured value.

*1: Default when option: /SIL is selected.
*2: Default when option: /SIL is not selected.
*3: The interval from when an event suspected to be a Fault is detected to when it is confirmed.

NOTE

Be sure to enable the Safety Mode when using TDLS8200 for a safety instrumented system. See “Appendix 4 Safety Instrumented System Installation” for details.

When Safety Mode is enabled, the AO output value, gas concentration value, Transmission, temperature value, and pressure value on the YH8000 are held during Fault diagnosis. Warning is determined by the value that is not held (latest value). During Fault diagnosis, there is no relationship between these numbers on the YH8000 display and whether or not warnings occur.

4.10 Initializing the Settings (Factory Default Settings)

This section describes the procedure to restore the settings to the state at the time of shipment and lists the initial values of the parameters at the time of shipment.

4.10.1 Initialization Procedure

Execution menu path:

[YH8000] >>Select analyzer >>Configuration >>System>>Configuration Initialization"

To execute initialization, open the above menu and then select from the following depending on the types of parameters you wish to initialize. Multiple items can be selected at the same time.

Item name	Initialization target
Setting data	All parameters settable from YH8000 (All parameters in “4.10.2 Parameter Initial Value List” except for “User info.”)
AI/AO cal data	Input/output calibration data of AI/AO
Calibration data	Zero/span calibration data
User info	TDLS8200 tag, IP settings, HMI (YH8000) user password

NOTE

When initialization is executed, the TDLS8200 restarts automatically.

4.10.2 Parameter Initial Value List

The initial values of parameters at the time of shipment are as follows.

Parameters with ○ in the “User specification” column are initialized to the values specified by the customer at the time of ordering if the values were specified by the customer at that time.

● Process parameters

Parameter	Initial value	User specification	Min. – Max.
OPL (Optical Path Length)	1[m]		0.01 – 100[m]
Pressure mode	Active input		Select in the screen
Pressure value for fixed mode	101.325[kPa]		0.1 – 10,000[kPa]
Pressure active input source	AI-1		Select in the screen
Pressure value at 4mA	40[kPa]		0 – 10,000[kPa]
Pressure value at 20mA	200[kPa]		0 – 10,000[kPa]
Pressure backup mode when AI-1 input is out of range or under AI calibration	Backup value		Select in the screen
Pressure backup set value	101.325[kPa]		0.1 – 10,000[kPa]
Temperature mode	Active input		Select in the screen
Temperature value for fixed mode	25[deg C]		-273 – 3,000[deg C]
Temperature active input source	AI-2		Select in the screen
Temperature value at 4mA input	0[deg C]		-273 – 3,000[deg C]
Temperature value at 20mA input	100[deg C]		-273 – 3,000[deg C]
Temperature backup mode when AI-2 input is out of range or under AI calibration	Backup value		Select in the screen
Temperature backup set value	25[deg C]		-273 – 3,000[deg C]
Temperature offset for active ambient method	-6[deg C]		-100 – 100[deg C]

● Units

Parameter	Initial value	User specification	Min. – Max.
OPL unit	m	○	Select in the screen
Pressure unit	kPa	○	Select in the screen
Temperature unit	deg C	○	Select in the screen

Process alarms

Parameter	Initial value	Min. – Max.
Warning selection	All selected	Select in the screen
L1 Transmission low warning limit	20[%]	0 – 100[%]
L2 Transmission low warning limit	20[%]	0 – 100[%]
Pressure low warning limit	90[kPa]	0.1 – 10,000[kPa]
Pressure high warning limit	110[kPa]	0.1 – 10,000[kPa]
Temperature low warning limit	0[deg C]	-273 – 3,000[deg C]
Temperature high warning limit	100[deg C]	-273 – 3,000[deg C]
Gas1 concentration low warning limit	10[ppm]	0 – 1E6[ppm]
Gas1 concentration high warning limit	900,000[ppm]	0 – 1E6[ppm]
Gas2 concentration low warning limit	10[ppm]	0 – 1E6[ppm]
Gas2 concentration high warning limit	900,000[ppm]	0 – 1E6[ppm]
Gas3 concentration low warning limit	10[ppm]	0 – 1E6[ppm]
Gas3 concentration high warning limit	900,000[ppm]	0 – 1E6[ppm]

Analog output

Parameter		Initial value	User specification	Min. – Max.
AO output item		Concentration 1	○	Select in the screen
Measurement value at 4mA output	Concentration	0[ppm]	○	-1E7 – 1E7[ppm]
	Transmission	0[%]		-1E7 – 1E7[%]
	Temperature	0[deg C]		-1E7 – 1E7[deg C]
	Pressure	0[kPa]		-1E4 – 1E4[kPa]
Measurement value at 20mA output	Concentration	100[ppm]	○	-1E7 – 1E7[ppm]
	Transmission	100[%]		-1E7 – 1E7[%]
	Temperature	100[deg C]		-1E7 – 1E7[deg C]
	Pressure	0.1[kPa]		-1E4 – 1E4[kPa]
AO hold mode during warning		Non-Hold		Select in the screen
Preset hold value during warning		3.0[mA]		3.0 – 21.6[mA]
Preset hold delay during warning		0		0 – 5
AO hold mode during fault		Preset hold		Select in the screen
Preset hold value during fault		3.0[mA]		3.0 – 21.6[mA]
Preset hold delay during fault		0		0 – 5
AO hold mode during Cal/Val/Blow Back		Preset hold		Select in the screen
Preset hold value during Cal/Val/Blow Back		3.8[mA]		3.8 – 20.5[mA]
AO hold mode during maintenance		Preset hold		Select in the screen
Preset hold value during maintenance		3.8[mA]		3.8 – 20.5[mA]
AO hold mode during warm-up		Preset hold		Select in the screen
Preset hold value during warm-up		3.8[mA]		3.8 – 20.5[mA]

Digital output

Parameter	Initial value	Min. – Max.
Number of output delays for warning and fault	0	0 – 100
DO output item selection	All selected	Select in the screen

Digital input

Parameter	Initial value	Min. – Max.
Filter time	0.5[s]	Select in the screen
DI item selection	Disable	Select in the screen

Valve

Parameter	Initial value	Min. – Max.
Valve usage	Online validation	Select in the screen

Loop check

Parameter	Initial value	Min. – Max.
Test auto release time	30[min]	Select in the screen

System

Parameter	Initial value	User specification	Min. – Max.
User averaging number	1		1 – 32(*1)
Analyzer tag	Blank	○	ASCII 32 characters
Analyzer IP address	192.168.1.10		IPv4 address
Subnet mask	255.255.255.0		IPv4 address
Default gateway address	192.168.1.254		IPv4 address
HMI user password	1234		ASCII 8 characters
LCD spectrum display mode	Hide		Select in the screen
LCD backlight brightness	10		0 – 10
LCD contrast	5		0 – 10
Safety mode	/SIL is not selected: Disable /SIL is selected: Enable		Select in the screen

*1: The maximum value varies depending on the measurement target gas (application). Normally, it is 16.

HART parameters

Parameter	Initial value	Min. – Max.
HART address	0	0 – 63
Loop current mode	Enable	Select in the screen
Short tag	All space	ASCII 8 characters (*1)
SV item	LD1-SubGas1	Select in the screen
TV item	Temperature	Select in the screen
QV item	LD1 transmission	Select in the screen
Response preamble number	5	5 – 20
Memo 1/ Memo 2/ Memo 3	All space	ASCII 32 characters
Message	All space	32 characters (*1)
Descriptor	All space	16 characters (*1)
Update failure mask	Disable	Select in the screen
Device malfunction mask	Disable	Select in the screen

*1: Uppercase letters, numbers, and symbols can be entered.

Zero calibration

Parameter	Initial value	Min. – Max.
Auto zero calibration LD	LD1	Select in the screen

Span calibration

Parameter	Initial value	Min. – Max.
Pressure mode for span calibration	Process parameter	Select in the screen
Temperature mode for span calibration	Process parameter	Select in the screen
OPL mode for span calibration	Process parameter	Select in the screen
Pressure fixed value for span calibration	101.325[kPa]	0.1 – 10,000[kPa]
Temperature fixed value for span calibration	25[deg C]	-273 – 3,000[deg C]
OPL fixed value for span calibration	0.66[m]	0.01 – 100[m]
Gas1 concentration value	219,000[ppm]	0 – 1E6[ppm](*1)
Gas2 concentration value	219,000[ppm]	0 – 1E6[ppm](*1)
Gas3 concentration value	219,000[ppm]	0 – 1E6[ppm](*1)
Gas type for span calibration	Gas 1	Select in the screen

*1: Zero is not allowed.

Offline validation (*1)

Parameter	Initial value	Min. – Max.
Pressure mode for offline validation 1	Process parameter	Select in the screen
Temperature mode for offline validation 1	Process parameter	Select in the screen
OPL mode for offline validation 1	Process parameter	Select in the screen
Pressure fixed value for offline validation 1	101.325[kPa]	0.1 – 10,000[kPa]
Temperature fixed value for offline validation 1	25[deg C]	-273 – 3,000[deg C]
OPL fixed value for offline validation 1	0.66[m]	0.01 – 100[m]
Gas1 concentration value for offline validation 1	200,000[ppm]	0 – 1E6[ppm](*2)
Gas2 concentration value for offline validation 1	200,000[ppm]	0 – 1E6[ppm](*2)
Gas3 concentration value for offline validation 1	200,000[ppm]	0 – 1E6[ppm](*2)
Gas type for offline validation 1	Gas 1	Select in the screen

*1: The initial value for the parameters related to “offline validation 2” is the same as those for “Offline validation 1.”
*2: Zero is not allowed.

Online validation (*1)

Parameter	Initial value	Min. – Max.
Temperature mode for online validation 1	Active ambient	Select in the screen
Temperature ambient offset for online validation 1	-2.2[deg C]	-100 – 100[deg C]
Pressure value for online validation 1	101.325[kPa]	0.1 – 10,000[kPa]
Temperature fixed value for online validation 1	25[deg C]	-273 – 3,000[deg C]
OPL value for online validation 1	0.1020[m](*2)	0.01 – 10[m]
Gas1 concentration value for online validation 1	200,000[ppm]	-1E6 – 1E6[ppm]
Gas2 concentration value for online validation 1	200,000[ppm]	-1E6 – 1E6[ppm]
Gas3 concentration value for online validation 1	200,000[ppm]	-1E6 – 1E6[ppm]
Gas type for online validation 1	Gas 1	Select in the screen
Auto online validation 1 time initiate	Disable	Select in the screen
Auto online validation 1 time initiate cycle (day)	0 (=Disable)	0 – 999
Auto online validation 1 time initiate cycle (hour)	0 (=Disable)	0 – 23
Auto online validation 1 time initiate base clock	2010/01/01 00:00:00	2010/01/01 00:00 – 2068/01/18 13:14
Auto online validation 1 validation gas purge time	600[s]	0 – 10,000[s]
Auto online validation 1 normal gas purge time	600[s]	0 – 10,000[s]
Auto valve control for manual online validation 1	Disable	Select in the screen
Reading mode for online validation 1	Process+Validation	Select in the screen
Concentration output factor during online validation 1	1.0	-9.9 – 9.9

*1: The initial value for the parameters related to “Online validation 2” is the same as those for “Online validation 1.”

Blowback

Parameter	Initial value	Min. – Max.
Auto blow back time initiate	Disable	Select in the screen
Auto blow back time initiate cycle (day)	0 (=Disable)	0-999
Auto blow back time initiate cycle (hour)	0 (=Disable)	0-23
Auto blow back time initiate cycle (minute)	0 (=Disable)	0-59
Auto blow back time initiate base clock	2010/01/01 00:00:00	2010/01/01 00:00 –2068/01/18 13:14
Auto blow back time	600[s]	0-10,000[s]
Auto blow back hold time	600[s]	0-10,000[s]
Auto valve control for manual blow back	Disable	Select in the screen

Concentration offset

Parameter	Initial value	Min. – Max.
Concentration offset for gas1	0[ppm]	-1E6 – 1E6[ppm]
Concentration offset for gas2	0[ppm]	-1E6 – 1E6[ppm]
Concentration offset for gas3	0[ppm]	-1E6 – 1E6[ppm]

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5. HART Communication

The following functions can be performed via HART communication.

- Checking concentration, transmission, process pressure, and process temperature
- Checking alarm statuses
- Setting parameters
- Performing calibration and validation
- Performing loop check
- Performing Piezo Proof Test

This chapter explains matters specific to HART communication.

5.1 Connection

For the method of connecting a HART setting tool to the TDLS8200, see “3.1 Connecting the HART Configuration Tool”.

5.2 Menu Tree

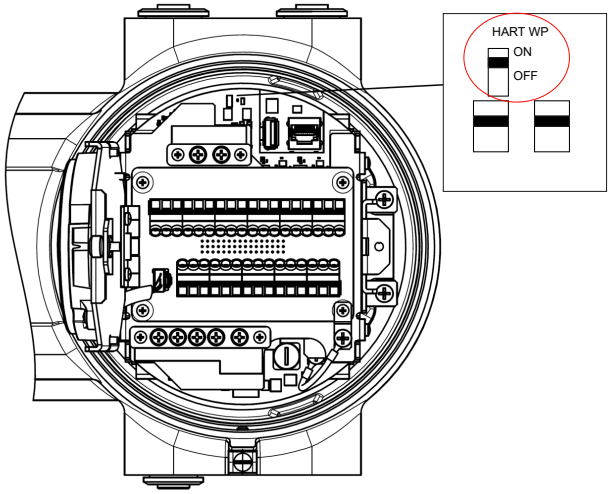
This section shows the hierarchal configuration of the DD menu. For the whole configuration containing all parameters, see Appendix 3 General View of HART DD.

5.3 Write Protection

The write protection via HART communication is an architecture of a hardware-switch protection.

By turning the switch ON the analyzer part, write protection is enabled. The default setting is ON. Make sure that the TDLS8200 is turned off before setting the switch. Failure to do so may cause damage to the equipment. In a Safety Instrumented System Application, switch ON the Write protection.

Switch position	Write protection
OFF	Disabled
ON	Enabled



5.4 Alarm Definition (Status group)

This section explains the device-specific alarms on HART communication and their definition.

On a HART setting tool, device-specific alarms and their status information are bundled in groups consisting of up to eight items. These groups are defined as “Status group#” and alarms are expressed in the format of the character string of an alarm followed by (AL-alarm number). The details of each group are given below.

Display menu: “Diagnostics >> Device Status”

Group	Status	Attribute	Description
Group 1	L1 Transmission Low (AL-01)	Warning	Refer to “7.2 Warning Display and Handling”.
	L2 Transmission Low (AL-02)		
	Pressure Low (AL-03)		
	Pressure High (AL-04)		
	Temperature Low (AL-05)		
	Temperature High (AL-06)		
	Conc Gas1 Low (AL-07)		
	Conc Gas1 High (AL-08)		
Group 2	Conc Gas2 Low (AL-09)		
	Conc Gas2 High (AL-10)		
	Conc Gas3 Low (AL-11)		
	Conc Gas3 High (AL-12)		
	Conc Gas4 Low (AL-13)		
	Conc Gas4 High (AL-14)		
Group 3	LU Temp Low (AL-17)		
	LU Temp High (AL-18)		
	SCU Temp Low (AL-19)		
	SCU Temp High (AL-20)		
	L1 Validation Required (AL-21)		
	L1 Validation Error (AL-22)		
	L1 Zero Cal Error (AL-23)		
	L1 Span Cal Error (AL-24)		
Group 4	L2 Validation Required (AL-25)		
	L2 Validation Error (AL-26)		
	L2 Zero Cal Error (AL-27)		
	L2 Span Cal Error (AL-28)		
	AI-1 (Pres) Low (AL-29)		
	AI-1 (Pres) High (AL-30)		
	AI-2 (Temp) Low (AL-31)		
	AI-2 (Temp) High (AL-32)		
Group 5	External Alarm (AL-33)		
	Clock Adj Required (AL-34)		
	Setting File Error (AL-35)		
	L1 Calib File Error (AL-36)		
	L2 Calib File Error (AL-37)		
Group 6	L1 Detect Signal High (AL-41)	Fault	Refer to “7.1 Fault Display and Handling”
	L2 Detect Signal High (AL-42)		
	Laser Md Temp Low (AL-43)		
	Laser Md Temp High (AL-44)		
	L1 Laser Temp OOR (AL-45)		
	L2 Laser Temp OOR (AL-46)		
	L1 Peak Center OOR (AL-47)		
	L2 Peak Center OOR (AL-48)		

Group	Status	Attribute	Description
Group 7	L1 Detect Signal Lost (AL-49)	Fault	Refer to “7.1 Fault Display and Handling”.
	L2 Detect Signal Lost (AL-50)		
	L1 Ref Signal OOR (AL-51)		
	L2 Ref Signal OOR (AL-52)		
	L1 Laser Unit Fail (AL-53)		
	L2 Laser Unit Fail (AL-54)		
	L1 Laser Module Error (AL-55)		
	L2 Laser Module Error (AL-56)		
Group 8	File Access Error (AL-57)		
	EEPROM Error (AL-58)		
	Inter Comm Fail (AL-59)		
	Power Failure (AL-60)		
	L1 LU Connect Error (AL-61)		
	L2 LU Connect Error (AL-62)		
	FPGA Failure (AL-63)		
	System Error (AL-64)		
Group 9	Warm-up	Status	Warming-up
	Maintenance mode		Maintenance
Group 10	Zero Cal		Zero calibration
	Span Cal		Span calibration
	Blow Back		Blow back
	Online Val		On line validation
	Offline Val		Off-line validation
	Piezo Proof Test		Piezo Proof Test
	AI1 (Pres) Cal		AI-1 (pressure input) calibration
	AI2 (Temp) Cal		AI-2 (temperature input) calibration

5.5 Functions Specific to HART Communication

This section explains functions that can be performed only via HART communication. These functions include those specified by HART communication and those of the TDLS8200 only for HART communication.

5.5.1 Multidrop Mode

In the multidrop mode, multiple HART communication devices can be connected to a single HART communication line. Set “Poll addr” to a value of 0 to 63 so that each device has a different address.

Set “Loop current mode” to “Disabled”. In this setting, AO-1 output will be fixed to 4 mA, and burnout output will be disabled. However, in the multidrop connection with devices that receive analog outputs (including actuators), one unit in one loop can output analog signals. In this case, set “Loop current mode” to “Enabled”. Figure 5.1 shows an example connection when using the TDLS8200 in multidrop mode.

Configuration menu: “Device Settings >> System >> Communication >> HART output”

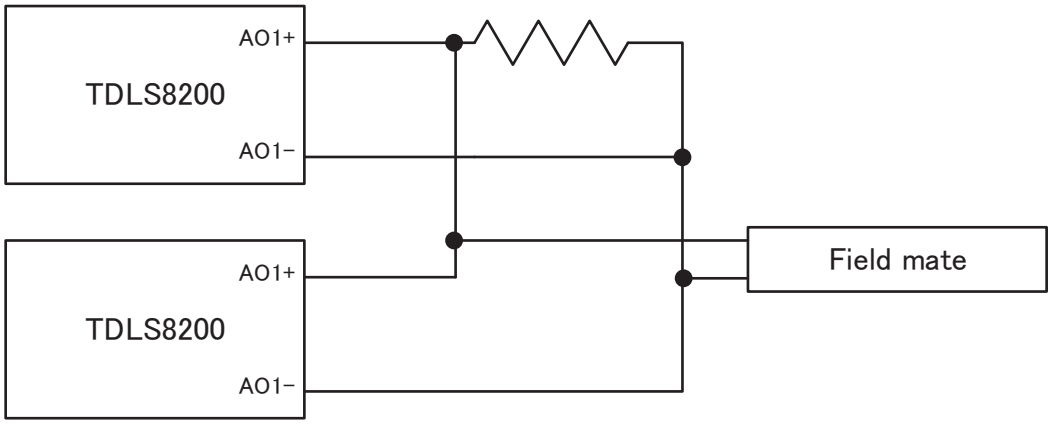


Figure 5.1 Connection example (Multidrop)

5.5.2 Aborting Calibration and Validation

Even if a setting tool is accidentally disconnected during calibration or validation via HART communication, these tasks do not suspend but continue on the TDLS8200. In this case, stop calibration and validation with the abort function, and then start these tasks afresh. Note that calibration and validation commanded from the YH8000 cannot be aborted with this function.

The abort function is available for calibration and validation.

For calibration: “Diagnostics >>Calibration>>Abort calibration”

For validation: ” Diagnostics >>Validation>>Abort validation”

5.5.3 Update Failure mask

Update Failure may appear on the factory default settings of the TDLS8200 depending on your HART configuration tools. This is a notification that the same measured value was read multiple times within the same analysis period. This is not a problem with the TDLS8200 operation. The analysis period is a fixed adjustment value assigned to each TDLS8200 and cannot be changed.

Enable “Update Failure”, if you don’t want it to appear.

Setup menu path:

“Device Settings >> System >> Communication >> HART output”

5.5.4 Device Malfunction during warming up

A measurement value is not valid until the warming-up of TDLS8200 completes after the startup. During that time, HART specifies Device Malfunction of Field Device Status. If you don't want Device Malfunction to appear then, enable "Device malfunction mask". However, if TDLS8200 detects Failure alarms, Device Malfunction appears whether or not the "Device malfunction mask" is on.

Setup menu path:

"Device Settings >> System >> Communication >> HART output"

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6. Inspection and Maintenance

CAUTION

If you need to remove the TDLS8200 from the process flange for inspection or maintenance, be sure to turn off the power beforehand.

Work performed by an unqualified engineer can cause injury or severe damage to instruments. Not following the warnings in this manual can also cause injury or severe damage to instruments.

Make sure that maintenance is carried out by a qualified engineer. A qualified engineer is an engineer who:

- Is knowledgeable about the safe handling of process analysis instruments (or general automation technology) and has read and understood the content of this manual.
- Has received instructions on how to start and configure instruments and has read and understood the content of this manual.

This chapter explains inspection and maintenance to retain the measurement performance of the TDLS8200.

There are no operations that need to be performed regularly on the TDLS8200.

When the laser beam transmission decreases, clean the probe area (probe, process window, reflector.)

6.1 Maintaining the Laser Beam and Transmission

Transmission is a value determined by the magnitude of laser power that reaches the photo detector in the analyzer part after the laser beam, being emitted from the laser element of the analyzer part, reflects at the tip of probe and passes through the gas to be measured. Transmission is used to verify aging after the optical axis is adjusted. As startup, adjust the optical axis correctly, perform transmission calibration, and set the transmission value to 100%.

By checking the variation in the transmission after startup, you can determine the state of the region that the laser beam travels through, the degree of optical axis misalignment, and the states of the laser beam emitting/receiving components. This information is important for maintenance and troubleshooting.

Generally, the transmission degrades due to the conditions shown below.

To maintain normal TDLS8200 operation, perform the required inspection and maintenance to prevent the transmission from degrading. To maximize the TDLS8200 performance, it is particularly important to optimally adjust the optical axis and keep the process window clean.

Stained process window

Stained process window keeps laser beam from reaching the photo detector. Perform process window purge continuously to prevent stains from adhering to the process window. See “6.1.4 Probe Cleaning”.

Dust in the process

Dust (particles) in the process gas keeps the laser beam from reaching the photo detector. If dust adheres to and accumulates around the opening of probe, the dust completely blocks the laser beam. When the equipment is installed with high level of particles in the process, clean the probe regularly.

- **Optical axis adjustment**

  When you remove analyzer part from probe or reassemble it to perform inspection and maintenance, optical axis may deviate. If the transmission falls down obviously, check the equipment is installed appropriately or adjust the optical axis as necessary.

6.1.1 Transmission Calibration

After reinstalling the TDLS8200 in the measurement location and performing optical axis adjustment according to “2.3 Optical Axis Adjustment”, perform transmission calibration.

NOTE

Optimum transmission may not be attainable if the optical axis is not adjusted correctly. Refer to “2.3 Optical Axis Adjustment”, and perform optical axis adjustment correctly.

Execution menu path:

[YH8000] “ >>Execution>>Transmission Adjustment>>Measurement >>Transmission Adjustment”

6.1.2 Blow Back

Blow Back is a function that cleans the process window and reflector with purge gas.

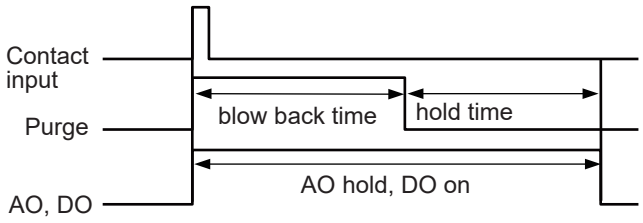
Blow Back includes manual Blow Back executed by the customer’s screen operation and manual valve control, automatic Blow Back executed at a preset time and time intervals, and semi-automatic Blow Back executed by a start command from contact input.

Since the valve is automatically controlled in automatic/semi-automatic execution, set the Blow Back time in advance.

See the figure below. The purge time is called “Blow Back time”. “hold time” coming next refers to the time when the gas inside of the probe is being replaced by the process gas.

“hold time” is the waiting time for the measured value to return to the normal process value stably.

TDLS8200 maintains Cal/Val/Blow Back status until the “hold time” ends, and holds AO. The diagram below is an example of the remote operation, showing that the operation starts with contact input.



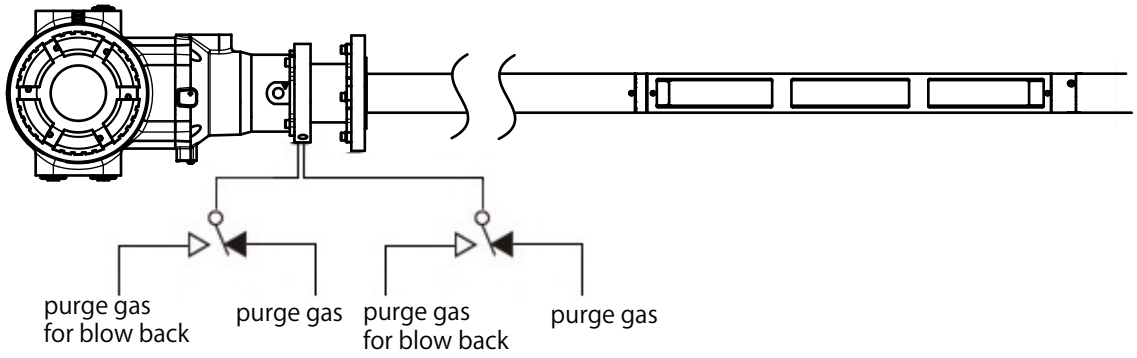
NOTE

To switch purge gas by automatic valve control through the SV terminal, Valve usage for TDLS8200 has to be set at “Blow Back”. For Valve usage, see 4.8.2 Valve Usage Setting

During Blow Back time, AO hold, DO on can be set disabled. See 4.4.2 Output Hold, 4.5.1 DO Contact (DO-1) for details.

Preparation

Provide piping properly according to the Blow Back before performing automatic or semi-automatic execution.



Setting

For automatic/semi-automatic execution, in addition to the Blow Back settings, automation settings are required.

Blow Back settings menu path:

[YH8000] “ >>Setting>>Blow Back

Blow Back time and hold time

The setting is always required whether auto/semi auto operation.

Parameter (YH8000)	Description
Blow Back time	Enter the purging time of purge gas. This refers to “Blow Back time”.
hold time	Set the time it takes until the output returns to the steady-state after the process gas inside the probe is replaced. Enter the purging time using the normal purge gas during process measurement. This refers to “hold time”.

Valve

Parameter name (YH8000)	Description
Offval1 auto vlv man	Selects whether to enable automatic valve control through the SV terminal during manual Blow Back time.

Setting parameters about automatic execution

Automatic execution requires each setting of parameters. Semi automatic operation does not require the settings.

Parameters for execution by time

Parameter (YH8000)	Description
Time Initiate	Enables time initiate of Blow Back.
Initial time	Enter the initial Blow Back date. Enter the initial execution time.
Cycle (day)	Enter the cycle in days.
Cycle (hour)	Enter the cycle in hours.
Cycle (minute)	Enter the cycle in minutes.

<Example>

When you enter
the initial execution time: “2021/4/1”, Cycle (day): “10”, Cycle (hour): “0”, cycle (minute): “0”
the Blow Back would be performed on “2021/4/1 12:00:00”, “2021/4/11 12:00:00”and so on.

Note

If both the day and hour cycles for time initiate are set to zero, automatic Blow Back takes place only once at the initial execution time.

To use contact input, refer to “4.7 Digital Input Settings”.

■ Execution

Make sure the preparation and settings are all correct before operating the Blow Back.

NOTE

If another Blow Back-start-request overlaps during a Blow Back, that start request is ignored.

For example, if the timing of automatic Blow Back time execution overlaps while performing manual Blow Back, the time execution request is ignored. At this time, the alarm history records that the request for autorun was ignored (skipped).

Since automatic Blow Back is executed at the set time cycle, there is no execution operation. This section describes the procedure for manual execution.

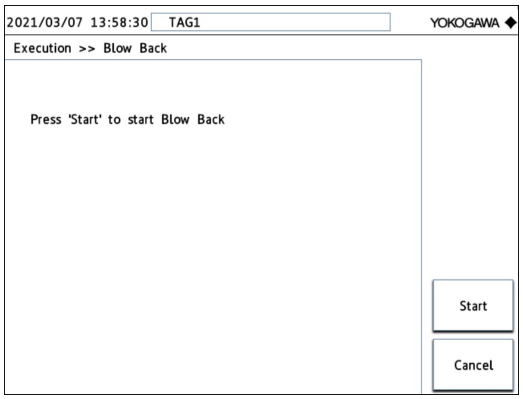
Manual execution menu path:

[YH8000] “  >>Execution>>Blow Back

● YH8000 manual execution

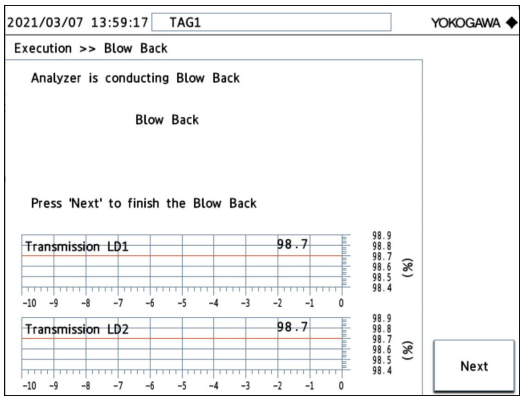
(1) Start up Blow Back

Press “Start” to start Blow back, then flow is switched. On the next screen, tap ENTER. If automatic valve control is enabled, the stream is switched, and the purge gas is introduced.



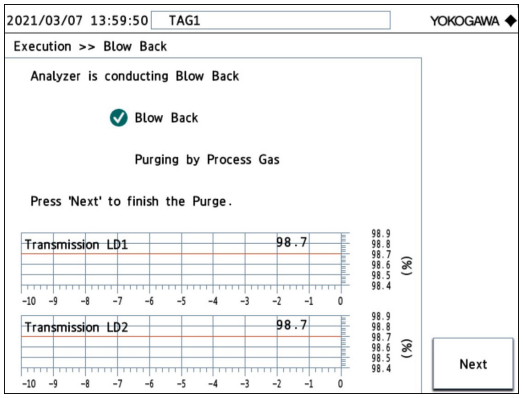
(2) Purge gas

If automatic valve control is disabled, manually control the valves to lead the purge gas. To end Blow Back, control the valve manually, stop the purge gas for Blow Back and press “Next”. If automatic valve control is enabled, the stream will be switched automatically, and the purge gas will be discharged.



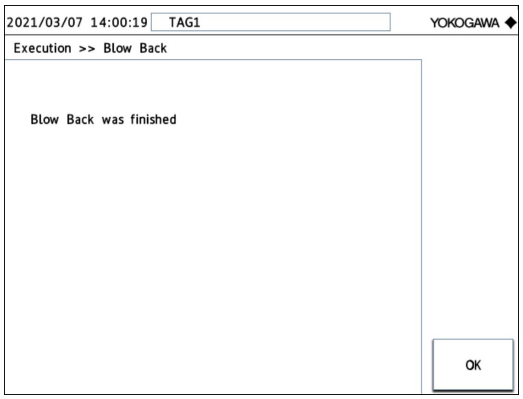
(3) Replacing with process gas

If automatic valve control is disabled, manually control the valves to lead the purge gas. Wait until the gas inside the probe is replaced with the process gas. After the stabilizing time passes, press “Next”.



(4) End of Blow Back

The message “Blow Back was finished” appears. Press “OK” to return to the setting menu.



6.1.3 Process Window Cleaning

Under normal operation, if process window purge is performed correctly, the surface of the process window rarely become stained. However, the surface of the process window may become stained or clouded under the following conditions.

- If the gas to be measured including dust or stain makes contact with the process window due to insufficient process window purge flow rate or purge gas pressure.
- If the surface of the process window condenses when the process window is hot
- If gas that would cause quality deterioration in the process window (e.g., hydrogen fluoride on BK-7) makes contact with the window
- If particles, oil, and the like from the purge gas facility adheres to the surface of the process window

If the surface of the process window is stained, remove and clean the process window according to the following procedure.

CAUTION

- Before removing the process window, check that the process is completely stopped or that the process is isolated from open air and no process gas will be discharged.
- Be careful in handling the process window as it is made of optical glass that is easily damaged.

CAUTION

Be sure to power off TDLS8200 when doing this maintenance/inspection.

(1) Remove the analyzer part from the process.
(If necessary, separate it completely from the process such as by using a process isolation valve.)

(2) Loosen the four M4 hexagon socket head screws on the process window holder installed in the probe, and remove the process window.

(3) Using clean and dry instrumental air or nitrogen gas, blow off the particles from the surface of the process window.

(4) Using warm water and low irritative cleansing agent, gently wipe the surface of the process window with a soft cloth, being careful not to scratch it. Then, if necessary, clean with alcohol (e.g., isopropyl alcohol).

(5) Blow clean and dry instrumental air or nitrogen gas again on the surface to dry it.

(6) Thoroughly examine the surface of the process window from various angles, and check that the stain has been sufficiently removed and that the process window is ready for use.

NOTE

If you cannot remove the stain from the surface of the process window, replace with a new one.
If the surface of the process window is corroded, it may have been contaminated with corrosive gas such as hydrogen fluoride. In such a case, replace the process window with a new one.

(7) Install the cleaned process window (or a new one).
Pay attention to the orientation of the process window. Install it in the same orientation as before.
Tighten the screws evenly.

(8) After installing the process window, install the analyzer part for use.
If the transmission is much lower than before cleaning, readjust the optical axis and use.

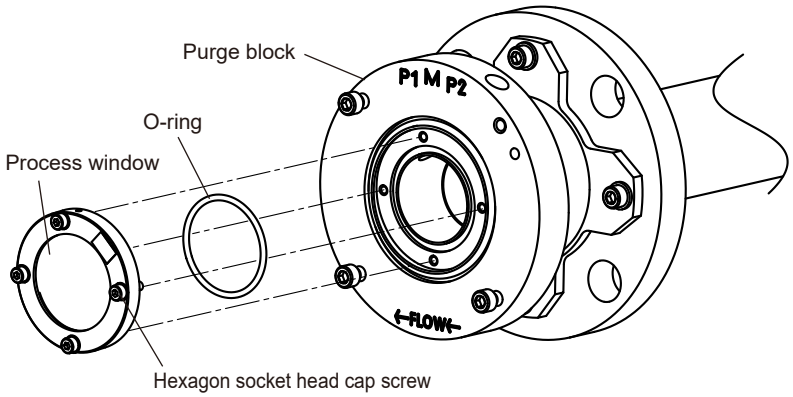


Figure 6.1 How to detach, mount the process window

6.1.4 Probe Cleaning

Under the following conditions, probe may become stained.

- Accumulation of dust due to long time use
- Dust and moist contained in process

If the probe becomes dirty, follow the procedure below to remove and clean the probe.

CAUTION

- Before removing the probe, check that the process is completely stopped or that the process is isolated from open air and no process gas will be discharged.
- Be sure to power off TDLS8200 before removing probe to perform the maintenance.

CAUTION

Handle with care the separation wall on the probe as shown below.

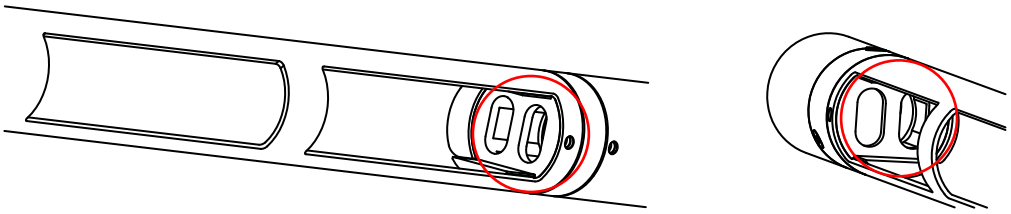


Figure 6.2 Separation wall

(1) Increase the purge rate for flushing. If the flushing does not remove the stain, take the probe apart.
(2) Power off TDLS8200.
(3) Remove piping. Apply vinyl tape or other protector to the TDLS8200 ports and pipe ferrule areas.
(4) Remove wiring. Be careful not to short the wires. Insulate and protect the removed wires with vinyl tape or the like, and bundle them together, making sure not to strain the cables.

(5) Remove the analyzer part from probe.
- Using a hex wrench (5 mm), remove only the upper right screw of the quick connector (see Figure 6.12).
- Loosen the other screws (upper left, lower left, and lower right).
- Slowly turn the TDLS82000 counterclockwise to remove the analyzer part from the probe.

(6) Take off the nuts on the process flange. Pull the probe out of the process flange.

CAUTION

When inside process is at high temperature, cool down the probe after removal and follow the next instruction.

(7) Scrub with brush both ends of process inlets and the separation wall. Handle with care the separation wall not to scratch it. If you cannot remove the stain, contact our service.

(8) After the cleaning, install the probe and analyzer or by following the instruction of “2.1 Installation”.
If the transition is much lower than before the cleaning, readjust the optical axis.

6.1.5 Reflector Cleaning

■ Probe type

Under normal operation, if reflector purge is performed correctly, the surface of the reflector rarely become stained. However, the surface of the reflector may become stained or clouded under the following conditions.
- If the gas to be measured including dust or stain makes contact with the reflector due to insufficient reflector purge flow rate or purge gas pressure.
- If the surface of the reflector condenses when the reflector is hot
- If particles, oil, and the like from the purge gas facility adheres to the surface of the reflector

Remove process window and clean the reflector by following the instructions.

CAUTION
- Shut down the process completely and make sure no process gas is emitted when you pull the probe out of the process for reflector cleaning.
- Be careful in handling the reflector as it is made of optical glass that is easily damaged.

CAUTION

Be sure to power off TDLS8200 when doing this maintenance/inspection.

(1) Remove piping. Apply vinyl tape or other protector to the TDLS8200 ports and pipe ferrule areas.

(2) Remove wiring. Be careful not to short the wires. Insulate and protect the removed wires with vinyl tape or the like, and bundle them together, making sure not to strain the cables.

(3) Remove the analyzer part from probe as necessary.
1. Using a hex wrench (5 mm), remove only the upper right screw of the quick connector (see Figure 6.9).
2. Loosen the other screws (upper left, lower left, and lower right).
3. Slowly turn the TDLS82000 counterclockwise to remove the analyzer part from the probe.

(4) Take off the nuts on the process flange. Pull the TDLS8200 out of the process flange. If the analyzer part is already removed in the process (3) above, pull the probe part out of the process flange.

CAUTION

- When you pull the probe, reserve enough space according to the length of probe.
- When inside process is at high temperature, cool down in air the probe after removal and follow the next instructions. Rapid cooling down may harm the reflector.

(5) Eliminate all the dust around the reflector. Remove the three fixing threads on the reflector and detach the reflector.

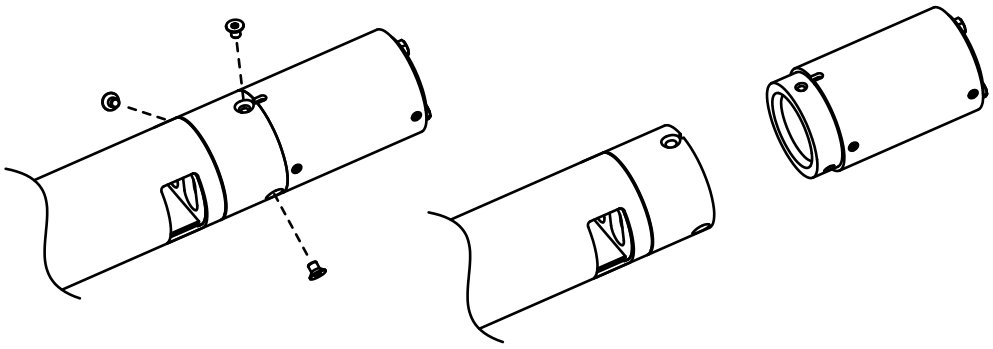


Figure 6.3 Reflector part

(6) Using clean and dry instrumental air or nitrogen gas, blow off the particles from the surface of the process window.

(7) Using warm water and low irritative cleansing agent, gently wipe the surface of the process window with a soft cloth, being careful not to scratch it. Then, if necessary, clean with alcohol (e.g., isopropyl alcohol).

(8) Blow clean and dry instrumental air or nitrogen gas again on the surface to dry it.

(9) Thoroughly examine the surface of the process window from various angles, and check that the stain has been sufficiently removed and that the process window is ready for use.

NOTE

If the stain is not removed, replace the reflector unit with new one.

(10) Install the cleaned reflector unit on the probe. Align the reflector unit and the notch at the tip of the probe. Fasten the three static screws one after the other until force is uniformly applied to those three screws.

(11) Install the probe and analyzer on process by the instruction in “2.1 Installation”. If the transition is much lower than before cleaning, readjust the optical axis.

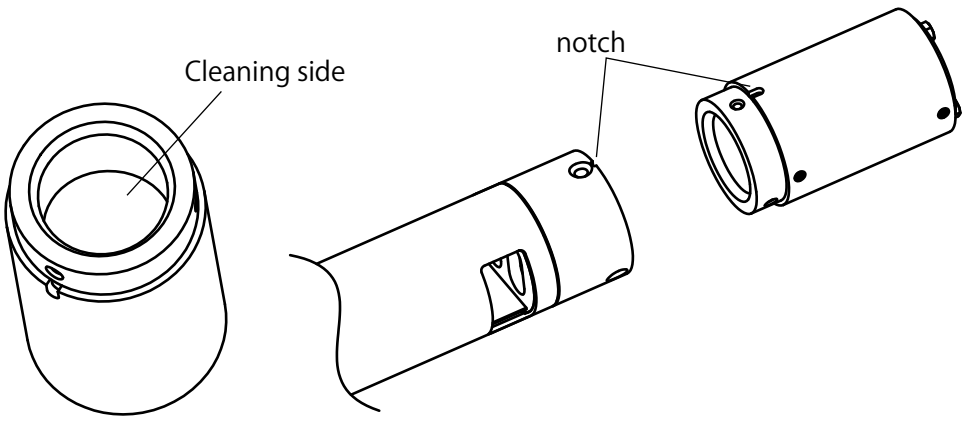


Figure 6.4 Reflector part

Flowcell type

If the reflector is contaminated with dust or other substances, clean the reflector according to the following procedure.

CAUTION

- Make sure that no process gas remains in the Flowcell before proceeding.
- The reflector is made of optical glass and is prone to breakage, so please handle it with care.

CAUTION

Be sure to power off TDLS8200 when doing this maintenance/inspection.

(1) Remove the three reflector fixing screws, and remove the reflector part. (Figure 6.5)
(2) Blow off particulate matter on reflector surfaces using clean, dry instrument air or nitrogen gas.
(3) Wipe gently with warm water with hypoallergenic soap detergent and a soft cloth that will not scratch reflector surfaces.
Then clean with alcohol (e.g., isopropyl alcohol) as needed.
(4) Spray clean and dry instrument air or nitrogen gas again onto the reflector surface and allow it to dry.
(5) Carefully observe the reflector surface from various angles to confirm that it is sufficiently clean and ready for use.

NOTE

If the reflector surface cannot be cleaned, replace the entire reflector unit with a new one.

(6) Attach the reflector unit to the Flowcell after cleaning.
Install the reflector unit so that the pin on the Flowcell side fits into the reflector unit, and then tighten the three fixing screws in turn, a little at a time, until the force is applied evenly to all three screws.

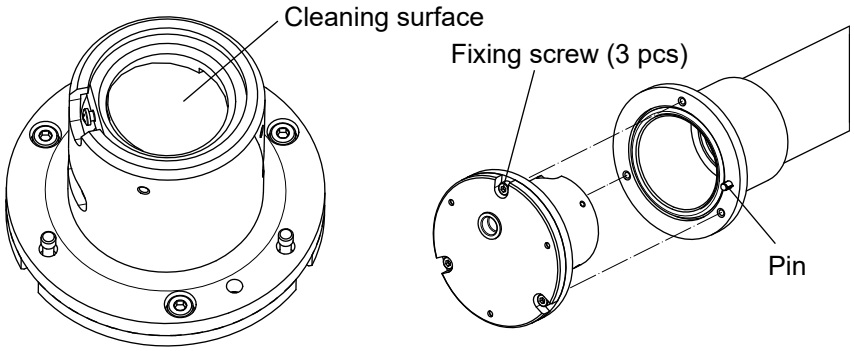


Figure 6.5 How to remove and install Reflector part

6.1.6 Process Window Cleaning (Flowcell type)

If the process window is contaminated with dust or other substances, clean the process window according to the following procedure.

CAUTION

- Make sure that no process gas remains in the Flowcell before proceeding.
- The process window is made of optical glass and is prone to breakage, so please handle it with care.

CAUTION

Be sure to power off TDLS8200 when doing this maintenance/inspection.

(1) Remove the analyzer part from the purge block. (Figure 6.12)
(2) Remove the four M6 bolts.
(3) Loosen the four M4 hex socket head bolts of the process window holder installed in the Flowcell section and remove the process window. (Figure 6.6)
(4) Blow off particulate matter on the process window using clean, dry instrument air or nitrogen gas.
(5) Wipe gently with warm water with hypoallergenic soap detergent and a soft cloth that will not scratch the surfaces of the process window.
Then clean with alcohol (e.g., isopropyl alcohol) as needed.
(6) Spray clean and dry instrument air or nitrogen gas again onto the surface of the process window and allow it to dry.
(7) Carefully observe the surface of the process window from various angles to confirm that it is sufficiently clean and ready for use.

NOTE

- If the reflector surface cannot be cleaned, replace the entire reflector unit with a new one.
- If you find the surface of the process window being corroded, it may have been contaminated by hydrogen fluoride or other corrosive gases. If so, replace it with a new process window.

(8) Install a cleaned process window (or a new process window). Install the process window in the same direction as it was removed, noting the orientation of the window. At this time, tighten the screws evenly.
(9) After installing the process window, fix the flange with four M6 bolts and attach the analyzer part to the purge block. (Figure 6.6, Figure 6.12) If the transmittance is significantly lower than before the work, adjust the optical axis again before use.

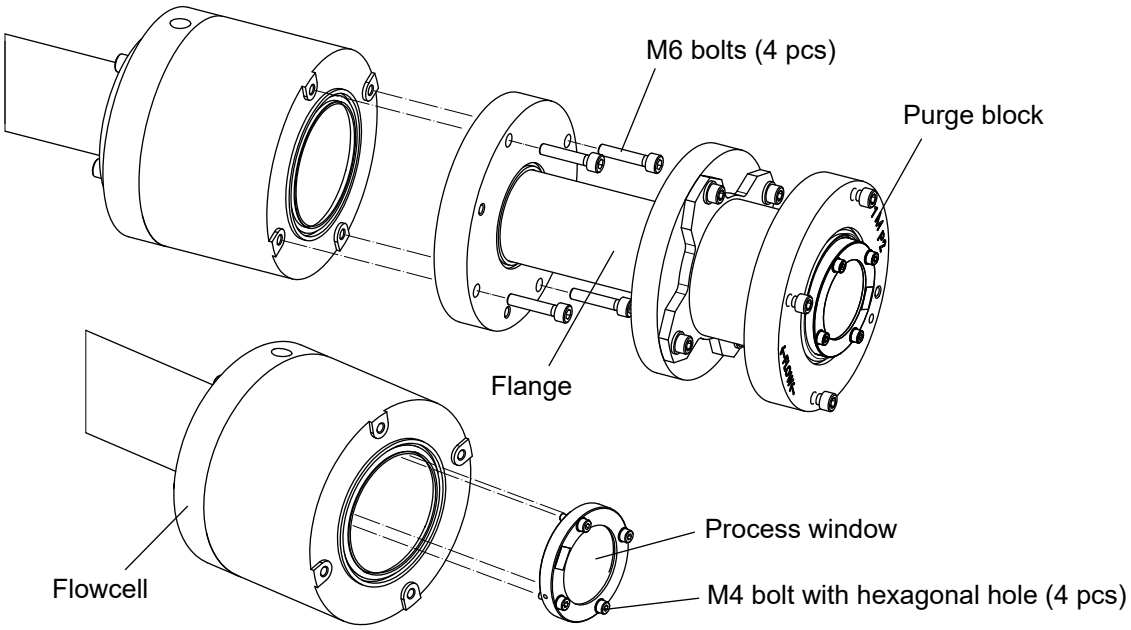


Figure 6.6 How to remove and install process windows

6.2 Online Validation

Online validation is performed by purging a validation cell with check gas of known concentration while measuring the concentration of the measured gas under stable measured gas concentration conditions. The conditions that are controlled (or known) when purging with check gas are as follows.

- Pressure of the purge check gas
- Temperature of the purge check gas
- Length of the validation cell purged with check gas
- Concentration of the purge check gas

The basic procedure is shown below.

- Set known validation parameters.
- Purge the validation cell with check gas of known concentration.
  => The result of “Process concentration” + “additional concentration from the check gas” is recorded in the TDLS8200.
- Purge the validation cell again with the original purge gas (typically nitrogen gas).
  => “Process concentration” is recorded in the TDLS8200.
  => The expected value for the “additional concentration from the check gas” is calculated from the known parameters.
  => The expected value and the actual value are compared and validated (pass or fail).

NOTE

Perform the online validation when the process is sufficiently stable.

NOTE

Validation is a procedure to check whether the TDLS8200 is operating properly. If there is a reading error because of validation, check that there is no gas leak from the process. If no gas leak is confirmed, perform calibration.

6.2.1 Preparation

In online validation, a validation cell is purged with check gas. The following shows check gas piping methods.

Up to two check gases are connected for online validation 1 and online validation 2. (Figure 6.7 or Figure 6.8)

NOTE

If you want to switch the check gas stream through automatic valve control using the TDLS8200 SV terminal, you need to set the TDLS8200 valve usage to Online validation. For details on valve usage, see “4.8.2 Valve Usage Setting”.

Online validation piping diagram is shown next.

Connect up to two types of online validation check gas. Execute online validation 1 or 2 to validate using the respective check gas. If you want to control valves automatically through the SV terminal, you need to set the valve usage to Cal/Val.

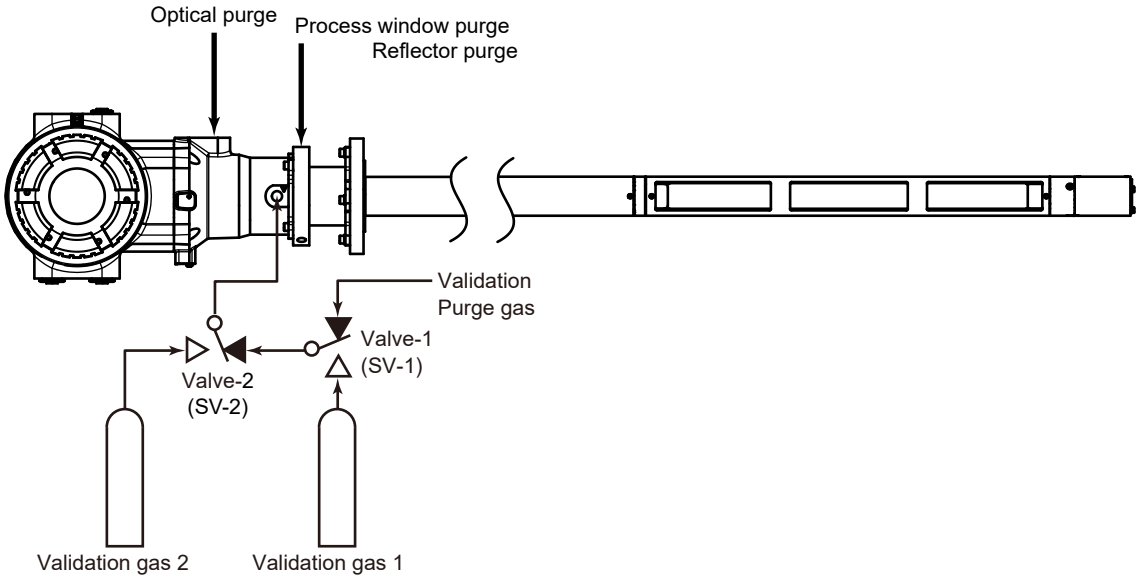


Figure 6.7 Online validation piping diagram (Probe type)

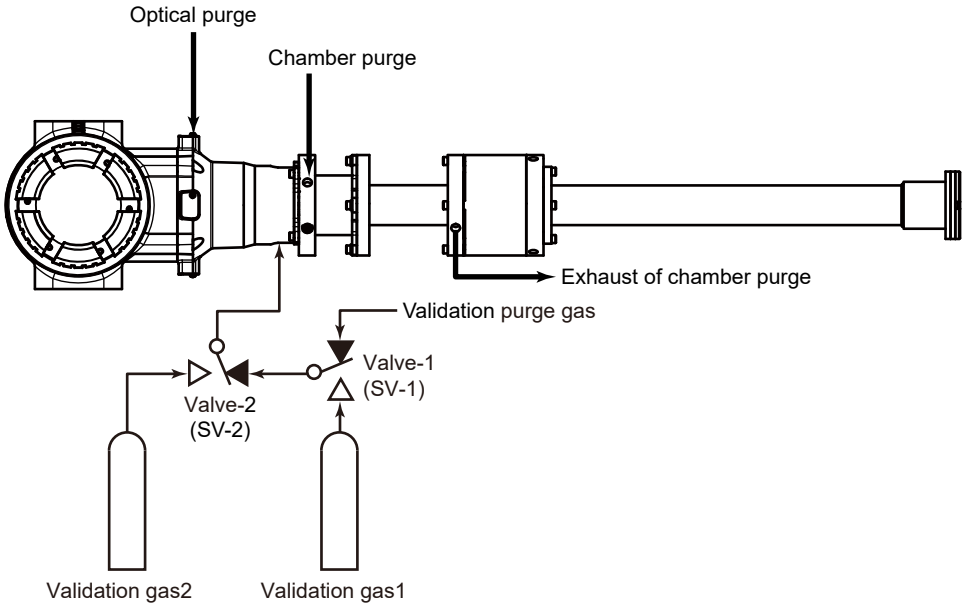


Figure 6.8 Online validation piping diagram (Flowcell type)

6.2.2 Configuration

Online validation configuration menu:

[HART] “Device Settings >> Validation >> Online Validation #”

[YH8000] >>Select analyzer >>Configuration >>Validation>>Online Validation #”

The setup parameters required to manually execute online validation are indicated for each of the above submenus (tabs on the YH8000). Here, online validation 1 will be used as an example.

● Parameter

Parameter name (HART)	Parameter name (YH8000)	Description
Onval1 gas type	Gas type	Selects the type of validation 1 check gas
Onval1 gas conc	Concentration	Enters the concentration of the validation 1 check gas
Onval1 temp mode	Temperature	Selects the temperature mode for validation 1 execution
Onval1 temp fix val	Fixed Value	Enters the temperature for when Temperature is set to Fixed
Onval1 act amb ofst	Offset Value	Enters the temperature offset for when Temperature is set to Active ambient
Onval1 pres fix val	Pressure	Enters the pressure value for validation 1 execution
Onval1 OPL fix val	OPL	Enters the optical path length of the region purged with validation 1 check gas (*1) Optical path length is 102 mm.

● Valve

Parameter name (HART)	Parameter name (YH8000)	Description
Onval1 auto vlv man	Auto valve for manual validation	Selects whether to enable automatic valve control through the SV terminal during manual validation 1 execution.
-	Validation gas purge time	For automatic execution. Set these when performing automatic execution (see “6.8.2 Configuration”).
-	Normal gas purge time	

● Auto time

For automatic execution. Set this when performing automatic execution (see “6.8.2 Configuration”).

● Reading mode

For automatic execution.

Parameter name	Description
Onval1 read mode	Selects the concentration reading setting for automatic validation. If “Process+Validation” is selected, the reading shows the sum of the process and validation cell concentrations. If “Validation only” is selected, the reading shows only the validation cell concentration.
Onval1 output factor	Scaling coefficient for the concentration reading during automatic validation. If Reading mode is set to Validation only, the reading will be the product of the calculated concentration and the scaling coefficient.

6.2.3 Execution

Before starting online validation, check that the piping and online validation settings are correct. Here, online validation 1 for CO-O_2 will be used as an example.

Execution menu path:

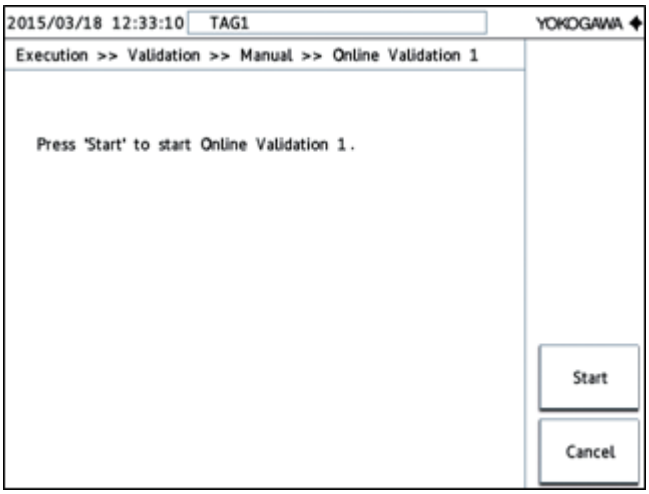
[HART] “Diagnostics >> Validation >> Manual > Manual online val 1”

[YH8000] “  >>Execution>>Validation>>Manual>>Online Validation 1”

■ YH8000 Execution Screen

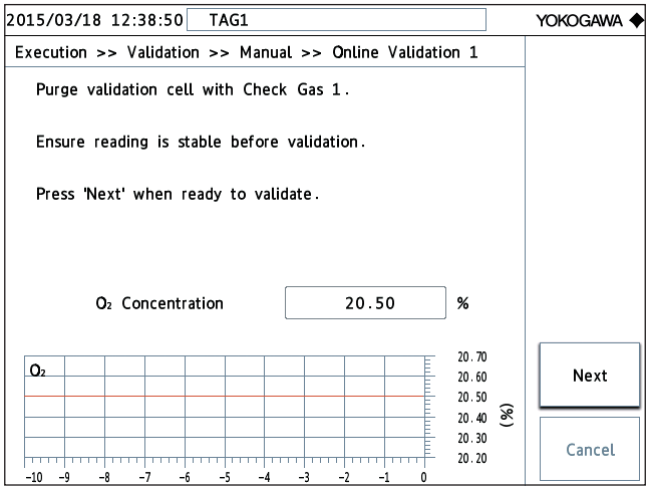
(1) Starting an online validation

Touch Start to begin online validation. If automatic valve control is enabled, the stream is switched, the validation cell is purged with check gas.



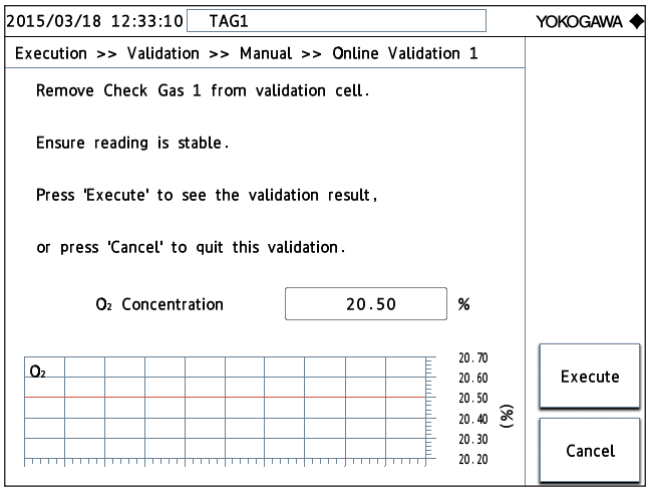
(2) Purging with the check gas

If automatic valve control is disabled, manually control the valves to purge the validation cell with the check gas. Check that the concentration is stable over a sufficient length of time (5 minutes as a guideline, at least 1 minute) with the validation cell filled with the check gas. When stability is confirmed, tap Next. If automatic valve control is enabled, the stream will be switched automatically, and check gas will be discharged from the validation cell.



(3) Discharging the check gas

If automatic valve control is disabled, manually control the valves to purge the validation cell with the analyzer internal purge gas (nitrogen gas) that is used during process measurement. Check that the concentration is stable, and then touch Execute. The validation result will be displayed.

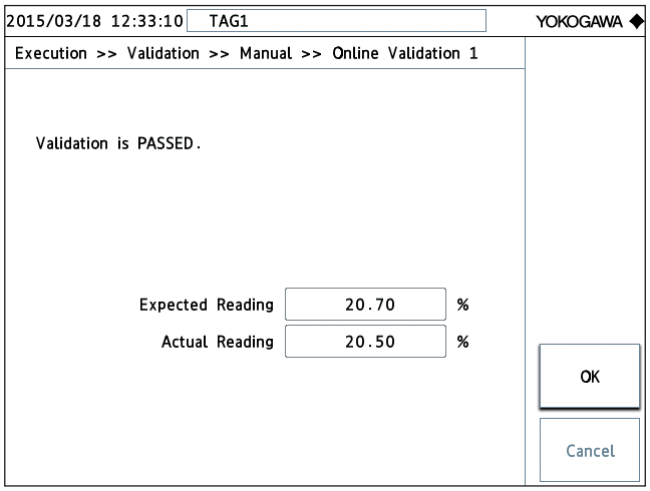


(4) Checking the online validation result

The online validation result is displayed, and online validation ends. If successful, “PASSED” appears. Otherwise, “FAILED” appears.

Expected Reading means concentration of defined check gas.

Tap OK to return to the configuration menu.



NOTE

If the validation fails, the following warning will occur. For the corrective action, see “7.2 Warning Display and Handling”.

Alarm number	Alarm name
21	L1 Validation Error
22	L2 Validation Error

6.2.4 Time Chart

The valve operation during manual online validation execution and the timing when the AO/DO output switches to Cal/Val/Blow Back mode are shown below. In Cal/Val/Blow Back mode, it is possible to hold the AO output or specify other settings. For the AO/DO output settings during Cal/Val mode, see “4.4.2 Output Hold” and “4.5.1 DO Contact (DO-1)”.

In Figure 6.9, Valve1 and Valve2 are switched manually by following the instructions on the operation screen. If automatic valve control is enabled, there is no need for the operator to switch the valves manually.

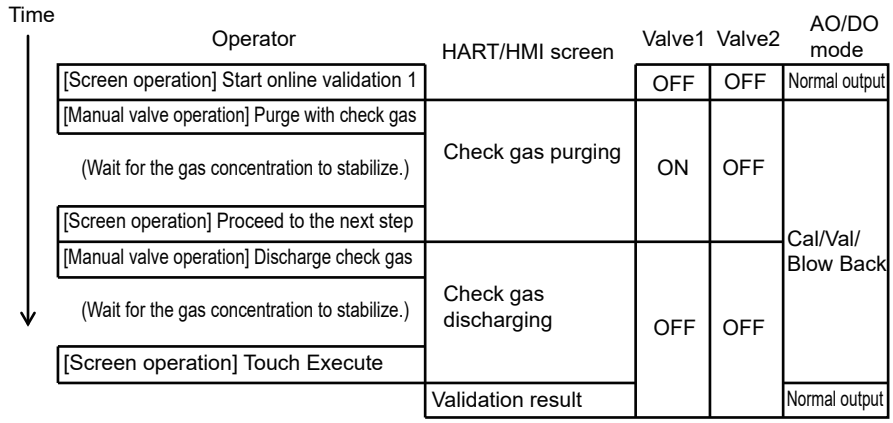


Figure 6.9 Valve and AO/DO output for manual online validation 1

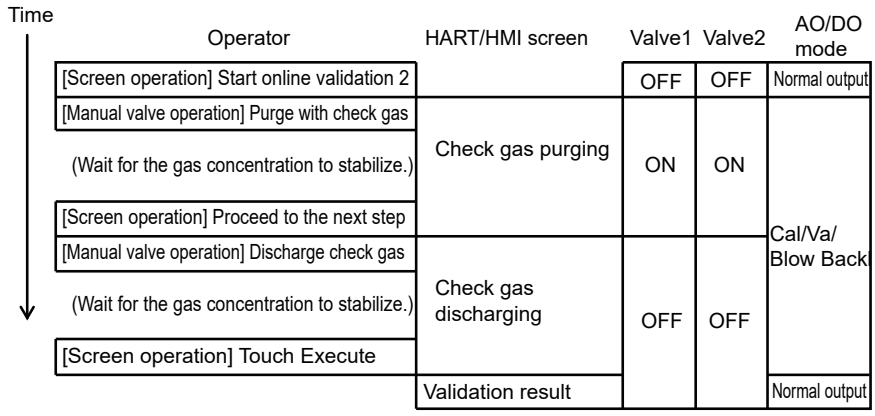


Figure 6.10 Valve and AO/DO output for manual online validation 2

6.3 Mounting on a Calibration Cell

Before performing offline validation, zero calibration, or span calibration, mount the calibration cell between the probe part and analyzer part. The process window on the side of the probe part enables safety removal of the analyzer part even during the process.

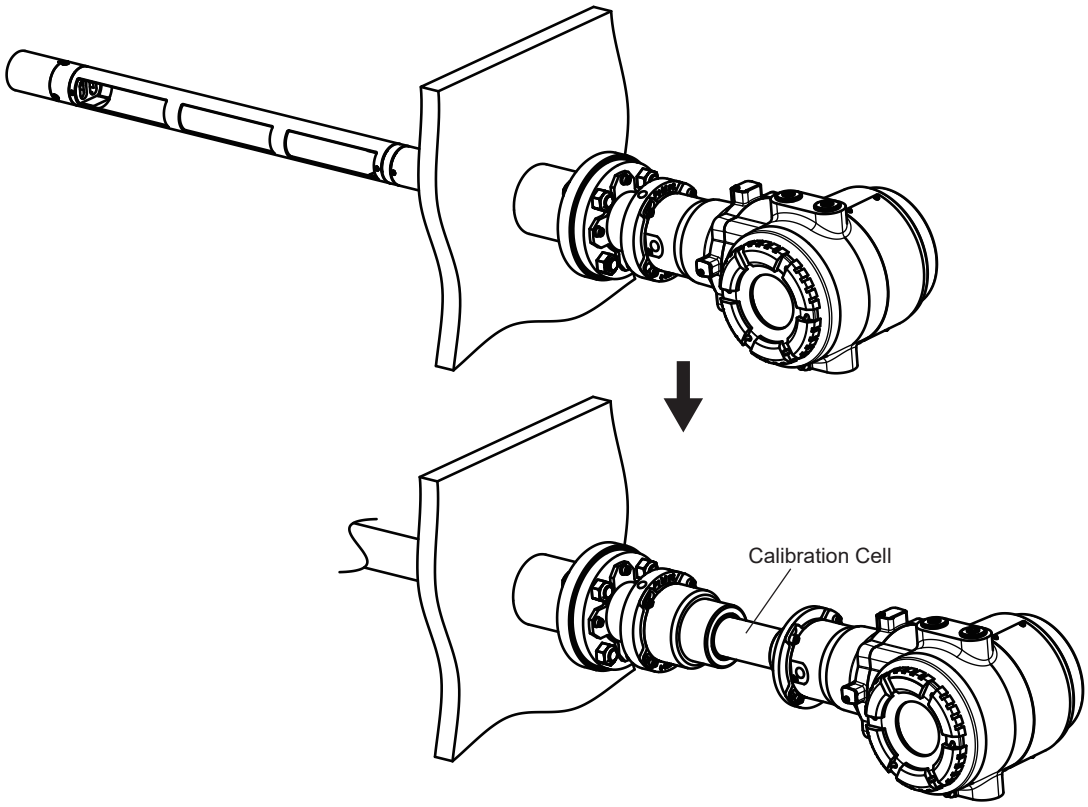


Figure 6.11 Figure 6.8 Connection example for offline work

6.3.1 Preparation

If you want to perform calibration or offline validation, prepare the following tools, instruments, nitrogen gas, and gas for offline work (check gas, zero calibration gas (nitrogen gas), span calibration gas).

Tool or instrument	Quantity	Remarks
Calibration cell	1	
YH8000	1	For executing offline calibration and validation
24 V DC power cable	1	
Valve drive cable	As required (1 or 2)	For controlling valves automatically through the SV terminal
YH8000 connection cable	1	When using the YH8000
24 V DC power supply	1	
1/4 inch piping	Several meters	
1/4 inch ferrule set	As required	
Pressure regulator	1	
1/4 inch pipe plug	2	
Three-way valve	As required	
Thermometer	1	
Pressure meter	1	
Coupling	As required	
Nitrogen gas	As required	For TDLS8200 purging For zero calibration
Span calibration gas	As required	For span calibration
Check gas	As required	For offline validation
Flowmeter	3	For TDLS8200 purging For zero calibration For span calibration and offline validation
Needle valve	3	For flow rate adjustment

6.3.2 Preparation Procedure

Perform the following procedure. Purge pipe connection is different for Offline validation, zero calibration, and span calibration. For details, see sections 6.4, 6.5, and 6.6.

CAUTION

- Do not apply physical shock to the TDLS8200 when relocating the TDLS8200 to a calibration cell and when returning it to the process. Doing so can cause a malfunction.
- During calibration work, do not remove the analyzer part while the power is on.
- If the process gas is positive pressure, shut off the TDLS8200 from the process, stop the process window purge, and prevent excessive pressure from being applied to the process window.

(1) Recording the settings

Check the following settings and the process conditions before removing the analyzer part.
These will be used when returning the TDLS8200 to the process.

- Process optical path length
- Process pressure (record only when the input mode is set to Fixed)
- Process temperature (record only when the input mode is set to Fixed)
- LD1 Transmission
- LD2 Transmission
- Process window/Reflector purge flow rate (record only when purge is stopped)

(2) Turning the TDLS8200 off

Turn the power of TDLS8200 off.

(3) Removing the analyzer part

(a) Stopping the purge gas

Stop the nitrogen gas (or instrumental air) for optical purging. Stop as necessary process window purge, reflector purge.

(b) Removing piping

Remove the pipes from the TDLS8200. (To make reinstallation easier after offline validation or calibration, we recommend that you mark the pipes.)

Optical purge is used in the calibration cell as well. Remove it if you need.

Apply vinyl tape or other protector to the TDLS8200 ports and pipe ferrule areas.

(c) Removing wiring (if needed)

Remove wiring.

Be careful not to short the wires. Insulate and protect the removed wires with vinyl tape or the like, and bundle them together, making sure not to strain the cables. For details on wiring, see “2.2 Wiring”.

NOTE

To make reinstallation easier, we recommend that you mark the wires to make the re-wiring in advance.

(d) Removing the analyzer part

Analyzer part is to be removed after the piping is removed.

If a YH8000 is installed, remove the entire YH8000 with its mounting bracket before removing the analyzer part.

(1) Using a hex wrench (5 mm), remove only the upper right screw of the quick connector (see Figure 6.12).

(2) Loosen the other screws.

(3) Slowly turn the TDLS8200 counterclockwise to remove the analyzer from the probe.

For details on how to remove the YH8000, see YH8000 user's manual (IM 11Y01D10-01EN).

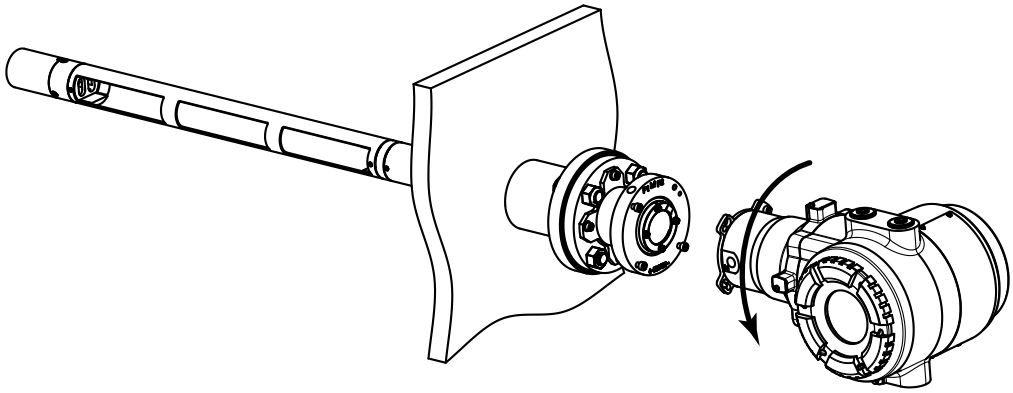


Figure 6.12 Removing from the process

(4)Mounting a Calibration Cell on probe

NOTE

Mount calibration cell on probe as necessary. Calibration cell is not required to be mounted on probe if you implement calibration or Offline validation.

After detaching the analyzer part, align the holes on the calibration cell (Quick Connector) and the screw position on the probe. Insert the calibration cell and rotate it clockwise.

First, fasten temporarily with the upper right screw. Then tighten the all the screws evenly, including the other screws placed on the rest of the three spots.

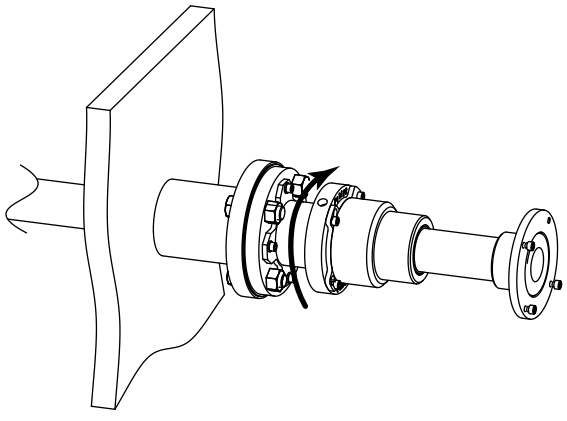


Figure 6.13 gap between calibration cell and hexagon socket head screw

(a) Mounting analyzer part on calibration cell

Fasten three M6 screws on screw holes for analyzer part, on the calibration cell (Quick Connector) in advance. Leave a gap of about 8 mm thick between flange side and Quick Connector. Don't fasten a screw on the upper right screw position viewed from front. The upper right screw is attached to the analyzer part. Align the holes on the calibration cell (Quick Connector) and the screw position on the probe. Insert the calibration cell and rotate it clockwise.

Temporarily fasten with the upper right screw, and then tighten the rest of the three screws evenly. Finally, mount the YH8000 as needed.

(b) Wiring (When disconnecting wiring)

Connect the following cables.

- Power cable
- Valve drive cable (when necessary)

For details on wiring, see "2.2 Wiring".

(c) Piping

Feed nitrogen gas for optical purging. For calibration cell, introduce validation gas/calibration gas from calibration port.

Use the connection port of validation gas of the analyzer part to exhaust gas.

NOTE

There are two ports (for inlet/outlet) on the connector to validation gas of analyzer. When calibration cell is being connected, use both ports as exhaust, or plug one port which is not used as exhaust so that no gas leak occurs.

Stainless tubes or Teflon tubes are used for piping.

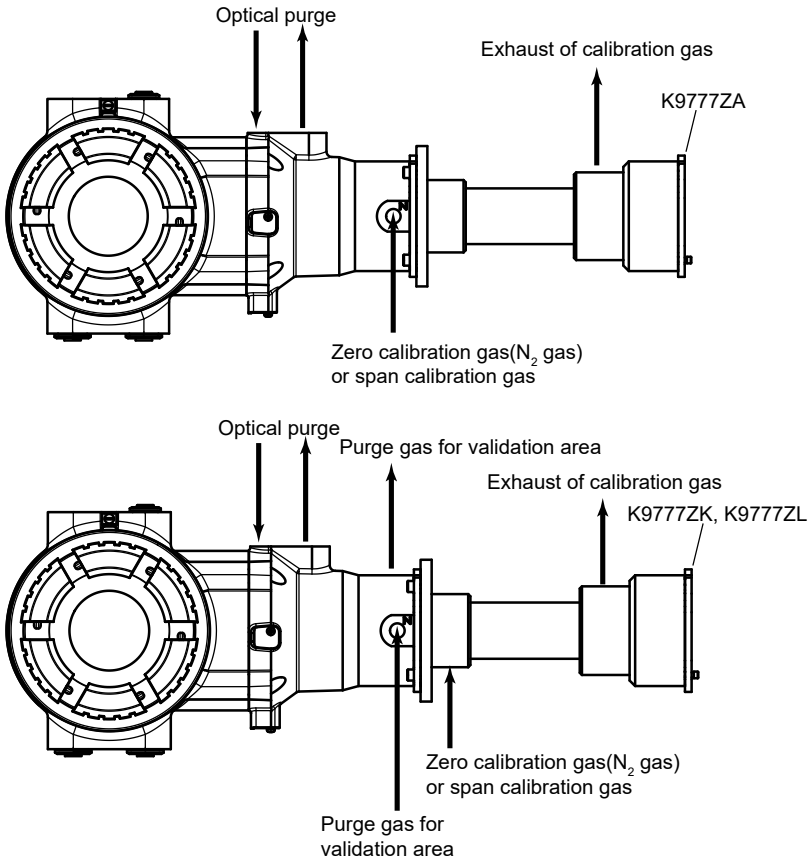


Figure 6.14 Purge gas piping

When piping is complete, check for leaks such as by using Snoop. Use nitrogen gas for this purpose.

(5)Feeding purge gas

When wiring and piping are complete, feed the gas.

Feed the appropriate gas for offline work at a flow rate no more than 2 L/min at a pressure no more than 0.02 MPa. For Explosionproof type, feed the gas at 100 to 200 mL/min, no more than 0.01 MPa.

(6)Turning the power on

Turn the power on. Check that the TDLS8200 starts normally.

6.3.3 Performing Calibration and Offline Validation

Refer to sections 6.4, 6.5, and 6.6, and perform offline work.

For each kind of offline work, the settings may be different. Change the settings as necessary.

6.3.4 Returning the TDLS8200 to the Process

When offline work is complete, return the TDLS8200 to the process. Follow the procedure below.

NOTE

Remove piping after gas inside the calibration cell is completely replaced with safety gas.

(1) Switching the span calibration gas or check gas

If hazardous gas is flowing (e.g., CO gas), switch it to nitrogen gas. Wait for the gas inside the calibration cell to be completely replaced before proceeding.

(2) Stopping the gas

On the TDLS8200 display, check that the calibration gas concentration has dropped to zero, and then stop all purge gases.

(3) Removing piping

Check that there is no residual internal pressure, and then remove the piping.

(4) Turning the TDLS8200 off

Check the above items, and then turn the TDLS8200 off.

(5) Removing wiring (as necessary)

Remove wiring according to the procedure of section 6.3.2 (3) (c).

(6) Removing the analyzer part from the calibration cell

Remove the analyzer part according to the procedure of section 6.3.2 (3) (d).

(7) Removing the calibration cell (as necessary)

Remove the calibration cell when it is attached to the probe.

(8) Installing the analyzer part in the process

Install the analyzer part by reversing the procedure for removing it.

(a) Wiring

Connect the following cables.

- Power cable
- Valve drive cable (when necessary)
- AI/AO/DO/DI cable (when necessary)

For details on wiring, see “2.2 Wiring”.

(b) Piping

Refer to “2.4 Piping”, and connect the pipes to restore the analyzer part to its original condition before it was removed.

(9) Feeding purge gas

When wiring and piping are complete, feed the purge gas.

(10) Turning the power on

Turn the power on. Check that the TDLS8200 starts normally.

(11) Optical Axis Adjustment

If the transmission rate is significantly lower than before removal, refer to “2.3 Optical Axis Adjustment” and perform optical axis adjustment.

(12) Checking the settings

Refer to the settings that you recorded before removing the TDLS8200, and reset them if necessary.

a) Process optical path length
b) Process pressure
c) Process temperature
d) LD1 Transmission
e) LD2 Transmission
f) Process window/reflector purge flow rate

6.4 Offline Validation

Offline validation is a function used to verify the validity of gas concentration measurements. For the validation process, the TDLS8200 is separated from the measurement process, and a known check gas if fed through a calibration cell or Flowcell.

Before performing a validation, you need to enter the following information in the TDLS8200.

- Pressure of the purge check gas
- Temperature of the purge check gas
- Length of the calibration cell
- Concentration of the purge check gas

The basic procedure is shown below.

- Set known validation parameters.
- Purge the calibration cell or Flowcell with check gas of known concentration.

  => The check gas concentration reading will be recorded.

  => The expected value for the “check gas” is calculated from the known parameters.

  => The expected value and the actual value are compared and validated (pass or fail).

NOTE

Validation is a procedure to check whether the TDLS8200 is operating properly. If there is an error in reading, implement calibration.

Normally, after detaching the analyzer part from process and installing on the calibration cell, Offline validation is to be performed.

For the Flowcell type, you do not need to attach it to the calibration cell. Perform the Offline validation with the Flowcell in place. See Figure 6.16 for the piping.

6.4.1 Preparation

Follow the instructions in “6.3 Mounting on a Calibration Cell”. For piping method, see the figure shown below.

Connect both Offline validation 1 and 2 check gases. Validation 1 and 2 can be executed.

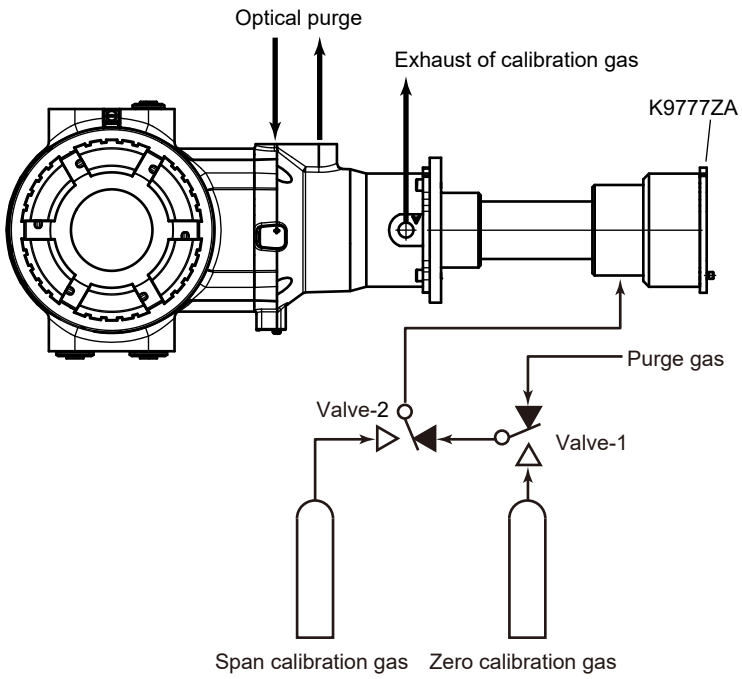


Figure 6.15 Calibration cell piping for Offline validation

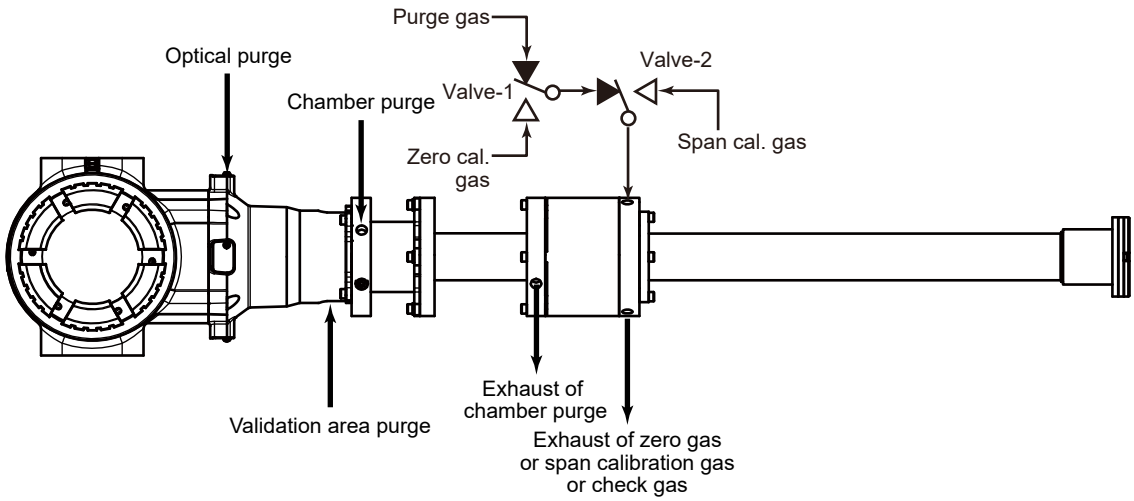


Figure 6.16 Flowcell type piping for Offline validation

6.4.2 Configuration

Offline validation configuration menu:

[YH8000] >>Select analyzer >>Configuration >Validation>>Offline Validation #”

The setup parameters required to manually execute Offline validation are indicated for each of the above submenus (tabs on the YH8000). Here, Offline validation 1 will be used as an example.

- **Parameter**

Parameter name (YH8000)	Description
Gas type	Selects the type of validation 1 check gas (two-gas measurement only)
Concentration	Enters the concentration of the validation 1 check gas
Pressure	Selects the pressure mode for validation 1 execution (*1)
Fixed Value	Enters the pressure for when Offval1 pres mode is set to Fixed
Temperature	Selects the temperature mode for validation 1 execution (*1)
Fixed Value	Enters the temperature for when Offval1 temp mode is set to Fixed
OPL	Selects the optical path length mode for validation 1 execution (*1)
Fixed Value	Enters the process optical path length for when Offval1 OPL mode is set to Fixed

*1: Process parameter: Uses the process parameter value
Fixed value: Set to a fixed value

6.4.3 Execution

Before starting offline validation, check that the piping and offline validation settings are correct. Here, offline validation 1 will be used as an example.

Execution menu path:

[YH8000] “  >>Execution>>Validation>>Manual>>Offline Validation 1”

(1) Starting an offline validation

On YH8000, open the above menu, and start offline validation. If automatic valve control is enabled, a message stating that the valves will be automatically controlled will appear.*1 In this case, you do not need to manually control the valves during offline validation.

(2) Purging with check gas

An instruction to purge the calibration cell with check gas will appear.*2 If automatic valve control is disabled, manually control the valves to purge the calibration cell with the check gas. For safety verification, the concentration trend is displayed on the YH8000. Check that the concentration is stable over a sufficient length of time (5 minutes as a guideline, at least 1 minute) with the validation cell filled with check gas. Then, execute validation.

(3) Checking the validation result

The validation result is displayed as “PASSED” or “FAILED.” After checking the result, proceed to the next screen to start purging with the process gas. Or select Retry to return to (2) and execute validation again.

(4) Discharging the check gas

An instruction to discharge the check gas from the calibration cell will appear.*3 If automatic valve control is disabled, manually control the valves to purge the calibration cell with the process gas. For safety verification, the concentration trend is displayed on the YH8000. Check that the concentration is stable, and proceed to the next screen.

(5) Ending validation

The TDLS8200 will exit from validation mode.

*1: [YH8000] Valve for Check Gas 1 will be opened automatically.
*2: [YH8000] Purge Flowcell with Check Gas 1.
*3: [YH8000] Remove Check Gas 1 from Flowcell.

NOTE

If the validation fails, the following warning will occur. For the corrective action, see “7.2 Warning Display and Handling”.

Alarm number	Alarm name
21	L1 Validation Error
22	L2 Validation Error

6.4.4 Time Chart

The valve operation during manual offline validation execution and the timing when the AO/DO output switches to Cal/Val/Blow Back mode are shown below. In Cal/Val mode, it is possible to hold the AO output or specify other settings. For the AO/DO output settings during Cal/Val/Blow Back mode, see “4.4.2 Output Hold” and “4.5.1 DO Contact (DO-1)”.

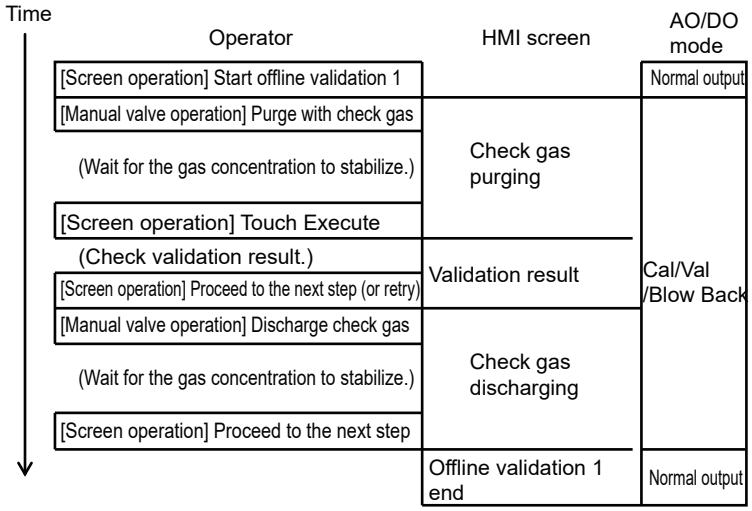


Figure 6.17 AO/DO output for manual offline validation 1

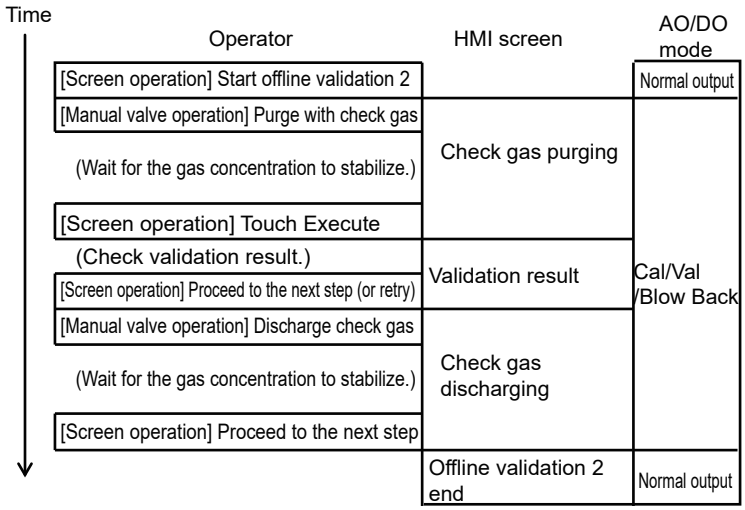


Figure 6.18 AO/DO output for manual offline validation 2

6.5 Zero Calibration

Zero calibration is a function used to align the zero point in a condition where absolutely none of the measured components are absorbed by running gas (such as nitrogen) that does not include the measured components in the region where the laser beam passes through.

Typically, zero calibration is performed in an ideal environment before product shipment. In principle, the TDLS8200 does not have any zero point drift. Therefore, customers normally do not have to perform zero calibration.

However, if the zero reading is clearly not normal, contact Yokogawa.

Carry out the zero calibration only when it is determined to be necessary by noting the following conditions.

Not meeting the following conditions may adversely affect measurement gas readings.

If you are unclear about how to perform zero calibration, contact your nearest Yokogawa representative.

Note the following items to perform zero calibration correctly.

- Nitrogen gas concentration meeting the product specifications (99.99%N_2 or higher, depends on the application)

  Insufficient nitrogen gas concentration may affect the measurement gas concentration readings.
- The region where the laser beam passes through is adequately filled with nitrogen gas.

  If measured gas is mixed, measurement gas concentration readings will be affected.
- There is no optical noise in the region where the laser beam passes through.

  Proper zero calibration cannot be performed in a condition where optical noise is present (for example, if the surface of the process window is clouded). This can affect measurement gas concentration readings.
- There is no electrical noise in the environment where zero calibration is to be performed.

  Proper zero calibration cannot be performed in a condition where electrical noise is present. This can affect measurement gas concentration readings.

NOTE

- If the purge piping leaks, correct results cannot be obtained.
- Wait at least 1 hour after turning on the power before performing calibration.

6.5.1 Preparation

Follow the instructions in “6.3 Mounting on a Calibration Cell”. The piping method is described below. When using a Flowcell type, ensure that it is performed with the Flowcell attached.

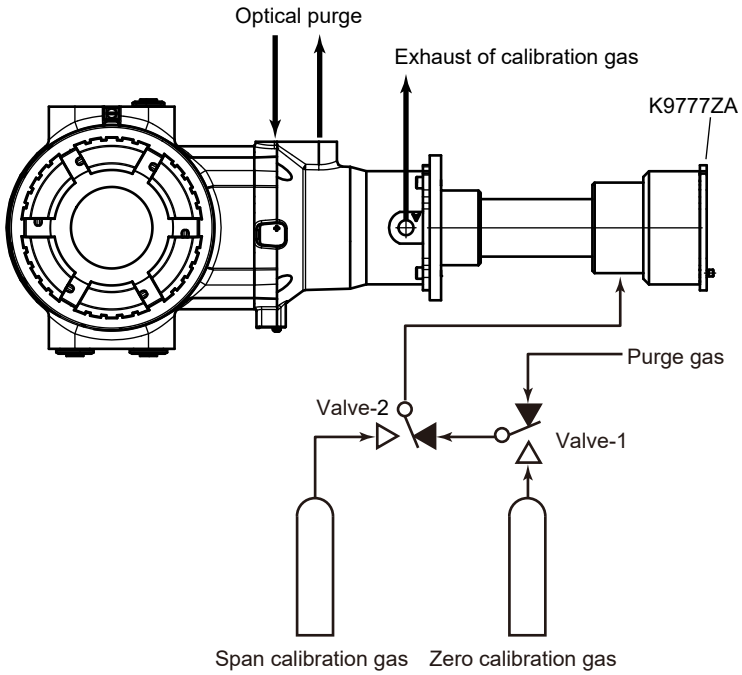


Figure 6.19 Calibration cell piping for zero calibration

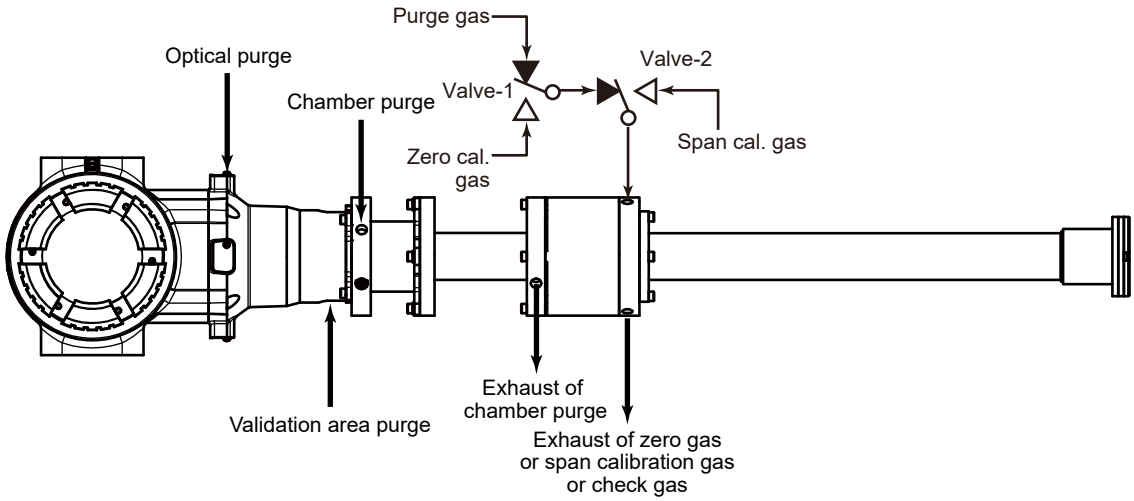


Figure 6.20 Flowcell type piping for zero calibration

6.5.2 Configuration

Zero calibration configuration menu:

[HART] “Device Settings >> Calibration >> Zero calibration”

[YH8000] >>Select analyzer >>Configuration >Calibration>>Zero Calibration”

The setting items required for manual execution of zero calibration are shown for each of the above tabs.

- **LD**

Parameter name (HART)	Parameter name	Description
Zero cal target	LD (for zero calibration) (*1)	Select the LD for zero calibration If “Both” is selected, both LD1 and LD2 are zero-calibrated at once.

*1: When the 1 laser specification is selected, this parameter is not displayed since it is not configurable.

6.5.3 Execution

Before starting zero calibration, check that the piping and zero calibration settings are correct.

Execution menu path:

[HART] “Diagnostics >> Calibration >> Manual >> Manual zero cal”

[YH8000] “>>Execution>>Calibration>>Manual>>Zero Calibration”

(1) Starting zero calibration

On HART or YH8000, open the above menu, and start zero calibration. First, a message appears to ask you for careful execution of zero calibration.*1

(2) Purging with zero calibration gas

An instruction to purge the calibration cell with zero calibration gas will appear.*2 If automatic valve control is disabled, manually control the valves to purge the calibration cell with the zero calibration gas. For safety verification, the standard deviation (stdev) of concentration is displayed on HART and the concentration trend on the YH8000. Check that the concentration is stable over a sufficient length of time (10 minutes as a guideline, at least 1 minute) with the validation cell filled with the zero calibration gas. Then, execute calibration.

(3) Checking the zero calibration result

The result of calibration is displayed as “successful” or “failed.” After checking the result, proceed to the next screen to start purging with the span calibration gas or process gas. Or select Retry to return to (2) and execute calibration again.

(4) Purging with process gas

An instruction to discharge the zero calibration gas from the calibration cell will appear.*3 If automatic valve control is disabled, manually control the valves to purge the calibration cell with the process gas. For safety verification, the standard deviation (stdev) of concentration is displayed on HART and the concentration trend on the YH8000. Check that the concentration is stable, and proceed to the next screen.

(5) Ending zero calibration

The TDLS8200 will exit from calibration mode.

*1: [YH8000] Are you sure to start manual zero calibration?
*2: [YH8000] Purge calibration cell with Zero Gas.
*3: [YH8000] Remove Zero Gas from calibration cell.

NOTE

If the zero calibration fails, the following warning will occur. For the corrective action, see “7.2 Warning Display and Handling”.

Alarm number	Alarm name
23	L1 Zero Cal Error
27	L2 Zero Cal Error

6.5.4 Time Chart

The valve operation during manual zero calibration execution and the timing when the AO/DO output switches to Cal/Val mode are shown below. In Cal/Val mode, it is possible to hold the AO output or specify other settings. For the AO/DO output settings during Cal/Val mode, see “4.4.2 Output Hold” and “4.5.1 DO Contact (DO-1)”.

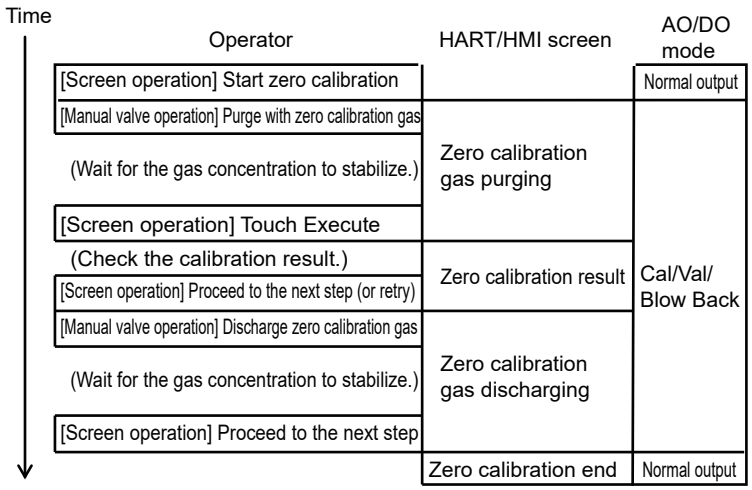


Figure 6.21 AO/DO output for zero calibration

6.6 Span Calibration

Span calibration adjusts the gas concentration to that of the span gas with a known gas concentration by leading it to the calibration cell.

If the analysis values are clearly different, please contact our service. Carry out the span calibration only when it is determined to be necessary by noting the following conditions.

- Use gas with accurate concentration for the span calibration gas.
- Perform span calibration with the target region adequately filled with span calibration gas (purge with calibration gas and check that the reading is adequately stable).
- There is no optical noise in the region where the laser beam passes through.

  Proper span calibration cannot be performed in a condition where optical noise is present (particularly if the surface condition of the process window changes). This can affect measurement gas concentration readings.
- There is no electrical noise in the environment where span calibration is to be performed.

  Proper span calibration cannot be performed in a condition where electrical noise is present. This can affect measurement gas concentration readings.

NOTE

- If the purge piping leaks, correct results cannot be obtained.
- Wait at least 1 hour after turning on the power before performing calibration.
- Correct measurements may not be obtained if span calibration is performed when the reading is not stable.

6.6.1 Preparation

Follow the instructions in “6.3 Mounting on a Calibration Cell”. There are two piping methods as below.
When using a Flowcell type, perform span calibration with the Flowcell installed.

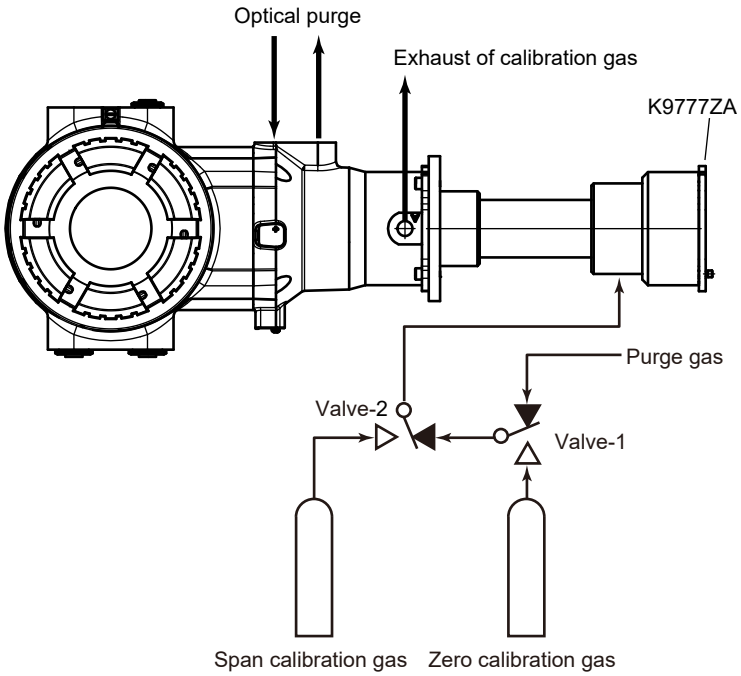


Figure 6.22 Calibration cell piping for span calibration

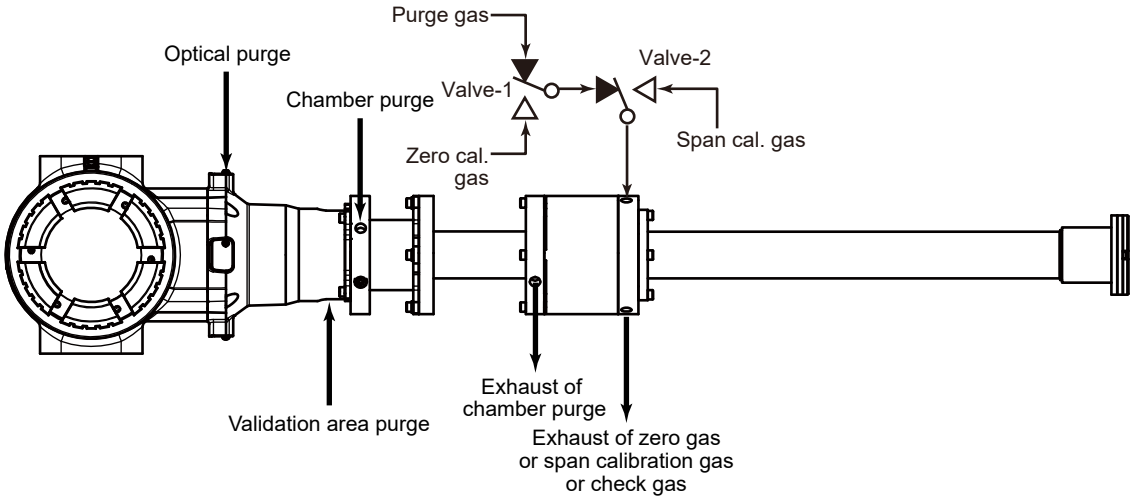


Figure 6.23 Flowcell type piping for span calibration

6.6.2 Configuration

Span calibration configuration menu:

[HART] “Device Settings >> Calibration >> Span calibration”

[YH8000] >>Select analyzer >>Configuration >Calibration>>Span Calibration”

The setup parameters required to manually execute span calibration are indicated for each of the above submenus (tabs on the YH8000).

● Parameter

Parameter name (HART)	Parameter name (YH8000)	Description
S-cal gas type	Gas type	Selects the type of span calibration gas (two-gas measurement only).
S-cal gas conc	Concentration	Enters the span calibration gas concentration.
S-cal pres mode	Pressure	Selects the pressure mode for span calibration execution (*1).
S-cal pres fix val	Fixed Value	Enters the pressure for when S-cal pres mode is set to Fixed.
S-cal temp mode	Temperature	Selects the temperature mode for span calibration execution (*1).
S-cal temp fix val	Fixed Value	Enters the temperature for when S-cal temp mode is set to Fixed
S-cal OPL mode	OPL	Selects the optical path length mode for span calibration execution (*1).
S-cal OPL fix val	Fixed Value	Enters the process optical path length for when S-cal OPL mode is set to Fixed.

*1: Process parameter: Uses the process parameter value
Fixed value: Set to a fixed value

NOTE

For two/three-gas measurement, you cannot set span calibration simultaneously on multiple types of gas.

The setting is valid only for the gas type specified by “S-cal gas type,” and span calibration can be executed on this gas type. To switch the gas to be calibrated, you need to change “S-cal gas type.” Further, only one type of span calibration gas can be subject to automatic execution.

6.6.3 Execution

Before starting span calibration, check that the piping and span calibration settings are correct.

Execution menu path:

[HART] “Diagnostics >> Calibration >> Manual >> Manual span cal”

[YH8000] “>>Execution>>Calibration>>Manual>>Span Calibration”

(1) Starting span calibration

On YH8000 or HART, open the above menu, and start span calibration. If automatic valve control is enabled, a message stating that the valves will be automatically controlled will appear.*1 In this case, you do not need to manually control the valves during span calibration.

(2) Purging with span calibration gas

An instruction to purge the calibration cell with span calibration gas will appear.*1 If automatic valve control is disabled, manually control the valves to purge the calibration cell with the span calibration gas. For safety verification, the standard deviation (stdev) of concentration is displayed on HART and the concentration trend on the YH8000. Check that the concentration is stable over a sufficient length of time (10 minutes as a guideline, at least 1 minute) with the validation cell filled with the span calibration gas. Then, execute calibration.

(3) Checking the span calibration result

The result of calibration is displayed as “successful” or “failed.” After checking the result, proceed to the next screen to purge with the process gas. Or select Retry to return to (2) and execute calibration again.

(4) Purging with process gas

An instruction to discharge the span calibration gas from the calibration cell will appear.*2 If automatic valve control is disabled, manually control the valves to purge the calibration cell with the process gas. For safety verification, the standard deviation (stdev) of concentration is displayed on HART and the concentration trend on the YH8000. Check that the concentration is stable, and proceed to the next screen.

(5) Ending span calibration

The TDLS8200 will exit from calibration mode.

*1: [YH8000] Valve for Check Gas 1 will be opened automatically.
*2: [YH8000] Purge calibration cell with Span Gas.
*3: [YH8000] Remove Span Gas from calibration cell.

NOTE

If the span calibration fails, the following warning will occur. For the corrective action, see “7.2 Warning Display and Handling”.

Alarm number	Alarm name
24	L1 Span Cal Error
28	L2 Span Cal Error

6.6.4 Time Chart

The valve operation during manual span calibration execution and the timing when the AO/DO output switches to Cal/Val/Blow Back mode are shown below. In Cal/Val/Blow Back mode, it is possible to hold the AO output or specify other settings. For the AO/DO output settings during Cal/Val/Blow Back mode, see “4.4.2 Output Hold” and “4.5.1 DO Contact (DO-1)”.

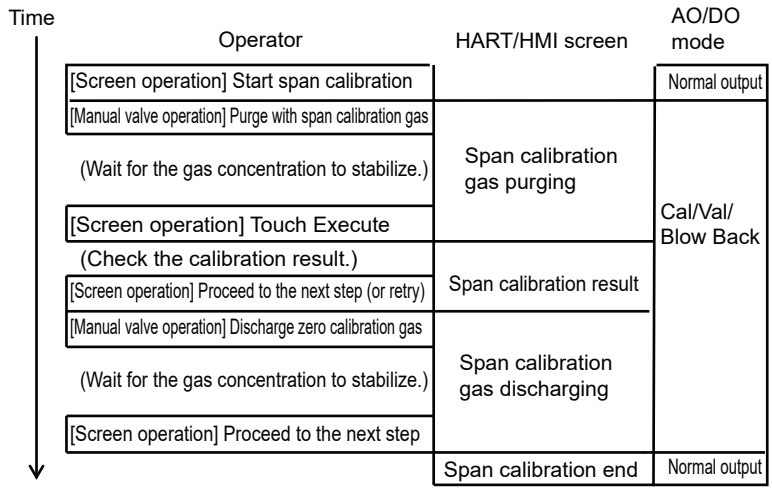


Figure 6.24 AO/DO of span calibration

6.7 Calibration Data Record and Restoring

This section explains the function used to view the history of calibration and validation results and restoring the zero and span calibration data to its original condition.

Calibration and validation history

You can view up to 10 events using HART and 99 events using the YH8000. For the displayed history content, see YH8000 user's manual (IM 11Y01D10-01EN).You can view using the following menu.

[YH8000] "ⓘ>>Log Book>>Cal/Val History"

Restoring calibration data

For zero and span calibration, you can restore past calibration results. You can restore separately for zero and span. You can select the original data for restoring from the following two types.

- Previous

  The calibration data executed previously is restored. When executed, the current calibration data is saved as past data. Therefore, restoring twice will cause the current calibration data to return.
- Factory

  The factory default calibration data is restored. When executed, the current calibration data is saved as past data. Therefore, if you restore using "Factory" and then using "Previous," the original current data will return.

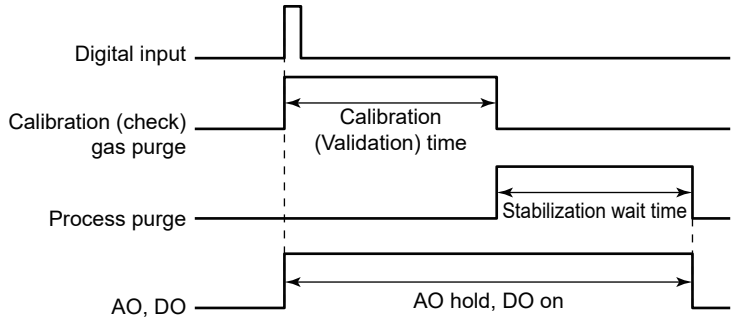
Execution menu path:

[YH8000] "🔧>>Execution>>Calibration>>Restore"

6.8 Automatic and Semi-automatic Execution of Online validation

There are several methods to perform online validation. One method is manual calibration and manual validation, which you execute from the screen. Another method is automatic calibration and validation, which are executed at a preset time or at preset time intervals. Yet another method is semi-automatic validation, which are executed in response to a start instruction from the YH8000, digital input, or Modbus. HART does not support the semi-automatic execution.

Since valves are controlled automatically in automatic and semi-automatic execution, you need to set time in advance for a check gas to be introduced. As shown in the following diagram, the time period during which calibration gas (or check gas) is being led is called *calibration (validation) time*. The subsequent time period during which process gas purging takes place is called *stabilization wait time*. The stabilization wait time is the period until the measurements stably return to normal process values. The TDLS8200 is in a Cal/Val/Blow Back state until the stabilization wait time is completed and holds the AO output. The following diagram shows a remote execution example. Digital input is used to start calibration (validation).



NOTE

It is possible to disable the AO hold operation and DO ON operation that take place while online validation is being executed. For details, see “4.4.2 Output Hold” and “4.5.1 DO Contact (DO-1)”.

6.8.1 Preparation

Before automatic execution or semi-automatic execution, connect the piping properly according to the online validation you want to perform. For the piping diagram, see the sections describing online validation.

6.8.2 Configuration

To perform automatic or semi-automatic execution, you need to set certain parameters, which are shared with manual execution, as well as settings for automatic operation. The settings that are shared with manual execution are described in the “Configuration” section for online validation. There are two types of settings for automatic operation. The menu path for accessing them is the same as that described in the “Configuration” section for online validation.

[YH8000] >>Select analyzer >>Configuration >>Validation>>Online Validation #”

Calibration gas or check gas and process gas purge time

The purge time must be set regardless of automatic execution or semi-automatic execution. As an example, the parameters for online validation 1 are shown below.

Parameter name (YH8000)	Description
Validation gas Purge time	Enters the purge time of online validation 1 check gas. This corresponds to the validation time.
Normal gas Purge time	Enters the normal purge gas purge time for process measurement. This corresponds to the stabilization wait time.

Automatic execution settings

To perform automatic execution, you need to set the execution method you want to use. This is not necessary for semi-automatic execution.

- Parameters for time initiate

  As an example, the parameters for online validation 1 are shown below.

Parameter name (YH8000)	Description
Time Initiate	Enables time initiate of online validation 1
Initial time	Enters the initial execution date
	Enters the initial execution time

  For example, if the initial execution time is “2021/4/1 12:00:00” (12:00:00 on April 1st, 2021), and the day cycle is “10”, the hour cycle is “0”,

  the next execution will be at “2021/4/11 12:00:00” (12:00:00 on April 11, 2021), and
  the third execution will be at “2021/4/21 12:00:00” (12:00:00 on April 21, 2021) and so on.

NOTE

If both the day and hour cycles for time initiate are set to zero, automatic execution takes place once at the initial execution time.

- If you want to use digital input, see “4.7 Digital Input Settings”.
- If you are using Modbus instructions, you do not need to set the parameters. For the instruction address, see “8.2 Coil”.

6.8.3 Execution

Before execution, check that the preparations and settings are correct.

NOTE

If a start request for another calibration or validation overlaps with a calibration or validation currently in progress, the request will be discarded. For example, if the start time of a time-based automatic calibration coincides with a manual calibration in progress, the time initiate request is discarded. Such incidents are recorded in the alarm history.

Since automatic calibration and validation are executed at the specified time cycle, there is no manual operation to start it. This section describes a procedure of the semi-automatic validation using online validation 1 as an example.

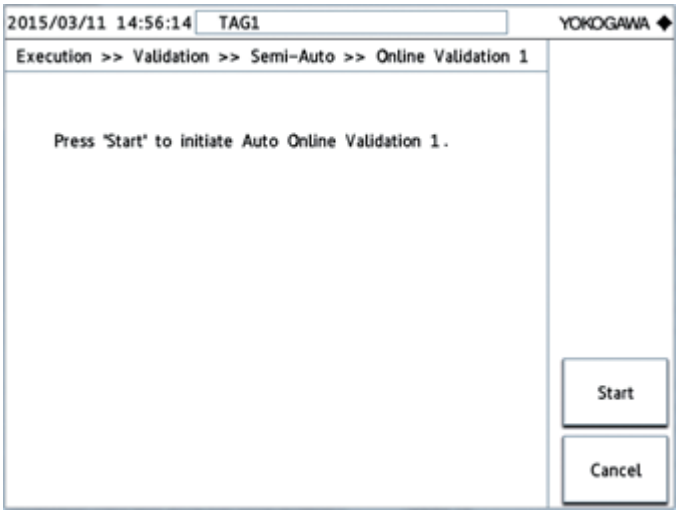
Semi-automatic execution menu path:

[YH8000] “  >>Execution>>Validation>>Semi-Auto”

YH8000 Execution Screen

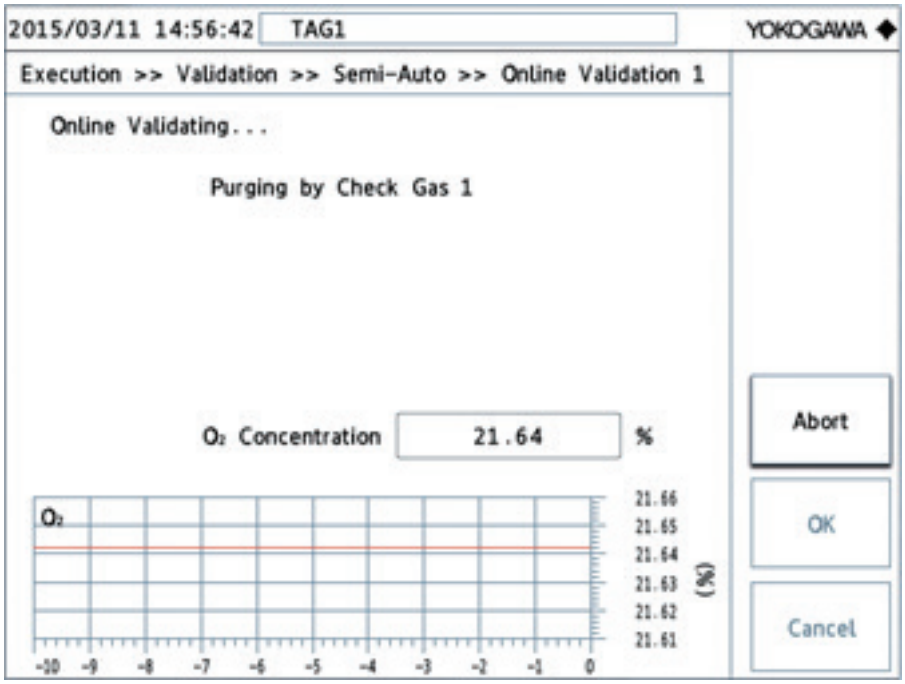
(1) Starting validation

Execute “Semi-Auto Online Validation 1.” Tap Start to begin.



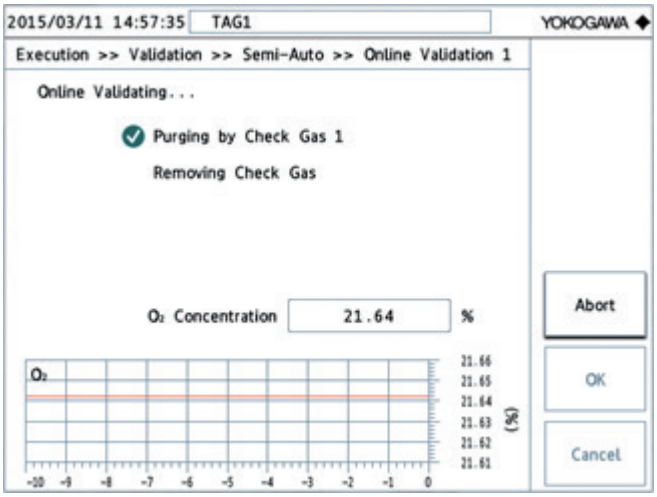
(2) Purging with the check gas

When validation starts, the stream is automatically switched, and the validation cell is purged with check gas. The purge time is the time specified by “Validation gas Purge time.” Tapping Abort cancels validation.



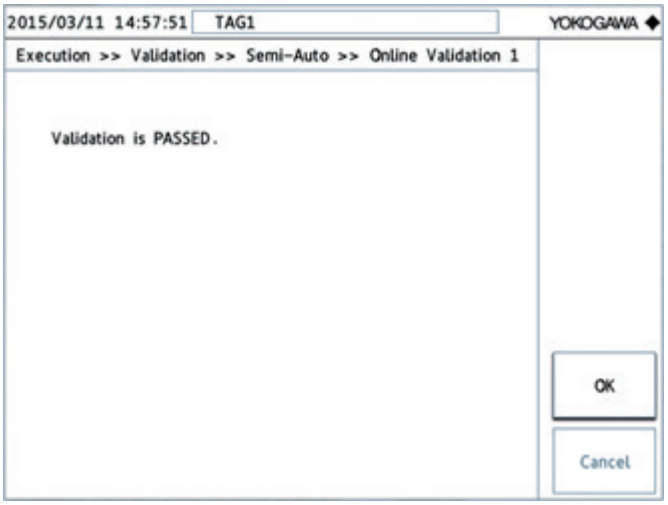
(3) Discharging the check gas (process purge)

The stream is automatically switched, and the validation cell is purged with normal process purge gas to discharge the check gas. The purge time is the time specified by “Normal gas Purge time.” Tapping Abort cancels validation.



(4) Checking the validation result

The validation result is displayed as “PASSED” or “FAILED,” and validation ends. If validation is unsuccessful, a warning will occur (see “6.2.3 Execution”). Tap OK to return to the configuration menu.



6.8.4 Aborting the Stabilization Wait Time for Automatic or Semi-automatic Execution

Since online validation uses the measured value in the normal process state for the validation result, the stabilization waiting time cannot be interrupted. If you do, the validation itself is aborted and the result is not displayed.

6.9 Analog Input Calibration

This section explains analog-digital conversion calibration of the analog input terminal (AI). Since the TDLS8200 is calibrated before shipment, you normally do not need to calibrate.

CAUTION

Analog input must be calibrated with Passive AI

Check the setting on “2.2.2 Connecting to Temperature and Pressure Transmitters”. If Active A is on, power down first and switch to “Passive A”

Execution menu path:

[YH8000] >>Select analyzer >>Configuration >>I/O>>Analog Input >>AI-1(Pressure)>>Calibration”

“ >>Select analyzer >>Configuration>>I/O>>Analog Input >>AI-2(Temperature)>>Calibration”

The calibration procedure is as follows.

(1) From YH8000, start AI calibration.
(2) Connect a current source to the AI terminal, and apply 4 mA as instructed on the screen.
(3) Check that the analog input is stable, and proceed to the next screen.
(4) Apply 20 mA as instructed on the screen.
(5) Check that the analog input is stable, and proceed to the next screen. Calibration is complete.

NOTE

If analog input calibration is executed when the analog input is set to process pressure or temperature, the pressure or temperature during calibration is calculated based on the backup function. For example, if the pressure’s Backup mode is set to Back value and Backup set value is set to 101.0 kPa, the pressure at AI-1 during calibration is fixed to 101.0 kPa. For details on the backup function, see “3.2.3 Setting the Process Pressure”.

CAUTION

To return to process, confirm Active A or Passive A are selected then turn the power on.

6.10 Analog Output Calibration

This section explains digital analog conversion calibration of the analog output terminal (AO). Since the TDLS8200 is calibrated before shipment, you normally do not need to calibrate.

Execution menu path:

[HART] “Diagnostics >> Trim analog channel >> Trim AO-1(PV)”
“Diagnostics >> Trim analog channel >> Trim AO-2”
“Diagnostics >> Trim analog channel >> Trim AO-3”
“Diagnostics >> Trim analog channel >> Trim AO-4”
“Diagnostics >> Trim analog channel >> Trim AO-5”

[YH8000] “>> Select analyzer >> Configuration>>I/O>>Analog Output>> AO-1>>Calibration”
“>> Select analyzer >> Configuration>>I/O>>Analog Output>> AO-2>>Calibration”
“>> Select analyzer >> Configuration>>I/O>>Analog Output>> AO-3>>Calibration”
“>> Select analyzer >> Configuration>>I/O>>Analog Output>> AO-4>>Calibration”
“>> Select analyzer >> Configuration>>I/O>>Analog Output>> AO-5>>Calibration”

The calibration procedure is as follows.

(1) Connect ammeter to the AO terminal.
(2) From YH8000 or HART, start AO calibration.
(3) A current corresponding to 4 mA will flow. When the measuring instrument reading becomes stable, enter the measured value.
(4) A current corresponding to 20 mA will flow. When the measuring instrument reading becomes stable, enter the measured value.
(5) Calibration is complete.

NOTE

When analog output calibration is complete, the 20 mA fixed output is released, and normal analog output returns. At this point, the AO loop check simulation output is also released. For example, if analog output calibration is executed while AO-1 loop check is in progress, when the calibration is complete, AO-1 returns to normal output.

6.11 Loop Check

See “3.3 Loop Check (Simulation output)”.

6.12 Alarm History

You can view the history of alarms (faults and warnings) that occurred in the past. In addition, if an non-alarm event shown in Table 6.1 occurs, it is recorded as a message.

Menu path:

[YH8000] "ⓘ>>Log Book>>Alarm History"

The information displayed in the alarm history is as follows.

- Times when faults and warnings occur and clear
- Times when messages occur
- Sub numbers of alarm messages (only for certain alarms and messages)

  These numbers are used by Yokogawa service representatives for troubleshooting purposes. The numbers are displayed in the YH8000.

You can view up to 99 events using the YH8000. For an explanation of the YH8000 alarm history screen, see YH8000 user's manual (IM 11Y01D10-01EN).

For details on faults and warnings, see "7. Troubleshooting".

Items recorded as messages are shown in the following table.

Table 6.1

No.	Message	Description
66	Power On	The power was turned on.
67	Restarted by WDT	Restarted due to a watchdog timeout.
68	Restarted by Power Failure	Restarted by a power supply monitoring IC.
69	Laser Module Replaced	Laser module was replaced.
70	Bootloader Updated	Boot loader was updated.
71	Firmware Updated	Firmware was updated.
72	FPGA Updated	CIO-FPGA was updated.
73	Config File Updated	The configuration file was updated.
74	Backup Config Loaded	Backup configuration was loaded.
75	Default Config Loaded	Default configuration was loaded.
76	Default Firmware Loaded	Default firmware was loaded.
77	Default HART config loaded	Default ROM values for HART parameters were loaded.
78	Reset by External Operation	Restarted by an external instruction.
79	RTC was Adjusted	The real-time clock was synchronized.
80	Auto Zero Cal was Skipped	Automatic zero calibration start instruction was skipped.
81	Auto Span Cal was Skipped	Automatic span calibration start instruction was skipped.
83	Auto Validation was Skipped	Automatic validation start instruction was skipped.
84	HMI Connected	YH8000 was connected.
85	HMI Disconnected	YH8000 was disconnected.
86	HMI Disconnected(recv)	YH8000 was disconnected while receiving.
87	HMI Disconnected(send)	YH8000 was disconnected while sending.
88	History File was Corrupted	The history file was corrupted.
89	AI damaged	AI was damaged.
90	AO-1 damaged	AO-1 was damaged.
91	AO-2damaged	AO-2 was damaged.
92	AO-3 damaged	AO-3 was damaged.
93	AO-4, AO-5 damaged	AO-4, AO-5 were damaged.
94	Blow Back skipped	Blow Back was skipped.

6.13 Access to stored data in TDLS8200

Plugging a USB flash drive into USB port on TDLS8200 enables downloading data stored in TDLS8200 memory.

The following files listed in the next table can be confirmed as in plain text or spreadsheet by converting file format to CSV file format or ".csv".

Folder name	File name	description
DATA	YYMMDD.rst	Concentration, Transmission, Process temperature, Pressure, temperature inside the equipment, Trend data of AII, AI2, AO1, AO2, AO3, AO4, AO5.
	YYMMDD.spc	Automatically saved spectrum data
	YYMMDD.spr	Automatically saved spectrum data of reference cell automatically stored
CAPTURE	xxxxxxx.spc	Manually saved spectrum data
	xxxxxxx.spr	Manually saved spectrum data of reference cell,
LOG	current.alm	Alarm history
	backup.alm	Alarm history (back up)
	current.cal	history of calibration/validation
	backup.cal	history of calibration/validation (back up)
	current.spc	Spectrum data at validation
	backup.spc	Spectrum data at validation (back up)

For file converter software, download the files from the following website. (member login required)

https://partner.yokogawa.com/global/an/

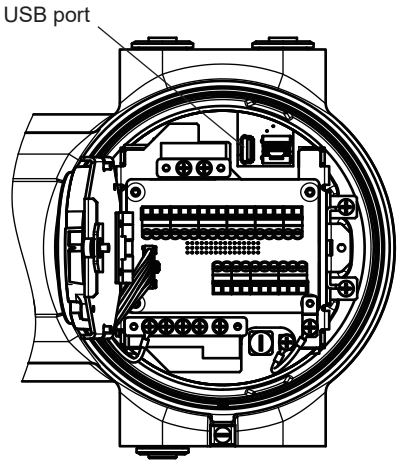
How to download data

1: Plug an empty USB flash drive* into USB port on TDLS8200.

2: TDLS8200 starts downloading files automatically.

3: After "Download complete" is displayed on the panel, remove the USB flash drive.

*: Use a USB flash drive with the capacity of 1 GB or greater. Note that all USB flash drives are not guaranteed to be compatible.



TDLS8200

7. Troubleshooting

This chapter explains the faults and warnings that the TDLS8200 may detect. It also explains how to inspect and restore the TDLS8200 when other problems occur.

7.1 Fault Display and Handling

A fault occurs when the various types of diagnostic information being monitored by the self-diagnostics function are clearly abnormal and correct concentration calculation is not possible. It may signify a malfunction. If a fault occurs, the TDLS8200 output and display responds in the following manner.

- The analog output is set to the specified state.
- The fault contact is opened.
- The fault LED (red) lights.
- The alarm indicator blinks on the YH8000 display.
- Alarm information is indicated over HART communication (see “5.4 Alarm Definition (Status group)”).
- Alarm information is shown on the SCU display.

The following table shows the fault types and their corrective actions. Alarm numbers are defined for fault type identification. These numbers are shared among the YH8000, HART and SCU displays, even though the abbreviations of the displayed fault names may differ. Depending on the alarm, a sub number may also be displayed. This number is used by Yokogawa service representatives for troubleshooting purposes.

NOTE

When Safety mode is enabled, a fault that occurs is not cleared automatically even when the cause of the fault is eliminated.

No.	Displayed name (YH8000)	Description	Corrective action
41	L1 Detector Signal High	LD1 Detector Signal is too high.	Contact Yokogawa service representative.
42	L2 Detector Signal High	LD2 Detector Signal is too high.	Contact Yokogawa service representative.
43	Laser Module Temp. Low	Laser Module temperature is too low.	Check the ambient temperature of the analyzer part.
44	Laser Module Temp. High	Laser Module temperature is too high.	Check the ambient temperature of the analyzer part.
45	L1 Laser Temp. Out of Range	Laser temperature is out of range.	Contact Yokogawa service representative.
46	L2 Laser Temp. Out of Range	Laser temperature is out of range.	Contact Yokogawa service representative.
47	L1 Peak Center Out of Range	LD1 Peak Center is out or range.	Contact Yokogawa service representative.
48	L2 Peak Center Out of Range	LD2 Peak Center is out or range.	Contact Yokogawa service representative.
49	L1 Detector Signal Lost	LD1 transmission is too low to continue the measuring.	Check the alignment is adjusted properly. Check that the laser beam is not blocked. Check that the process window is not stained. See “7.3 Handling Degraded Laser Transmission” for details.
50	L2 Detector Signal Lost	LD2 transmission is too low to continue the measuring.	Check the alignment is adjusted properly. Check that the laser beam is not blocked. Check that the process window is not stained. See “7.3 Handling Degraded Laser Transmission” for details.

No.	Displayed name (YH8000)	Description	Corrective action
51	L1 Ref Signal Out of Range	L1 Ref Signal is out or range.	Contact Yokogawa service representative.
52	L2 Ref Signal Out of Range	L2 Ref Signal is out or range.	Contact Yokogawa service representative.
53	L1 Laser Unit Failure	Analyzer unit is damaged.	Contact Yokogawa service representative.
54	L2 Laser Unit Failure	Analyzer unit is damaged.	Contact Yokogawa service representative.
55	L1 Laser Module Error	Analyzer unit is damaged.	Contact Yokogawa service representative.
56	L2 Laser Module Error	Analyzer unit is damaged.	Contact Yokogawa service representative.
57	File Access Error	File access fails.	Contact Yokogawa service representative.(*1)
58	EEPROM Error	EEPROM is damaged.	Contact Yokogawa service representative.(*1)
59	Internal Comm fail	Internal communication fails.	Contact Yokogawa service representative.
60	Power Failure	Power fails.	Contact Yokogawa service representative.
61	L1 Laser Unit Connection Err	An error occurred in the analyzer part.	Contact Yokogawa service representative.
62	L2 Laser Unit Connection Err	An error occurred in the analyzer part.	Contact Yokogawa service representative.
63	FPGA Failure	FPGA failure.	Contact Yokogawa service representative.(*1)
64	System Error	Internal communication fails.	Contact Yokogawa service representative.(*1)

*1: If the fault occurs again after you restart the TDLS8200, contact your Yokogawa service representative.

7.2 Warning Display and Handling

A warning occurs when the various types of diagnostic information being monitored by the TDLS8200 self-diagnostics function are outside the normal range. If a warning occurs, the TDLS8200 output and display will respond in the following manner.

- The analog output is set to the specified state (the factory default hold setting is off).
- DO digital output is generated (for the digital output wiring, see “3.2.6 Setting Process Alarms”.
- The DO LED (yellow) lights.
- The alarm indicator blinks on the YH8000 display.
- Alarm information is indicated over HART communication (see “5.4 Alarm Definition (Status group)”).
- Alarm information is shown on the display.

The following table shows the warning types and their corrective actions. Alarm numbers are defined for warning type identification. These numbers are shared among the YH8000, HART and displays, even though the abbreviations of the displayed warning names may differ. Depending on the alarm, a sub number may also be displayed. This number is used by Yokogawa service representatives for troubleshooting purposes.

No.	Displayed name	Description	Corrective action
1	L1 Transmission Low	LD1 transmission is less than the low limit.	Check the alignment is adjusted properly. Check that the laser beam is not blocked. Check that the process window is not stained. Check the lower alarm threshold. See “7.3 Handling Degraded Laser Transmission” for details.
2	L2 Transmission Low	LD2 transmission is less than the low limit.	Check the alignment is adjusted properly. Check that the laser beam is not blocked. Check that the process window is not stained. Check the lower alarm threshold. See “7.3 Handling Degraded Laser Transmission” for details.
3	AI-1 (Pressure) Low	Process pressure is less than the low limit.	Check the process gas pressure. Check whether the gas pressure meter signal is correct. Check whether the AI range setting is correct. Check the lower alarm threshold. See “3.2.6 Setting Process Alarms” for details.

No.	Displayed name	Description	Corrective action
4	AI-1 (Pressure) High	Process pressure is higher than the high limit.	Check the process gas pressure. Check whether the gas pressure meter signal is correct. Check whether the AI range setting is correct. Check the higher alarm threshold. See “3.2.6 Setting Process Alarms” for details.
5	AI-2 (Temperature) Low	Process pressure is lower than the low limit	Check the process gas temperature. Check whether the gas thermometer signal is correct. Check whether the AI range setting is correct. Check the higher alarm threshold. See “3.2.6 Setting Process Alarms” for details.
6	Process Temperature High	Process pressure is higher than the high limit	Check the process gas temperature. Check whether the gas thermometer signal is correct. Check whether the AI range setting is correct. Check the lower alarm threshold. See “3.2.6 Setting Process Alarms” for details.
7	Concentration Gas1 Low	LD1 Gas1 concentration is lower than the low limit.	Check LD1 Gas1 concentration. Check the lower alarm threshold. See “3.2.6 Setting Process Alarms”for details
8	Concentration Gas1 High	LD1 Gas1 concentration is higher than the high limit.	Check LD1 Gas1 concentration. Check the higher alarm threshold. See “3.2.6 Setting Process Alarms” for details
9	Concentration Gas2 Low	LD1 Gas2 concentration is lower than the low limit.	Check LD1 Gas2 concentration. Check the lower alarm threshold. See “3.2.6 Setting Process Alarms” for details
10	Concentration Gas2 High	LD1 Gas2 concentration is higher than the high limit.	Check LD1 Gas2 concentration. Check the higher alarm threshold. See”3.2.6 Setting Process Alarms”for details
11	Concentration Gas3 Low	LD2 Gas1 concentration is lower than the low limit.	Check LD2 Gas1 concentration. Check the lower alarm threshold. See “3.2.6 Setting Process Alarms” for details
12	Concentration Gas3 High	LD2 Gas1 concentration is higher than the high limit.	Check LD2 Gas1 concentration. Check the higher alarm threshold. See “3.2.6 Setting Process Alarms” for details
17	Laser Unit Temperature Low	Laser unit temperature is too low.	Check the ambient temperature of the laser unit. Contact Yokogawa service representative.
18	Laser Unit Temperature High	Laser unit temperature is too high.	Check the ambient temperature of the laser unit. Contact Yokogawa service representative.
19	SCU Temperature Low	Laser unit temperature is too low.	Check the ambient temperature of the laser unit. Contact Yokogawa service representative.
20	SCU Temperature High	Laser unit temperature is too high.	Check the ambient temperature of the laser unit. Contact Yokogawa service representative.
21	L1 Validation Required	A validation is required for LD1 accuracy.	Execute validation. Or, if you confirm that validation is not required, clear the alarm. (*1)
22	L1 Validation Error	LD1 validation failed.	Verify the check gas. Check whether the validation settings are correct. For details, see “6.2 Online Validation”, “6.4 Offline Validation”.
23	L1 Zero Calibration Error	LD1 zero calibration failed.	Check the zero calibration gas. Check whether the zero calibration settings are correct. For details, see “6.5 Zero Calibration” (*2)
24	L1 Span Calibration Error	LD1 span calibration failed.	Check the span calibration gas. Check whether the span calibration settings are correct. For details, see “6.6 Span Calibration”. (*2)
25	L2 Validation Required	A validation is required for LD2 accuracy.	Execute validation. Or, if you confirm that validation is not required, clear the alarm. (*1)
26	L2 Validation Error	LD2 validation failed.	Verify the check gas. Check whether the validation settings are correct. For details, see “6.2 Online Validation”, “6.4 Offline Validation”.
27	L2 Zero Calibration Error	LD2 zero calibration failed.	Check the zero calibration gas. Check whether the zero calibration settings are correct. For details, see “6.5 Zero Calibration” (*2)
28	L1 Span Calibration Error	LD2 span calibration failed.	Check the span calibration gas. Check whether the span calibration settings are correct. For details, see “6.6 Span Calibration”. (*2)
29	AI-1 (Pressure) Low	AI-1 (Pressure) input current is less than 4 mA.	Check the process gas pressure. Check whether the gas pressure meter signal is correct. Check whether the AI range setting is correct. See “4.3 Analog Input Settings”for details.

No.	Displayed name	Description	Corrective action
30	AI-1 (Pressure) Hig	AI-1 (Pressure) input current is more than 20 mA.	Check the process gas pressure. Check whether the gas pressure meter signal is correct. Check whether the AI range setting is correct. See “4.3 Analog Input Settings” for details.
31	AI-2 (Temperature) Low	AI-2 (Temperature) input current is less than 4 mA.	Check the process gas temperature. Check whether the gas thermometer signal is correct. Check whether the AI range setting is correct. Check the higher alarm threshold. See “4.3 Analog Input Settings” for details.
32	AI-2 (Temperature) High	AI-2 (Temperature) input current is more than 20 mA.	Check the process gas temperature. Check whether the gas thermometer signal is correct. Check whether the AI range setting is correct. Check the higher alarm threshold. See “4.3 Analog Input Settings” for details.
33	External Alarm	An alarm triggered by digital input occurred.	Check the external alarm status.
34	Clock Adjustment Required	The real-time clock is not synchronized.	Set the current time.
35	Setting File Corrupted	Restored from backup due to a setup file corruption.	Configure the settings again, and restart.
36	L1 Calibration File Corrupted	Restored from backup due to a LD1 calibration file corruption.	Calibrate again, and restart.
37	L2 Calibration File Corrupted	Restored from backup due to a LD2 calibration file corruption.	Calibrate again, and restart.

*1: For validation alarms, you can manually clear the alarm without re-executing validation.
Menu path:
[YH8000] “  >>Execution>>Validation>>Clear Validation Alarm”

*2: For calibration alarms, you can manually clear the alarm without re-executing calibration.
Menu path:
[YH8000] “  >>Execution>>Calibration>>Clear Calibration Alarm”

7.3 Handling Degraded Laser Transmission

For the TDLS8200 to operate normally, the optimal level of laser beam needs to reach the photo detector unit.

The following phenomena can cause the laser beam level to degrade. These factors may occur separately or together.

- Optical axis error: Degradation of received light level due to optical axis misalignment
- Clogging: The opening where the laser beam travels through is blocked or is unclean.
  - Dust has accumulated inside probe, blocking the laser beam.
  - Stain or foreign substances adhering to the process window are attenuating the laser beam level.
- Particles: Dust in the process gas is attenuating the laser beam level.
  - Smoke concentration, opacity, or particle concentration is extremely high, and not enough laser beam is reaching the photo detector unit.
- Laser degradation: The output power of the laser element itself has degraded.
  - The laser light source has degraded or malfunctioned, and not enough laser beam is being emitted.

Improving transmission

This section provides corrective actions for when the transmission is lost or reduced after installing the TDLS8200.

(1) Adjusting the optical axis

If the laser beam is not shut off but the transmission is low, double check that the optical axis is adjusted correctly. As described in “2.3 Optical Axis Adjustment”, normally optical axis adjustment and transmission calibration are performed after the TDLS8200 is installed. But if the process gas temperature is high, the optical axis may diverge from the initial adjustment due to a deformation in the duct or the like causing the process flange or nozzle to be misaligned.

If optical axis readjustment is necessary, do so by referring to “2.3 Optical Axis Adjustment”.

If the transmission does not improve even when the optical axis adjustment described in section 2.3 is executed, other factors may be causing the problem.

(2) Solving Degraded/Lost Laser Transmission

If no improvement is seen even when the measures described in (1) above are taken, the laser itself might be malfunctioning.

To verify the laser output power, first detach the analyzer from probe and mount the analyzer on a calibration cell, then read the transmission.

Follow the instruction of “6.3 Mounting on a Calibration Cell” on how to mount calibration cell.

7.4 Process Window Replacement

If the stain on the surface of a process window does not come off even if you clean it according to section “6.1.3 Process Window Cleaning” or if the surface has corroded due to corrosive gas such as hydrogen fluoride, you need to replace the process window. Replace it according to the procedures in “7.4.2 Process Window Replacement Procedure”. When you replace a process window, be sure to also replace the O-ring.

7.4.1 Replacement Parts (Process window)

If you need to replace a process window, prepare the relevant parts in Table 7.1.

Table 7.1 Replacement parts

Parts no.	Parts name	Purpose *	Quantity
K8010CA	Process Window Assy (for CO/O_2)	For purge block (for -C2, -C3, -C4/-X1, -X2)	1 or 2
K9776GA	Process Window Assy (for O_2)	For purge block (for -X1, -X2)	
K9772TH	O ring	For process window attached to purge block	

*: Codes in parenthesis represent Gas Parameter on Model and Suffix Codes of TDLS8200.

7.4.2 Process Window Replacement Procedure

The procedure for replacing the process window is provided below.

NOTE

Before removing the probe from process to clean, check that the process is completely stopped and no process gas will be discharged.

CAUTION

Be careful in handling the process window as it is made of optical glass.

(1) Turn the power off.

(2) Stop the purge gas.

(3) Remove the purge piping.

(4) Remove the analyzer from the process.

(If necessary, separate it completely from the process such as by using a process isolation valve.)

(5) Check the stained area of the process window, and remove the relevant process window.

(6) Loosen the four M4 hexagon socket head cap screws on the process window holder, and remove the process window.

(7) Install a new process window. Replace the O-ring also.

The position of the O-ring is indicated in Figure 7.1. Firmly mount the O-ring in the O-ring groove.

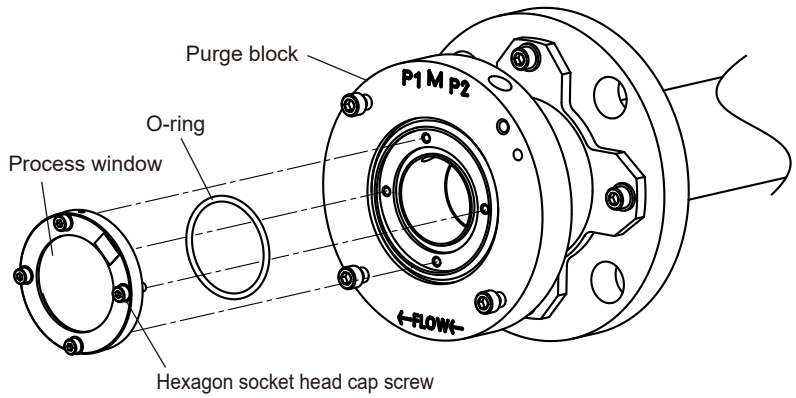


Figure 7.1 Replacing the process window, O-ring

(8) Pay attention to the orientation of the process window. Install it in the same orientation as before.

Tighten the screws evenly.

(9) After installing the process window, install the analyzer for use.

7.4.3 How to replace Flowcell type process window

See “6.1.6 Process Window Cleaning (Flowcell type)” to remove/replace the process window.

7.5 Reflector Replacement

Refer to “6.1.5 Reflector Cleaning” to remove/replace reflector unit.

7.6 Fuse Replacement

(1) To safely replace the fuse, shut off the external circuit breaker to stop the power supply to the TDLS8200.

(2) Remove the fuse from the fuse holder. Using a flat-blade screwdriver that matches the holder cap, turn the cap 90 degrees counterclockwise.

Then you will be able to remove the fuse with the cap.

(3) Check that the rating of the new fuse is correct, place it in the fuse cap, and insert the cap in the holder. Using a flat-blade screwdriver, turn the cap 90 degrees clockwise while pressing down.

(4) If the new fuse blows immediately, there may be a problem with the circuitry. Contact your Yokogawa representative.

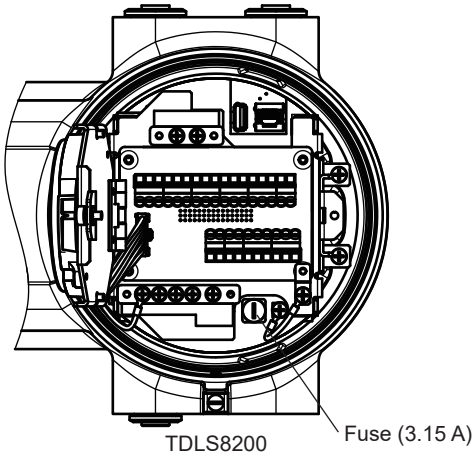


Figure 7.2 Fuse replacement

7.7 Communication Interruption during Manual Calibration and Validation

If the communication between YH8000 or HART and the TDLS8200 is disconnected while performing manual calibration or validation from YH8000 or HART, take the following corrective action.

- **HART**

  See “5.5.2 Aborting Calibration and Validation”.

- **YH8000**

  (1) Reconnect.

  (2) Tap  to enter the TDLS8200 configuration screen. The screen for the calibration or validation in progress automatically recovers. You can continue the calibration or validation.

7.8 Piezo Proof Test

Piezo Proof Test verifies the piezo actuator used inside TDLS8200.

Execution menu path:

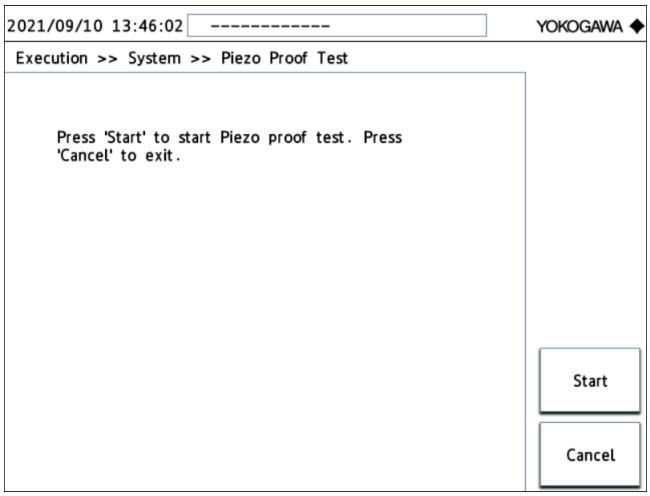
[HART] “Diagnostics >> Piezo proof test”

[YH8000] “  >>Execution>> System >> Piezo proof test”

YH8000 execution screen

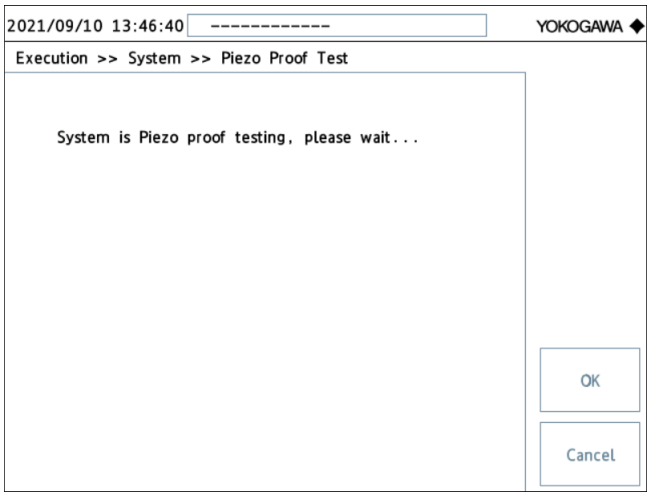
(1) Start Piezo Proof Test

Open the menu above, start Piezo Proof Test.



(2) Testing

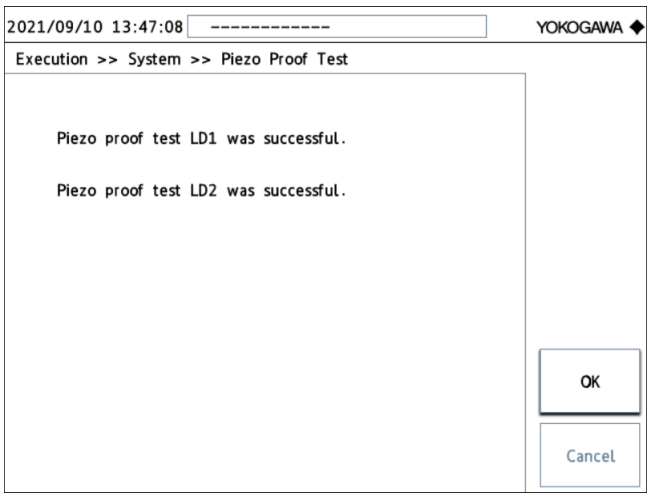
“System is Piezo proof testing..” (*1) is displayed. The test takes normally about 60 seconds, up to 90 seconds.



(3) Check the result

After the test completes, the screen automatically shifts from the test screen to the test result. However, some HART configuration tools disable the shift automatically. In that case, tap “OK” or the functionally equivalent key to display the result on the screen.

If the test has not been completed, the screen returns to show the testing mode. The test result is displayed as success or fail. After confirming the result, proceed to the next screen.



(4) End of the test

Piezo Proof Test ends. (*2)

*1: [HART] Wait until piezo proof test is done. It takes up to 90 seconds.
[YH8000] The system is under piezo proof test. Wait.

*2: When the 1 laser specification is selected, the result of LD2 is not displayed.

NOTE

When the piezo proof test fails, TDLS8200 may not operate properly. Please consult Yokogawa.
The piezo proof test is different from the proof test required for IEC 61508.

8. Modbus

Modbus protocol can be used for TDLS8200 DCS communication. This section explains the Modbus communication specifications that apply to the TDLS8200.

The main uses of Modbus communication on the TDLS8200 are shown below. Only a portion of the TDLS8200 configuration function is supported.

- Checking measured values, I/O, and alarms
- Executing calibration, validation, and clock setting
- A portion of configuration functions (setting the current stream, inputting the temperature and pressure)

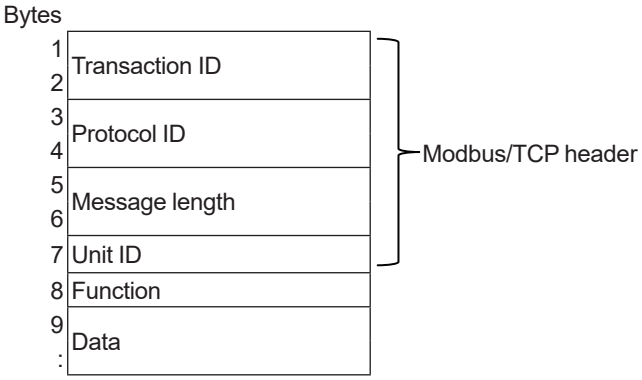
8.1 Communication Specifications

The TDLS8200 can be used as a Modbus slave device. Modbus communication is possible by connecting to a master device via Ethernet cable.

Communication standard	Ethernet
Number of sessions (max.)	2
Protocol	Modbus/TCP
Port number	502

8.1.1 Message Structure

The communication message structure is shown below. The first seven bytes are the Modbus/TCP header.



- **Transaction ID**

  Data assigned by the master device to manage transactions. Slave devices simply return the received value.

- **Protocol ID**

  Fixed at zero.

- **Message length**

  Data byte length after the unit ID.

Unit ID

Don't care for Modbus/TCP. Slave devices simply return the received value.

Function

The supported function numbers are listed in the following table.

Function no.	Function	Type	Max. number of data points per transaction
1	Read coils	Bit	2000 points
2	Read the input relays	Bit	2000 points
3	Read hold registers	Word	125 points
4	Read the input registers	Word	125 points
5	Write to a single coil	Bit	1 point
6	Write to a single hold register	Word	1 point
16	Write to hold registers	Word	123 points
43	Read device information	ASCII string	(*1)

*1: The following parameters, which are basic device ID parameters (in the basic category) are read by function 43.

ID	Object name	Meaning	Value
0x00	VenderName	Vendor name	"YOKOGAWA"
0x01	ProductCode	Product code	"TDLS8200"
0x02	MajorMinorRevision	Revision number	"[Device Revision]-[Software Revision]" Example: "01-1.01.01"

Data

There are two types of data: "coil/relay" in unit of bits and "register" in unit of 16 bits. Data attributes and data addresses are shown in the following table.

Type	Attribute	Modbus name	Address (*1)	Application
Bit	W	Coil	0XXXX	Instruction
	R	Input relay	1XXXX	Status
Register	R	Input register	3XXXX	Measured value
	W	Hold register	4XXXX	Valve control, temperature/pressure input

*1: XXXX: 0001 to 9999

8.1.2 Slave Response

Function and subsequent content of response messages vary depending on whether there are errors in instruction messages.

Normal response

In the case of writing to a single coil or single hold register, the slave device returns the same message as the instruction message. In the case of a read function, the read data is added to the function in the response message. If an address in which no data is assigned is read, zero, not an error, is returned as the read data.

Error response

If there is an error in the instruction message, the slave device returns an error response without executing the instruction. In an error response, the slave device returns the value obtained by adding 128 to the instruction function as the error function. Therefore, the master device can check the function in the response message to determine whether an instruction has been accepted normally. If the master device determines an error has occurred, it can find out the details by checking the error code.

The message structure from the function and beyond in an error response is as follows.

Error function (instruction function + 128)
Error code

The error code details are provided below.

Error code	Description
01	Function code error (nonexistent function)
02	Coil, input relay, or register address error (out of range)
03	Coil, input relay, or register data number error (out of range)
06	During instruction message execution, an error which is the slave device cannot execute occurs. Example: Writing not possible because maintenance is in progress
07	Command error Example: Write-data is out of range.

8.2 Coil

Coil name	Address	Action performed when “1” is set
Automatic online validation 1 execution	00006	Remotely execute automatic online validation 1
Automatic online validation 2 execution	00007	Remotely execute automatic online validation 2
Time set instruction	00008	Set the hold register time value (40201 to 40206)

8.3 Input relay

Input relay name	Address	Description
Analyzer error	10001	Alarm occurring when set to 1 (refer to address 10101 and beyond for the alarm details)
Maintenance in progress	10002	Maintenance in progress when set to 1
AO-1, 2, 3, 4, 5 fixed output	10003	AO-1 to AO-5 fixed output when set to 1
AO-1 fixed output	10004	AO-1 fixed output in progress when set to 1
AO-2 fixed output	10005	AO-2 fixed output in progress when set to 1
AO-3 fixed output	10006	AO-3 fixed output in progress when set to 1
AO-4 fixed output	10007	AO-4 fixed output in progress when set to 1
AO-5 fixed output	10008	AO-5 fixed output in progress when set to 1
Zero calibration in progress	10009	Zero calibration in progress when set to 1
Span calibration in progress	10010	Span calibration in progress when set to 1
Offline validation in progress	10011	Offline validation in progress when set to 1
Online validation in progress	10012	Online validation in progress when set to 1
DAQ Offset calibration in progress	10013	DAQ Offset calibration in progress when set to 1
Blow Back in progress	10014	Blow Back in progress when set to 1
Piezoelectric sensor diagnosis	10015	Piezoelectric sensor diagnosis in progress when set to 1
Warming up	10016	Warming up when set to 1
Normal measurement in progress	10017	Normal measurement in progress when set to 1
Measurement update notification	10031	Set to 1 after measurement is updated. Reading this address resets the value to 0. (*1)
Alarm update	10032	Set to 1 when a new alarm occurs or when an alarm is cleared. Reading this address resets the value to 0. (*1)
Instruction failure update	10033	Set to 1 when an instruction by a coil fails. Reading this address or a successful next instruction resets the value to 0. (*1)
Digital input state	10051	DI-1 contact state (0: Open, 1: Closed)
	10052	
Digital output state	10061	DI-2 contact state (0: Open, 1: Closed)
	10062	
Manual Zero Calibration	10071	Calibration (validation) in progress when set to 1
Manual Span Calibration	10072	
Manual Offline Validation 1	10073	
Manual Offline Validation 2	10074	
Manual Online Validation 1	10075	
Manual Online Validation 2	10076	
Manual Blow Back	10077	
Auto Online Validation 1	10078	
Auto Online Validation 2	10079	
Auto Blow Back	10080	
L1 DAQ Offset calibration	10081	
L2 DAQ Offset calibration	10082	
Piezoelectric sensor diagnosis	10083	

Input relay name	Address	Description
Warning: Transmission low (AL-1)	10101	Alarm occurring when set to 1 * (AL-##) in the name column denotes the alarm number.
Warning: Process pressure low (AL-2)	10102	
Warning: Process pressure high (AL-3)	10103	
Warning: Process temperature low (AL-4)	10104	
Warning: Process temperature high (AL-5)	10105	
Warning: Concentration gas1 low (AL-6)	10106	
Warning: Concentration gas1 high (AL-7)	10107	
Warning: Concentration gas2 low (AL-8)	10108	
Warning: Concentration gas2 high (AL-9)	10109	
Warning: Laser unit temperature low (AL-10)	10110	
Warning: Laser unit temperature high (AL-11)	10111	
Warning: Sensor control unit temperature low (AL-12)	10112	
Warning: Laser unit temperature low (AL-17)	10117	
Warning: Laser unit temperature high (AL-18)	10118	
Warning: Sensor control unit temperature low (AL-19)	10119	
Warning: Sensor control unit temperature high (AL-20)	10120	
Warning: L1 Validation required (AL-21)	10121	
Warning: L1 Validation failure(AL-22)	10122	
Warning: L1 Zero calibration Error (AL-23)	10123	
Warning: L1 Span calibration Error (AL-24)	10124	
Warning: L2 Validation required (AL-25)	10125	
Warning: L2 Validation failure (AL-26)	10126	
Warning: L2 Zero calibration Error (AL-27)	10127	
Warning: L2 Span calibration Error (AL-28)	10128	
Warning: AI-1 (Pressure) input current low (AL-29)	10129	
Warning: AI-1 (Pressure) input current high (AL-30)	10130	
Warning: AI-2 (Pressure) input current low (AL-31)	10131	
Warning: AI-2 (Pressure) input current high (AL-32)	10132	
Warning: External alarm (AL-33)	10133	
Warning: Clock adjustment required (AL-34)	10134	
Warning: Setting file corrupted (AL-35)	10135	
Warning: L1 Calibration file corrupted (AL-36)	10136	
Warning: L2 Calibration file corrupted (AL-37)	10137	
Warning: L1 Detector signal high (AL-41)	10141	
Warning: L2 Detector signal high (AL-37)	10142	
Fault: Laser module temperature low (AL-43)	10143	
Fault: Laser module temperature high (AL-44)	10144	
Fault: Laser temperature low (AL-47) (AL-45)	10145	
Fault: Laser temperature high (AL-48) (AL-46)	10146	
Fault: Reference peak height outside range (AL-47)	10147	
Fault: Reference peak height outside range (AL-48)	10148	
Fault: L1 Detector signal lost (AL-49)	10149	
Fault: L2 Detector signal lost (AL-50)	10150	
Fault: L1 Ref cell signal outside range (AL-51)	10151	
Fault: L2 Ref cell signal outside range (AL-52)	10152	
Fault: L1 Laser unit failure (AL-53)	10153	
Fault: L2 Laser unit failure (AL-54)	10154	
Fault: L1 Laser module error (AL-55)	10155	
Fault: L2 Laser module error (AL-56)	10156	

Input relay name	Address	Description
Fault: File access error (AL-57)	10157	Alarm occurring when set to 1 * (AL-##) in the name column denotes the alarm number.
Fault: EEPROM error (AL-58)	10158	
Fault: Internal communication failure (AL-59)	10159	
Fault: Power error (AL-50)	10160	
Fault: L1 Laser Unit Connection Error (AL-61)	10161	
Fault: L2 Laser Unit Connection Error (AL-62)	10162	
Fault: FPGA Failure (AL-63)	10163	
Fault: System error (AL-64)	10164	

*1: If this address is read from two sessions, the first access has priority.

8.4 Hold register

Name	Address	Setting details
Temperature input value	40101, 40102	Temperature input value via Modbus, IEEE754 float format (*1) The unit follows to the temperature unit setting. *: Writing is possible even when maintenance is in progress.
Pressure input value	40103, 40104	Pressure input value via Modbus, IEEE754 float format (*1) The unit follows to the pressure unit setting. *: Writing is possible even when maintenance is in progress.
Time setting (year)	40201	RTC setting date/time (year) based on 2000 (2015 is expressed as 15) (*2) (*3)
Time setting (month)	40202	RTC setting date/time (month) 1 to 12 (*2) (*3)
Time setting (day)	40203	RTC setting date/time (day) 1 to 31 (*2) (*3)
Time setting (hour)	40204	RTC setting time (hour) 0 to 23 (*2)
Time setting (minute)	40205	RTC setting time (minute) 0 to 59 (*2)
Time setting (second)	40206	RTC setting time (second) 0 to 59 (*2)

*1: IEEE754 float format (in 2 registers, In the order upper 16 bits and then lower 16 bits)
Write the both upper and lower bits together.
*2: Apply the settings using the coil “time setting instruction”.
*3: Write the year, month, and day in order from the highest address.

NOTE

When inputting the temperature value or pressure value via Modbus, set the input unit the same as the TDLS8200 unit. If input using a different unit, the concentration reading will not be output correctly.

As a default setting, when Modbus connection is shut down, the backup operation starts to restore data of temperature and pressure value. If you want to change or disable this backup function, see the description on the backup mode in “4.1.2 Process Pressure”

8.5 Input register

<table>
<tr><th>Input register name</th><th>Address</th><th>Description</th></tr>
<tr><td rowspan="3">Concentration value</td><td>30001, 30002</td><td>Component 1 gas concentration value, IEEE754 float format (*1)
The unit follows to the component 1 gas setting.</td></tr>
<tr><td>30003, 30004</td><td>Component 2 gas concentration value, IEEE754 float format (*1)
The unit follows to the component 2 gas setting.</td></tr>
<tr><td>30011, 30012</td><td>Component 3 gas concentration value, IEEE754 float format (*1)
The unit follows to the component 1 gas setting</td></tr>
<tr><td rowspan="2">Transmission value</td><td>30007, 30008</td><td>L1 Transmission [%], IEEE754 float format (*1)</td></tr>
<tr><td>30017, 30018</td><td>L2 Transmission [%], IEEE754 float format (*1)</td></tr>
<tr><td>Temperature value</td><td>30021, 30022</td><td>Temperature value, IEEE754 float format (*1)
The unit follows to the temperature unit setting.</td></tr>
<tr><td>Pressure value</td><td>30023, 30024</td><td>Pressure value, IEEE754 float format (*1)
The unit follows to the pressure unit setting.</td></tr>
<tr><td rowspan="2">AI value</td><td>30031, 30032</td><td>AI-1 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td>30033, 30034</td><td>AI-2 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td rowspan="2">AO value</td><td>30041, 30042</td><td>AO-1 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td>30043, 30044</td><td>AO-2 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td></td><td>30045, 30046</td><td>AO-3 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td></td><td>30047, 30048</td><td>AO-4 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td></td><td>30049, 30050</td><td>AO-5 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td>Calibration/validation execution state</td><td>30071</td><td>A value indicating the calibration/validation execution state
<table>
<tr><th>Value</th><th>Calibration state</th></tr>
<tr><td>0</td><td>Not in progress</td></tr>
<tr><td>1</td><td>Zero calibration</td></tr>
<tr><td>2</td><td>Span calibration</td></tr>
<tr><td>5</td><td>Offline validation</td></tr>
<tr><td>6</td><td>Online validation</td></tr>
<tr><td>8</td><td>Blow Back</td></tr>
</table></td></tr>
<tr><td>Active alarm state value</td><td>30075 to 30078</td><td>Indicates active alarm states.
A value in unsigned long format (Big-endian arrangement in four registers). Bit numbers correspond to alarm numbers in which warning or fault is occurring. When multiple alarms are occurring, they are expressed as a sum of the bits.
Example: The read value when transmission low (alarm number 1) and transmission lost (alarm number 53) are occurring is 0x10000000000001:
30075: 0x0010
30076: 0x0000
30077: 0x0000
30078: 0x0001</td></tr>
<tr><td>SCU temperature</td><td>30081, 30082</td><td>[degC] temperature of Sensor Control Unit (SCU) , IEEE754 float(*1)</td></tr>
<tr><td>LU temperature</td><td>30083, 30084</td><td>[degC] temperature of Laser Unit (LU), IEEE754 float(*1)</td></tr>
<tr><td>Current time (year)</td><td>30201</td><td>RTC Current time (year) based on 2000</td></tr>
<tr><td>Current time (month)</td><td>30202</td><td>RTC Current time (month) 1 to 12</td></tr>
<tr><td>Current time (day)</td><td>30203</td><td>RTC Current time (day) 1 to 31</td></tr>
<tr><td>Current time (hour)</td><td>30204</td><td>RTC Current time (hour) 0 to 23</td></tr>
<tr><td>Current time (minute)</td><td>30205</td><td>RTC Current time (minute) 0 to 59</td></tr>
<tr><td>Current time (second)</td><td>30206</td><td>RTC Current time (second) 0 to 59</td></tr>
</table>

*1: IEEE754 float format (in 2 registers, In the order upper 16 bits and then lower 16 bits)
Read the both upper and lower bits together.

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Appendix 1 What is an Analysis Period?

The TDLS8200 calculates process gas concentration from a value obtain by integrating the spectrum data over a given period. This integration period is the *analysis period*.

Measured values and analog output are updated every analysis period. The analysis period is set to an optimal value depending on the application and cannot be changed.

On the TDLS8200, you can specify how many analysis periods of spectrum data to calculate the moving average over. The number of times moving average is taken in a single concentration calculation is called the *average number*, and the corresponding time is called *average time*. The average number is variable. The average time can be increased by increasing the average number in order to reduce the influence of disturbance existent in the measurement process. Even if the average number is increased, measured values and analog output are updated according to the analysis period, but the analysis responsiveness declines.

The analysis period and average number are set to optimal values according to the process to be measured before factory shipment. The average number set before factory shipment is called the *basic average number*. The final average time is determined as follows.

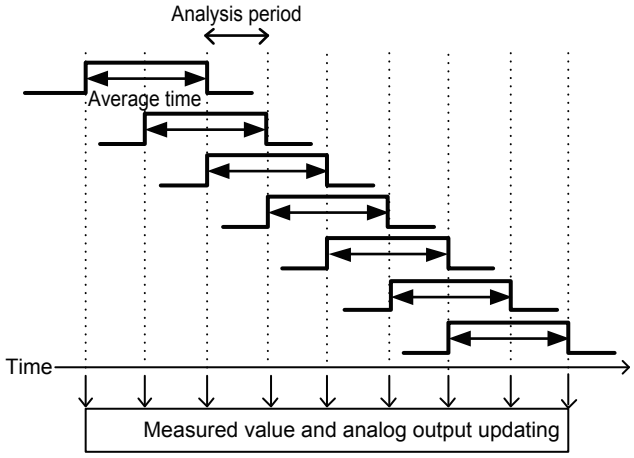
Average time = (analysis period × basic average number) × average number)

Given a basic average number of 2, the following figures illustrate the moving average ranges when the average number is changed.

⎍⎍ indicates an interval during which a spectrum is acquired and the concentration is calculated.

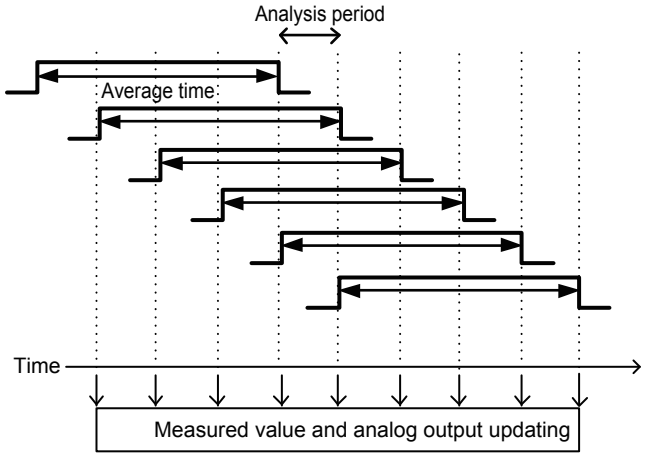
When the average number is 1

(Average time = analysis period × basic average number × average number = analysis period × 2)



When the average number is 2

(Average time = analysis period × 2 × 2 = analysis period × 4)



You can view the analysis period from the following menu.

[YH8000] “ ⓘ >>System Information>>Analysis Period”

For instructions on how to set the average number and how to view the average time, see “4.9.6 Moving Average Count for Analysis Values”

Appendix 2 Explosion Protected Type Instrument

In this chapter, further requirements and differences for explosion proof type instrument are described. For explosion protected type, the description in this chapter is prior to other description in this User's Manual.

Refer to Japanese User's manual for TDLS8200-J1.

Refer to Korean User's manual for TDLS8200-K1.

CAUTION

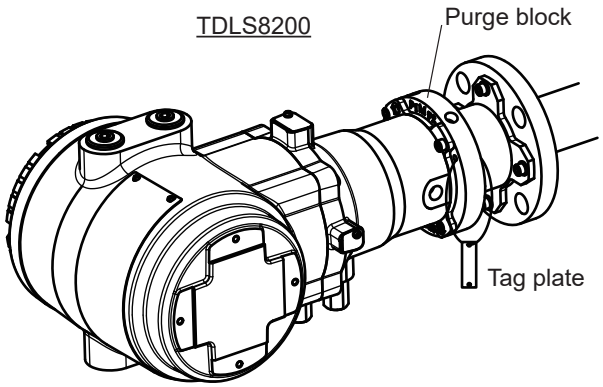
TDLS8200 has been tested and certified as being explosion proof. Please note that severe restrictions apply to the instrument's construction, installation, external wiring, maintenance and repair. A failure to abide by these restrictions could make the instrument a hazard to operate.

WARNING

A modification of the equipment would no longer comply with the construction described in the certificate documentation.

WARNING

Tag plate which is provided as an option of TDLS8200 shall be hung by a wire and the wire shall be tightly bound to non-painted metal part such as purge block of TDLS8200 not to insulate electrically and to avoid electrostatic charging.



Example of Tag plate attachment

TDLS8200-D1 (FM Approval for US)

(1) Technical data

- Applicable standards

  FM Class 3600: 2018
  FM Class 3615: 2018
  FM Class 3616: 2011
  FM Class 3810: 2018
  NEMA 250: 2014
  ANSI/UL 50E: 2015
  ANSI/UL 60079-0:2013
  ANSI/UL 60079-1: 2015,
  ANSI/UL 60079-28:2017,
  ANSI/UL 60079-31: 2015,
  ANSI/IEC 60529:2004
  ANSI/UL 61010-1:2012
  ANSI/UL 61010-2-30:2012
  ANSI/ISA-12.27.01: 2011

- Certificate No.

  FM18US0164X

Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use. Refer to specific condition of use.

- Specifications

  Refer to chapter 2 for other specifications than that described below.

  - Equipment ratings (Ex marking)

    Explosionproof for Class I, Division 1, Groups A, B, C and D; T6
    Dust-Ignitionproof for Class II/III; Division 1;, Groups E, F, G; T6
    Class I, Zone 1, □ AEx db [op is Ga] IIC T6 Gb
    Zone21, □ AEx tb [op is Da] IIIC T85°C Db

Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

  - Enclosure

    TYPE4X, IP66

  - Ambient temperature

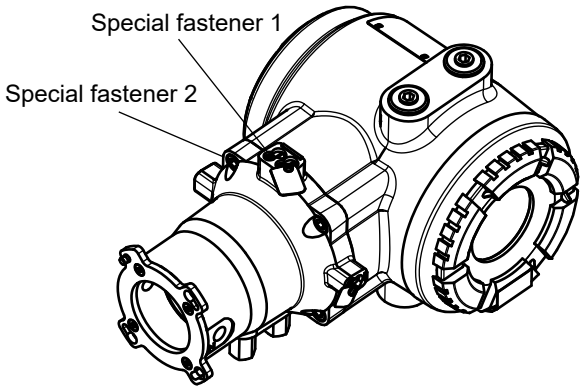
    -20 to +55°C

Specific condition of use

- Electrostatic charges on the non-metallic parts (excluding glass parts) or coated parts of the equipment shall be avoided.
- If the TDLS8200 is mounted in Zone 21 or Zone 22, it shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.
- Flameproof joints are not intended to be repaired. Contact Yokogawa representative or Yokogawa office.
- The property class of the Special fastener 1 used to fasten the shaft onto the enclosure below is at least A*-50, C*-50, or F1-60.
- The property class of the Special fastener 2 used to fasten the optics case to the case below is at least A*-80 or C*-80.

- The Special fastener 1 used to fasten the shaft onto the enclosure shall only be replaced with Yokogawa fastener,
  Part number: K9776VF.
- Process temperature is not considered for the certification. Install and operate so as not to be affected by process temperature.

Note: The "*" shown is replaced by a property grade numeral.



Special fasteners

Installation

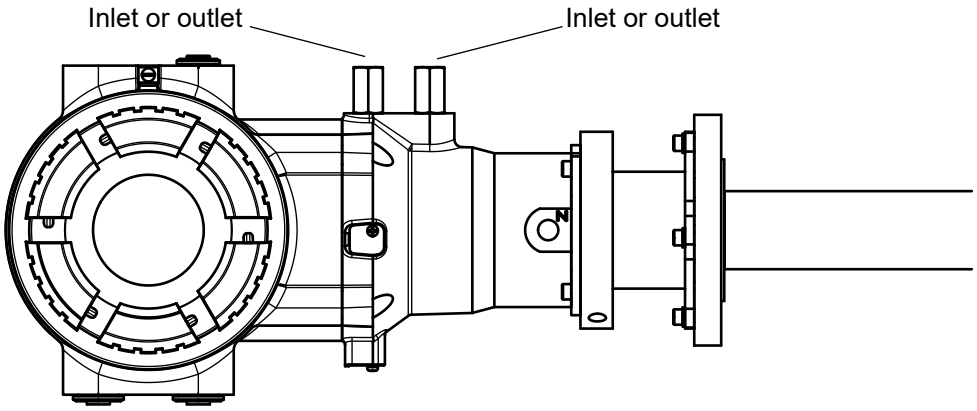
Refer to chapter 3 for other than that described below.

- Warning: In cases where the ambient temperature exceeds 40 °C, use external heat resistant cable with a maximum allowable temperature of 75 °C or above.
- Take care the following warning marking.
  "POTENTIAL ELECTROSTATIC CHARGING HAZARD"
- All wiring shall comply with NFPA70, and local electric codes and requirements.
- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 2.0 N•m (M5) or 1.2 N•m (M4). Care must be taken not to twist the conductor.
- In a hazardous area, use appropriate certified cable glands for connecting cables, adaptors and/or blanking element to maintain the specific degree of protection of the equipment.
- If the equipment is installed to Zone 21 or Zone 22 area, it shall be avoided the risk from electrostatic discharge and propagating brush discharges caused by rapid flow of dust.
- Unused entries shall be closed with suitable certified blanking elements.

Operation

Refer to chapter 3 for other than that described below.

- Take care the following warning marking.
  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”
- Take care not to generate mechanical spark when access to the equipment and the peripheral devices in hazardous locations.
- Take care the following warning marking when opening the cover.
  “DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT”
- Seal all conduits within 18 inches when installed in CL I, DIV 1.
- Pressure inside purged compartment shall not exceed 10kPa.



Inlet and outlet of purged compartment

Maintenance and repair

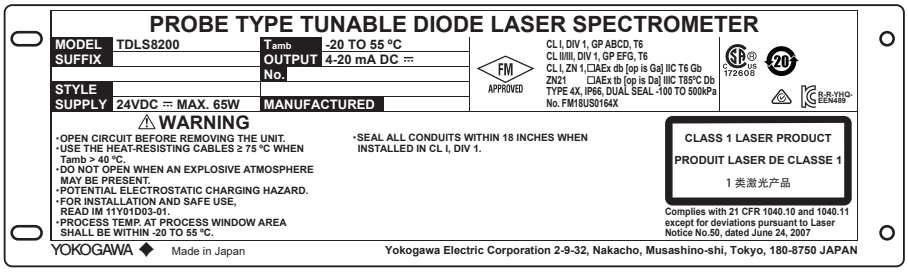
- Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Dual seal

TDLS8200 is Dual seal equipment with annunciation according to ANSI/ISA 12.27.01-2011.
Primary seal is the process window on the purge block.

- Wetted materials of primary seal:
  Stainless steel, Borosilicate glass, Teflon encapsulated viton (O-ring)
- Process gas pressure (working pressure) shall be within -100 to 500kPa.
- Process temperature at process window area shall be within -20 to 55 °C.
- The validation is used as annunciation of the primary seal failure. Failure of the primary seal is detected by the validation failure.

Nameplate



Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- OUTPUT: Specified analog output range
- No.: Serial number
- MANUFACTURED: Month and year of production
- Ex marking: CL I, DIV 1, GP ABCD, T6
  CL II/III, DIV 1, GP EFG, T6
  CL I, ZN 1, □ AEx db [op is Ga] IIC T6 Gb
  ZN 21 □ AEx tb [op is Da] IIIC T85ºC Db

Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- Enclosure: TYPE4X, IP66
- Seal type: DUAL SEAL
- Working pressure range: -100 to 500kPa
- Process temperature: Written in the warning
- Certificate No. FM18US0164X
- Warning:

  OPEN CIRCUIT BEFORE REMOVING THE UNIT.

  USE THE HEAT-RESISTING CABLES ≥ 75 °C WHEN Tamb > 40°C.

  DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.

  POTENTIAL ELECTROSTATIC CHARGING HAZARD.

  FOR INSTALLATION AND SAFE USE, READ IM 11Y01D03-01.

  PROCESS TEMP. AT PROCESS WINDOW AREA SHALL BE WITHIN -20 TO 55ºC.

  SEAL ALL CONDUITS WITHIN 18 INCHES WHEN INSTALLED IN CL I, DIV 1.
- Laser class:

  CLASS 1 LASER PRODUCT

  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated June 24, 2007.
- Country of origin: Specified country of origin
- Address of the manufacture: Address of Yokogawa Electric Corporation

TDLS8200-C1 (FM Approval for Canada)

Applicable standards

CSA-C22.2 No. 94.2-15:2015
CAN/CSA-C22.2 No. 60079-0:2015
CAN/CSA-C22.2 No. 60079-1:2016
CAN/CSA C22.2 No. 60079-28:2016
CAN/CSA C22.2 No. 60079-31:2015
CSA-C22.2 No. 60529:2016
CAN/CSA-C22.2 No. 61010-1-12:2012
CAN/CSA-No. 61010-2-030-12:2016
ANSI/ISA-12.27.01:2011

Certificate No.

FM18CA0075X

Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use. Refer to specific condition of use.

Specifications

Refer to chapter 2 for other specifications than that described below.

- Equipment ratings (Ex marking)
  - □ Ex db [op is Ga] IIC T6 Gb
  - □ Ex tb [op is Da] IIIC T85°C Gb Db

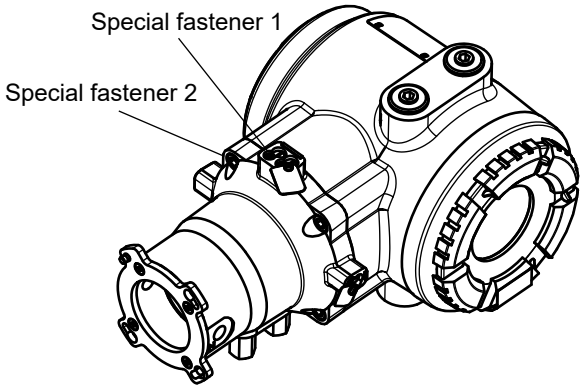
Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- Enclosure
  TYPE4X, IP66
- Ambient temperature
  -20 to +55°C

Specific condition of use

- Electrostatic charges on the non-metallic parts (excluding glass parts) or coated parts of the equipment shall be avoided.
- If the TDLS8200 is mounted in Zone 21 or Zone 22, it shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.
- Flameproof joints are not intended to be repaired. Contact Yokogawa representative or Yokogawa office.
- The property class of the Special fastener 1 used to fasten the shaft onto the enclosure below is at least A*-50, C*-50, or F1-60.
- The property class of the Special fastener 2 used to fasten the optics case to the case below is at least A*-80 or C*-80.
- The Special fastener 1 used to fasten the shaft onto the enclosure shall only be replaced with Yokogawa fastener,
  Part number: K9776VF.
- Process temperature is not considered for the certification. Install and operate so as not to be affected by process temperature.

Note: The "*" shown is replaced by a property grade numeral.



Special fasteners

Installation

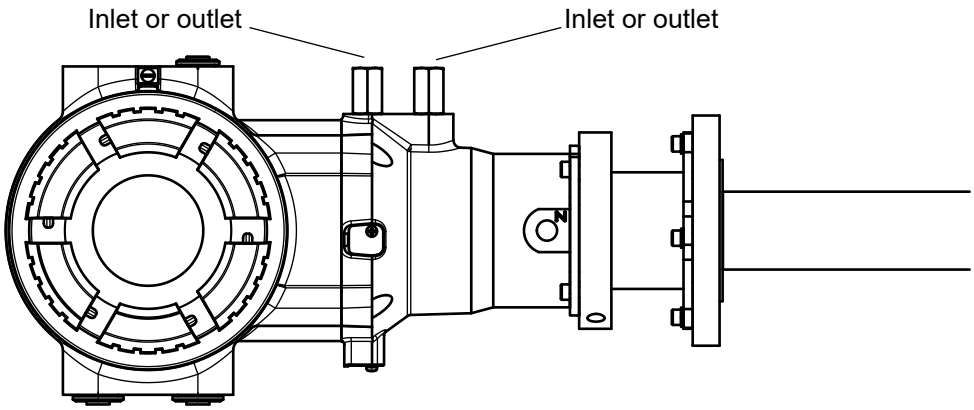
Refer to chapter 3 for other than that described below.

- Warning: In cases where the ambient temperature exceeds 40 °C, use external heat resistant cable with a maximum allowable temperature of 75 °C or above.
- Take care the following warning marking.
  "POTENTIAL ELECTROSTATIC CHARGING HAZARD"
- All wiring shall comply with C22.1-12, and local electric codes and requirements.
- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 2.0N•m (M5) or 1.2N•m (M4). Care must be taken not to twist the conductor.
- In a hazardous area, use appropriate certified cable glands for connecting cables, adaptors and/or blanking element to maintain the specific degree of protection of the equipment.
- If the equipment is installed to Zone 21 or Zone 22 area, it shall be avoided the risk from electrostatic discharge and propagating brush discharges caused by rapid flow of dust.
- Unused entries shall be closed with suitable certified blanking elements.

Operation

Refer to chapter 3 for other than that described below.

- Take care the following warning marking.
  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”
- Take care not to generate mechanical spark when access to the equipment and the peripheral devices in hazardous locations.
- Take care the following warning marking when opening the cover.
  “DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT”
- Pressure inside purged compartment shall not exceed 10kPa.



Inlet and outlet of purged compartment

Maintenance and repair

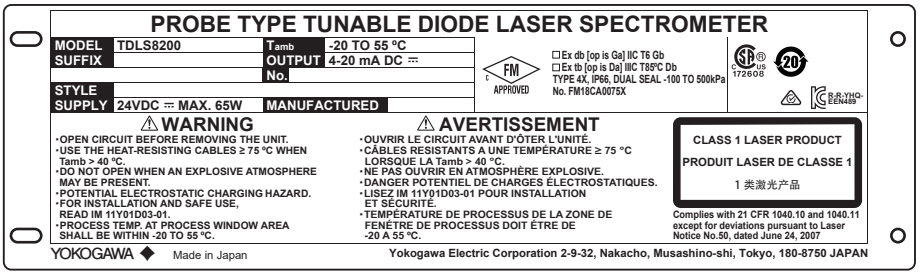
Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Dual seal

TDLS8200 is Dual seal equipment with annunciation according to ANSI/ISA 12.27.01-2011.
Primary seal is the process window on the purge block.

- Wetted materials of primary seal:
  Stainless steel, Borosilicate glass, Teflon encapsulated viton (O-ring)
- Process gas pressure (working pressure) shall be within -100 to 500kPa.
- Process temperature at process window area shall be within -20 to 55 °C.
- The validation is used as annunciation of the primary seal failure. Failure of the primary seal is detected by the validation failure.

Name plate



Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- OUTPUT: Specified analog output range
- No.: Serial number
- MANUFACTURED: Month and year of production
- Ex marking:
  - □ Ex db [op is Ga] IIC T6 Gb
  - □ Ex tb [op is Da] IIIC T85°C Db

Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- Enclosure: TYPE4X, IP66
- Seal type: DUAL SEAL
- Working pressure range: -100 to 500kPa
- Process temperature: Written in the warning
- Certificate No. FM18CA0075X
- Warning:

  OPEN CIRCUIT BEFORE REMOVING THE UNIT.

  USE THE HEAT-RESISTING CABLES ≥ 75 °C WHEN Tamb > 40°C.

  DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.

  POTENTIAL ELECTROSTATIC CHARGING HAZARD.

  FOR INSTALLATION AND SAFE USE, READ IM 11Y01D03-01.

  PROCESS TEMP. AT PROCESS WINDOW AREA SHALL BE WITHIN -20 TO 55°C.
- AVERTISSEMENT:

  OUVRIR LE CIRCUIT AVANT D'ÔTER L'UNITÉ.

  CÂBLES RESISTANTS A UNE TEMPÉRATURE ≥ 75°C LORSQUE LA Tamb > 40°C.

  NE PAS OUVRIR EN ATMOSPHÈRE EXPLOSIVE.

  DANGER POTENTIEL DE CHARGES ÉLECTROSTATIQUES.

  LISEZ IM 11Y01D03-01 POUR INSTALLATION ET SÉCURITÉ.

  TEMPÉRATURE DE PROCESSUS DE LA ZONE DE FENÊTRE DE PROCESSUS DOIT ÊTRE DE -20 A 55°C.

- Laser class:

  CLASS 1 LASER PRODUCT

  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated June 24, 2007.
- Country of origin: Specified country of origin
- Address of the manufacture: Address of Yokogawa Electric Corporation

TDLS8200-E1 (IECEx)

Applicable standards

IEC 60079-0:2017
IEC 60079-1:2014
IEC 60079-28:2015
IEC 60079-31:2013

Certificate No.

IECEx FMG 18.0016X

Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use. Refer to specific condition of use.

Specifications

Refer to chapter 2 for other specifications than that described below.

- Equipment ratings (Ex marking)

  □ Ex db [op is Ga] IIC T6 Gb
  □ Ex tb [op is Da] IIIC T85°C Db

  Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

Enclosure

IP66

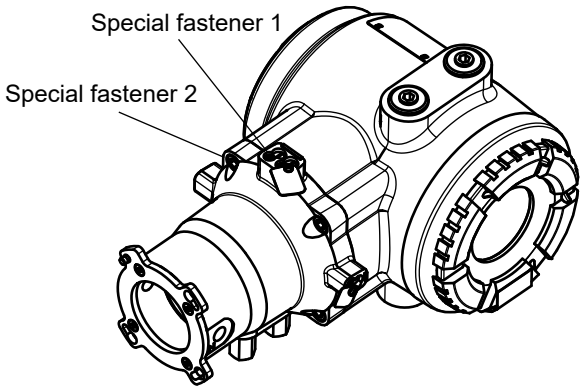
Ambient temperature

-20 to +55°C

Specific condition of use

- Electrostatic charges on the non-metallic parts (excluding glass parts) or coated parts of the equipment shall be avoided.
- If the TDLS8200 is mounted in an area where the use of EPL Db or Dc equipment is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.
- Flameproof joints are not intended to be repaired. Contact Yokogawa representative or Yokogawa office.
- The property class of the Special fastener 1 used to fasten the shaft onto the enclosure below is at least A*-50, C*-50, or F1-60.
- The property class of the Special fastener 2 used to fasten the optics case to the case below is at least A*-80 or C*-80.
- The Special fastener 1 used to fasten the shaft onto the enclosure shall only be replaced with Yokogawa fastener,
  Part number: K9776VF.
- Process temperature is not considered for the certification. Install and operate so as not to be affected by process temperature.

  Note: The "*" shown is replaced by a property grade numeral.



Special fasteners

Installation

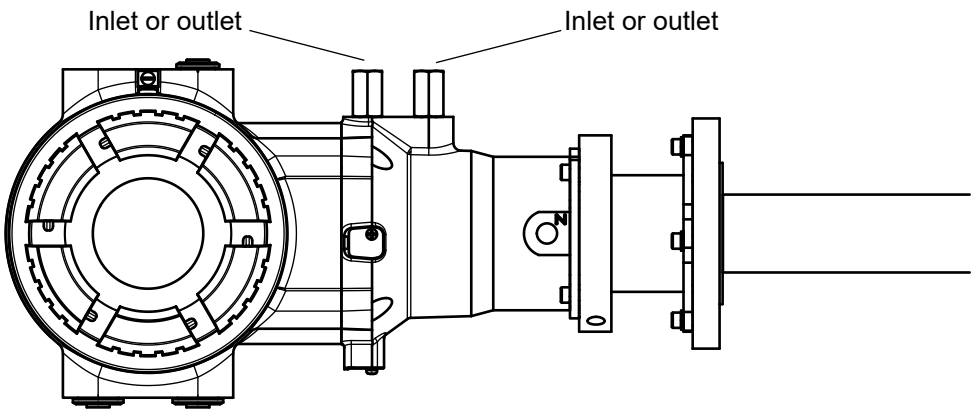
Refer to chapter 3 for other than that described below.

- Warning: In cases where the ambient temperature exceeds 40 °C, use external heat resistant cable with a maximum allowable temperature of 75 °C or above.
- Take care the following warning marking.
  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”
- All wiring shall comply with IEC60079-14, and local electric codes and requirements.
- Cable glands, adapters and/or blanking elements with a suitable IP rating shall be of Ex db IIC/Ex tb IIIC certified by IECEx and shall be installed so as to maintain the specific degree of protection (IP Code) of the equipment.
- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 2.0 N•m (M5) or 1.2 N•m (M4). Care must be taken not to twist the conductor.
- If the equipment is installed to EPL Db or Dc area, it shall be avoided the risk from electrostatic discharge and propagating brush discharges caused by rapid flow of dust.
- Unused entries shall be closed with suitable certified blanking elements.

Operation

Refer to chapter 3 for other than that described below.

- Take care the following warning marking.
  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”
- Take care not to generate mechanical spark when access to the equipment and the peripheral devices in hazardous locations.
- Take care the following warning marking when opening the cover.
  “DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT”
- Pressure inside purged compartment shall not exceed 10kPa

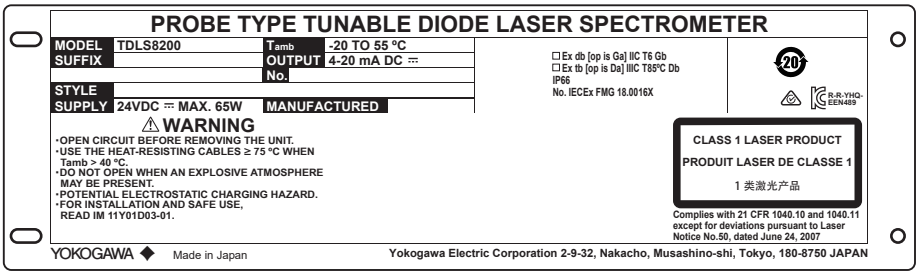


Inlet and outlet of purged compartment

● Maintenance and repair

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Nameplate



Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- OUTPUT: Specified analog output range
- No.: Serial number
- MANUFACTURED: Month and year of production
- Ex marking:
  - □ Ex db [op is Ga] IIC T6 Gb
  - □ Ex tb [op is Da] IIIC T85°C Db

Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- Enclosure: IP66
- Certificate No. IECEx FMG 18.0016X
- Warning:

  OPEN CIRCUIT BEFORE REMOVING THE UNIT.

  USE THE HEAT-RESISTING CABLES ≥ 75 °C WHEN Tamb > 40°C.

  DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.

  POTENTIAL ELECTROSTATIC CHARGING HAZARD.

  FOR INSTALLATION AND SAFE USE, READ IM 11Y01D03-01.
- Laser class:

  CLASS 1 LASER PRODUCT

  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated June 24, 2007.
- Country of origin: Specified country of origin
- Address of the manufacture: Address of Yokogawa Electric Corporation

TDLS8200-S1 (ATEX, UKEX)

Applicable standards

EN IEC 60079-0:2018
EN 60079-1:2014
EN 60079-28:2015
EN 60079-31:2014

Certificate No.

FM18ATEX0041X, FM22UKEX0019X

Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use. Refer to specific condition of use.

Specifications

Refer to chapter 2 for other specifications than that described below.

- Equipment ratings (Ex marking)

II 2(1) G □ Ex db [op is Ga] IIC T6 Gb
II 2(1) D □ Ex tb [op is Da] IIIC T85°C Db

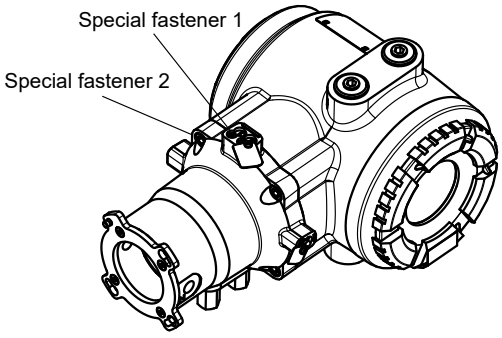
Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- Enclosure
  IP66
- Ambient temperature
  -20 to +55°C

Specific condition of use

- Electrostatic charges on the non-metallic parts (excluding glass parts) or coated parts of the equipment shall be avoided.
- If the TDLS8200 is mounted in an area where the use of Category 2 D or 3 D equipment is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.
- Flameproof joints are not intended to be repaired. Contact Yokogawa representative or Yokogawa office.
- The property class of the Special fastener 1 used to fasten the shaft onto the enclosure below is at least A*-50, C*-50, or F1-60.
- The property class of the Special fastener 2 used to fasten the optics case to the case below is at least A*-80 or C*-80.
- The Special fastener 1 used to fasten the shaft onto the enclosure shall only be replaced with Yokogawa fastener, Part number: K9776VF.
- Process temperature is not considered for the certification. Install and operate so as not to be affected by process temperature.

Note: The "*" shown is replaced by a property grade numeral.



Special fasteners

Installation

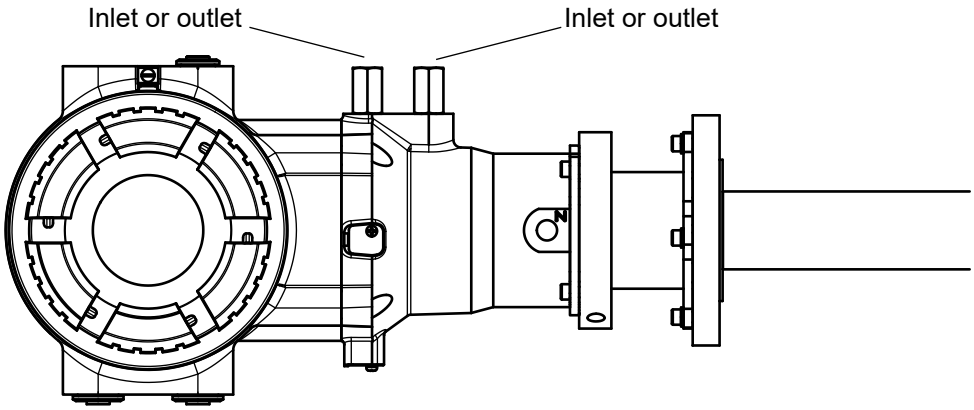
Refer to chapter 3 for other than that described below.

- Warning: In cases where the ambient temperature exceeds 40 °C, use external heat resistant cable with a maximum allowable temperature of 75 °C or above.
- Take care the following warning marking.
  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”
- All wiring shall comply with EN60079-14, and local electric codes and requirements.
- Cable glands, adapters and/or blanking elements with a suitable IP rating shall be of Ex db IIC/Ex tb IIIC certified by ATEX and shall be installed so as to maintain the specific degree of protection (IP Code) of the equipment.
- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 2.0 N•m (M5) or 1.2 N•m (M4). Care must be taken not to twist the conductor.
- If the equipment is installed to Category 2 D or 3 D area, it shall be avoided the risk from electrostatic discharge and propagating brush discharges caused by rapid flow of dust.
- Unused entries shall be closed with suitable certified blanking elements.

Operation

Refer to chapter 3 for other than that described below.

- Take care the following warning marking.
  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”
- Take care not to generate mechanical spark when access to the equipment and the peripheral devices in hazardous locations.
- Take care the following warning marking when opening the cover.
  “DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT”
- Pressure inside purged compartment shall not exceed 10kPa.

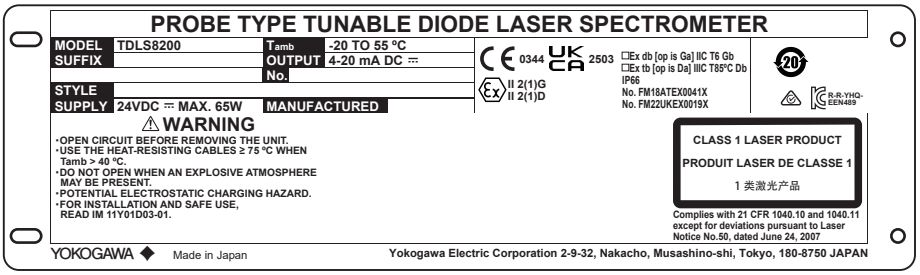


Inlet and outlet of purged compartment

Maintenance and repair

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Nameplate



Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- OUTPUT: Specified analog output range
- No.: Serial number
- MANUFACTURED: Month and year of production
- Ex marking:

  II 2(1) G □ Ex db [op is Ga] IIC T6 Gb*

  II 2(1) D □ Ex tb [op is Da] IIIC T85°C Db*

Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- Enclosure: IP66
- Certificate No. FM18ATEX0041X, FM22UKEX0019X
- Warning:

  OPEN CIRCUIT BEFORE REMOVING THE UNIT.

  USE THE HEAT-RESISTING CABLES ≥ 75 °C WHEN Tamb > 40°C.

  DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.

  POTENTIAL ELECTROSTATIC CHARGING HAZARD.

  FOR INSTALLATION AND SAFE USE, READ IM 11Y01D03-01.
- Laser class:

  CLASS 1 LASER PRODUCT

  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated June 24, 2007.
- Country of origin: Specified country of origin
- Address of the manufacture: Address of Yokogawa Electric Corporation

TDLS8200-N1 (NEPSI)

Applicable standards 适用标准

GB/T 3836.1-2021
GB/T 3836.2-2021
GB/T 3836.22-2017
GB/T 3836.31-2021

Certificate No. 防爆认证号码

GYJ19.1380X

Specific Ex marking 防爆标志

Ex db [op is Ga] IIC T6 Gb
Ex tb [op is Da] IIIC T85 ºC Db

Ambient temperature 使用环境温度

-20 to +55°C

Specific condition of use 产品安全使用特殊条件

- Electrostatic charges on the non-metallic parts (excluding glass parts) or coated parts of the equipment shall be avoided.

  产品外壳部分为非金属材质，且部分金属外壳带有非金属涂覆层，用于爆炸性气体危险场所时应注意严禁干擦以防静电积累危险（玻璃除外）。

- If the equipment is mounted in an area where the use of EPL Db or Dc equipment is required, it shall be installed in such a way that the risk from propagating brush discharges caused by rapid flow of dust is avoided.

  若产品金属外壳带有非金属涂覆层，且应用在EPL Db 或Dc的环境中时，应防止由于快速流体吹扫粉尘引起的刷形放电及静电放电。

- The values of the flamepaths are different from the standard values given in GB/T3836.2-2021. Repair of the equipment is only allowed when done by the manufacturer or authorized representative.

  产品隔爆接合面参数与GB/T3836.2-2021标准中所规定的最小值或最大值不同。仅允许制造商或授权机构对产品进行维修。

- The property class of the special fastener 1 used to fasten the shaft onto the enclosure below is at least A*-50, C*-50, or F1-60.

  产品轴与壳体间的特殊紧固螺钉1的性能等级不得低于A*-50，C*-50，或F1-60。

- The property class of the special fastener 2 used to fasten the optics case to the case below is at least A*-80 or C*-80.

  产品光学腔与壳体间的特殊紧固螺钉2的性能等级不得低于A*-80或C*-80。

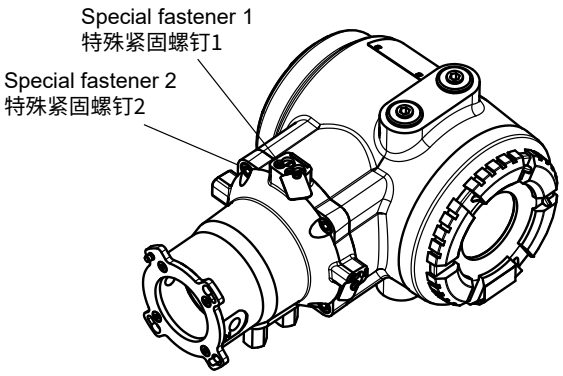
- The special fastener 1 shall only be replaced with Yokogawa fastener, Part number: K9776VF.

  特殊紧固螺钉1的仅能用编号为K9776VF 的紧固件进行替换。

- Process temperature is not considered for the certification. Install and operate so as not to be affected by process temperature.

  产品认证未考虑过程介质温度，安装及使用必须确保不受介质温度影响。

The “*” shown is replaced by a property grade numeral.
显示的“*”由性能等级数字代替。



Special fasteners 特殊紧固螺钉

● Installation and erection 安装

- Installation and maintenance of the equipment shall be done in accordance with GB/T 3836.13, GB/T 3836.15, GB/T 3836.16, GB 50257, and GB 15577.

  设备的安装、使用、以及维护、须根据GB/T 3836.13、GB/T 3836.15、GB/T 3836.16、GB 50257、GB 15577 以及相 关的现地法律、法规来执行。

- Cable glands, adapters and/or blanking elements with a suitable IP rating shall be of Ex db IIC/Ex tb applicable to GB standard and shall be installed so as to maintain the specific degree of protection (IP Code) of the equipment. “POTENTIAL ELECTROSTATIC CHARGING HAZARD”

  具有适当 IP 等级的电缆密封套、适配器和/或堵头元件应为适用于 GB 标准的 Ex db IIC/Ex tb 并应安装以保持设备的特定防护等级 (IP 代码)。

- The enclosure provides a degree of protection of IP66 in accordance with GB/T 4208-2017.

  光谱仪外壳防护等级为符合GB4208-2017 标准要求的IP66。

- Warning: In cases where the ambient temperature exceeds 40 °C, use external heat resistant cable with a maximum allowable temperature of 75 °C or above.

  警告：如果环境温度超过 40 °C、请使用最高允许温度为75 °C 或更高的外部耐热电缆。

- Take care the following warning marking.

  注意以下警告标记。

  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”

- Regarding option code “/SCT”, Tag plate shall be strapped to non-painted part by metal wire in order to prevent from potential electrostatic charging hazard.

  关于选项代码“/SCT”，标签板应通过金属线绑在非涂漆部分，以防止潜在的静电充电危险。

- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 2.0 N•m (M5) or 1.2 N•m (M4). Care must be taken not to twist the conductor.

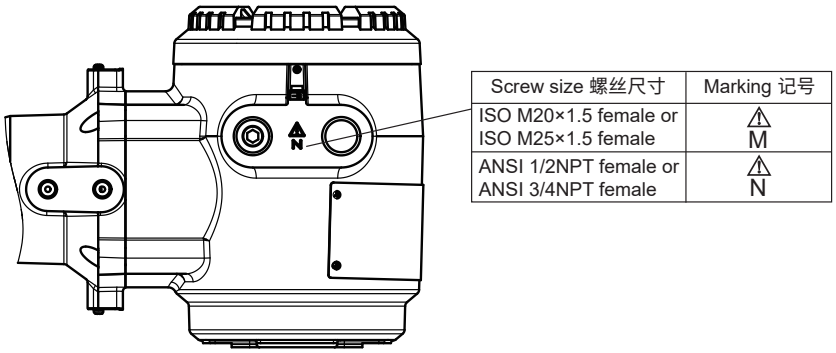
  为防止接地导体松动，必须将导体固定到端子上，收紧螺钉扭矩约为。2.0 N·m (M5) 或 1.2 N·m (M4)。必须注意不要扭曲导线。

- Unused entries shall be closed with suitable certified blanking elements.

  未使用的入口应用合适的认证消隐元件封闭。

- A mark indicating the electrical connection type is stamped near the electrical connection part. These marks are as follows.

  在电连接部分附近压印有表示电连接类型的标记。这些标记如下。



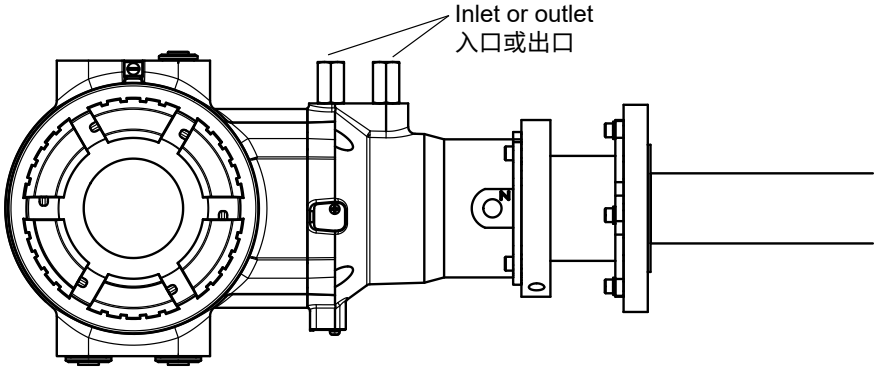
Screw size 螺丝尺寸	Marking 记号
ISO M20×1.5 female or ISO M25×1.5 female	⚠ M
ANSI 1/2NPT female or ANSI 3/4NPT female	⚠ N

Marking of screw size 螺丝尺寸记号

- When installing the equipment, the selected Type of Protection should be ticked as follows.
  安装设备时，选择的保护类型应如下勾选。
  ☒ Ex db [op is Ga] IIC T6 Gb
  □ Ex tb [op is Da] IIIC T85 ºC Db

● Use and setting-up (operation) 操作

- Take care the following warning marking.
  注意以下警告标记。
  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”
- Take care not to generate mechanical spark when access to the equipment and the peripheral devices in hazardous locations.
  在危险场所接触设备和外围设备时注意不要产生机械火花。
- Take care the following warning marking when opening the cover.
  打开盖子时请注意以下警告标记。
  “DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT”
- Pressure inside purged compartment shall not exceed 10kPa.
  吹扫室内压力不得超过10kPa



Inlet and outlet of purged compartment 净化室的入口或出口

- **Maintenance and repair 维护和修理**

WARNING 警告

A modification of the equipment would no longer comply with the construction described in the certificate documentation.

设备的改装将不再符合证书文档中描述的结构。

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

横河电机株式会社的授权人员，才可以修理设备。

- **Warning 警告**

WARNING 警告

USE THE HEAT-RESISTING CABLES ≥ 75 °C WHEN T_{amb} > 40 °C.

当 T_{amb} > 40 °C 时、请使用 ≥ 75 °C 的耐热电缆

DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.

存在爆炸性环境时严禁打开

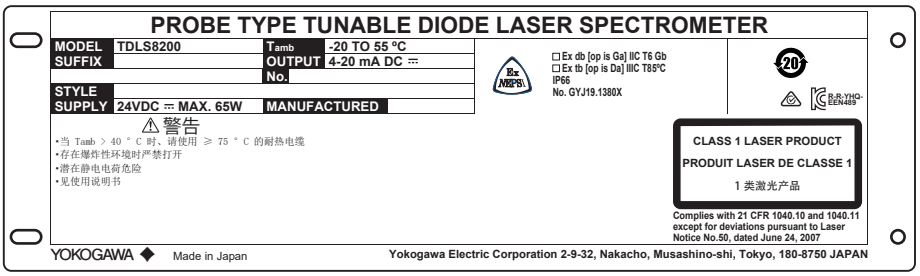
POTENTIAL ELECTROSTATIC CHARGING HAZARD.

潜在静电电荷危险

SEE USER'S MANUAL

见使用说明书

Nameplate 铭牌



Example of nameplate (Design and texts may be changed) 铭牌示例（设计和文字可能会更改）

- MODEL: Specified model code 指定模型
- SUFFIX: Specified suffix code 指定后缀和选项代码
- STYLE: Specified style code 指定样式代码
- SUPPLY: Specified supply voltage and wattage 指定电源和能量消耗
- T_{amb}: Specified ambient temperature range 指定使用环境温度
- OUTPUT: Specified analog output range 指定模拟输出范围
- No.: Serial number 流水号
- MANUFACTURED: Month and year of production 生产年月
- Specific Ex marking 防爆标志:
  - □ Ex db [op is Ga] IIC T6 Gb
  - □ Ex tb [op is Da] IIIC T85 ºC Db

Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.
"□"是选择保护类型的复选框。选择保护类型并勾选铭牌上的"□"之一。保护类型一经选择，不得更改。

- Enclosure 外壳保护等级: IP66
- Certificate No. 防爆认证号码: GYJ19.1380X
- Warning 警告

  当 T_{amb} > 40 °C 时、请使用 ≥ 75 °C 的耐热电缆
  存在爆炸性环境时严禁打开
  潜在静电电荷危险
  见使用说明书
- Laser class 激光类:

  CLASS 1 LASER PRODUCT

  1 类激光产品

  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated June 24, 2007.
- Country of origin 出生国家: Specified country of origin 指定出生国家
- Address of the manufacture 生产地址:

  Address of Yokogawa Electric Corporation 横河电机株式会社地址

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Appendix 3 General View of HART DD

The entire structure of the DD menu including parameter arrangement is listed below. The menu for a TDLS8200 with four-gas measurement specification is indicated here. Therefore, the list includes menus and parameters that do not appear in a specification of a TDLS8200 with three or fewer gas measurements.

Online menu

1st	2nd	3rd	4th	5th	Item
Process variables	View process vars	Dynamic variables			PV is
					PV
					PV Loop current
					SV is
					SV
					TV is
					TV
					QV is
					QV
		Device variables			LD1-SubGas1 conc
					LD1-SubGas1 gas name
					LD1-SubGas2 conc
					LD1-SubGas2 gas name
					LD1 transmission
					LD2-SubGas1 conc (*1)
					LD2-SubGas1 gas name (*1)
					LD2-SubGas2 conc (*1)
					LD2-SubGas2 gas name (*1)
					LD2 transmission (*1)
					Temperature
					Pressure
					SCU temp
					LU temp
	Set process vars	PV range			PV is
					PV Unit
					PV LRV
					PV URV
		SV/TV/QV is			SV is
					TV is
					QV is
		AO-2 range			AO-2 is
					AO-2 LRV
					AO-2 URV
		AO-3 range			AO-3 is
					AO-3 LRV
					AO-3 URV
		AO-4 range			AO-4 is
					AO-4 LRV
					AO-4 URV
		AO-5 range			AO-5 is
					AO-5 LRV
					AO-5 URV

1st	2nd	3rd	4th	5th	Item
Diagnostics	Device Status				Status group 1
					Status group 2
					Status group 3
					Status group 4
					Status group 5
					Status group 6
					Status group 7
					Status group 8
					Status group 9
					Status group 10
					Device status
					Ext dev status
					Device Diagnostic Status 0
					Cfg chng count
					Reset cfg chng flag
	Calibration	Manual			Manual zero cal
					Manual span cal
					Clear cal alarms
					Abort calibration
	Validation	Manual			Manual online val 1
					Manual online val 2
					Clear val alarms
					Abort validation
	Loop check				Test auto release time
		Analog Output			AO-1 loop chk mode
					AO-1 chk output
					AO-2 loop chk mode
					AO-2 chk output
					AO-3 loop chk mode
					AO-3 chk output
					AO-4 loop chk mode
					AO-4 chk output
					AO-5 loop chk mode
					AO-5 chk output
		Analog Input			AI-1 (pres)
					AI-2 (temp)
					Piezo proof test
	Trim analog channel				Trim AO-1 (PV)
					Trim AO-2
					Trim AO-3
					Trim AO-4
					Trim AO-5
Device Settings	Basic setup				Tag
					Long tag
		Set process vars	PV range		PV is
					PV Unit
					PV LRV
					PV URV
			SV/TV/QV is		SV is
					TV is
					QV is
			AO-2 range		AO-2 is
					AO-2 LRV
					AO-2 URV
			AO-3 range		AO-3 is
					AO-3 LRV
					AO-3 URV
			AO-4 range		AO-4 is
					AO-4 LRV
					AO-4 URV
			AO-5 range		AO-5 is
					AO-5 LRV
					AO-5 URV

1st	2nd	3rd	4th	5th	Item
(Device Settings)	I/O condition	Analog output	AO-1	Warning hold	AO1 warn hld mode
					AO1 warn hld level
					AO1 warn hld delay
				Fault hold	AO1 fault hld mode
					AO1 fault hld level
					AO1 fault hld delay
				Cal/Val/ Blowback hold	AO1 calvalb hld mode
					AO1 calvalb hld level
				Warm-up hold	AO1 w-up hld mode
					AO1 w-up hld level
			AO-2	Warning hold	AO2 warn hld mode
					AO2 warn hld level
					AO2 warn hld delay
				Fault hold	AO2 fault hld mode
					AO2 fault hld level
					AO2 fault hld delay
				Cal/Val/ Blowback hold	AO2 calvalb hld mode
					AO2 calvalb hld level
				Warm-up hold	AO2 w-up hld mode
					AO2 w-up hld level
			AO-3	Warning hold	AO3 warn hld mode
					AO3 warn hld level
					AO3 warn hld delay
				Fault hold	AO3 fault hld mode
					AO3 fault hld level
					AO3 fault hld delay
				Cal/Val/ Blowback hold	AO3 calvalb hld mode
					AO3 calvalb hld level
				Warm-up hold	AO3 w-up hld mode
					AO3 w-up hld level
			AO-4	Warning hold	AO4 warn hld mode
					AO4 warn hld level
					AO4 warn hld delay
				Fault hold	AO4 fault hld mode
					AO4 fault hld level
					AO4 fault hld delay
				Cal/Val/ Blowback hold	AO4 calvalb hld mode
					AO4 calvalb hld level
				Warm-up hold	AO4 w-up hld mode
					AO4 w-up hld level
			AO-5	Warning hold	AO5 warn hld mode
					AO5 warn hld level
					AO5 warn hld delay
				Fault hold	AO5 fault hld mode
					AO5 fault hld level
					AO5 fault hld delay
				Cal/Val/ Blowback hold	AO5 calvalb hld mode
					AO5 calvalb hld level
				Warm-up hold	AO5 w-up hld mode
					AO5 w-up hld level
	Calibration	Zero calibration			Zero cal target (*1)
		Span calibration	Parameter		S-cal gas type
					S-cal gas conc
					S-cal pres mode
					S-cal pres fix val
					S-cal temp mode
					S-cal temp fix val
					S-cal OPL mode
					S-cal OPL fix val

1st	2nd	3rd	4th	5th	Item
(Device Settings)	Validation	Online validation 1	Parameter		Onval1 gas type
					Onval1 gas conc
					Onval1 temp mode
					Onval1 temp fix val
					Onval1 act amb ofst
					Onval1 pres fix val
					Onval1 OPL fix val
			Valve control		Onval1 auto vlv man
		Online validation 2	Parameter		Onval2 gas type
					Onval2 gas conc
					Onval2 temp mode
					Onval2 temp fix val
					Onval2 act amb ofst
					Onval2 pres fix val
					Onval2 OPL fix val
			Valve control		Onval2 auto vlv man
	Field device info				Descriptor
					Message
					Date
					Final asmbly num
					Dev id
					Distributor
					Universal rev
					Fld dev rev
					Software rev
	System	Communication	HART output		Poll addr
					Loop current mode
					Num req preams
					Num resp preams
					Update failure mask
					Device malfunction mask
					Safety mode
Maintenance	Factory info				Model name
					Analyzer SN
					SI unit control
					Software ver

*1: For 1 laser specification, the setting items are not displayed.

Offline menu

* Same for Upload variables

1st	Item
Offline	Probe mode sel
	LD1-SubGas2 enable
	LD2-SubGas2 enable
	SI unit control
	LD1-SubGas1 decimal digits
	LD1-SubGas2 decimal digits
	LD2-SubGas1 decimal digits
	LD2-SubGas2 decimal digits
	LD1-SubGas1 unit
	LD1-SubGas2 unit
	LD2-SubGas1 unit
	LD2-SubGas2 unit
	Temp unit
	Pres unit
	PV is
	PV LRV
	PV URV
	SV is
	TV is
	QV is
	AO-2 is
	AO-2 unit
	AO-2 LRV
	AO-2 URV
	AO-3 is
	AO-3 unit
	AO-3 LRV
	AO-3 URV
	AO-4 is
	AO-4 unit
	AO-4 LRV
	AO-4 URV
	AO-5 is
	AO-5 unit
	AO-5 LRV
	AO-5 URV
	AO1 warn hld mode
	AO1 warn hld level
	AO1 warn hld delay
	AO1 fault hld mode
	AO1 fault hld level
	AO1 fault hld delay
	AO1 calvalb hld mode
	AO1 calvalb hld level
	AO1 w-up hld mode
	AO1 w-up hld level
	AO2 warn hld mode
	AO2 warn hld level
	AO2 warn hld delay
	AO2 fault hld mode
	AO2 fault hld level
	AO2 fault hld delay
	AO2 calvalb hld mode
	AO2 calvalb hld level
	AO2 w-up hld mode
	AO2 w-up hld level
	AO3 warn hld mode
	AO3 warn hld level
	AO3 warn hld delay
	AO3 fault hld mode
	AO3 fault hld level
	AO3 fault hld delay
	AO3 calvalb hld mode
	AO3 calvalb hld level
	AO3 w-up hld mode
	AO3 w-up hld level
	AO4 warn hld mode
	AO4 warn hld level
	AO4 warn hld delay

1st	Item
(Offline)	AO4 fault hld mode
	AO4 fault hld level
	AO4 fault hld delay
	AO4 calvalb hld mode
	AO4 calvalb hld level
	AO4 w-up hld mode
	AO4 w-up hld level
	AO5 warn hld mode
	AO5 warn hld level
	AO5 warn hld delay
	AO5 fault hld mode
	AO5 fault hld level
	AO5 fault hld delay
	AO5 calvalb hld mode
	AO5 calvalb hld level
	AO5 w-up hld mode
	AO5 w-up hld level
	Safety mode
	Test auto release time
	Tag
	Long tag
	Descriptor
	Message
	Date
	Final asmbly num

Appendix 4 Safety Instrumented System Installation

WARNING

When using TDLS8200 as a Safety Instrumented Systems (SIS), in order to maintain the necessary level of safety, strictly observe the instructions and procedures provided in this Appendix.

Scope and Purpose

This section describes the handling precautions to be taken when installing and operating the TDLS8200 in order to maintain the level of safety designed for using the TDLS8200 in a Safety Instrumented System application. It also provides an overview of the operation. The topics discussed in this section are the TDLS8200's proof test, repairs, and replacement; safety data; useful lifetime; environmental and application limitations; and parameter settings.

Functional safety is targeted for hardware revision 4 or 5, software revision 1.04, and option code / SIL.

Using the TDLS8200 in a Safety Instrumented System Application

Safety accuracy

The following table shows the TDLS8200 safety accuracy. When an error caused by an internal component failure exceeds the safety accuracy, the TDLS8200 is considered to have malfunctioned.

Measured gas		Measuring range	Safety accuracy	Note
O_2		Less than 0-2%	+/- 20% F.S.	Min. range: 0-1% Max. range: 0-25%
		0-2% or more	+/- 15% F.S.	
CO (ppm)		Less than 0-400 ppm	+/- 25% F.S.	Min. range: 0-200 ppm Max. range: 0-10,000 ppm
		0-400 ppm or more	+/- 15% F.S.	
CO or CH_4	CO	Less than 0-400 ppm	+/- 25% F.S.	Min. range: 0-200 ppm Max. range: 0-10,000 ppm
		0-400 ppm or more	+/- 15% F.S.	
	CH_4	0-5%	+/- 15% F.S.	—
NH_3 (Pending)		Less than 0-100 ppm	+/- 34% F.S.	Min. range: 0-30 ppm Max. range: 0-5,000 ppm
		0-100 ppm or more	+/- 15% F.S.	
HCl (ppm) (Pending)		0-5,000 ppm or less	+/- 15% F.S.	Min. range: 0-50 ppm Max. range: 0-5,000 ppm

OPL=1m basis

Diagnostic response time

The TDLS8200 can indicate an internal malfunction within 30 seconds.

I/O Restriction

Only analog output AO-1, AO-2, AO-3 and analog input AI-1, AI-2 comply with Safety Instrumented System. Do not use other input or outputs as part of a Safety Instrumented System.

Opening and Closing the TDLS8200

When online, do not open or close the cover. If you need to open and close the TDLS8200 cover for maintenance, obtain permission from your safety administrator.

Configuration

Use the HART Configuration tool or a YH8000 HMI unit to set the range and unit. Connect the HART Configuration tool or the YH8000 according to the instructions in this manual. After installing the TDLS8200, check that the range and unit are set correctly. Calibrate the TDLS8200 after setting the parameters.

HART communication, YH8000 can only be used for offline maintenance of SIF. It can be used during start-up, trouble analysis, and proof test work.

Connecting External Transmitters

If you want to connect external transmitters for temperature or pressure input, use products that, when used by themselves, comply with Safety Integrity Level (SIL) 2 based on a PFDavg calculation of the entire safety instrumented function or in a redundant configuration, Safety Integrity Level (SIL) 3 based on a PFDave calculation of the entire safety instrumented function. For details on installation and operation of the external transmitters in safety applications, see the relevant safety manuals.

Temperature and pressure transmitters that we recommend are shown below

Temperature Transmitter	YOKOGAWA YTA series
Pressure Transmitter	YOKOGAWA EJX, EJA series

Setting required parameters

To maintain the appropriate level of safety, set the following parameters.

Parameter	Description
Current setting during warm-up	Using the HART configuration tool, or the YH8000 HMI Unit, set the output of AO-1, AO-2 and AO-3 during warm-up to Preset hold and the output value to 3.8 mA Preset hold. See “4.4.2 Output Hold” for setting instruction.
Current setting during warning occurrence	Using the HART configuration tool or the YH8000 HMI unit, set the output of AO-1, AO-2 and AO-3 during warning occurrence to Non hold. See “4.4.2 Output Hold” for setting instruction.
Current setting during fault occurrence	Using the HART configuration tool or the YH8000 HMI unit, set the output of AO-1, AO-2 and AO-3 for when an internal fault is detected to Preset hold and the output value to 21.0 mA or higher or to a burnout current of 3.6 mA or less. See “4.4.2 Output Hold” for setting instruction.
Safety mode setting	Using the HART configuration tool of the YH8000 HMI unit, set the Safety Mode to Enable. See “4.9.8 Safety Mode” for setting instructions.
HART write protection switch	Disable the HART write function. See “5.3 Write Protection” for setting instruction.

Using the YH8000 HMI unit

When using the YH8000 in a system, use password protection to prevent parameter settings from being changed in modes other than offline. The safety administrator should manage the password properly by referring to section “4.9.3 User Password Setting”.

Proof Test

You must perform a proof test in order to detect faults that are not detected through self-diagnostics but still hinder the execution of the intended safety functions of the TDLS8200.

The proof test interval is determined by the safety calculation that is performed for each safety instrumented function, including the TDLS8200. To maintain the safety level of the safety instrumentation, proof tests must be performed at a frequency determined by the safety calculation or a higher frequency.

You need to choose either of the two test methods described below, and conduct it accordingly.

The one is Extended Proof Test which performs two-point offline validation. This test is intended to be performed during plant shutdown, such as periodic maintenance, because TDLS8200 needs to be safely removed from the process. Please prepare appropriate calibration cell for your analyzer.

The other is Abbreviated Proof Test which performs an online validation.

(Coverage rate should be lower)

The result of proof tests must be documented, and the documents should be handled as part of the plant's safety management. If a fault is detected, please consult with Yokogawa. The operator that performs proof tests on the TDLS8200 must have a thorough knowledge of the operation of Safety Instrumented Systems, including the bypass procedure, TDLS8200 maintenance, and change procedures. In addition, proof tests must be performed in accordance with the requirements of the applicable standards.

Test method		Required tools	Estimated result
Extended Proof Test			Proof Test coverage
1	Bypass the safety functions, and perform appropriate measures to prevent malfunction	HART Configuration tool or YH8000	Dual Laser with Reference Cell: 77.3% Dual Laser without Reference Cell: 77.0% Single Laser with Reference Cell: 73.5% Single Laser without Reference Cell: 73.1%
2	Install the calibration cell to the analyzer .		
3	Use the HART Configuration tool or YH8000 to properly execute all diagnostics and collect the results.		
4	Use the loop function of the HART Configuration tool or YH8000 to output a burn-up current, and verify that the current is at this level.		
5	Use the loop function of the HART Configuration tool or YH8000 to output a burn-down current, and verify that the current is at this level.		
6	Thoroughly check for leakages and visible damages and stains.		
7	Perform two-point offline validation over the entire operating range.		
8	Remove the calibration Cell from the analyzer.		
9	Release the bypass, and restore normal operation.		

Test method		Required tools	Estimated result
Abbreviated Proof Test			Proof Test coverage
1	Bypass the safety functions, and perform appropriate measures to prevent malfunction	HART Configuration tool or YH8000	Dual Laser with Reference Cell: 58.3% Dual Laser without Reference Cell: 57.9% Single Laser with Reference Cell: 57.4% Single Laser without Reference Cell: 56.7%
2	Use the HART Configuration tool or YH8000 to properly execute all diagnostics and collect the results.		
3	Use the loop function of the HART Configuration tool or YH8000 to output a burn-up current, and verify that the current is at this level.		
4	Use the loop function of the HART Configuration tool or YH8000 to output a burn-down current, and verify that the current is at this level.		
5	Thoroughly check for leakages and visible damages and stains.		
6	Perform online validation.		
7	Release the bypass, and restore normal operation.		

* For the detail of PFDavg, please refer to FMEDA No. YEC20-08-156 R003 V4R5.

Repair and replacement

To repair the TDLS8200 while the process is online, bypass the TDLS8200. You must perform the bypass procedure correctly. If a fault is detected, please consult with Yokogawa. TDLS8200 replacement must be performed by a trained engineer.

Startup time

TheTDLS8200 sends valid signal within 6 minutes after power on.

Firmware updating

For firmware updating, please consult with Yokogawa.

Reliability Data

The FMEDA (Failure Mode, Effects and Diagnostic Analysis) report that Yokogawa provides contains failure rates and failure modes.

When used by itself. The TDLS8200 is certified for compliance with up to Safety Integrity Level (SIL) 2 based on a PFDavg calculation of the entire safety instrumented function. The development process of the TDLS8200 is certified for compliance with up to SIL3. When used in a redundant configuration, it can be used at Safety Integrity Level (SIL) 3 based on a PFDavg calculation of the entire safety instrumented function.

When used in a redundant configuration, we recommend that the common cause factors (β-factor) for the PFD calculation of the entire safety instrumented function be set at 5%. If the plant operator provides “common cause failure” training and a clear, detailed maintenance procedure for preventing common cause failures, the common cause factors (β-factor) can be set to 2%.

* For the detail of PFDavg, please refer to FMEDA No. YEC20-08-156 R003 V4R5.

Useful lifetime limitation

The expected useful lifetime of the TDLS8200 is 10 years. The reliability data in the FMEDA report is valid to 10 years. It is assumed that the failure rates of the TDLS8200 would increase when it is used over 10 years. Therefore, the safety integrity level based on the reliability data given in the FMEDA report may not be attainable.

Environmental limitation

The environmental limitation of the TDLS8200 is defined in this manual.

Application limitation

If the TDLS8200 is used in an application outside the limits defined in this manual, the reliability data is void.

The TDLS8200 cannot guarantee the integrity of Loop Wiring and system power supply.

Precautions at Startup

The following Faults may occur at “Startup”. It can be recovered by restarting the system. If the Fault occurs repeatedly after several reboots, please contact Yokogawa service representative.

Alarm No. 55: L1 Laser Module Error
Alarm No. 56: L2 Laser Module Error

Precautions for Restoring Calibration Data

When restoring zero or span calibration data to “factory default data”, an error may occur. It is possible to restore the data by performing the operation again. If the error occurs repeatedly, please contact Yokogawa service representative.

For details about the operation, see “6.7 Calibration Data Record and Restoring”.

Terminology and Acronyms

Terms

Safety

Freedom from unacceptable risk of harm

Functional Safety

The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment, machinery, plant, and apparatus under control of the system.

Basic Safety

The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition.

Verification

- Compliance and confirmation

  The demonstration for each phase of the life-cycle that the (output) deliverables of the phase meet the objectives and requirements specified by the inputs to the phase. The verification is usually executed by analysis, testing, or both.

- Validation

  The demonstration that the safety-related system(s) or the combination of safety-related system(s) and external risk reduction facilities meet, in all respects, the Safety Requirements Specification. The validation is usually executed by testing.

- Safety Assessment

  The investigation to arrive at a judgment—based on evidence—of the safety achieved by safety-related systems.

Further definitions of terms used for safety techniques and measures and the description of safety related systems are given in IEC 61508-4.

Acronyms

FMEDA: Failure Mode, Effects and Diagnostic Analysis

SIF: Safety Instrumented Function

SIL: Safety Integrity Level

SIS: Safety Instrumented System

SLC: Safety Lifecycle

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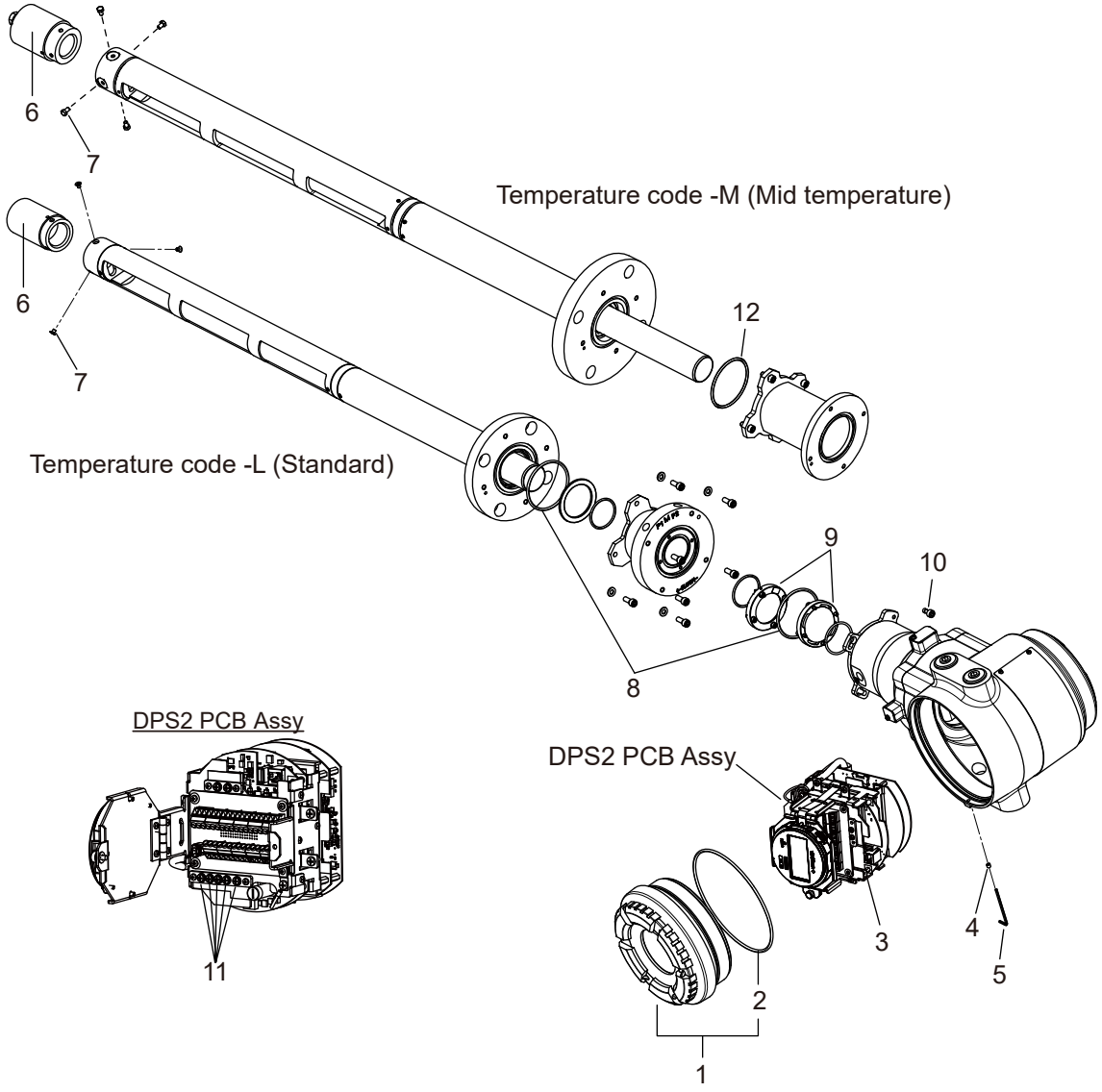
Customer Maintenance Parts List

TDLS8200
Probe type
Tunable Diode Laser Spectrometer



Item	Part No.	Qty	Description
1	K9776HC	1	Cover Assy (with O-ring)
2	K9771KG	1	O-ring
3	A1624EF	1	Fuse
4	B1093BS	1	Set Screw
5	L9827AC	1	Hex. L-key
6	K9776AZ	1	Retro Reflector Assy (for -L)
	K8010SA	1	Retro Reflector Assy (for -M)
7	K9777XA	1	Screw 3pcs Set (for -L)
	K8010YA	1	Screw 4pcs Set (for -M)
8	K9772TJ	2	O-ring

Item	Part No.	Qty	Description
9		2	Process Window Assy
	K8010CA		(for CO/O_2)
	K9776GA		(for O_2)
	K9776GB		(for CO)
	K9776GC		(for NH_3)
	K9776GD		(for HCL)
10	K9771KZ	1	Captive Bolt
11	K8010HJ	5	Screws for grounding terminal
12	K8010HU	1	O-ring (for -M)

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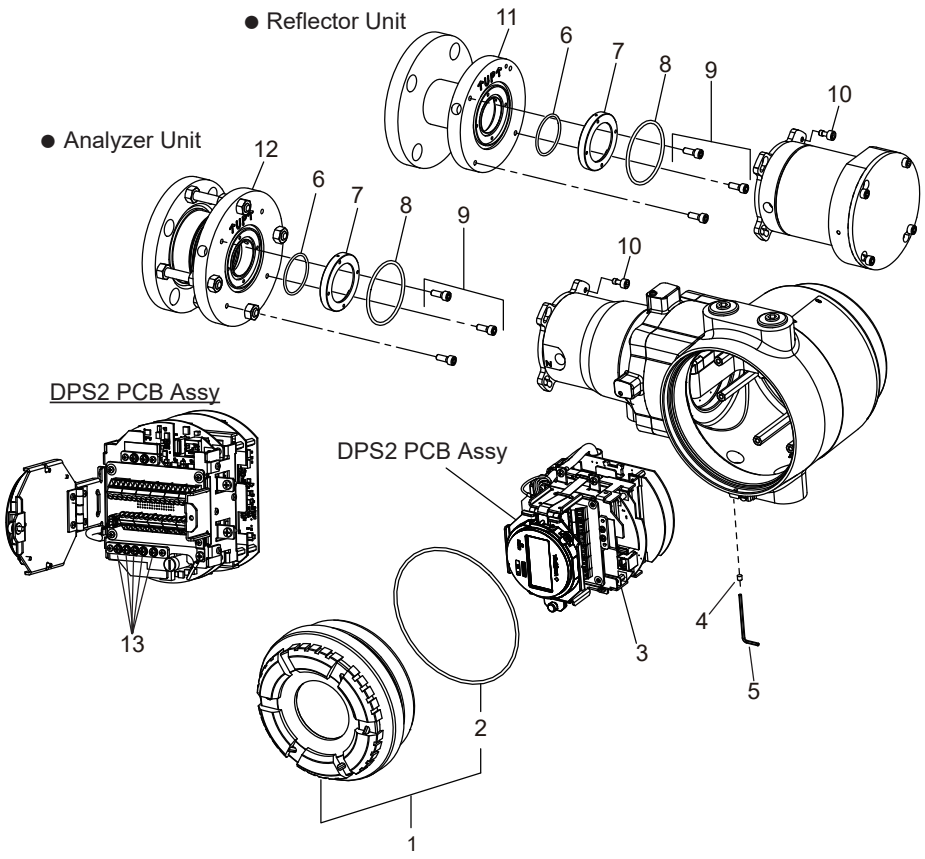
CMPL 11Y01D03-01EN
1st Edition: June 2021 (YK)
4th Edition: May 2024 (YK)

Customer Maintenance Parts List

TDLS8200 (Probe length: -REF, Reflect type)
Probe type Tunable Diode Laser Spectrometer



Item	Part No.	Qty	Description
1	K9776HC	1	Cover Assy (with O-ring)
2	K9771KG	1	O-ring
3	A1624EF	1	Fuse
4	B1093BS	1	Set Screw
5	L9827AC	1	Hex. L-key
6	K9772TH	2	O-ring
7	—	2	Process Window Assy
	K8010CA		(for CO/O_2)
	K9776GA		(for O_2)
8	K9772TJ	2	O-ring
9	K9771JS	2	Screw 3pcs Set
10	K9771KZ	2	Captive Bolt
11*	—	1	Flange Assy
	K8010VA		(for -U2)
	K8010VL		(for -U3)
	K8010VM		(for -U4)
	K8010VN		(for -D5)
	K8010VP		(for -D8)
	K801VQ		(for -J5)
	K8010VR		(for -J8)

Item	Part No.	Qty	Description
12*	—		Alignment Flange Assy
	K9772NA	1	(for -U2)
	K9772NB		(for -U3)
	K9772NC		(for -U4)
	K9772ND		(for -D5)
	K9772NE		(for -D8)
	K9772NF		(for -J5)
	K9772NG		(for -J8)
13	K8010HJ	5	Screws for grounding terminal

*: Process window assy is not included.

CMPL 11Y01D03-02EN
1st Edition: Sep. 2023 (YK)

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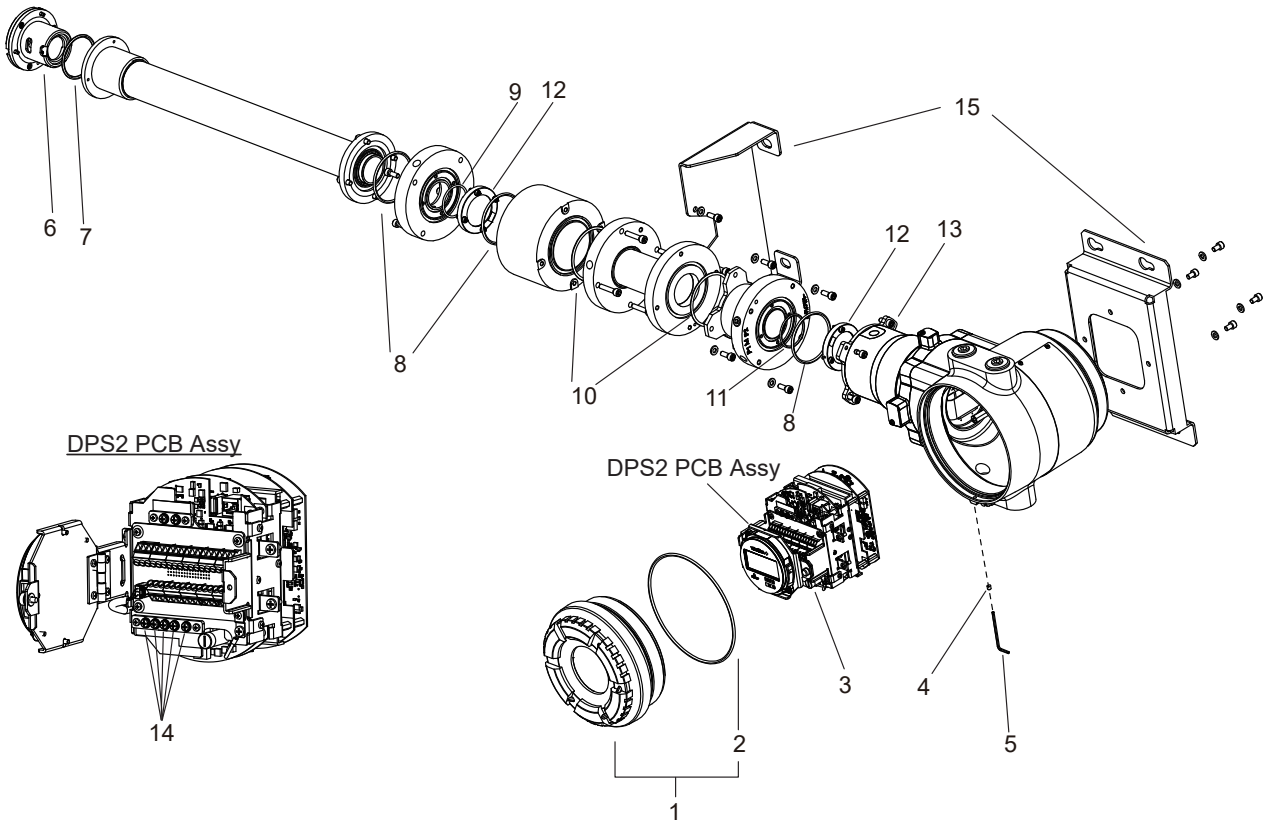
Customer Maintenance Parts List

TDLS8200 (Probe length: -EXT, Flowcell type)
Probe type Tunable Diode Laser Spectrometer



Item	Part No.	Qty	Description
1	K9776HC	1	Cover Assy (with O-ring)
2	K9771KG	1	O-ring
3	A1624EF	1	Fuse
4	B1093BS	1	Set Screw
5	L9827AC	1	Hex. L-key
6	K9777VB	1	Retro Reflector Assy
7	K9777WZ	1	O-ring

Item	Part No.	Qty	Description
8	K9772TJ	3	O-ring
9	K9776VG	1	O-ring
10	K9777WY	2	O-ring
11	K9772TH	1	O-ring
12	K8010CA	2	Process Window Assy (For O_2/CO)
13	K9771KZ	1	Captive Bolt
14	K8010HJ	5	Screws for grounding terminal
15	K9777VT	1	Bracket Assy

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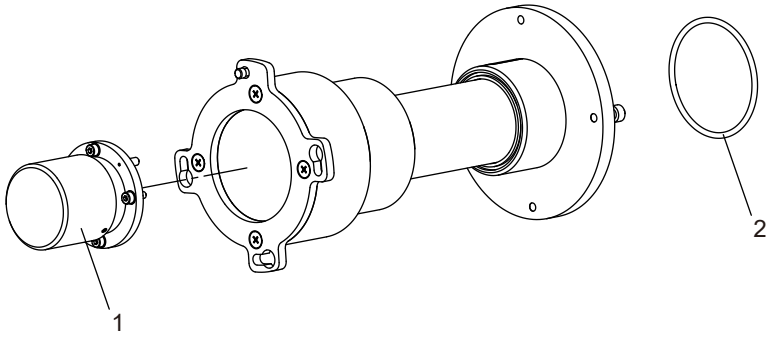
CMPL 11Y01D03-03EN
1st Edition: Sep. 2023 (YK)

Customer Maintenance Parts List

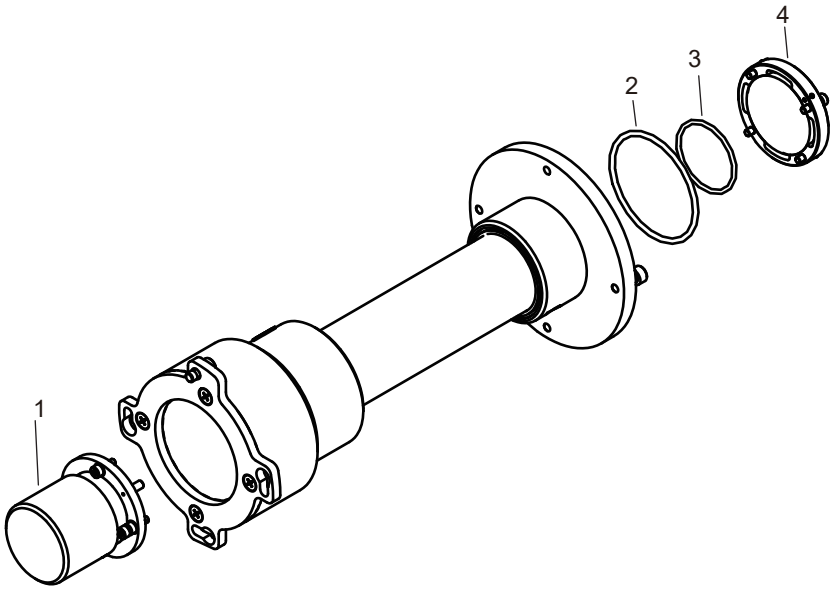
K9777ZA, K9777ZK, K9777ZL
Calibration Cell

K9777ZA



Item	Part No.	Qty	Description
1	K9777ZB	1	Retro Reflector Assy Cal
2	K9772TJ	1	O-ring

K9777ZK, K9777ZL



Item	Part No.	Qty	Description
1	K9777ZM	1	Retro Reflector Assy Cal NH_3/HCl
2	K9772TJ	1	O-ring
3	K9772TH	1	O-ring
4	K9776GC	1	Process window assy for K9777ZK
	K9776GD	1	Process window assy for K9777ZL

CMPL 11Y01D02-21EN
1st Edition: Mar. 2019 (YK)
3rd Edition: May 2024 (YK)

Revision Information

- Manual Title : TDLS8200 Probe Type Tunable Diode Laser Spectrometer
- Manual No. : IM 11Y01D03-01EN

May 2024/11th Edition
Added -A1 (NH3), -L1 (HCl) on 1st Gas Parameter (pages 1-1, 1-8, 1-11, 1-14, 1-15, 1-22, 2-26)
Updated safety conformity standards (pages Vii, 1-8)
Others (App.4)
Revised CMPL 11Y01D03-01EN (parts added), CMPL 11Y01D02-21EN (added K9777ZK, K9777ZL)

Feb. 2023/10th Edition
YH8000 HMI unit contents are newly issued as a separate IM (IM 11Y01D10-01EN) and deleted from this IM.

Nov. 2023/9th Edition
The user's manual for the YH8000 HMI Unit alone has been published in a separate volume as IM (IM 11Y01D10-01EN).
The description of the YH8000 HMI Unit was deleted from this IM.

Nov. 2023/9th Edition
Added description. (pages App. 6-3, App. 6-4, App. 6-5)

Oct. 2023/8th Edition
Updated YH8000 RoHS conformity. (pages viii, 2-6)

Sep. 2023/7th Edition
Added TDLS8200 -K1, -N1, -J1
Added 1 laser specification, Flowcell type, Reflect type
Updated YH8000-N2 (NEPSI)
Revised CMPL 11Y01D03-01EN(3rd edition)
Newly released CMPL 11Y01D03-02EN, CMPL 11Y01D03-03EN.

Feb. 2023/6th Edition
Revised CMPL 11Y01D03-01EN (parts added for TDLS8200-M)

Jan. 2023/5th Edition
Updated the safety standard certification of compliance: TDLS8200/SIL (pages 2-1, 2-8)
UKCA marking conformity (pages iii, vi, vii, viii, 2-1, 2-3, 2-4,, 2-5, 2-7, 2-8, App. 4-14, App. 4-16)
Other corrections (page 2-3, Chapter 5, Chapter 6, Chapter 7, page 8-24, Chapter 9, Chapter 10, page 11-7, App. 2-3, 2-4, 3-2)
Added Appendix 6

Aug. 2022/4th Edition
Added Explosion proof conformity (TDLS8200-D1 (FM(US), -C1 (FM(Canada)), -E1(IECEx), -S1(ATEX)):
Added Explosion proof conformity (YH8000-N2 (NEPSI))
Added HART communication (Chapter 7, Appendix 6)
Other correction (page 2-5)

Apr. 2022/3rd Edition
Added TDLS8200 -M (Mid temperature), TDLS8200 -X2, TDLS8200 -A (pages 2-2, 2-3, 2-7, 2-10)
Updated Explosion proof conformity YH8000 -R2 (EAC),YH8000 -K2 (Korea Ex),YH8000-J2 (pages 2-6)
Added Explosion proof conformity YH8000 -U2 (INMETRO). (pages 2-6, 2-8)
Other correction (page 2-5)

Nov. 2021/2nd Edition

Updated the safety standard certification of compliance. (pages vii, vi, viii, 2-1)

June 2021/1st Edition
Newly released

Yokogawa Electric Corporation
2-9-32 Nakacho, Musashino-shi, Tokyo 180-8750, JAPAN
http://www.yokogawa.com/

User's Manual

Supplement

TDLS8200
Probe Type
Tunable Diode Laser Spectrometer

Thank you for selecting our TDLS8200 Probe Type Tunable Diode Laser Spectrometer.
There are changes to the User's Manual "IM 11Y01D03-01EN 11th Edition" attached to the product.
Read this information carefully before using the product.

Note

■ UKCA and UKEX markings are not currently compliant.

- **UKCA and UKEX and their Certificate No. have been removed from the pages.**
- **Appendix 2-14 to 2-21 have been replaced by the following attached pages.**

■ TDLS8200-N1 (NEPSI) has been revised.

- **Appendix 2-17 to 2-21 have been replaced by the following attached pages.**

■ Appendix 4 has been revised.

- **Appendix 4 has been revised as attached.**

YOKOGAWA
Yokogawa Electric Corporation

IM 11Y01D03-01EN1/14
11th Edition

TDLS8200-S1 (ATEX)

Applicable standards

EN IEC 60079-0:2018
EN 60079-1:2014
EN 60079-28:2015
EN 60079-31:2014

Certificate No.

FM18ATEX0041X

Note: The symbol "X" placed after the certificate number indicates that the equipment is subjected to specific conditions of use.
Refer to specific condition of use.

Specifications

Refer to chapter 2 for other specifications than that described below.

- Equipment ratings (Ex marking)

II 2(1) G □ Ex db [op is Ga] IIC T6 Gb
II 2(1) D □ Ex tb [op is Da] IIIC T85°C Db

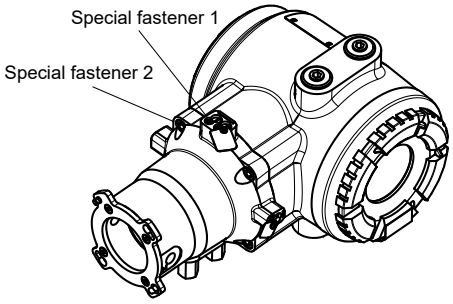
Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate.
Once the type of protection is selected, it shall not be changed.

- Enclosure
  IP66
- Ambient temperature
  -20 to +55°C

Specific condition of use

- Electrostatic charges on the non-metallic parts (excluding glass parts) or coated parts of the equipment shall be avoided.
- If the TDLS8200 is mounted in an area where the use of Category 2 D or 3 D equipment is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.
- Flameproof joints are not intended to be repaired. Contact Yokogawa representative or Yokogawa office.
- The property class of the Special fastener 1 used to fasten the shaft onto the enclosure below is at least A*-50, C*-50, or F1-60.
- The property class of the Special fastener 2 used to fasten the optics case to the case below is at least A*-80 or C*-80.
- The Special fastener 1 used to fasten the shaft onto the enclosure shall only be replaced with Yokogawa fastener, Part number: K9776VF.
- Process temperature is not considered for the certification. Install and operate so as not to be affected by process temperature.

Note: The "*" shown is replaced by a property grade numeral.



Special fasteners

Installation

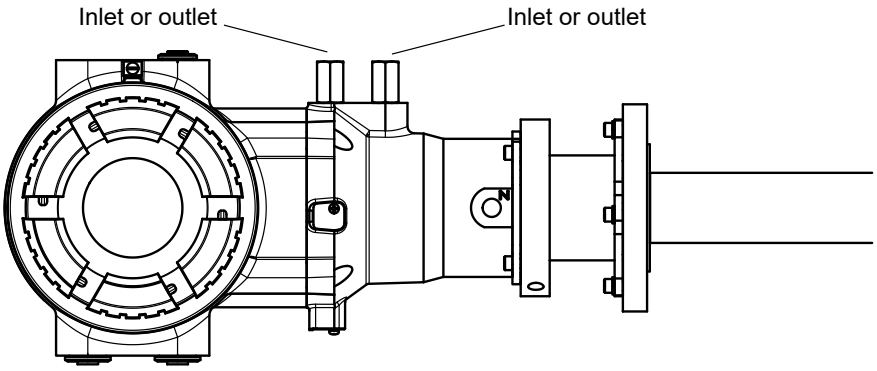
Refer to chapter 3 for other than that described below.

- Warning: In cases where the ambient temperature exceeds 40 °C, use external heat resistant cable with a maximum allowable temperature of 75 °C or above.
- Take care the following warning marking.
  "POTENTIAL ELECTROSTATIC CHARGING HAZARD"
- All wiring shall comply with EN60079-14, and local electric codes and requirements.
- Cable glands, adapters and/or blanking elements with a suitable IP rating shall be of Ex db IIC/Ex tb IIIC certified by ATEX and shall be installed so as to maintain the specific degree of protection (IP Code) of the equipment.
- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 2.0 N•m (M5) or 1.2 N•m (M4). Care must be taken not to twist the conductor.
- If the equipment is installed to Category 2 D or 3 D area, it shall be avoided the risk from electrostatic discharge and propagating brush discharges caused by rapid flow of dust.
- Unused entries shall be closed with suitable certified blanking elements.

Operation

Refer to chapter 3 for other than that described below.

- Take care the following warning marking.
  "POTENTIAL ELECTROSTATIC CHARGING HAZARD"
- Take care not to generate mechanical spark when access to the equipment and the peripheral devices in hazardous locations.
- Take care the following warning marking when opening the cover.
  "DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT"
- Pressure inside purged compartment shall not exceed 10kPa.

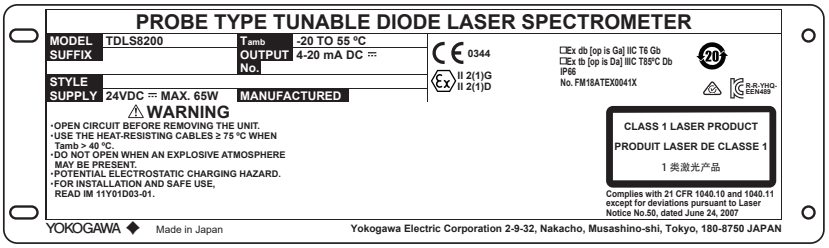


Inlet and outlet of purged compartment

Maintenance and repair

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

● Nameplate



Example of nameplate (Design and texts may be changed)

- MODEL: Specified model code
- SUFFIX: Specified suffix code
- STYLE: Specified style code
- SUPPLY: Specified supply voltage and wattage
- Tamb: Specified ambient temperature range
- OUTPUT: Specified analog output range
- No.: Serial number
- MANUFACTURED: Month and year of production
- Ex marking:

II 2(1) G □ Ex db [op is Ga] IIC T6 Gb*
II 2(1) D □ Ex tb [op is Da] IIIC T85°C Db*

Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- Enclosure: IP66
- Certificate No. FM18ATEX0041X
- Warning:

  OPEN CIRCUIT BEFORE REMOVING THE UNIT.
  USE THE HEAT-RESISTING CABLES ≥ 75 °C WHEN Tamb > 40°C.
  DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.
  POTENTIAL ELECTROSTATIC CHARGING HAZARD.
  FOR INSTALLATION AND SAFE USE, READ IM 11Y01D03-01.
- Laser class:

  CLASS 1 LASER PRODUCT

  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated June 24, 2007.
- Country of origin: Specified country of origin
- Address of the manufacture: Address of Yokogawa Electric Corporation

TDLS8200-N1 (NEPSI)

Applicable standards 适用标准

GB/T 3836.1-2021
GB/T 3836.2-2021
GB/T 3836.22-2017
GB/T 3836.31-2021

Certificate No. 防爆认证号码

GYJ24.1138X

Specific Ex marking 防爆标志

Ex db [op is Ga] IIC T6 Gb
Ex tb [op is Da] IIIC T85 ºC Db

Ambient temperature 使用环境温度

-20 to +55°C

Specific condition of use 产品安全使用特殊条件

- Electrostatic charges on the non-metallic parts (excluding glass parts) or coated parts of the equipment shall be avoided.

  产品外壳部分为非金属材质，且部分金属外壳带有非金属涂覆层，用于爆炸性气体危险场所时应注意严禁干擦以防静电积累危险（玻璃除外）。

- If the equipment is mounted in an area where the use of EPL Db or Dc equipment is required, it shall be installed in such a way that the risk from propagating brush discharges caused by rapid flow of dust is avoided.

  若产品金属外壳带有非金属涂覆层，且应用在EPL Db 或Dc的环境中时，应防止由于快速流体吹扫粉尘引起的刷形放电及静电放电。

- The values of the flamepaths are different from the standard values given in GB/T3836.2-2021. Repair of the equipment is only allowed when done by the manufacturer or authorized representative.

  产品隔爆接合面参数与GB/T3836.2-2021标准中所规定的最小值或最大值不同。仅允许制造商或授权机构对产品进行维修。

- The property class of the special fastener 1 used to fasten the shaft onto the enclosure below is at least A*-50, C*-50, or F1-60.

  产品轴与壳体间的特殊紧固螺钉1的性能等级不得低于A*-50，C*-50，或F1-60。

  The "*" shown is replaced by a property grade numeral.
  所示"*"由性能等级数字代替。

- The property class of the special fastener 2 used to fasten the optics case to the case below is at least A*-80 or C*-80.

  产品光学腔与壳体间的特殊紧固螺钉2的性能等级不得低于A*-80或C*-80。

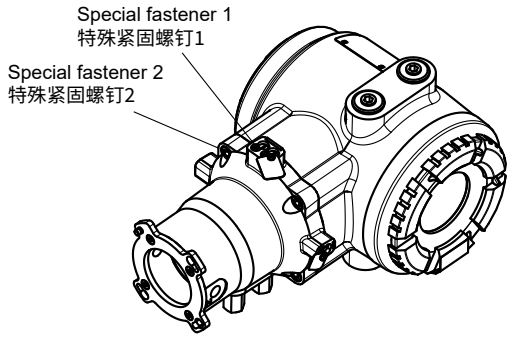
  The "*" shown is replaced by a property grade numeral.
  所示"*"由性能等级数字代替。

- The special fastener 1 shall only be replaced with Yokogawa fastener, Part number: K9776VF.

  特殊紧固螺钉1的仅能用编号为K9776VF 的紧固件进行替换。

- Process temperature is not considered for the certification. Install and operate so as not to be affected by process temperature.

  产品认证未考虑过程介质温度，安装及使用必须确保不受介质温度影响。



Special fasteners 特殊紧固螺钉

● Installation and erection 安装

- Installation and maintenance of the equipment shall be done in accordance with GB/T 3836.13, GB/T 3836.15, GB/T 3836.16, GB 50257, and GB 15577.

  设备的安装、使用、以及维护、须根据GB/T 3836.13、GB/T 3836.15、GB/T 3836.16、GB 50257、GB 15577 以及相 关的现地法律、法规来执行。

- Cable glands, adapters and/or blanking elements with a suitable IP rating shall be of Ex db IIC/Ex tb applicable to GB standard and shall be installed so as to maintain the specific degree of protection (IP Code) of the equipment.

  具有适当 IP 等级的电缆密封套、适配器和/或堵头元件应为适用于 GB 标准的 Ex db IIC/Ex tb 并应安装以保持设备的特定防护等级 (IP 代码)。

- The enclosure provides a degree of protection of IP66 in accordance with GB/T 4208-2017.

  光谱仪外壳防护等级为符合GB4208-2017 标准要求的IP66。

- Warning: In cases where the ambient temperature exceeds 40 °C, use external heat resistant cable with a maximum allowable temperature of 75 °C or above.

  警告:如果环境温度超过 40 °C、请使用最高允许温度为75 °C 或更高的外部耐热电缆。

- Take care the following warning marking.

  注意以下警告标记。

  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”

  “潜在静电电荷危险”

- Regarding option code “/SCT”, Tag plate shall be strapped to non-painted part by metal wire in order to prevent from potential electrostatic charging hazard.

  关于选项代码“/SCT”,标签板应通过金属线绑在非涂漆部分,以防止潜在的静电充电危险。

- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with torque of approx. 2.0 N•m (M5) or 1.2 N•m (M4). Care must be taken not to twist the conductor.

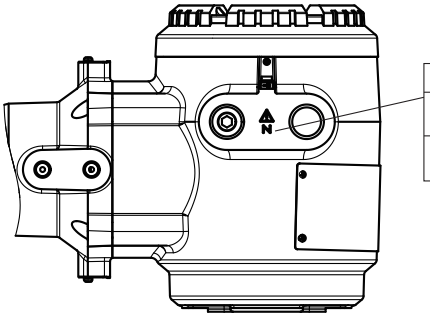
  为防止接地导体松动,必须将导体固定到端子上,收紧螺钉扭矩约为。2.0 N•m (M5) 或 1.2 N•m (M4)。必须注意不要扭曲导线。

- Unused entries shall be closed with suitable certified blanking elements.

  未使用的入口应用合适的认证消隐元件封闭。

- A mark indicating the electrical connection type is stamped near the electrical connection part. These marks are as follows.

  在电连接部分附近压印有表示电连接类型的标记。这些标记如下。



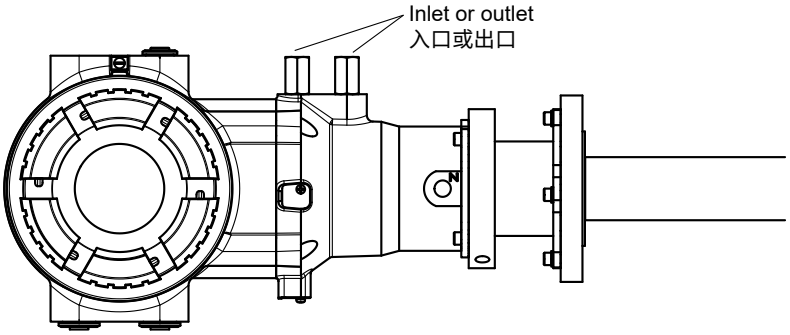
Screw size 螺丝尺寸	Marking 记号
ISO M20×1.5 female or ISO M25×1.5 female	⚠ M
ANSI 1/2NPT female or ANSI 3/4NPT female	⚠ N

Marking of screw size 螺丝尺寸记号

- When installing the equipment, the selected Type of Protection should be ticked as follows.
  安装设备时，选择的保护类型应如下勾选。
  - ☒ Ex db [op is Ga] IIC T6 Gb
  - □ Ex tb [op is Da] IIIC T85 ºC Db

● Use and setting-up (operation) 操作

- Take care the following warning marking.
  注意以下警告标记。
  “POTENTIAL ELECTROSTATIC CHARGING HAZARD”
  “潜在静电电荷危险”
- Take care not to generate mechanical spark when access to the equipment and the peripheral devices in hazardous locations.
  在危险场所接触设备和外围设备时注意不要产生机械火花。
- Take care the following warning marking when opening the cover.
  打开盖子时请注意以下警告标记。
  “DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT”
  “存在爆炸性环境时严禁打开”
- Pressure inside purged compartment shall not exceed 10kPa.
  吹扫室内压力不得超过10kPa



Inlet and outlet of purged compartment 净化室的入口或出口

- **Maintenance and repair 维护和修理**

WARNING 警告

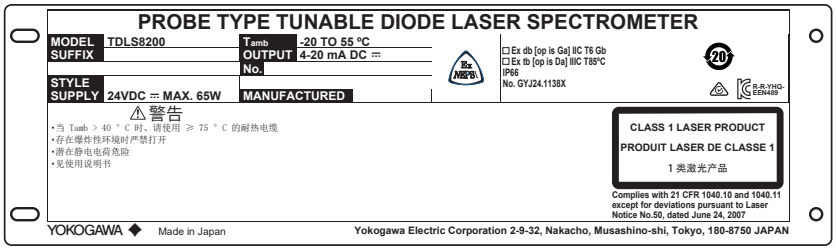
A modification of the equipment would no longer comply with the construction described in the certificate documentation.
设备的改装将不再符合证书文档中描述的结构。
Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.
横河电机株式会社的授权人员，才可以修理设备。

- **Warning 警告**

WARNING 警告

USE THE HEAT-RESISTING CABLES ≥ 75 °C WHEN T_{amb} > 40 °C.
当 T_{amb} > 40 °C 时、请使用 ≥ 75 °C 的耐热电缆
DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT.
存在爆炸性环境时严禁打开
POTENTIAL ELECTROSTATIC CHARGING HAZARD.
潜在静电电荷危险
SEE USER'S MANUAL
见使用说明书

● Nameplate 铭牌



Example of nameplate (Design and texts may be changed) 铭牌示例（设计和文字可能会更改）

- MODEL: Specified model code 指定模型
- SUFFIX: Specified suffix code 指定后缀和选项代码
- STYLE: Specified style code 指定样式代码
- SUPPLY: Specified supply voltage and wattage 指定电源和能量消耗
- T_{amb}: Specified ambient temperature range 指定使用环境温度
- OUTPUT: Specified analog output range 指定模拟输出范围
- No.: Serial number 流水号
- MANUFACTURED: Month and year of production 生产年月
- Specific Ex marking 防爆标志:
  - □ Ex db [op is Ga] IIC T6 Gb
  - □ Ex tb [op is Da] IIIC T85 ºC Db

Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.
"□"是选择保护类型的复选框。选择保护类型并勾选铭牌上的"□"之一。保护类型一经选择，不得更改。

- Enclosure 外壳保护等级: IP66
- Certificate No. 防爆认证号码: GYJ24.1138X
- Warning 警告

  当 T_{amb} > 40 °C 时、请使用 ≥ 75 °C 的耐热电缆
  存在爆炸性环境时严禁打开
  潜在静电电荷危险
  见使用说明书
- Laser class 激光类:

  CLASS 1 LASER PRODUCT

  1 类激光产品

  Complies with 21 CFR 1040.10 and 1040.11 except for deviations pursuant to Laser Notice No.50, dated June 24, 2007.
- Country of origin 出生国家: Specified country of origin 指定出生国家
- Address of the manufacture 生产地址:

  Address of Yokogawa Electric Corporation 横河电机株式会社地址

Appendix 4 Safety Instrumented System Installation

WARNING

When using TDLS8200 as a Safety Instrumented Systems (SIS), in order to maintain the necessary level of safety, strictly observe the instructions and procedures provided in this Appendix.

Scope and Purpose

This section describes the handling precautions to be taken when installing and operating the TDLS8200 in order to maintain the level of safety designed for using the TDLS8200 in a Safety Instrumented System application. It also provides an overview of the operation. The topics discussed in this section are the TDLS8200's proof test, repairs, and replacement; safety data; useful lifetime; environmental and application limitations; and parameter settings.

Functional safety is targeted for hardware revision 4 or 5, software revision 1.05, and option code / SIL.

Using the TDLS8200 in a Safety Instrumented System Application

Safety accuracy

The following table shows the TDLS8200 safety accuracy. When an error caused by an internal component failure exceeds the safety accuracy, the TDLS8200 is considered to have malfunctioned.

Measured gas		Measuring range	Safety accuracy	Note
O_2		Less than 0-2%	+/- 20% F.S.	Min. range: 0-1% Max. range: 0-25%
		0-2% or more	+/- 15% F.S.	
CO (ppm)		Less than 0-400 ppm	+/- 25% F.S.	Min. range: 0-200 ppm Max. range: 0-10,000 ppm
		0-400 ppm or more	+/- 15% F.S.	
CO or CH_4	CO	Less than 0-400 ppm	+/- 25% F.S.	Min. range: 0-200 ppm Max. range: 0-10,000 ppm
		0-400 ppm or more	+/- 15% F.S.	
	CH_4	0-5%	+/- 15% F.S.	—
NH_3 (Pending)		Less than 0-100 ppm	+/- 34% F.S.	Min. range: 0-30 ppm Max. range: 0-5,000 ppm
		0-100 ppm or more	+/- 15% F.S.	
HCl (ppm) (Pending)		0-5,000 ppm or less	+/- 15% F.S.	Min. range: 0-50 ppm Max. range: 0-5,000 ppm

OPL=1m basis

Diagnostic response time

The TDLS8200 can indicate an internal malfunction within 30 seconds.

I/O Restriction

Only analog output AO-1, AO-2, AO-3 and analog input AI-1, AI-2 comply with Safety Instrumented System. Do not use other input or outputs as part of a Safety Instrumented System.

Opening and Closing the TDLS8200

When online, do not open or close the cover. If you need to open and close the TDLS8200 cover for maintenance, obtain permission from your safety administrator.

Configuration

Use the HART Configuration tool or a YH8000 HMI unit to set the range and unit. Connect the HART Configuration tool or the YH8000 according to the instructions in this manual. After installing the TDLS8200, check that the range and unit are set correctly. Calibrate the TDLS8200 after setting the parameters.

HART communication, YH8000 can only be used for offline maintenance of SIF. It can be used during start-up, trouble analysis, and proof test work.

Connecting External Transmitters

If you want to connect external transmitters for temperature or pressure input, use products that, when used by themselves, comply with Safety Integrity Level (SIL) 2 based on a PFDavg calculation of the entire safety instrumented function or in a redundant configuration, Safety Integrity Level (SIL) 3 based on a PFDave calculation of the entire safety instrumented function. For details on installation and operation of the external transmitters in safety applications, see the relevant safety manuals.

Temperature and pressure transmitters that we recommend are shown below

Temperature Transmitter	YOKOGAWA YTA series
Pressure Transmitter	YOKOGAWA EJX, EJA series

Setting required parameters

To maintain the appropriate level of safety, set the following parameters.

Parameter	Description
Current setting during warm-up	Using the HART configuration tool, or the YH8000 HMI Unit, set the output of AO-1, AO-2 and AO-3 during warm-up to Preset hold and the output value to 3.8 mA Preset hold. See “4.4.2 Output Hold” for setting instruction.
Current setting during warning occurrence	Using the HART configuration tool or the YH8000 HMI unit, set the output of AO-1, AO-2 and AO-3 during warning occurrence to Non hold. See “4.4.2 Output Hold” for setting instruction.
Current setting during fault occurrence	Using the HART configuration tool or the YH8000 HMI unit, set the output of AO-1, AO-2 and AO-3 for when an internal fault is detected to Preset hold and the output value to 21.0 mA or higher or to a burnout current of 3.6 mA or less. See “4.4.2 Output Hold” for setting instruction.
Safety mode setting	Using the HART configuration tool of the YH8000 HMI unit, set the Safety Mode to Enable. See “4.9.8 Safety Mode” for setting instructions.
HART write protection switch	Disable the HART write function. See “5.3 Write Protection” for setting instruction.

Using the YH8000 HMI unit

When using the YH8000 in a system, use password protection to prevent parameter settings from being changed in modes other than offline. The safety administrator should manage the password properly by referring to section “4.9.3 User Password Setting”.

Proof Test

You must perform a proof test in order to detect faults that are not detected through self-diagnostics but still hinder the execution of the intended safety functions of the TDLS8200.

The proof test interval is determined by the safety calculation that is performed for each safety instrumented function, including the TDLS8200. To maintain the safety level of the safety instrumentation, proof tests must be performed at a frequency determined by the safety calculation or a higher frequency.

You need to choose either of the two test methods described below, and conduct it accordingly.

The one is Extended Proof Test which performs two-point offline validation. This test is intended to be performed during plant shutdown, such as periodic maintenance, because TDLS8200 needs to be safely removed from the process. Please prepare appropriate calibration cell for your analyzer.

The other is Abbreviated Proof Test which performs an online validation.

(Coverage rate should be lower)

The result of proof tests must be documented, and the documents should be handled as part of the plant's safety management. If a fault is detected, please consult with Yokogawa. The operator that performs proof tests on the TDLS8200 must have a thorough knowledge of the operation of Safety Instrumented Systems, including the bypass procedure, TDLS8200 maintenance, and change procedures. In addition, proof tests must be performed in accordance with the requirements of the applicable standards.

Test method		Required tools	Estimated result
Extended Proof Test			Proof Test coverage
1	Bypass the safety functions, and perform appropriate measures to prevent malfunction	HART Configuration tool or YH8000	Dual Laser with Reference Cell: 79.1% Dual Laser without Reference Cell: 78.9% Single Laser with Reference Cell: 75.7% Single Laser without Reference Cell: 75.4%
2	Install the calibration cell to the analyzer .		
3	Use the HART Configuration tool or YH8000 to properly execute all diagnostics and collect the results.		
4	Use the loop function of the HART Configuration tool or YH8000 to output a burn-up current, and verify that the current is at this level.		
5	Use the loop function of the HART Configuration tool or YH8000 to output a burn-down current, and verify that the current is at this level.		
6	Thoroughly check for leakages and visible damages and stains.		
7	Perform two-point offline validation over the entire operating range.		
8	Remove the calibration Cell from the analyzer.		
9	Release the bypass, and restore normal operation.		

Test method		Required tools	Estimated result
Abbreviated Proof Test			Proof Test coverage
1	Bypass the safety functions, and perform appropriate measures to prevent malfunction	HART Configuration tool or YH8000	Dual Laser with Reference Cell: 59.9% Dual Laser without Reference Cell: 59.5% Single Laser with Reference Cell: 59.1% Single Laser without Reference Cell: 58.7%
2	Use the HART Configuration tool or YH8000 to properly execute all diagnostics and collect the results.		
3	Use the loop function of the HART Configuration tool or YH8000 to output a burn-up current, and verify that the current is at this level.		
4	Use the loop function of the HART Configuration tool or YH8000 to output a burn-down current, and verify that the current is at this level.		
5	Thoroughly check for leakages and visible damages and stains.		
6	Perform online validation.		
7	Release the bypass, and restore normal operation.		

* For the detail of PFDavg, please refer to FMEDA No. YEC20-08-156 R003 V5R2.

Repair and replacement

To repair the TDLS8200 while the process is online, bypass the TDLS8200. You must perform the bypass procedure correctly. If a fault is detected, please consult with Yokogawa. TDLS8200 replacement must be performed by a trained engineer.

Startup time

TheTDLS8200 sends valid signal within 6 minutes after power on.

Firmware updating

For firmware updating, please consult with Yokogawa.

Reliability Data

The FMEDA (Failure Mode, Effects and Diagnostic Analysis) report that Yokogawa provides contains failure rates and failure modes.

When used by itself. The TDLS8200 is certified for compliance with up to Safety Integrity Level (SIL) 2 based on a PFDavg calculation of the entire safety instrumented function. The development process of the TDLS8200 is certified for compliance with up to SIL3. When used in a redundant configuration, it can be used at Safety Integrity Level (SIL) 3 based on a PFDavg calculation of the entire safety instrumented function.

When used in a redundant configuration, we recommend that the common cause factors (β-factor) for the PFD calculation of the entire safety instrumented function be set at 5%. If the plant operator provides “common cause failure” training and a clear, detailed maintenance procedure for preventing common cause failures, the common cause factors (β-factor) can be set to 2%.

* For the detail of PFDavg, please refer to FMEDA No. YEC20-08-156 R003 V5R2.

Useful lifetime limitation

The expected useful lifetime of the TDLS8200 is 10 years. The reliability data in the FMEDA report is valid to 10 years. It is assumed that the failure rates of the TDLS8200 would increase when it is used over 10 years. Therefore, the safety integrity level based on the reliability data given in the FMEDA report may not be attainable.

Environmental limitation

The environmental limitation of the TDLS8200 is defined in this manual.

Application limitation

If the TDLS8200 is used in an application outside the limits defined in this manual, the reliability data is void.

The TDLS8200 cannot guarantee the integrity of Loop Wiring and system power supply.

Precautions at Startup

The following Faults may occur at “Startup”. It can be recovered by restarting the system. If the Fault occurs repeatedly after several reboots, please contact Yokogawa service representative.

Alarm No. 55: L1 Laser Module Error
Alarm No. 56: L2 Laser Module Error

Precautions for Restoring Calibration Data

When restoring zero or span calibration data to “factory default data”, an error may occur. It is possible to restore the data by performing the operation again. If the error occurs repeatedly, please contact Yokogawa service representative.

For details about the operation, see “6.7 Calibration Data Record and Restoring”.

Terminology and Acronyms

Terms

Safety

Freedom from unacceptable risk of harm

Functional Safety

The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment, machinery, plant, and apparatus under control of the system.

Basic Safety

The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition.

Verification

- Compliance and confirmation

  The demonstration for each phase of the life-cycle that the (output) deliverables of the phase meet the objectives and requirements specified by the inputs to the phase. The verification is usually executed by analysis, testing, or both.

- Validation

  The demonstration that the safety-related system(s) or the combination of safety-related system(s) and external risk reduction facilities meet, in all respects, the Safety Requirements Specification. The validation is usually executed by testing.

- Safety Assessment

  The investigation to arrive at a judgment—based on evidence—of the safety achieved by safety-related systems.

Further definitions of terms used for safety techniques and measures and the description of safety related systems are given in IEC 61508-4.

Acronyms

FMEDA: Failure Mode, Effects and Diagnostic Analysis

SIF: Safety Instrumented Function

SIL: Safety Integrity Level

SIS: Safety Instrumented System

SLC: Safety Lifecycle