User's Manual

TDLS8100
Probe Type
Tunable Diode Laser Spectrometer

IM 11Y01D02-01EN

YOKOGAWA
Yokogawa Electric Corporation

IM 11Y01D02-01EN
9th Edition

Introduction

Thank you for purchasing the TDLS™8100 Probe Type Tunable Diode Laser Spectrometer.

Please read the following respective documents before installing and using the TDLS8100.

The description of the following products are also included in this manual.

YH8000 HMI Interface Unit

The related documents are as follows.

General Specifications GS 11Y01D02-01EN
User's Manual IM 11Y01D02-01EN (this manual)

* 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.

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.

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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 TDLS8100 and YH8000 are used in a manner not specified in this user's manual, the protection provided by these instruments 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 TDLS8100 and YH8000 are designed to protect against explosion.

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

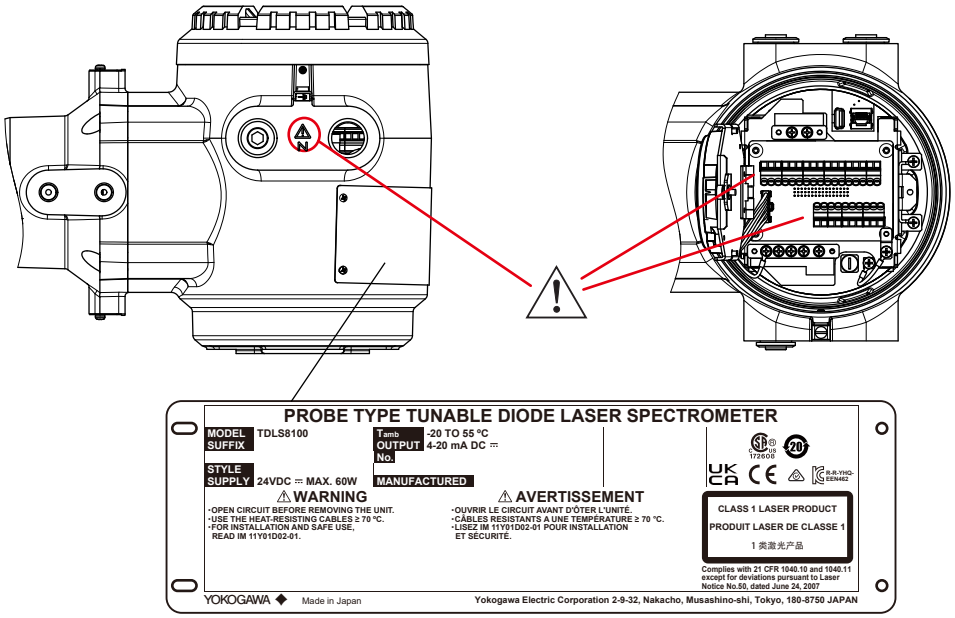
CAUTION

Only trained persons use TDLS8100 and YH8000 in industrial locations.

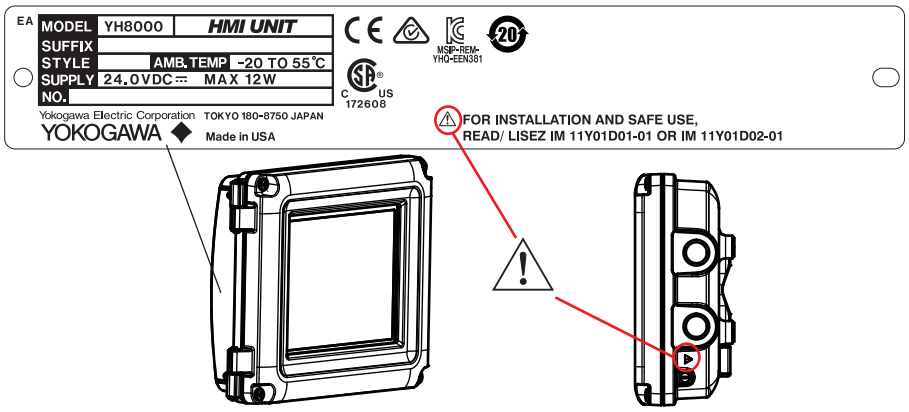
TDLS8100 and YH8000

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

TDLS8100



YH8000



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 70 °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 TDLS8100 probe type tunable diode laser spectrometer and YH8000 HMI interface unit. 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 TDLS8100 probe type tunable diode laser spectrometer and YH8000 HMI interface unit.
- The HART communication may be influenced by strong electromagnetic field.

  In this case another trial of the HART communication and/or operation with TDLS8100 touch screen can be carried out.

CAUTION

TDLS8100 and YH80000 are EN61326-1 Class A products, and it is designed for use in the industrial environment. Please use these instruments in the industrial environment only.

WARNING

Depending on the specifications, toxic CO and NH_3 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 TDLS8100 and YH8000 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 TDLS8100 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 TDLS8100 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

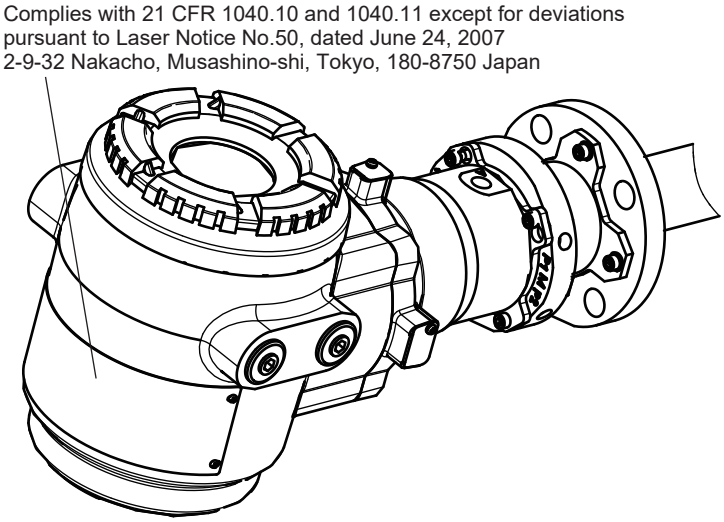
TDLS8100 contains lithium batteries. Primary lithium batteries are regulated in transportation by the U.S. Department of Transportation, and are also covered by the International Air Transport Association (IATA), the International Civil Aviation Organization (ICAO), and the European Ground Transportation 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

TDLS8100 uses a laser light source. TDLS8100 is a Class 1 laser product as defined by IEC60825-1 Safety of Laser Products—Part1: Equipment Classification, Requirements and User's Guide. In addition, TDLS8100 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 TDLS8100 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.

TDLS8100 probe type tunable Diode Laser Spectrometer

Safety conformity standards:

CE,UKCA	EN61010-1, EN61010-2-030
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 TDLS8100-G1, -G2, -S1

● YH8000 HMI Unit

Safety conformity standards:
CE,UKCA EN61010-1
UL UL61010-1
CSA CAN/CSA-C22.2 No.61010-1
GB GB30439 Part 1
Installation Altitude: 2000 m or less
Installation category: I (Anticipated transient overvoltage 330 V)
Pollution degree: 2, Indoor/Outdoor use

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

한국 전자파적합성 기준

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사용하는 것을 목적으로 합니다.

RoHS conformity standards:
EN IEC 63000:2018*
*: For only YH8000-G1-G2 (manufactured in Japan) and -S2

Cable conditions:

- Power cable Use a shielded cable.
- Local HMI connection cable
  Use a separately sold dedicated cable (shield cable).
- Ethernet cable Use an STP cable (shielded) of category 5e or higher.

Product conformity assessments of YH8000 for the relevant standards are performed in its own right.

■ Unused function on TDLS8100

TDLS8100 and TDLS8000 use common software. Although the following function are only for TDLS8000 but not assumed to be available to TDLS8100, the software enables operators to use these functions.

- Non-process Parameter settings (This function is not described in this manual.)
- Process gas flow path switch
- Automatic offline validation
- Automatic calibration
- LU LED (TDLS8100 does not have this function.)

Terminology

TDLS8100 and TDLS8000 use common software. In this manual, some words relevant to TDLS8100's operations or alarms are defined according to the user's manual of TDLS80000.

Word	Definition on TDLS8100
Sensor control unit (SCU)	analyzer part
Laser unit (LU)	analyzer part
flow cell	calibration cell

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

UKCA marking compliant

UK CA 2503

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TDLS8100
Probe Type
Tunable Diode Laser Spectrometer

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CONTENTS

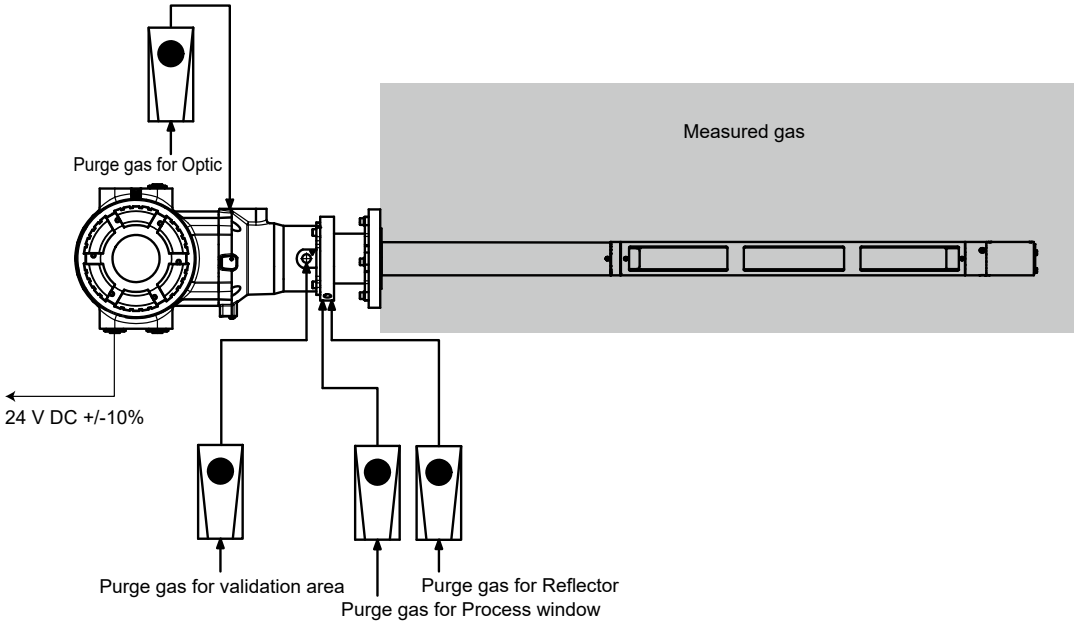
1. Overview

Yokogawa's TDLSTM8100 is a laser gas analyzer that measures the concentration of various gases (O_2, CO, CH_4, NH_3, HCl and many more NIR absorbing gases) in various processes such as petrochemical, power geneartion.

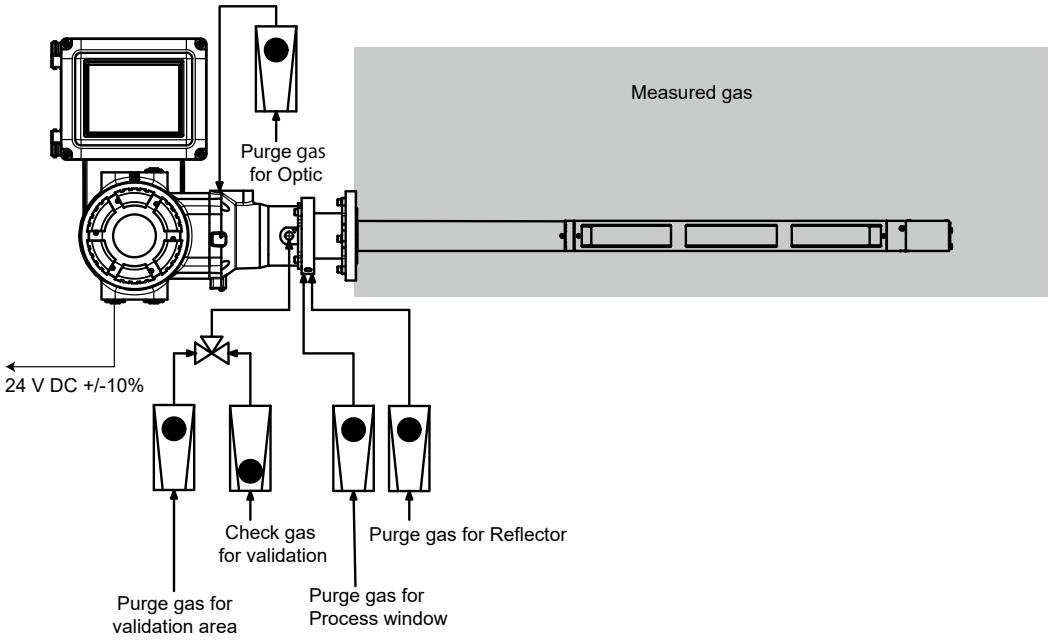
Since it can be inserted directly into the duct, the sampling equipment is unnecessary and installation cost and maintenance cost can be reduced. Moreover, it is possible to measure with high accuracy compared to other process analyzers because it is rarely affected by interference of other components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

1.1 System configuration

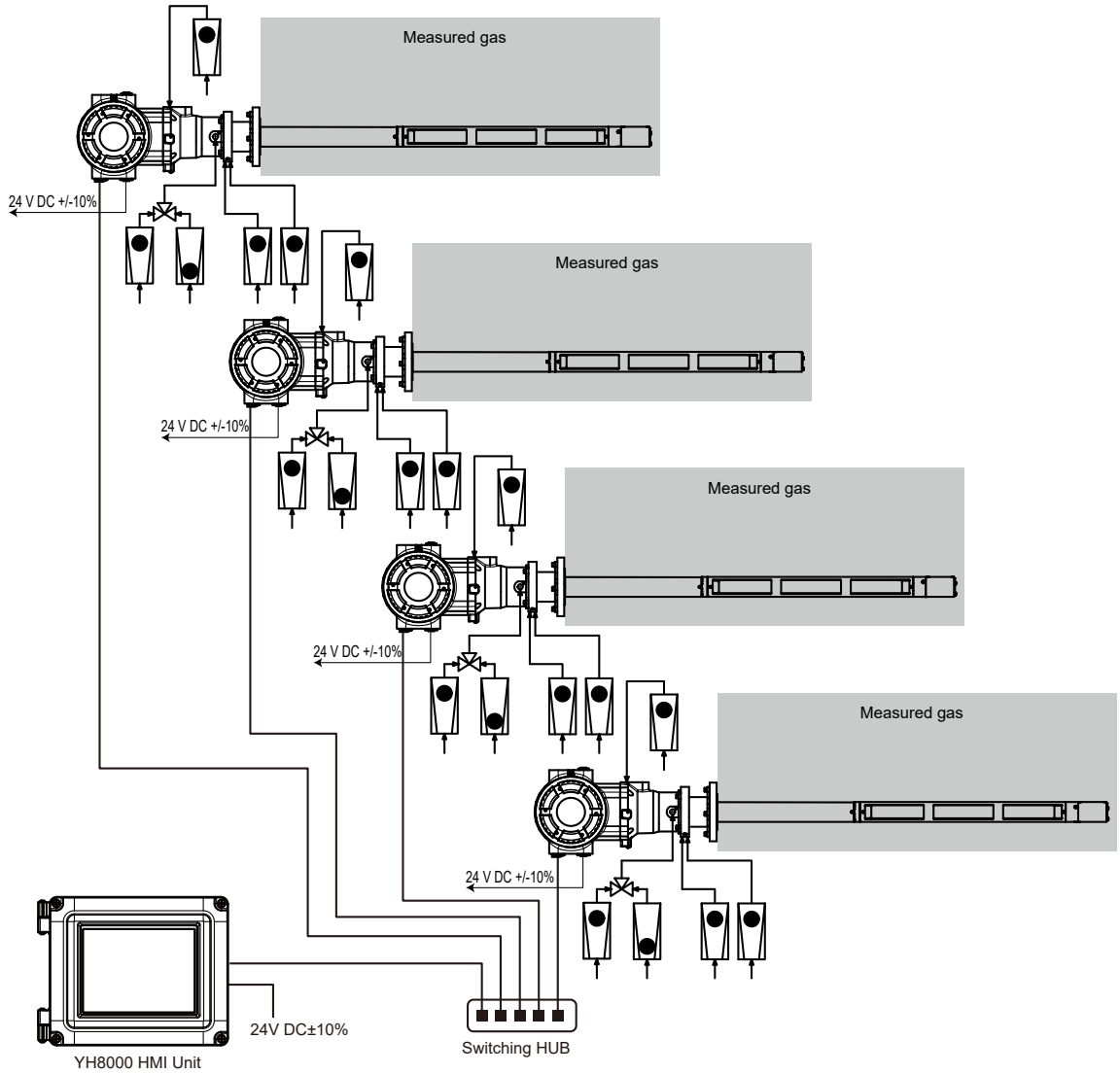
Standard System Configuration



System Configuration with YH8000 HMI Unit and Validation gas line



Multi Analyzer Configuration with Remote HMI

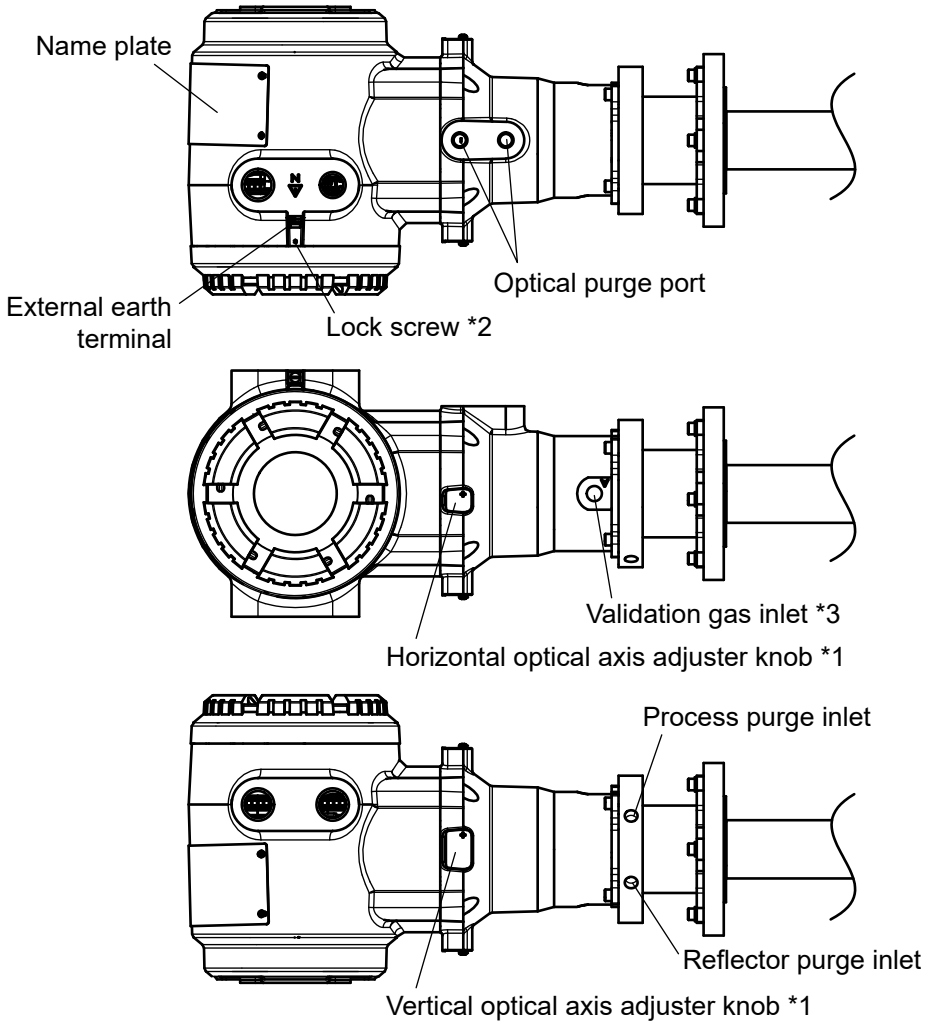


Note: If power supply is 100 to 240 V AC, power supply must be supplied by customer.
If four multi analyzer configuration with remote YH8000 HMI is made, five universal power supply including HMI are needed.

1.2 Name and Function of Each Part

TDLS8100 is composed of analyzer part and probe part.

1.2.1 TDLS8100 analyzer part

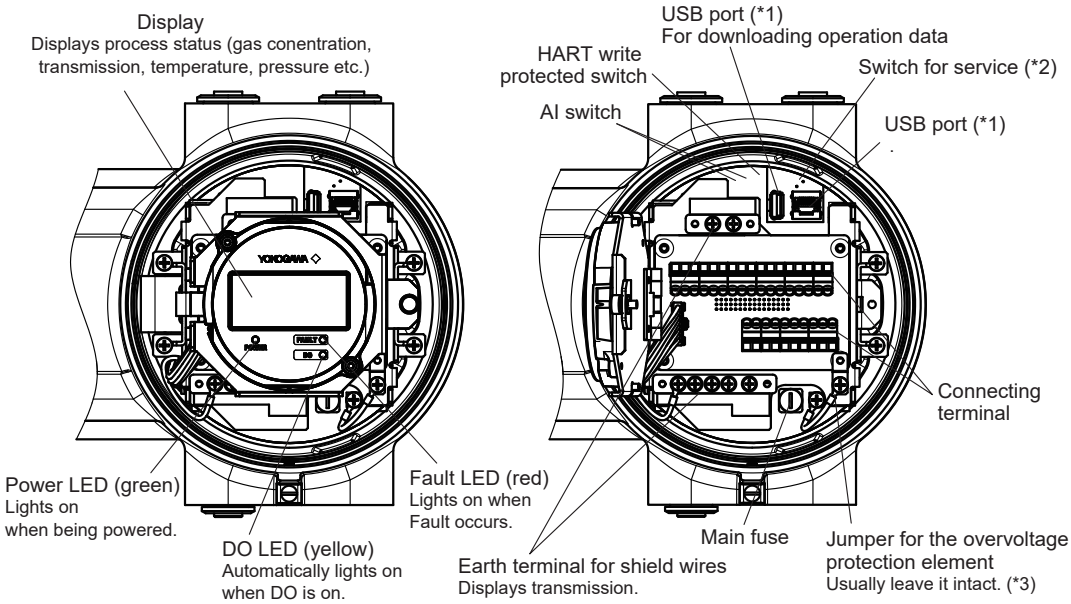


*1: Type of knob varies depending on each specification.
*2: Close the cover securely and fix it with a lock screw. Loosen the lock screw before opening the cover.
*3: Outlet is on the other side, not shown inside the figure.
NOTE
The actual positioning of each part may be different from those on the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

NOTE

Do not lose the lock screw when loosening it.

TDLS8100 inside analyzer part

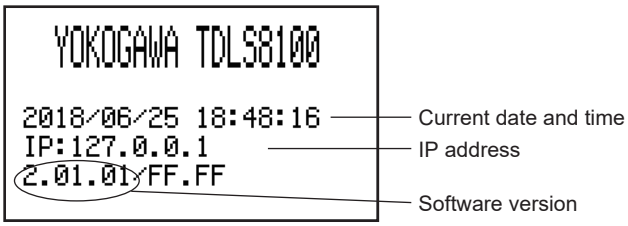


*1: On the USB port, do not plug anything except USB flash drive. For further information, see “9.13 Access to stored data in TDLS8100”.
*2: Service staff use these switches for maintenance. Leave them all OFF.
*3: The TDLS8100 is equipped with an overvoltage protection element to prevent failure caused by surges and other overvoltages. 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

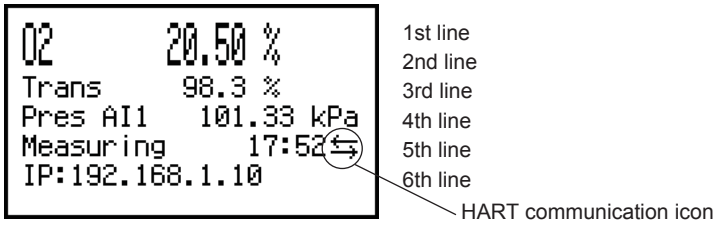
The screen below is displayed for approx. 10 seconds after power-on.



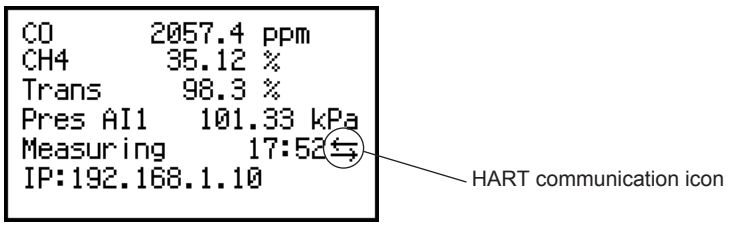
LCD starting screen

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 TDLS8100.



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 the 4th line in every analysis cycle. This means that measurement is updated whenever the content of the 4th line 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 the 1st component gas (two lines are used for the single-gas measuring specifications) (*1)</td><td>O_2 20.71%</td></tr>
<tr><td>2</td><td colspan="2">Concentration of the 2nd component gas (for double-gas measuring specifications) (*1)</td><td>CH_4 1.82%</td></tr>
<tr><td>3</td><td colspan="2">Transmission</td><td>Trans 94.6%</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>
</table>

<table>
<tr><th>Line</th><th colspan="2">Item</th><th>Display example</th></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 and validation</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>6</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>

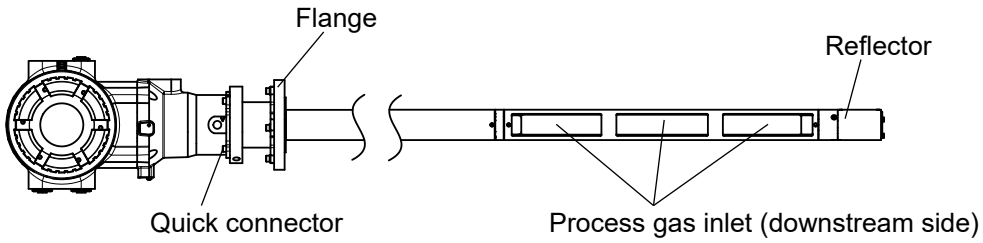
*1: Displays the invalid value “***” while the following alarms are generated. Example: 02 ***%

Number	Alarm
49	Detector signal high
50	Peak center out of range
52	Absorption too high
53	Transmission lost
56	Outlier Rejection Limit

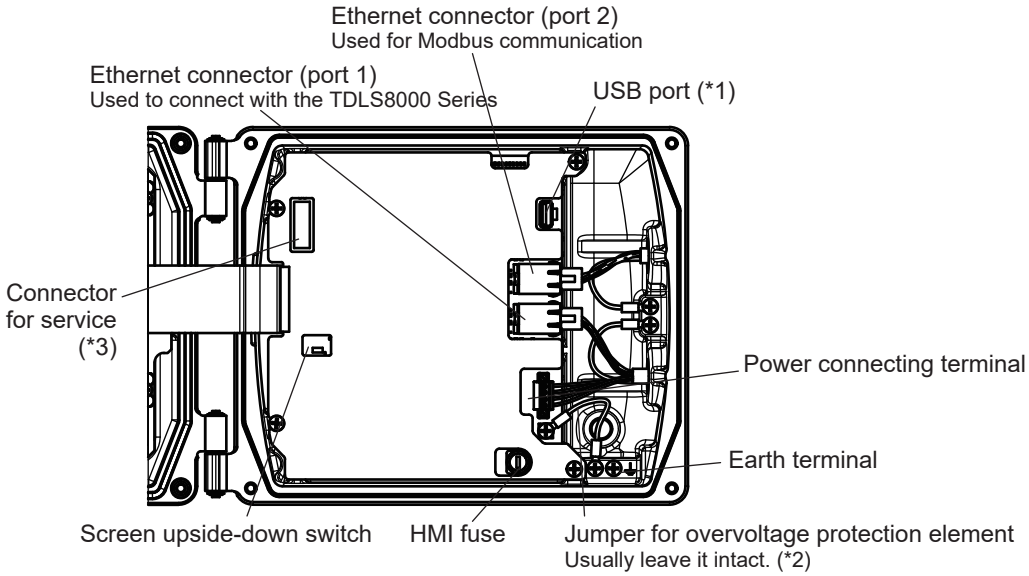
Spectrum screen

Absorption spectrum and receiving signals can be checked. Displaying the spectrum screen requires changes in the setting of the TDLS8100. See “6.9.4 Display”.

1.2.2 TDLS8100 Probe



1.2.3 YH8000 HMI Unit



*1: On the USB port, do not plug anything except USB flash drive. For further information, see “9.13 Access to stored data in TDLS8100”.

*2: The YH8000 is equipped with an overvoltage protection element to prevent failure caused by surges and other overvoltage. This element may hinder the correct measurement of insulation resistance of the power line during insulation tests. To disable this element, disconnect the jumper.

*3: Service staff use this connector for maintenance.

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2. Specifications

2.1 TDLS8100 Tunable Diode Laser Spectrometer Specifications

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	0-10000 ppm
CH_4 (*1)	0-5%	
NH_3	0-30 ppm	0-5000 ppm
HCl	0-50 ppm	0-5000 ppm

*1: Please consult with 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 sample gas is outside of the above ranges.

Safety, EMC, and RoHS conformity standards:
Safety conformity standards:
CE,UKCA EN61010-1, EN61010-2-030
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,
GB7247.1-2012, FDA 21 CFR part 1040.10,Class 1 laser product
SIL Certification:
The TDLS8100 except digital output (2 points),digital input (2 points), valve control output (2 points), and digital communications (HART, Modbus/TCP) are certified in compliance with the following standard.
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
RoHS conformity standards: EN IEC 63000:2018*
*: For only TDLS8100-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), Processgas 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: 2 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 1 (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 or validation 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 TDLS8100. 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, Semi-Auto (YH8000/HART)
Validation: Validation method; Up to 2 points
Validation mode; Manual, Auto (Time initiated, Remote initiate (DI/Modbus)), Semi-Auto (YH8000/HART)

Power supply: 24V DC +/-10%
Power consumption: Max. 20W; TDLS8100 only
Max. 60W; TDLS8100 with YH8000 and 2 solenoid valves
Protection degree: IP66, Type 4X
Material: Case; Aluminum alloy
Wetted materials: 316 SS(eq.), BK-7 glass, Teflon encapsulated FKM, ASE wool
Paint color: Mint green (RAL 190 30 15 or equivalent)
Weight (approx.): Probe part; 0.7 m 2.7 kg, 1 m 4.3 kg,1.5 m 7.0 kg, 2 m 9.8 kg
Analyzer part; explosion proof 15.7 kg,
general purpose 14.8 kg (Not include flange)
Process gas condition: Process gas temperature; Max. 600ºC, Application dependent
Process gas pressure; Max.500 kPa abs., Min. 90 kPa abs., Application dependent
Process gas velocity; over 1m/s (recommendation over 5 m/s)
Dust in process gas; When the process dust load is high, please consult with Yokogawa.

Note: When using TDLS8100 as CE 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.
ATEX model (-S1):
The upper limit of the measurement gas pressure is 500kPa abs. 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), vinylfluoride (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
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) 2 to 20L/min and 100 to 200 mL/min (explosionproof)
* Not more than 10 kPa at the inlet for explosionproof
Process window/Reflector: 5 to 30 L/min (Application dependent)

● Hazardous area classifications:

Division 1, Zone 1: Explosionproof
TDLS8100-D1 (FM Approval for US)
Division system:
Type of 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/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/ISA-12.27.01: 2011

TDLS8100-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

TDLS8100-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

TDLS8100-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

TDLS8100-K1 (Korea Ex)
Type of protection: Ex d IIC T6
Ex tb IIIC T85ºC
Enclosure rating: IP66 (In Accordance with IEC 60529)
Applicable standards: Notice of Ministry of Labor No. 2019-15
Harmonized with IEC 60079-0: 2017, IEC 60079-1: 2014,
IEC 60079-31: 2013

TDLS8100-N1 (NEPSI)
Type of protection: Ex db [op is Ga] IIC T6 Gb
Ex tD [op is 20] A21 IP6X T85ºC
Enclosure rating: IP66 (in accordance with GB/T 4208-2017)
Applicable standards: GB 3836.1-2010
GB 3836.2-2010
IEC 60079-28:2015
GB 12476.1-2013
GB 12476.5-2013

TDLS8100-J1 (Japan Ex)
Type of protection: Ex db IIC T6 Gb
Ex tb IIIC T85ºC Db
Enclosure rating: IP66 (In Accordance with IEC 60529)
Applicable standards: JNIOSH-TR-46-1:2015
JNIOSH-TR-46-2:2018
JNIOSH-TR-46-9:2018

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 temperaturecompensated 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.

2.2 Specification of other unit

2.2.1 YH8000 HMI Unit

The YH8000 is an HMI designed specifically for the TDLS8000 series. The YH8000 features an easy-to-use touchscreen 7.5 inch color LCD which can be used to display maintenance information, display alarm statuses and records, and set all parameters of the TDLS8000 series.

The YH8000 can be installed directly on the TDLS8000 series or installed remotely.
An Ethernet connection is used to connect the YH8000 to up to four TDLS8000 series simultaneously via a hub.

Display: Touchscreen 7.5 inch TFT color LCD panel, 640 x 480 (VGA)
Communication: Ethernet; RJ-45 connector
Communication speed; 100 Mbps
Case: Aluminum alloy
Paint color: Mint green (RAL 190 30 15 or equivalent)
Protection degree of enclosure: IP65, Type 4X
Window: Polycarbonate
Weight: Approx. 4 kg
Cable gland for Japan Ex; (/JA1, /JA2) Approx. 320 g/pc
Mounting: Analyzer mount (Front, left-side, right-side) with tilt function, Pipe mount, or Panel mount (Stainless steel)
Cable Entries: 1/2NPT or M20x1.5 mm, two holes
Installation conditions:
Ambient operating temperature; -20 to 55ºC
Storage temperature: -30 to 70ºC
Humidity: 10 to 90%RH at 40ºC (Non-condensing)
Power Supply: 24V DC +/-10%
Power consumption: Max.12 W

Safety, EMC, and RoHS conformity standards:
Safety conformity standards:
CE,UKCA EN61010-1
UL UL61010-1
CSA CAN/CSA-C22.2 No.61010-1
GB GB30439 Part 1
Installation Altitude: 2000 m or less
Installation category: I
(Anticipated transient overvoltage 330 V)
Pollution degree: 2, Indoor/Outdoor use
EMC conformity standards:
CE,UKCA EN55011 Class A Group 1 EN61326-1 Class A Table 2 (For use in industrial location)
RCM EN55011 Class A Group 1
KC KN11 Class A Group 1, KN61000-6-2 (Korea Electromagnetic Conformity)
RoHS conformity standards: EN IEC 63000:2018*
*: For only YH8000-G1-G2 (manufactured in Japan) and -S2
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.

● Hazardous area classifications

Division 2, Zone2: Nonincendive/Type n
YH8000-D2 (FM Approval for US)
Division system
Type of protection: Nonincendive for Class I, Division 2, Groups A, B, C, D, T5
Enclosure rating: Type 4X
Applicable standards: FM Class 3600: 2018, FM Class 3611: 2018
FM Class 3810: 2018, NEMA 250: 2003

Zone system
Type of protection:
Class I, Zone 2, AEx nA ic IIC T5 Gc
Enclosure rating: IP65
Applicable standards: ANSI/UL 60079-0:2019,
ANSI/UL 60079-11:2018, ANSI/UL 60079-15:2013
ANSI/UL 121201:2019, ANSI/IEC 60529-2004

YH8000-C2 (FM Approval for Canada)
Type of protection: Ex nA ic IIC T5 Gc
Enclosure rating: IP65, Type 4X
Applicable standards:
CAN/CSA-C22.2 No.94.2-07 (R2012),
CAN/CSA-C22.2 No.60079-0:19,
CAN/CSA-C22.2 No.60079-11:14,
CAN/CSA-C22.2 No.60079-15:16,
CAN/CSA-C22.2 No.61010-1-12,
CAN/CSA-C22.2 No.60529:05 (R2010)

YH8000-S2 (ATEX)
Type of protection: II 3 G Ex nA ic IIC T5 Gc
Enclosure rating:
IP65 (In accordance with EN 60529)
Applicable standards:
EN IEC 60079-0:2018
EN 60079-11: 2012, EN 60079-15: 2010

YH8000-E2 (IECEx)
Type of protection: Ex nA ic IIC T5 Gc
Enclosure rating:
IP65 (In accordance with IEC 60529)
Applicable standards: IEC 60079-0: 2017,
IEC 60079-11: 2011, IEC 60079-15: 2010

YH8000-J2 (Japan Ex)
Type of protection: Ex nA ic IIC T5 Gc
Enclosure rating: IP65 (In accordance with IEC 60529)
Applicable standards: JNIOSH-TR-46-1:2020
JNIOSH-TR-46-6:2015
JNIOSH-TR-46-8:2015

YH8000-K2 (Korea Ex)
Type of protection: Ex nA ic IIC T5 Gc
Enclosure rating: IP65 (In accordance with IEC 60529)
Applicable standards: Notice of Ministry of Labor No. 2021-22 Harmonized with
IEC60079-0: 2017, IEC 60079-11: 2011, IEC 60079-15:2010

YH8000-N2 (NEPSI)
Type of protection: Ex nA ic IIC T5 Gc
Enclosure rating: IP65 (In accordance with GB/T 4208)
Applicable standards: GB3836.1-2010,
GB3836.4-2010,
GB3836.8-2014

YH8000-R2 (EAC)
Type of protection: 2Ex nA ic IIC T5 Gc X
Enclosure rating: IP65 (In accordance with GOST 14254)
Applicable standards: GOST 31610.0-2014
GOST 31610.15-2014
GOST 31610.11-2014

YH8000-U2 (INMETRO)
Type of protection: Ex nA ic IIC T5 Gc
Enclosure rating: IP65
Applicable standards: ABNT NBR IEC 60079-0:2020
ABNT NBR IEC 60079-11:2013 Versão Corrigida:2017
ABNT NBR IEC 60079-15:2019

2.2.2 Calibration Cell

Used for off-line calibrations and validations.

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

2.3 Model and Codes

- **TDLS8100 Probe Type Tunable Diode Laser Spectrometer**

Model	Suffix Code	Option Code	Description
TDLS8100	.....	.....	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 explosionproof, cable entry:Metric thread, piping: Rc (*6)
Temperature	**-L**	.....	Standard < 600 °C
Gas Parameter	**-X1**	.....	O_2 < 600°C, 0-25% (*1)
	-C2	.....	CO ppm <500°C (*2)
	-C3	.....	CO ppm <600°C for combustion (*2)
	-C4	.....	CO ppm <500°C or CH_4 0-5%. for combustion (*2)
	-A1	.....	NH_3 up to 0-5,000 ppm <450°C DeNOx
	-L1	.....	HCl 0-50ppm/0-5,000 ppm <500°C
—	**-NN**	.....	Always -NN
Probe length	**-070**	.....	0.7m
	-100	.....	1m
	-150	.....	1.5m
	-200	.....	2m
Probe material	**-S**	.....	316SS
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.)
	-J5	.....	JIS 10K-50-FF(Eq.)
	-J8	.....	JIS 10K-80-FF(Eq.)
I/O interface	**-A1**	.....	Analog with HART + Modbus Ethernet
SI Unit	**-J**	.....	Only SI unit
	-N	.....	SI unit or non SI unit (*3)
—	**-N**	.....	Always -N
Option		**/RX**	Reference Cell for O_2 (*4)
		/RC	Reference Cell for CO (*5)
		/SCT	Stainless Steel Tag Plate
		/SIL	With IEC61508 SIL2 (SC3)
		/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: When the process gas pressure is out of 90 to 130 kPa (abs.), please contact YOKOGAWA.
*2: When CO and CH_4 ingredient coexist, please contact YOKOGAWA.
*3: Enable only to an end user located outside of Japan
*4: The Option "/RX" can be used when Gas Parameter "-X1" is selected.
*5: The Option "/RC" can be used when Gas Parameter "-C2", "-C3" or "-C4" are selected. When both "-C3" or "-C4" of the Gas Parameter is selected, "/RC" must be specified.
*6: For Japan Ex model (TDLS8100-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.

YH8000 HMI Unit

Model	Suffix Code	Option Code	Description
YH8000	.....	.....	HMI Unit
Type	**-G1**	.....	General Purpose, NPT thread for cable entry
	-G2	.....	General Purpose, Metric thread for cable entry
	-GR	.....	EAC General Purpose, Metric thread for cable entry
	-D2	.....	FM (US) Class I Div 2, Zone2, NPT thread for cable entry
	-C2	.....	FM (Canada) Class I Zone2, NPT thread for cable entry
	-S2	.....	ATEX Type of protection “n”, Metric thread for cable entry (*3)
	-E2	.....	IECEx Type of protection “n”, Metric thread for cable entry
	-J2	.....	Japan Ex / Zone 2, Metric thread for cable entry (*2)
	-K2	.....	Korea Ex Type of protection “n”, Metric thread for cable entry
	-N2	.....	NEPSI Type of protection “n”, Metric thread for cable entry
	-R2	.....	EAC Type of protection “n”, Metric thread for cable entry
	-U2	.....	INMETRO Type of protection “n”, Metric thread for cable entry
Language	**-E**	.....	English and 9 languages (*1)
—	**-N**	.....	Always -N
Option		**/M**	Mounting kit for TDLS8000 series
		/P	Pipe mount
		/W	Wall mount
		/S	Sun Shield
		/C	Local HMI connection cable: 3m
		/SCT	Stainless Steel Tag Plate
		/JA1	Cable gland for Japan Ex (Cable O.D. 8-12mm, G1/2), 1 pc (*2)
		/JA2	Cable gland for Japan Ex (Cable O.D. 8-12mm, G1/2), 2 pc (*2)

*1: These languages are message languages on the display.
One analyzer has English and 9 languages.
All languages are as follows; English, German, French, Spanish, Portuguese, Russian, Hungarian, Korean, Chinese and Japanese.

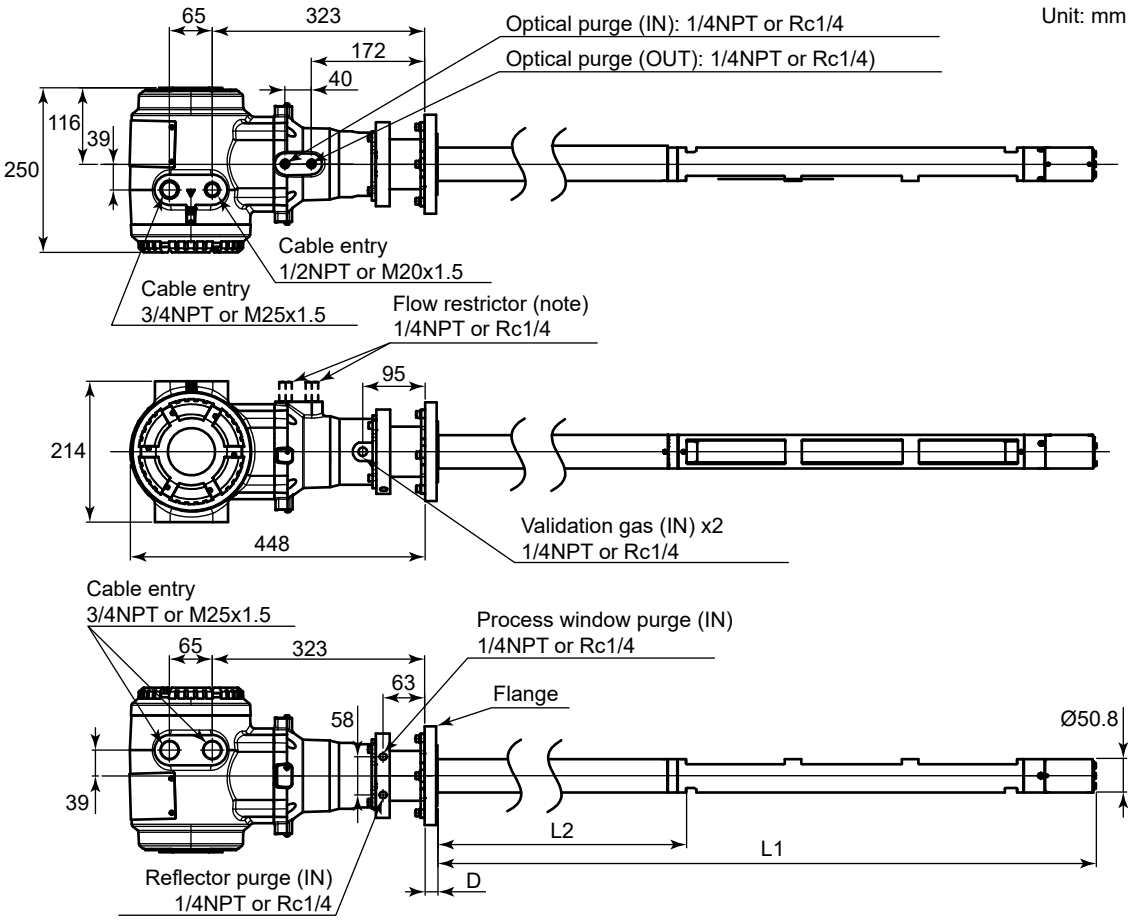
*2: For Japan Ex/Zone 2 certified model (YH8000-J2), specified cable glands shall be attached to each cable entry for wiring.
For detailed information, refer to Japanese General Specifications (GS 11Y01D01-01JA).
The Option “/JA1” and “/JA2” can be used only when Japan Ex/Zone 2 certified model (YH8000-J2) is selected.
If “/JA1” or “JA2” is necessary for other model, please contact Yokogawa.

*3: This model is available for UKCA.

2.4 External Dimensions

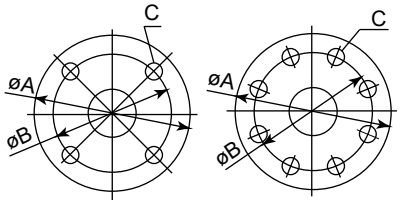
■ TDLS8100 Probe Type Tunable Diode Laser Spectrometer

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

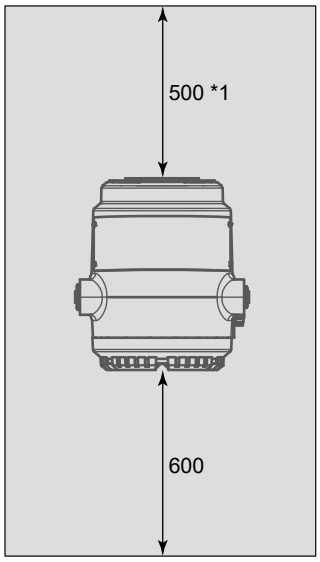


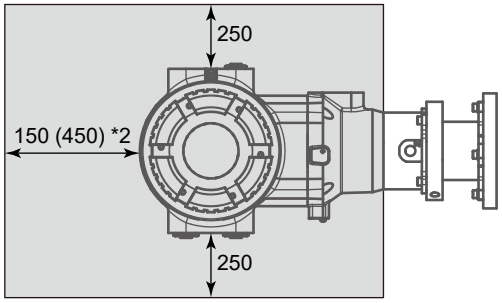
Flange

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

Maintenance space

Unit: mm

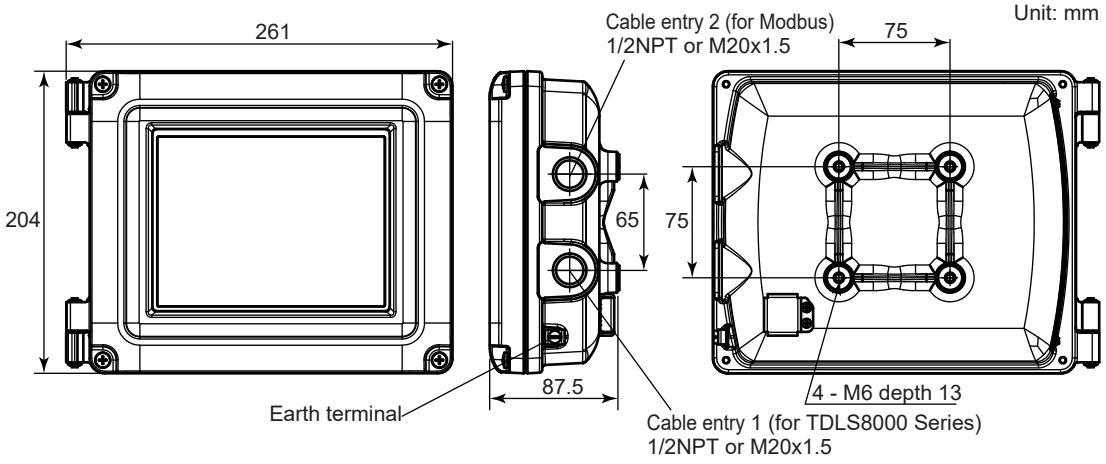




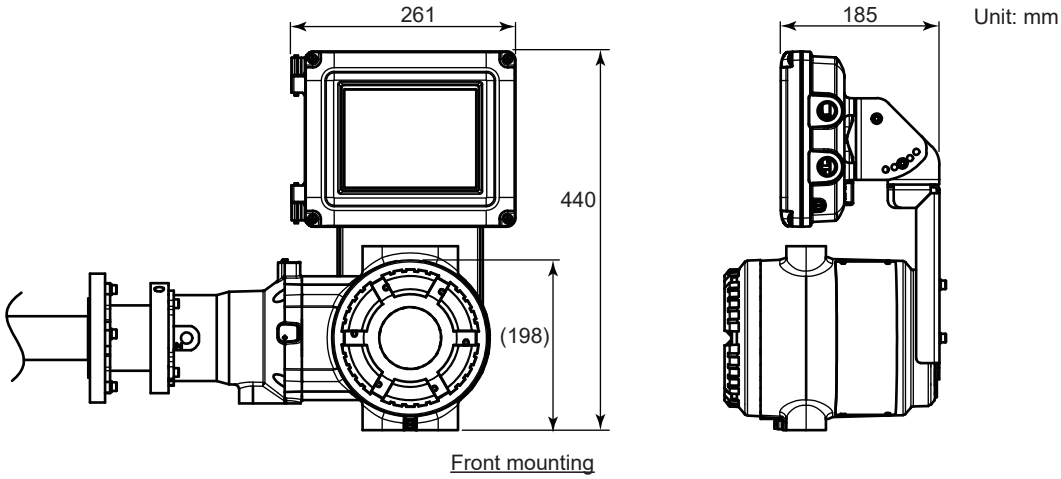
*1: When installing YH8000 on TDLS8100 with /M, it is necessary to secure this space.
*2: When connecting the calibration cell, it is necessary to secure this space. If install or uninstall of probe, need the additional space depend on probe length.

YH8000 HMI Unit

Unit: mm

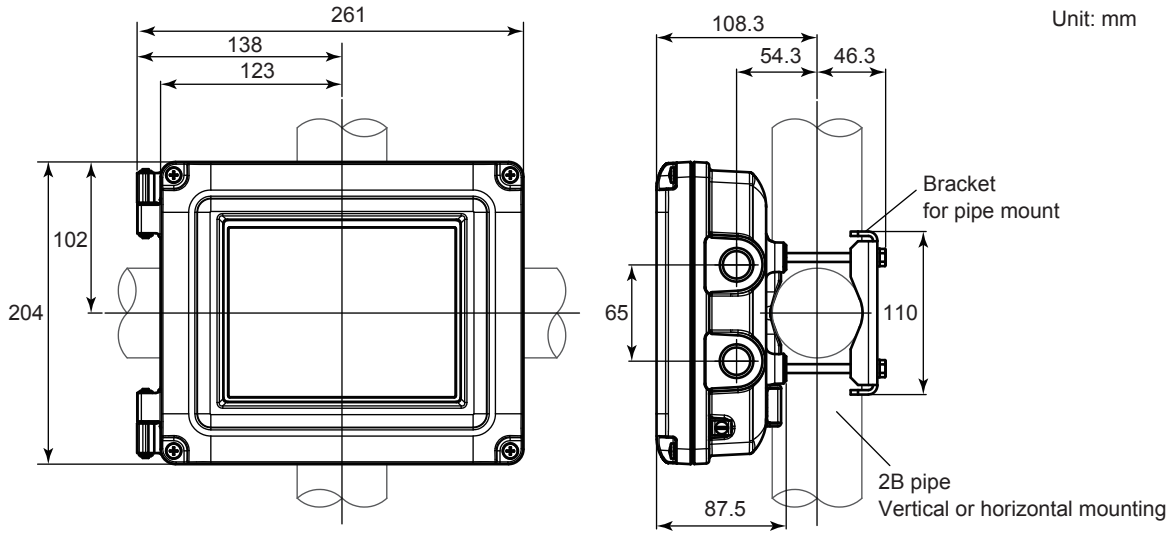


Mounting kit for TDLS8100 (Option code: /M)



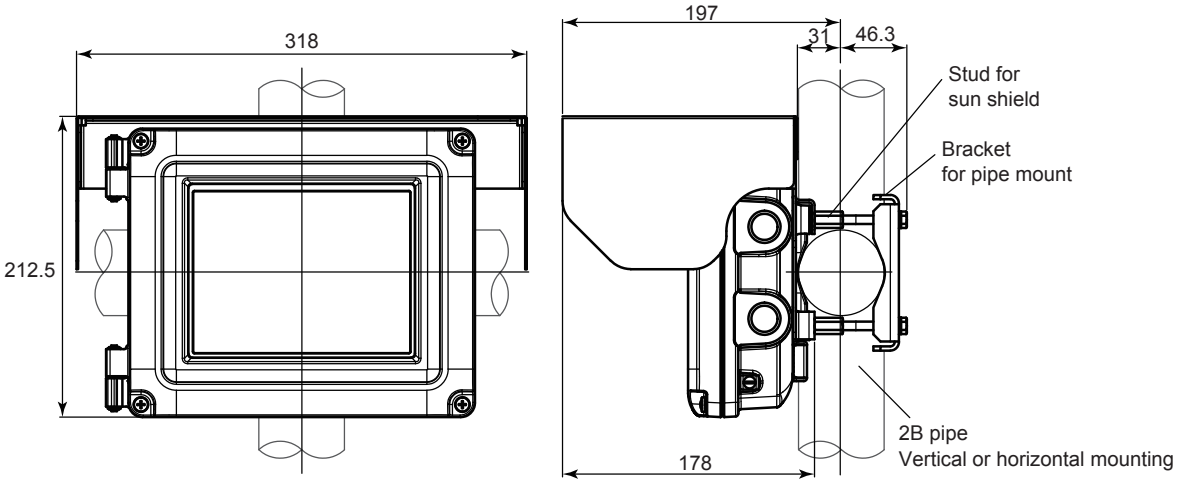
Available for left mounting

Pipe mount (Option code: /P)



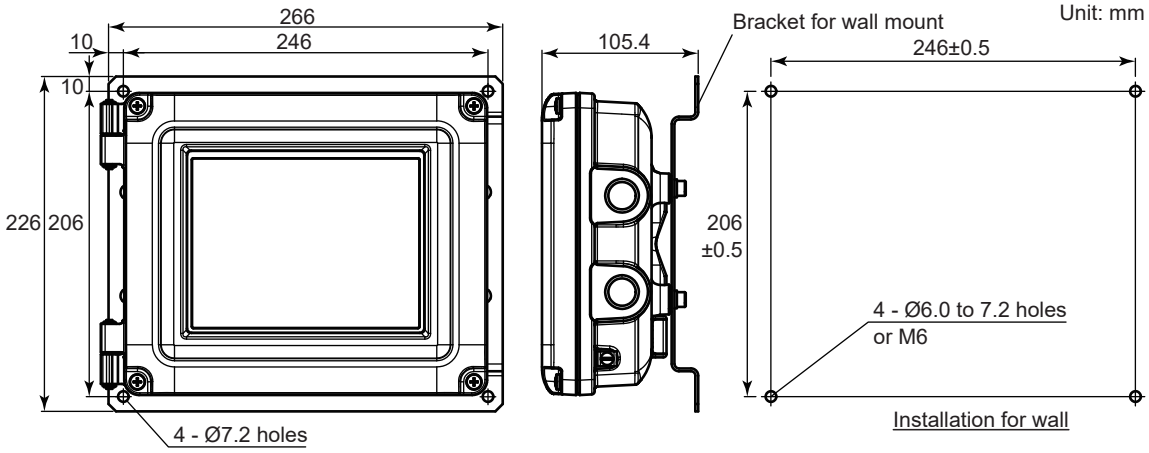
Sun Shield (Option code: /S)

Unit: mm



● Wall mount (Option code: /W)

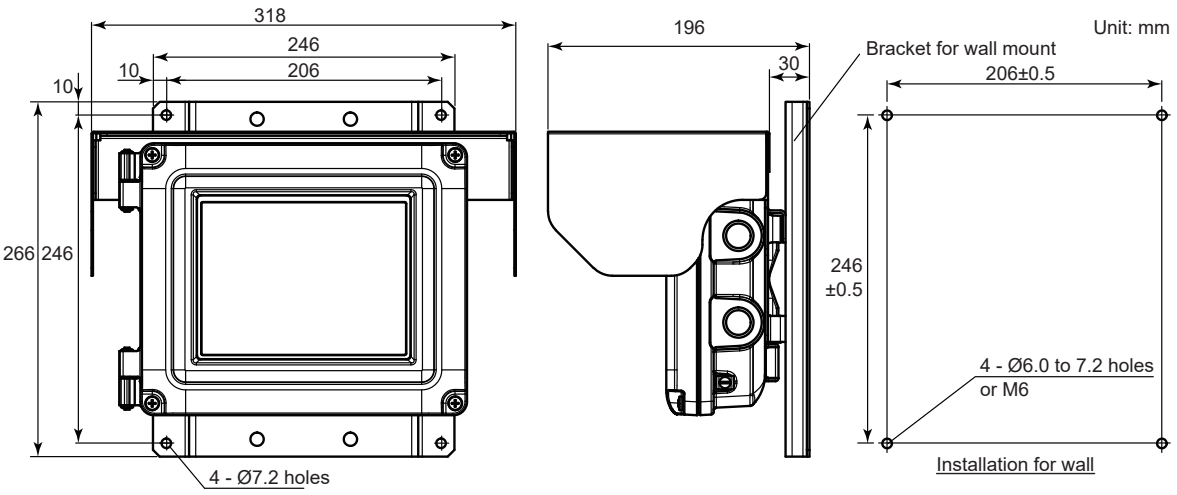
Unit: mm



*: The wall construction for mounting has to be designed for 4 times the weight of the YH8000.
Bracket for wall mount can be placed in lengthwise

Sun Shield (Option code: /S)

Unit: mm

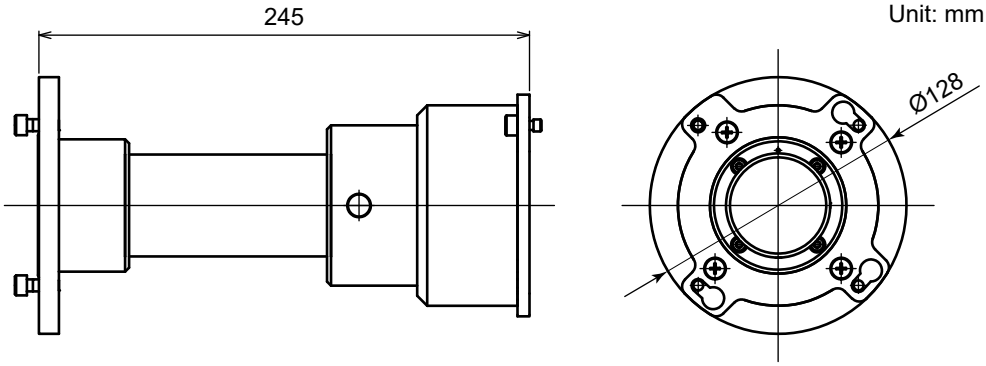


When the sun shield is mounted, the bracket for wall have to be placed in widthwise.

Calibration Cell

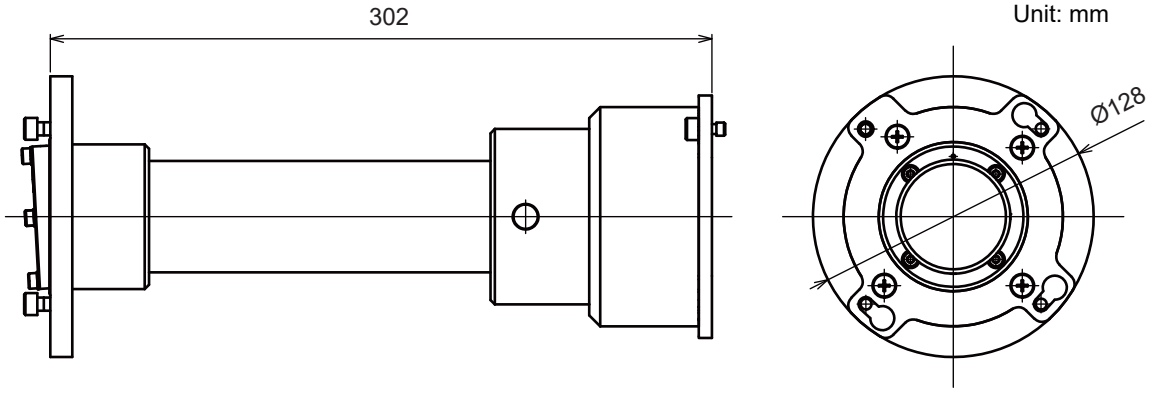
Part number: K9777ZA

Unit: mm



Part number: K9777ZK, K9777ZL

Unit: mm



3. 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.

3.1 Installation

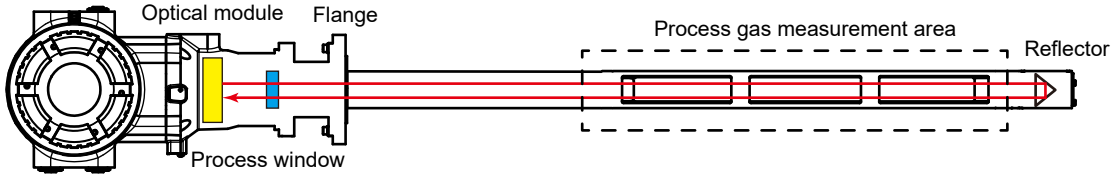
The TDLS8100 uses laser beam.

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 TDLS8100 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 “2.4 External Dimensions” to install the product. Reserve enough maintenance space where you can adjust the optical axis.

● Installation conditions

Install the product in a location that meets the conditions indicated in “2.1 TDLS8100 Tunable Diode Laser Spectrometer Specifications”.

Note the following points.

- Process window purge protects the TDLS8100 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 in the inside of the alignment flange 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 TDLS8100’s process window corrodes, the inside of the TDLS8100 will also corrode, causing the TDLS8100 to malfunction. Set the purge gas flow rate appropriately to keep corrosive gas from entering the process window area or inside the alignment flange.

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

3.1.1 Measurement Point Selection

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 TDLS8100 in a location with minimal process gas temperature fluctuations.

If the gas temperature fluctuation where the TDLS8100 is installed exceeds ±10 °C, connect an external thermometer to the TDLS8100 temperature input terminal and enter the actual measured gas temperature to obtain correct measurements (for details, see “6.1.3 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 TDLS8100 in a location with minimal pressure fluctuations.

If the gas pressure fluctuation where the TDLS8100 is installed exceeds ±5 kPa, enter the pressure signal from a separately applied process pressure meter to obtain correct measurements (for details, see “6.1.2 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 TDLS8100 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 TDLS8100 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 TDLS8100 at a location with minimum fluctuation of flow rate, otherwise it may result in the deviation of the measurement result.

- **Probe and process gas**

  Install TDLS8100 so that the probe side with wider opens can face downstream of process gas flow.

3.1.2 Constructing Process Flanges

Please prepare your own process flanges.

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 3.1 shows an example of welding reinforcing plates. Provide a secure platform to install the TDLS8100 on at your discretion.

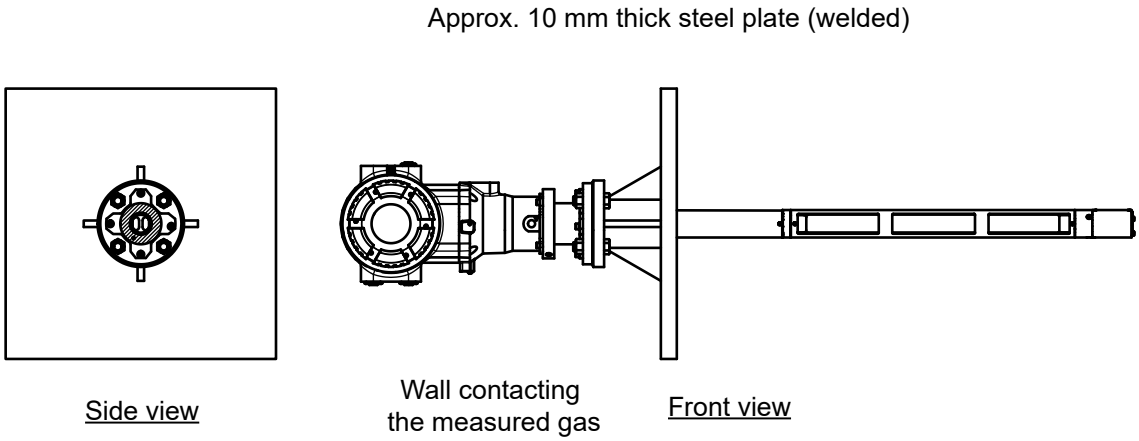


Figure 3.1 Reinforcing plate for LU and SCU process flanges

3.1.3 Probe direction

To introduce process gas to TDLS8100 probe, install TDLS8100 so that the probe openings can face downstream of process gas flow.

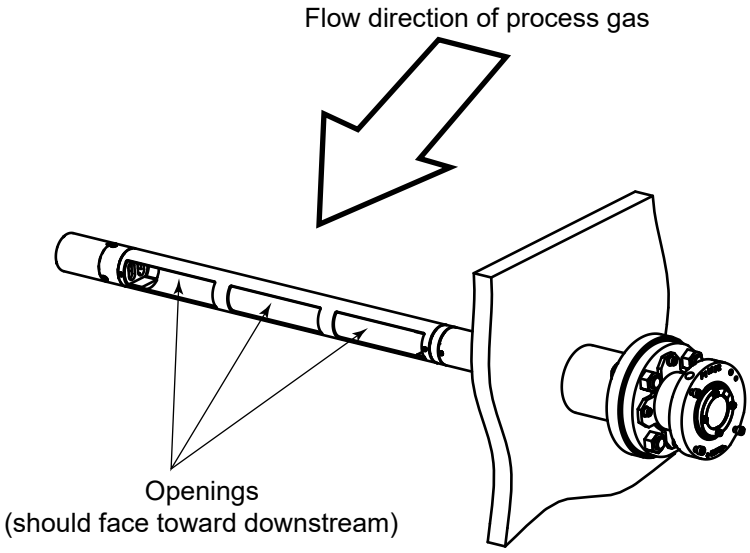


Figure 3.2

TDLS8100 indicator or probe are assembled according to each customer's specification. If you need to change the orientation of the indicater or probe opening, consult Yokogawa service.

3.1.4 Installation of TDLS8100 to the process flange

This section explains how to mount TDLS8100 in the pre-shipping condition directly on process flange

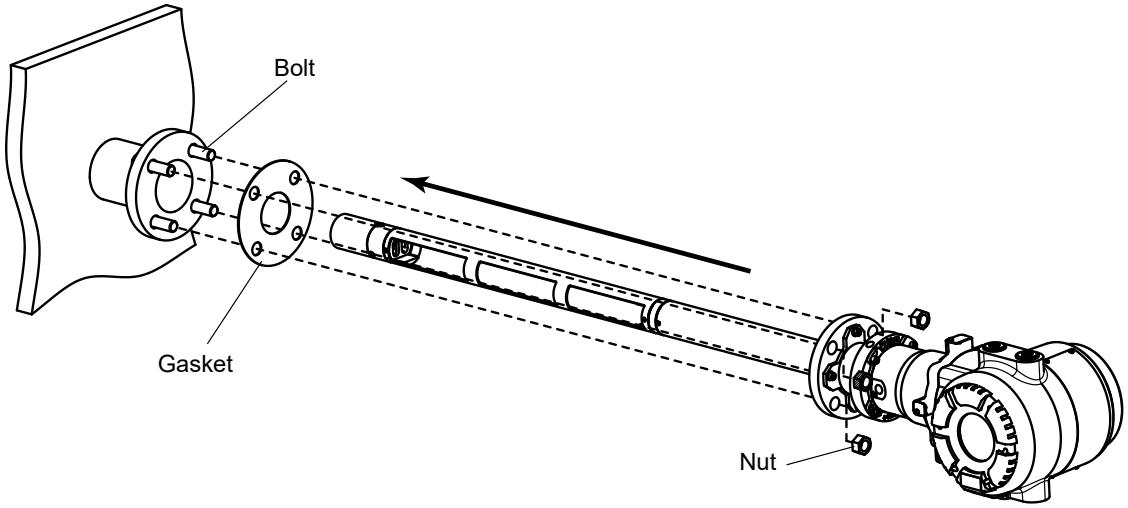


Figure 3.3 How to mount TDLS8100 to process flange

Install the TDLS8100 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

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

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.

3.1.5 Installation of Analyzer part and probe on to the process flange

TDLS8100 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 “2.4 External Dimensions”.

CAUTION

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

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

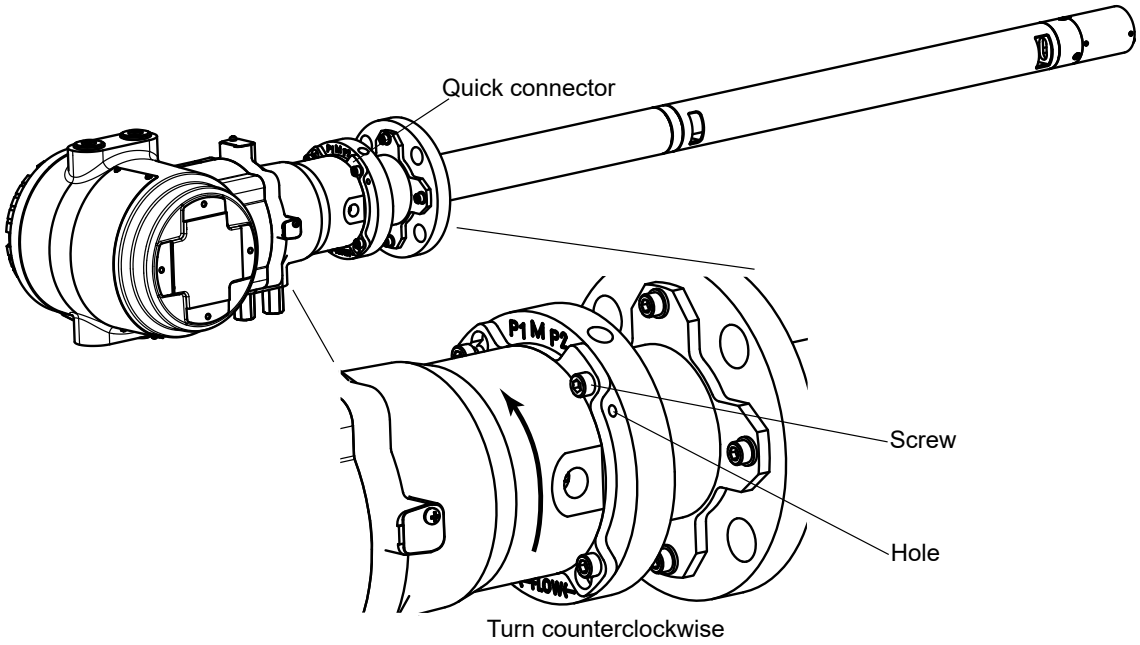


Figure 3.4 Detaching probe from analyzer part

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

TDLS8100 analyzer part and probe part can be detached and be mounted separately onto the process flange. See "1.1 System configuration" and "2.4 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.

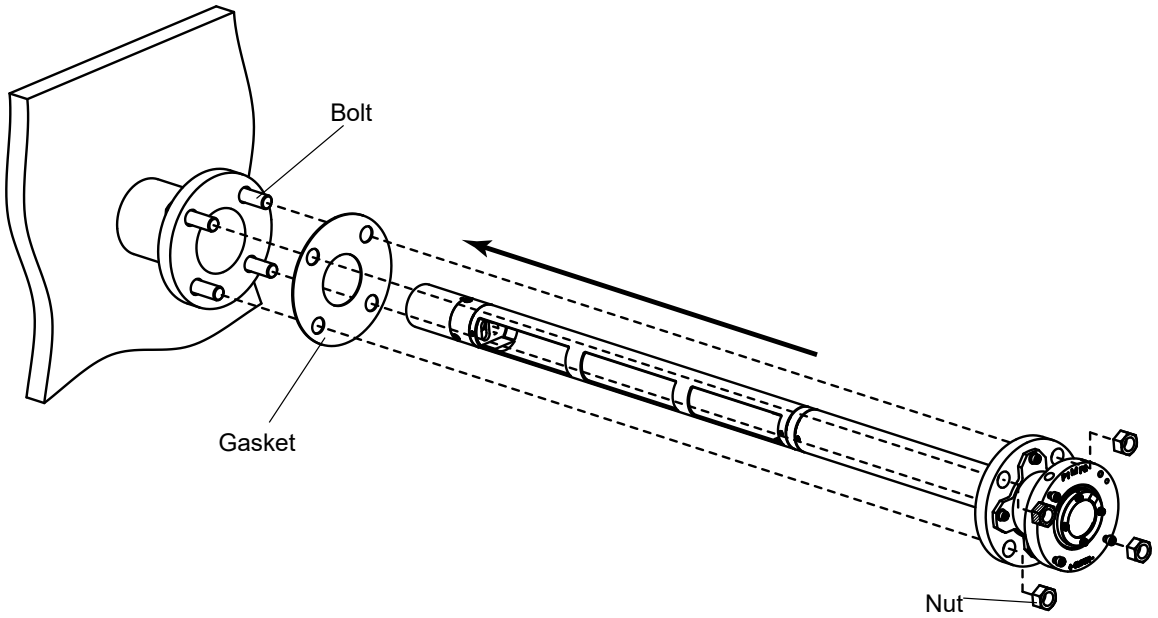


Figure 3.5 Installation of probe part

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.

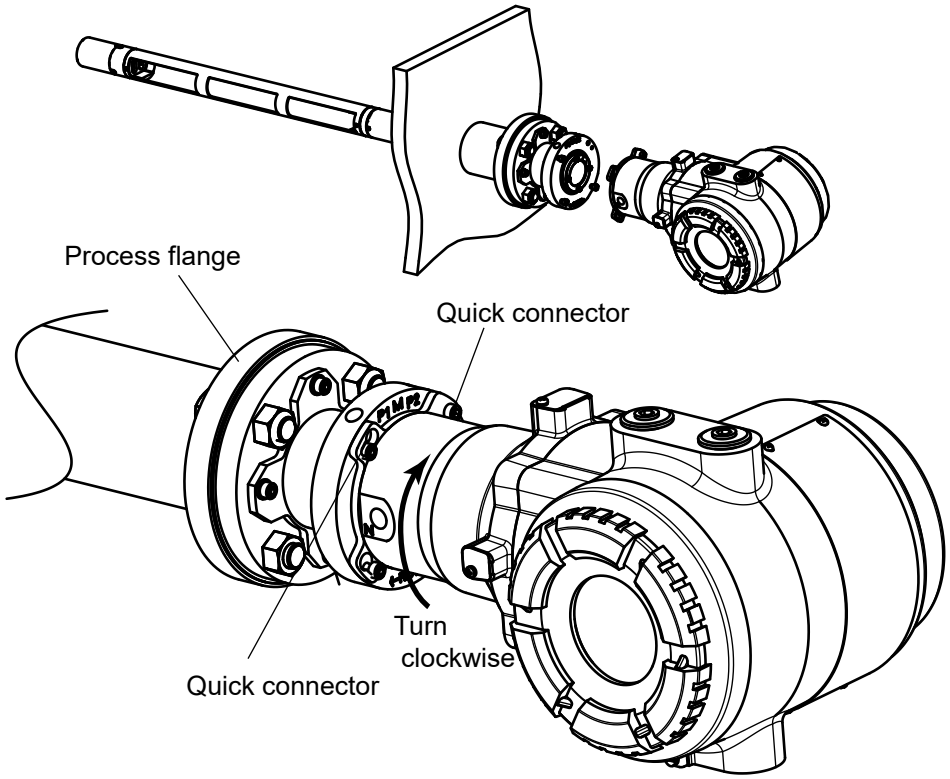


Figure 3.6 How to mount analyzer part

3.2 Wiring

When the installation is complete, wire the TDLS8100 and external devices.
YH8000 wiring is explained in “4. YH8000 Installation”.

■ 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 TDLS8100 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.

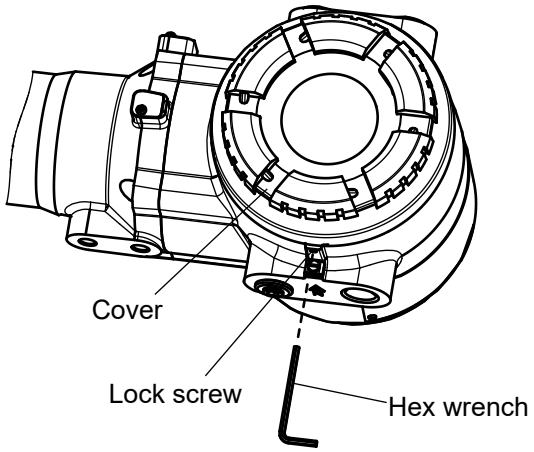


Figure 3.7 Open/Close of cover

CAUTION

Never turn on the power to the TDLS8100 or the devices connected to the TDLS8100 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 TDLS8100.

(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 3-11 “n Types of Wiring and Cabling”.

(6) Wire each shielded cable for power supply, I/O or YH8000 dedicated cable to functional ground terminal for shields. Then, attach the ferrite clamp on the shield cables. For further information, see “3.2.8 Attaching ferrite clamp”.

(7) 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.

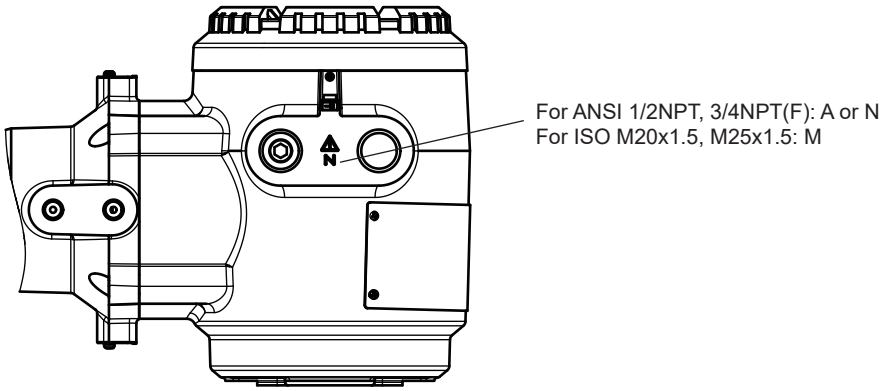


Figure 3.8 Inscribed thread identification

Attach conduits and cable glands with the appropriate screw size to the TDLS8100 cable entries.

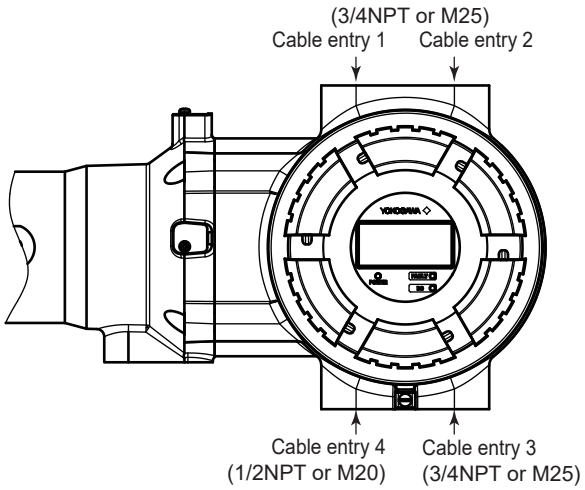


Figure 3.9 Cable entries

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

TDLS8100 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 (POWER, VO[HMI]) or solenoid valve control output terminals (SV-1, 2) can damage the TDLS8100 or the devices connected to the TDLS8100.

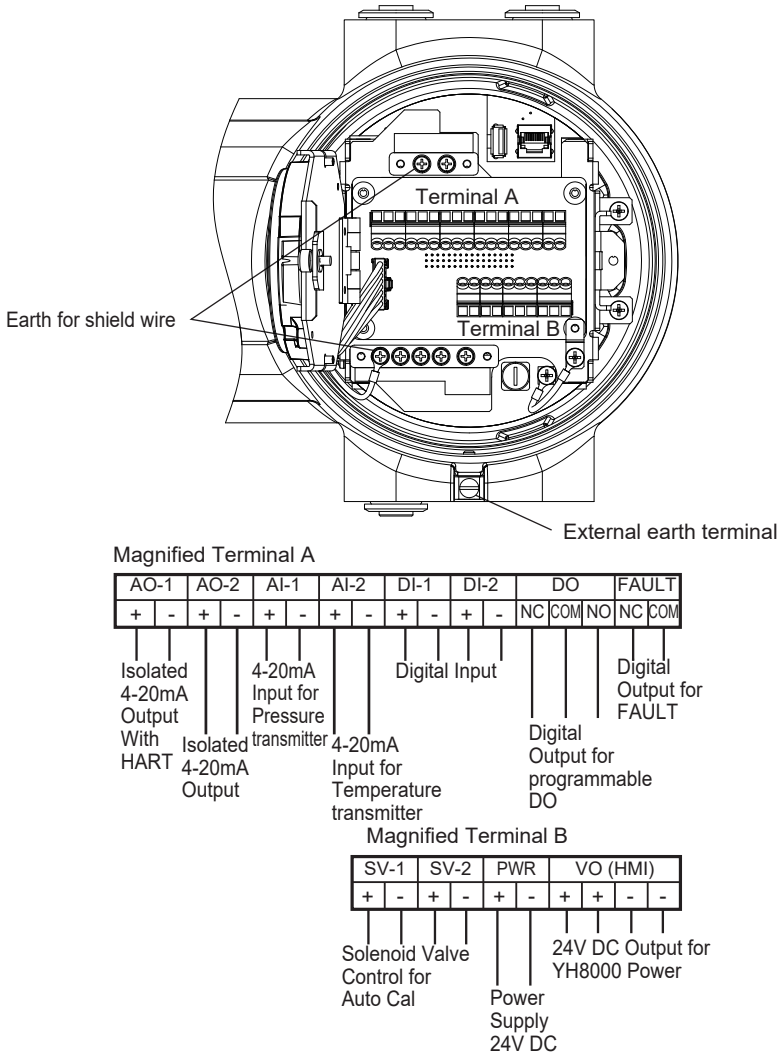


Figure 3.10 TDLS8100 wiring

Table 3.1 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-	
	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-	
	POWER+	Power supply. 24 V DC ± 10%
	POWER-	
	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 70 °C.

In the case of construction -C1, -D1, -E1, -S1, use cables with a durable temperature of at least 75°C when ambient temperature exceeds 40°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 3.2 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: Shield: M4 screw crimp-on terminal	500 V or more VW1	3.2.1
	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: Shield: M4 screw crimp-on terminal	500 V or more VW-1 or more	3.2.2 to 3.2.6
4	YH8000 connection cable	Special cable (YH8000 option) AWG24 4 pairs Covering outer diameter approx. 8.4 mm	Required	Wire: Shield: M4 screw crimp-on terminal	500 V or more FT-4	4
	Ethernet cable	CAT.5e AWG24 4 pairs 100 m max.	Required	Wire: Shield: M4 screw crimp-on terminal	VW-1 or more	3.2.7
Functional ground terminal (external)	Functional grounding	AWG16 or more	Not required	M5 screw crimp-on terminal		3.2.1

Use cables with outer diameters that match the conduits or cable glands that you are using.

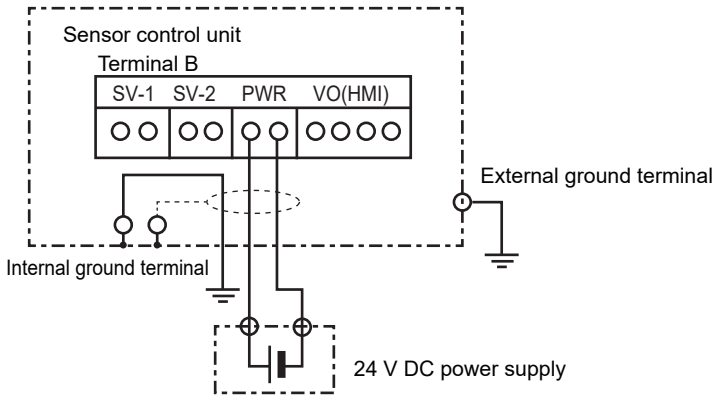
3.2.1 Connecting the Power Cable and Grounding

CAUTION

Connect the power supply wires to the correct locations and don't reverse polarity.
Incorrectly connecting the power supply can cause the TDLS8100 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 TDLS8100 side and on the other side.



3.2.2 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 “6.3 Analog Input Settings”.

Connection Preparation

To supply power to the transmitters from the TDLS8100, 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 TDLS8100
AI-1 (pressure signal)	SW1	Passive AI	Active AI
AI-2 (temperature signal)	SW2	Passive AI	Active AI

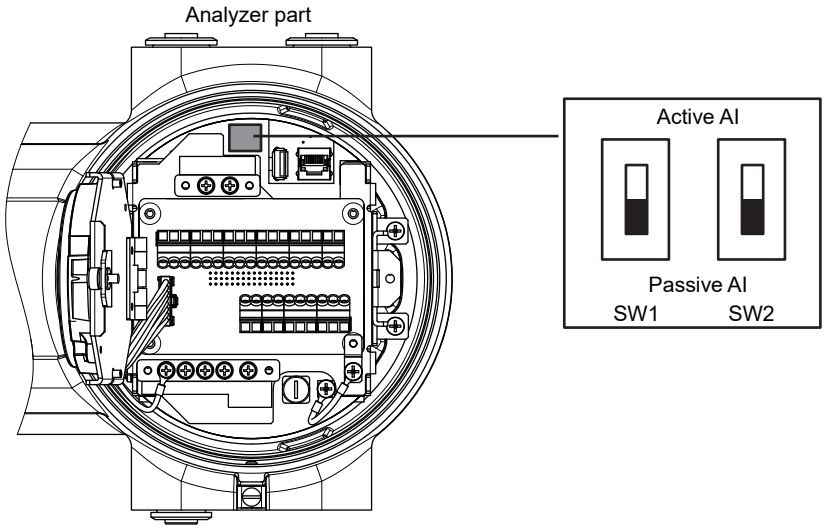


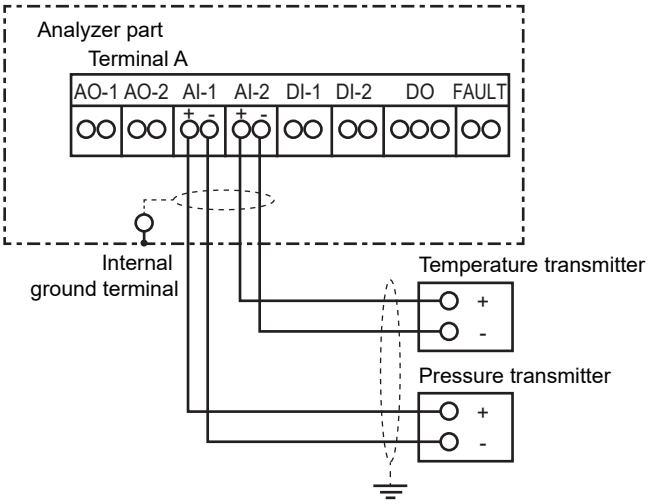
Figure 3.11 SW1 and SW2 settings

CAUTION

To avoid damages on devices, be sure to check that the TDLS8100 is turned off before setting SW1 or SW2.

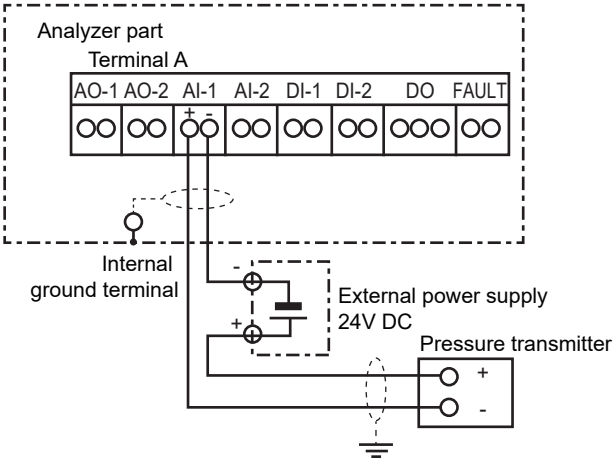
■ Connecting a Pressure Meter and Thermometer

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 "■ Types of Wiring and Cabling".
- Be sure to ground the cable shield on the TDLS8100 side and on the other side.
- When supplying power to the transmitters from the TDLS8100, take into account the drop in the transmitter supply voltage due to wiring resistance and the like.

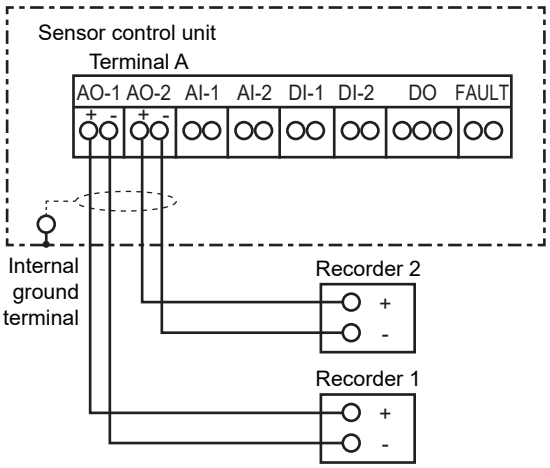
CAUTION

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

3.2.3 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 “6.4 Analog Output Settings”.



Wiring procedure

- For the cable type to use, see "■ Types of Wiring and Cabling".
- Be sure to ground the cable shield on the TDLS8100 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.

3.2.4 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 “6.5 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>

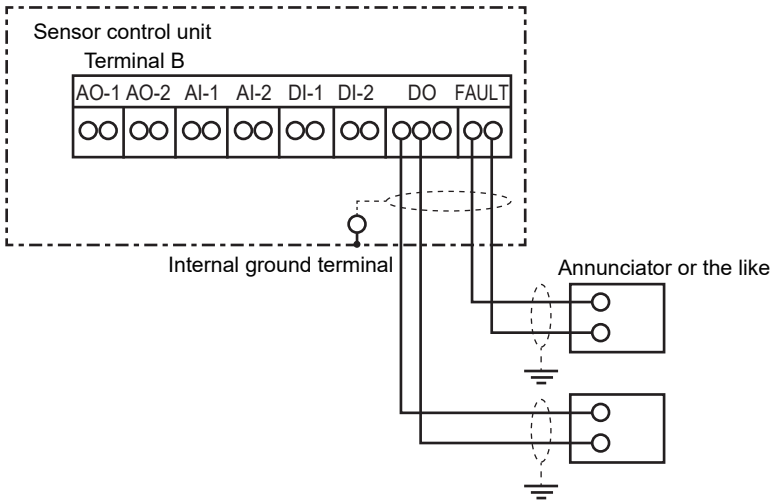
Contact state	State between the NO and COM terminals	State between the NC and COM terminals
Power off	Open	Closed
Output on	Closed	Open
Output off	Open	Closed

● 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



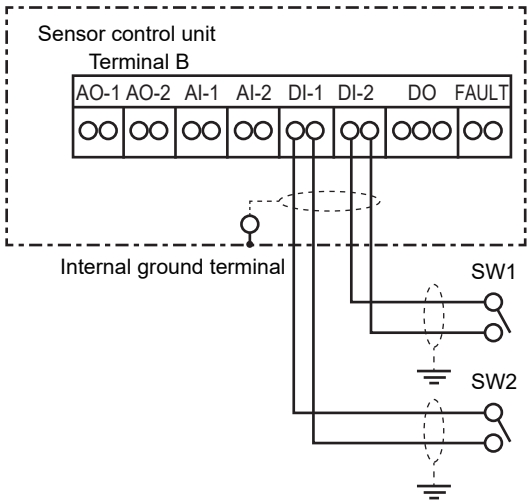
● Wiring procedure

- For the cable type to use, see 3-11 “■ Types of Wiring and Cabling”.
- Be sure to ground the cable shield on the TDLS8100 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.

3.2.5 Wiring Digital Inputs

The TDLS8100 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 “6.7 Digital Input Settings”.



Wiring procedure

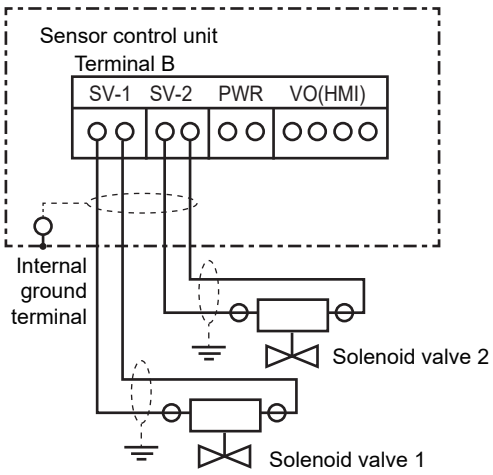
- For the cable type to use, see “■ Types of Wiring and Cabling”.
- Be sure to ground the cable shield on the TDLS8100 side and on the other side.
- The open and closed levels of the digital inputs are identified by the resistance seen from the TDLS8100 side. Wire the digital inputs to meet the following 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

3.2.6 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, see 3-11 "■ Types of Wiring and Cabling".
- Be sure to ground the cable shield on the TDLS8100 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.

3.2.7 Connecting an Ethernet Cable

NOTE

Reception of numerous invalid packets may affect the TDLS8100 functionality.
When connecting the TDLS8100 to a network, manage the network appropriately.

If you want to connect the TDLS8100 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 TDLS8100 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.

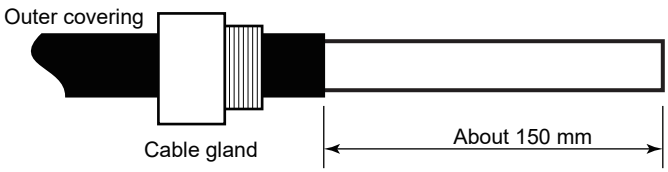
- Use an eight-core CAT 5e shielded cable for the Ethernet cable.
  Use a braided wire type shield. If the shield is a metallic foil type, the shield may not be properly grounded.
  Use a cable with straight wiring.
- Use a cable gland with a cable diameter specification that matches the outer diameter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

RJ45 modular plug	
RJ45 modular plug crimp tool	
LAN cable tester	
Wire cutter	
Wire stripper	
Round crimp-on terminal (for shielded wires)	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
Crimp tool for round crimp-on terminals	
Heat shrink tube	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
Heating gun	For shrinking heat shrink tubes

● Processing an Ethernet cable

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

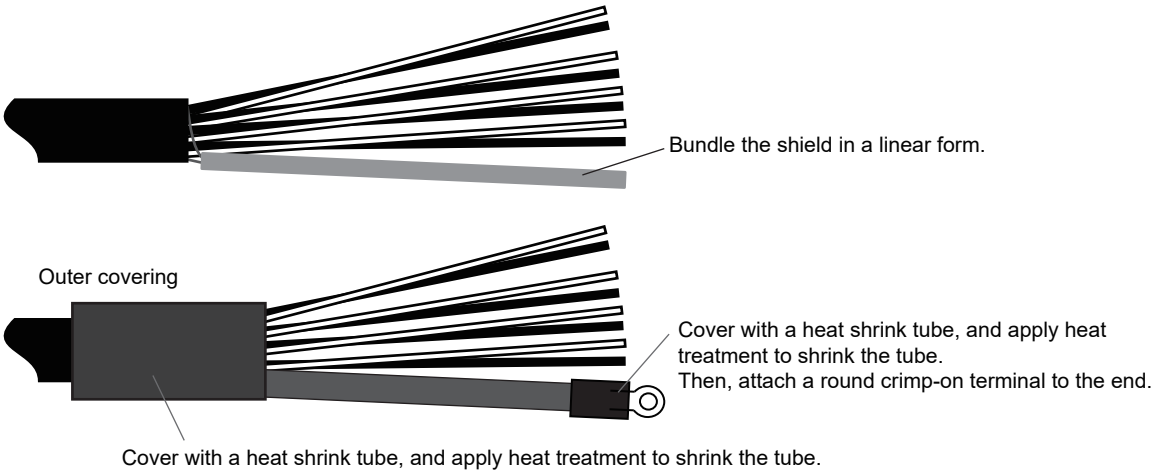
(2) Remove about 150 mm of covering from the shielded Ethernet cable.
Be careful not to cut off the shield.



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

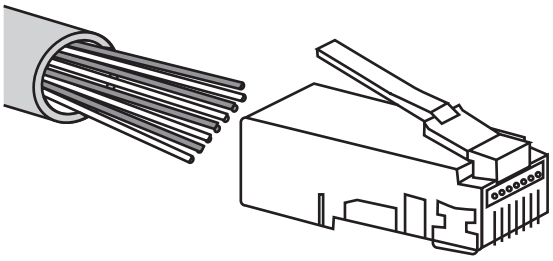
Then, attach a round crimp-on terminal to the end of the shield.

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



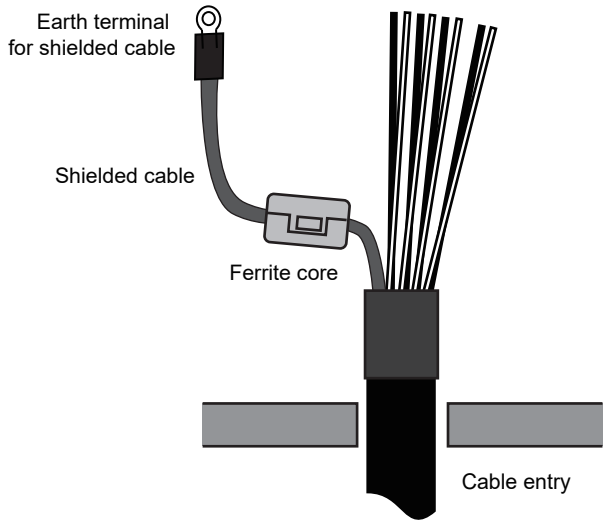
Insert the wires in the correct arrangement into the RJ45 modular plug, check that the wires are firmly inserted, and then crimp the plug with a RJ45 modular plug crimp tool.

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 TDLS8100 Ethernet port and the round crimp-on terminal at the end of the shielded wire to the functional ground terminal (M4 screw) inside the SCU.

3.2.8 Attaching ferrite clamp

Attach the supplied ferrite clamp to each shielded cable for power cable, I/O signal cable, YH8000 dedicated cable.



3.3 Optical Axis Adjustment

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

CAUTION

The TDLS8100 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 TDLS8100 laser unit emits laser beam from the analyzer part as soon as the power is turned on. Turn the power on after installing TDLS8100 probe or calibration cell in a condition where the laser beam is not irradiated outside the process.

TDLS8100 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 TDLS8100 installation at site. If the transmission falls below 70%, check again that the installation according to “3.1 Installation” had any problem.

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

When the TDLS8100 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 3.16.)

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 4 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 3.12, there are some optical axis adjustment knobs on TDLS8100. Their position varies depending on the specification of each equipment. Unused knobs are sealed with stickers.

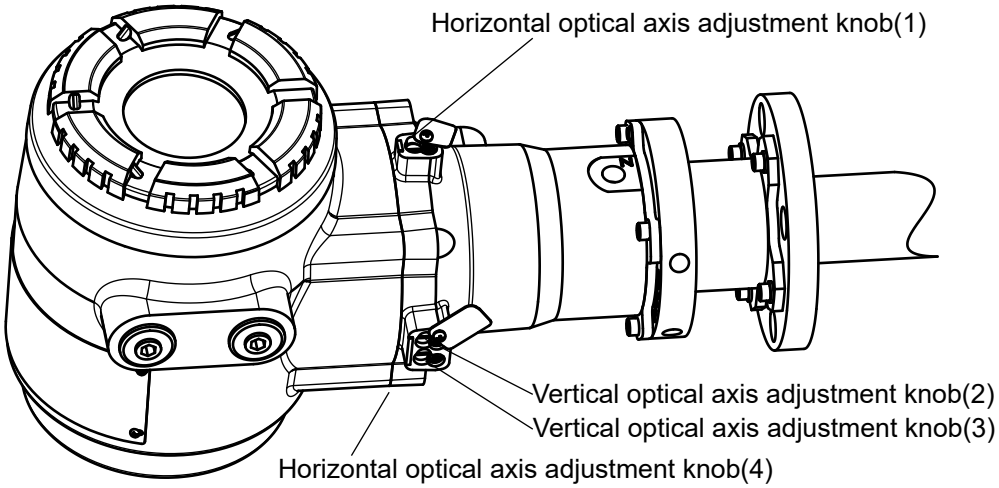


Figure 3.12 Optical axis adjustment when not using an LAO unit

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

Adjustment knob (number)	Measured component
(1)	CO, CO+CH_4,NH_3, HCl (-C2, -C3, -C4, -A1, -L1)
(2)	CO, CO+CH_4,NH_3, HCl (-C2, -C3, -C4, -A1, -L1)
(3)	O_2, -X1
(4)	O_2, -X1

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%. (“9.1.1 Transmission Calibration”).

3.4 Piping

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

After piping is complete, to keep the TDLS8100 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 TDLS8100, 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
TDLS8100	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	Rc1/4 or 1/4NPT, off-the-shelf product
	Purge port	Tube joint	Rc1/4 or 1/4NPT, off-the-shelf product
Calibration cell	Piping port	Tube joint	1/4NPT, off-the-shelf product

Purge Gas

Refer to the information provided in the specifications of “2. 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.

- Is clean. Dust particle diameter is less than 0.5 μm.
- Does not contain oil.
- Nitrogen gas with 99.99% or higher purity when measuring O_2 or ppm H_2O.
- Nitrogen gas with less than 20 ppm moisture content when measuring ppm H_2O.

(2) Areas that needs to be purged

The TDLS8100 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.

To perform validation, areas under analyzer internal purge is temporarily replaced with check gas. This is called *validation purge*.

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.

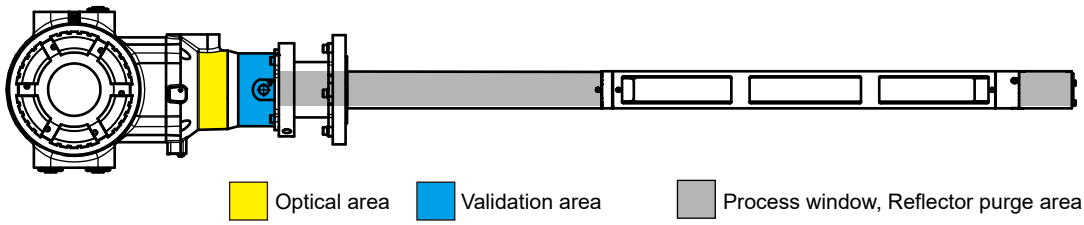


Figure 3.13 Purge position

(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 200 mL/min (not exceeding 10 kPA at the inlet)

- Validation area:

  10 to 20 L/min (Application dependent)

- Process window purge, Reflector purge

  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
1 to 5	15 to 25	5 to 15
5 to 10	25 to 45	5 to 25
10 to 20	40 to 60	20 to 40
2o to 30	45 to 80	20 to 45

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

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

(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.

3.4.1 Purge Gas Piping

(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 3.21.

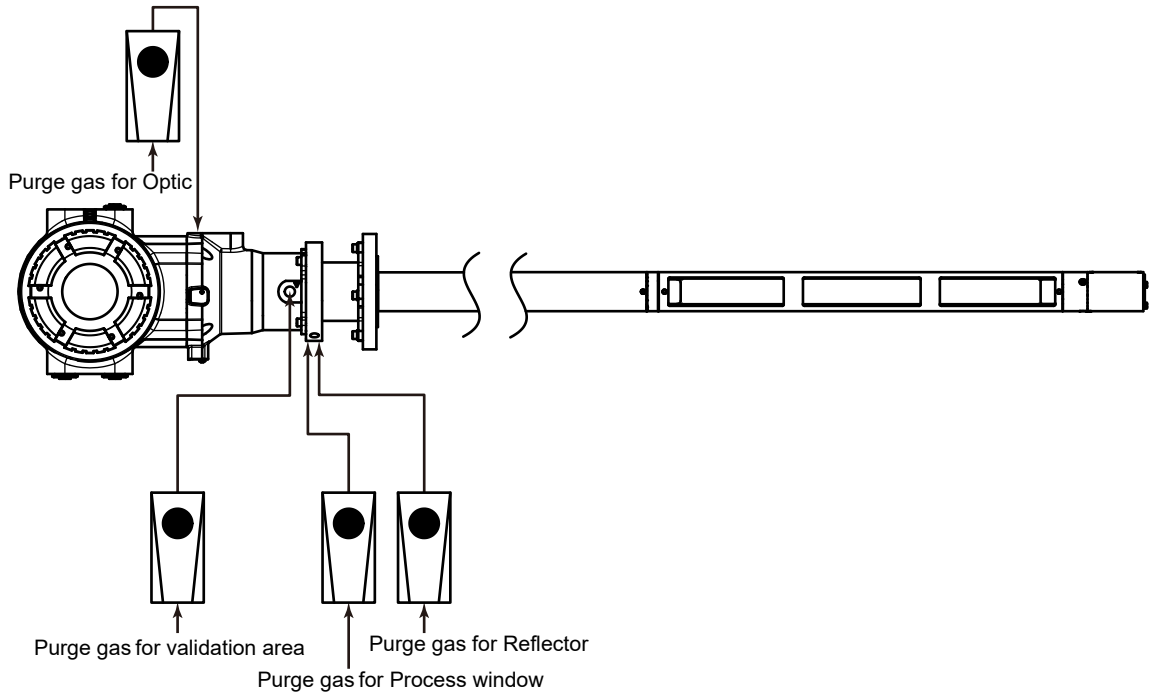


Figure 3.14 Piping when not using the online validation function/process in situ

(2) When using the online validation function

Connect the piping as shown in Figure 3.22.

Check gas is fed during the validation. Connect the piping with a three-way valve so that the gas can be switched between nitrogen gas and check gas.

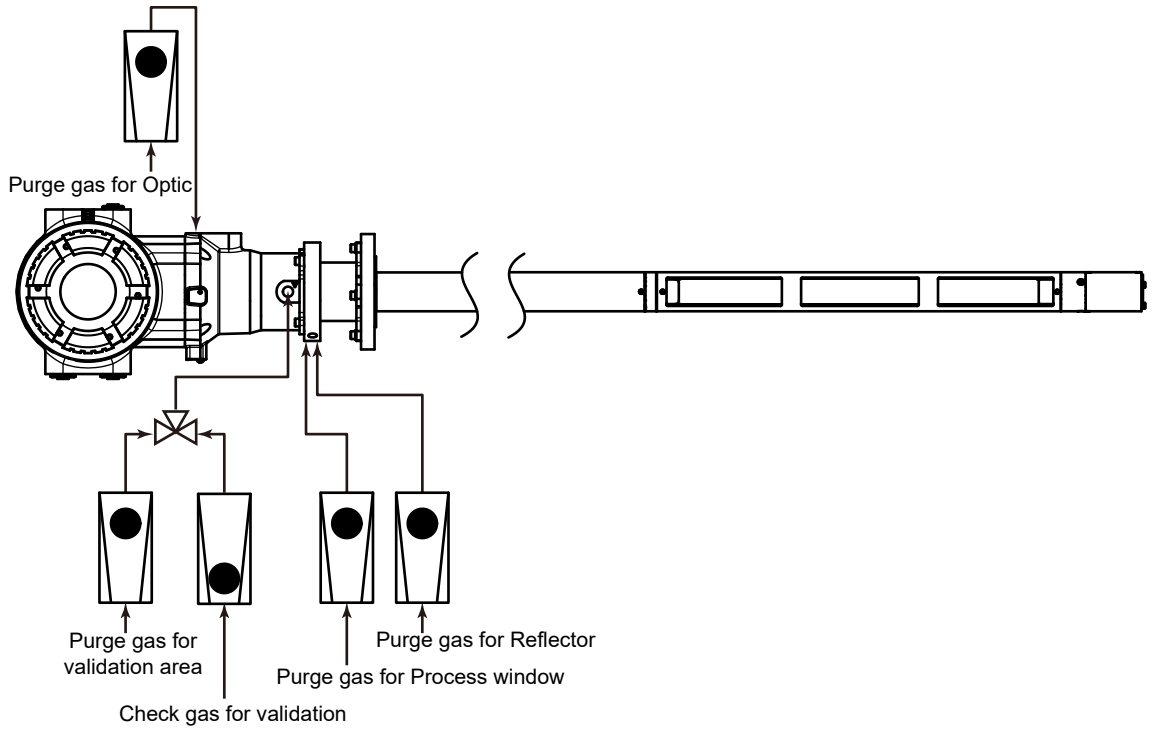


Figure 3.15 Piping when using online validation function

3.4.2 Optical area Purge of Zone 1/Div. 1/Flameproof “d”

TDLS8100 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.

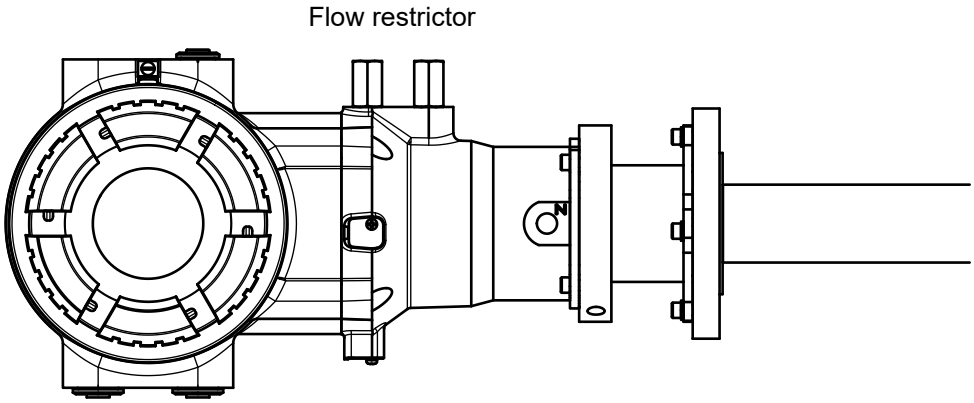


Figure 3.16 Optical purge gas inlet and outlet of Zone 1/Div.1/Flameproof “d”

CAUTION

For TDLS8100 flameproof, excess flow rate for optical area may cause damages on internal optical components.

WARNING

For TDLS8100 flameproof, pressure at the inlet for optical area shall not exceed 10 kPa.

4. YH8000 Installation

There are two methods of YH8000 HMI unit installation: local HMI installation in which the unit is mounted directly on the TDLS8000 series and remote HMI installation in which the unit is mounted by itself on a wall or the like.

See “2.4 External Dimensions”.

CAUTION

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

Installation location

The YH8000 is designed to work even in harsh environmental conditions, but note the following points in order to use it stably for a long time.

Select an installation location where the ambient temperature and humidity are within the specifications.

Be sure to block direct sunlight such as by attaching a sun shield or installing it in a cubicle.

If the YH8000 it subject to heat radiation such as from plant facilities, take heat insulation measures.

Also, select a location that meets the following conditions.

- Where there is hardly any mechanical vibration or shock
- Where it is not subject to direct sunlight or harsh weather conditions
- Where there is no corrosive atmosphere

4.1 Local HMI Installation

The YH8000 can be mounted on the TDLS8100 by using the mounting kit for TDLS8000 series (option code: /M). The YH8000 can be mounted on the front, right, or left.

If you want the front cover to open in the opposite direction due to the installation location, the YH8000 can be mounted upside down.

The sun shield (option code: /S) for avoiding the effects of direct sunlight can also be mounted.

When attaching the mounting kit to the YH8000, fasten the supplied TDLS8000- series bolt and YH8000 bolt with a torque of about 5 to 6 N•m.

Procedure for attaching the bracket to the front

(1) Fasten accessory brackets 1 and 2 in place with the YH8000 bolts (M6x14 mm).

You can tilt the YH8000 in the range of -20° to 20° by changing the angle adjustment hole used to fasten accessory bracket 1 in place.

(2) Fasten accessory bracket 1 to the YH8000 with the YH8000 bolts.

(3) Fasten accessory bracket 3 to the TDLS8000 series with the TDLS8000-series bolts (M6x10 mm).

Note that the length of the TDLS8000-series bolts and YH8000 bolts is different.

(4) Fasten accessory bracket 2 to accessory bracket 3 with the YH8000 bolts.

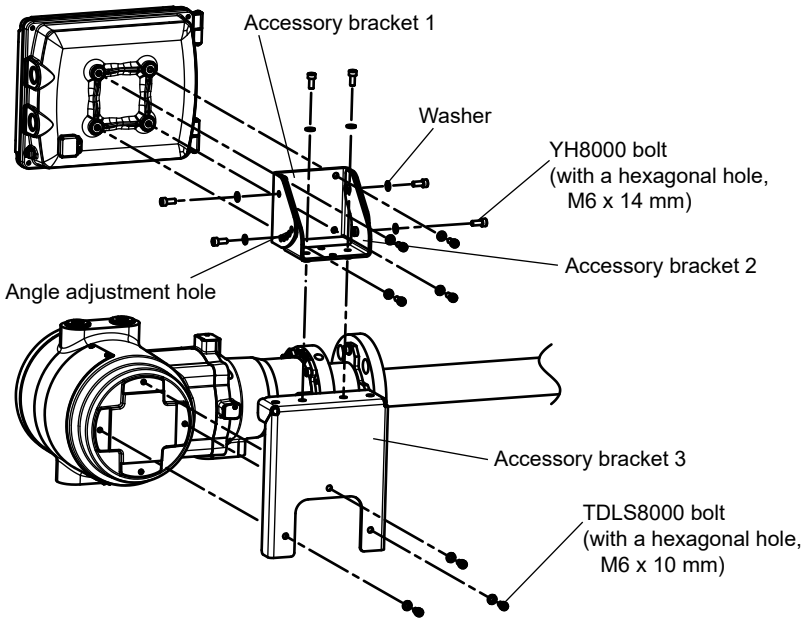


Figure 4.1 Mounting to the front

Procedure for attaching the bracket to the left-right side

(1) Fasten accessory brackets 1 and 2 in place with the YH8000 bolts.

You can tilt the YH8000 in the range of -20° to 20° by changing the angle adjustment hole used to fasten accessory bracket 1 in place.

(2) Fasten accessory bracket 1 to the YH8000 with the YH8000 bolts.

(3) Fasten accessory bracket 3 to the TDLS8100 with the TDLS8000-series bolts.

(4) Fasten accessory bracket 2 to accessory bracket 3 with the YH8000 bolts. You can fasten it to the left or the right side.

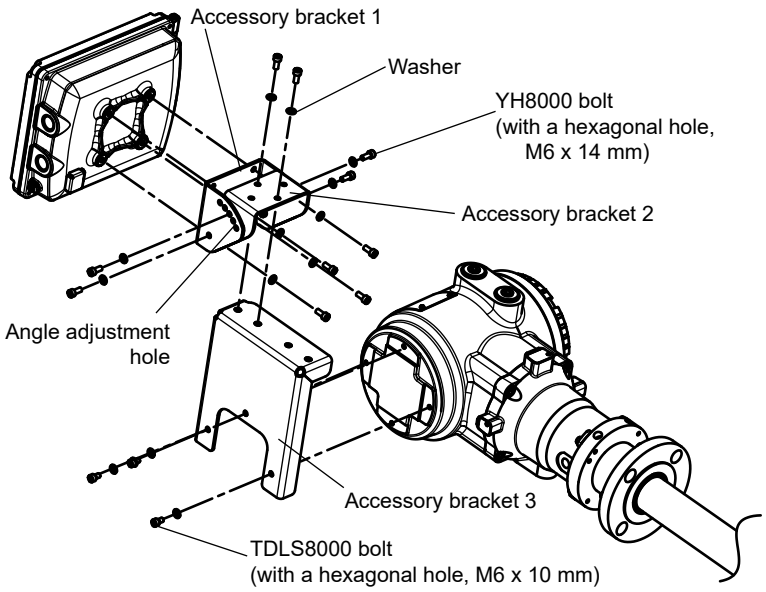


Figure 4.2 Mounting to the right

● When attaching the sun shield

Place the sun shield over the YH8000, and then fasten accessory bracket 1 in place with the YH8000 bolts. Fasten the bolts with a torque of about 5 to 6 N•m.

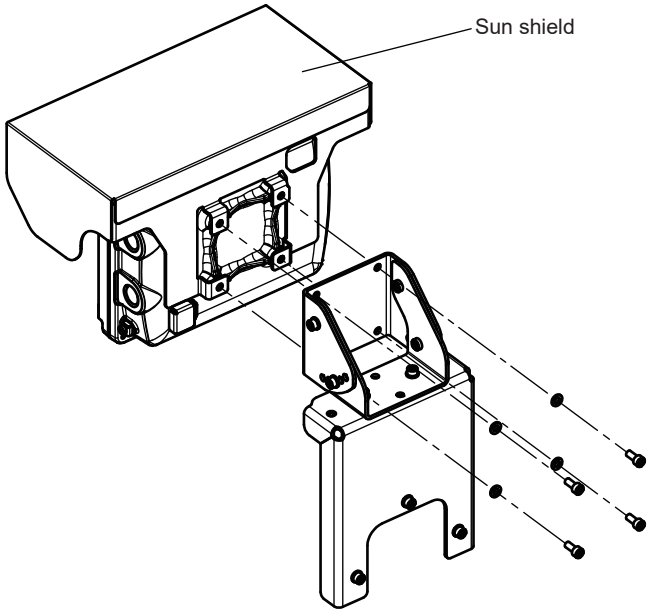


Figure 4.3 Attaching the sun shield

● Inverted YH8000 installation

The YH8000 can be mounted upside down so that the cables come out on the left side. When you mount the YH8000 upside down, you can invert the screen using the inversion switch. For details on how to use the inversion switch, see page 4-3 of ● Inverted YH8000 installation “4-7 I Setting the YH8000 inversion switch”.

This mounting method can be used when mounting the YH8000 on the mounting kit for TDLS8000 series, a wall, or a pipe. For details on the mounting bracket and the YH8000 tightening torque, see the details of each mounting method.

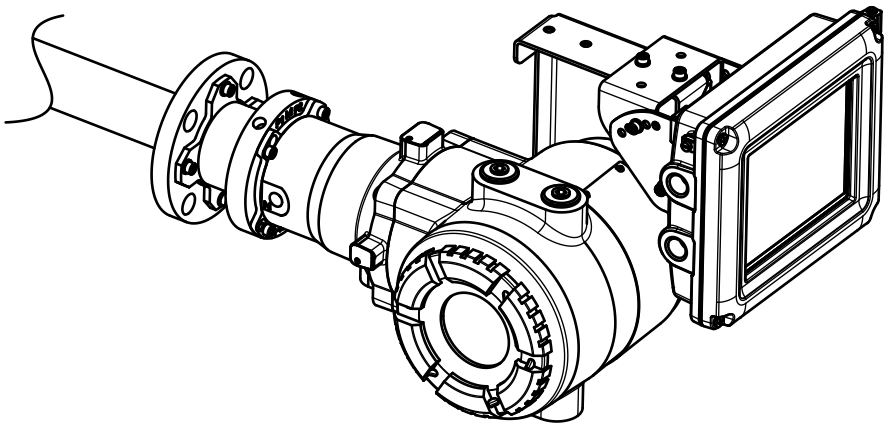


Figure 4.4 Upside down mounting

4.2 Wiring for Local HMI Installation

After mounting the YH8000 on the TDLS8000 series, wire it.

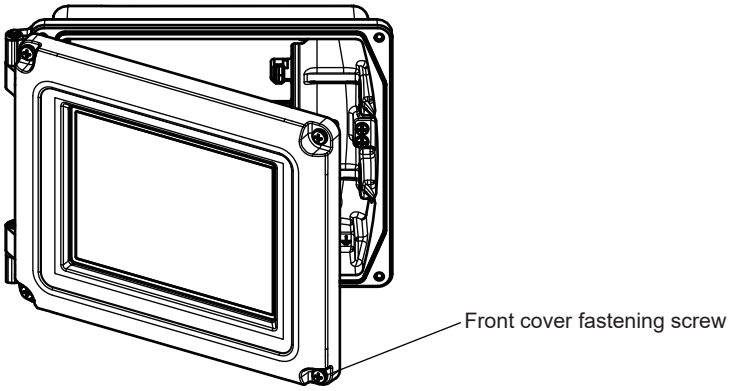
If the YH8000 is mounted upside down, reverse the YH8000 inversion switch.

CAUTION

Never turn on the power to the TDLS8000 series or the devices connected to the TDLS8000 series until all wiring is complete.

● Opening the YH8000 front cover

Open the front cover according to the following procedure.



How to open the front cover

(1) Loosen the M5 screws holding the front cover. The screws are designed not to come off the front cover.

(2) Open the front cover outward to the left.

How to close the front cover

(1) Close the front cover. Be careful not to get your fingers or other body parts caught in the hinge area and between the front cover and the case.

(2) Align the front cover to the screw holes of the case, and fasten the screws evenly. Do not tighten any screw all the way. When the gasket load starts to be applied to the four corner screws, tighten the screws evenly about one turn. Use a tightening torque of 1.8 to 2.0 N•m.

CAUTION

When opening or closing the front cover, be careful not to get your fingers or other body parts from being caught between the front cover and the case.

CAUTION

When opening the front cover, check that the screws are lifted completely off the screw holes, and open the cover slowly. This is to prevent damaging the threaded parts of the housing.

If the threaded parts are damaged and the screws cannot be tightened securely, waterproof capability will be lost.

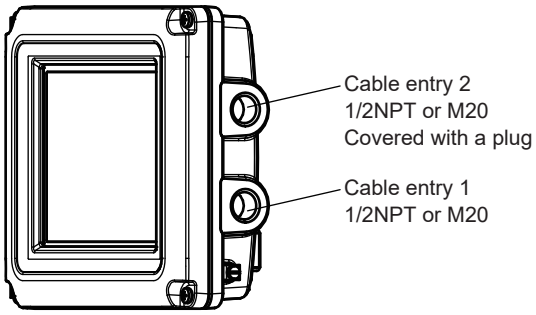
Cable entries

There are two cable entries on the YH8000. Attach conduits or cable glands with the appropriate thread size to the YH8000 cable entries.

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

For ANSI 1/2NPT: A

For ISO M20x1.5: M



Cable entry 1 Cable entry for the cable that connects to the TDLS8000 series.

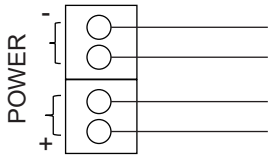
Cable entry 2 A plug with a hexagonal hole covers this entry. To use Port 2 for Modbus communication, remove the plug and run the cable through this entry. This entry is also used when running an Ethernet cable for remote HMI installation.

Be careful of the tightening torque when assembling cable glands.

Wiring

CAUTION

Connect the power supply wires to the correct locations. Don't reverse the polarity. Incorrect connection of the power supply can cause a malfunction.



Terminal name	Function
POWER+	YH8000 power supply input. 24 V DC±10%
POWER-	In the case of a local connection, power is supplied from the TDLS8100. In the case of special cables, connect two to the positive terminal and two to the negative.
PORT1	Connection to the TDKS8100
PORT2	Modbus communication, Ethernet communication for remote connection

For the cables you need to use, see “3-11 n Types of Wiring and Cabling”.

When the YH8000 is mounted on the TDLS8100 (local HMI installation), you need to use a local HMI connection cable (option code: /C), which is a special option cable. The wiring of the special cable is explained below.

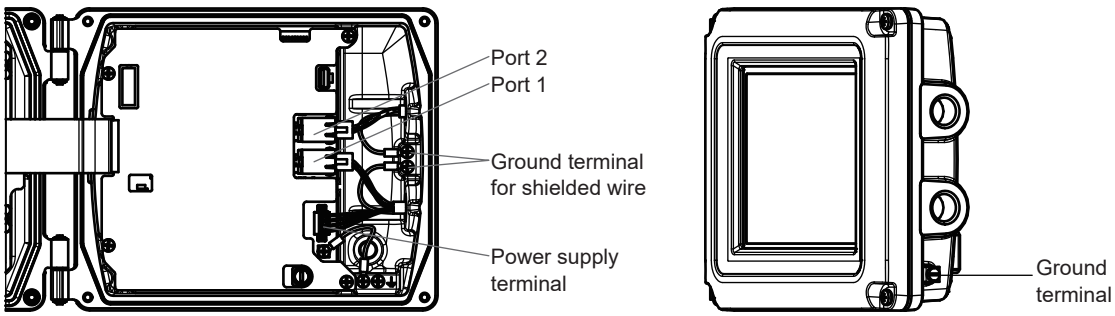
This cable must be processed before it is connected. For details on how to process the cable, see “Appendix 1 Constructing Local HMI Connection Cables”.

(1) Connect the cable to the power supply terminal with the correct polarity. Use a tightening torque of 0.22 to 0.25 N•m for the power supply terminal.

(2) Insert the RJ45 connector into Port1 until you hear a click.

(3) Connect the shielded wire of the special cable to the ground terminal for the shielded wire.

(4) Connect a grounding cable that complies with “3-11 n Types of Wiring and Cabling”.



Setting the YH8000 inversion switch

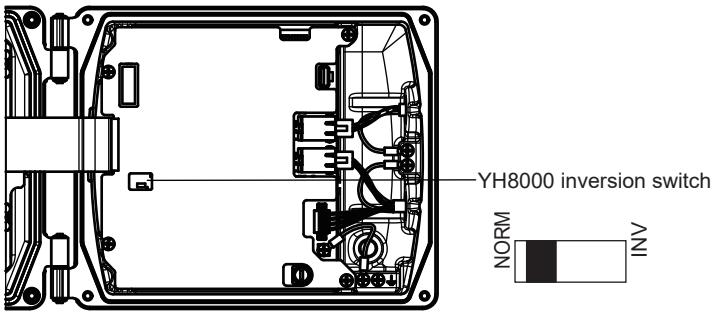
NOTE

Set the inversion switch with the YH8000 turned off. Turning it off applies the setting.

The YH8000 can be positioned so that the cables come out on the right side or the left side.

Depending on the direction, you need to reverse the YH8000 inversion switch, which is inside the case. The inversion switch is for inverting the screen upside down. Set the switch according to how the YH8000 is mounted as shown below.

The factory default setting is for the cables to come out from the right side.



YH8000 inversion switch

How the YH8000 is mounted	Inversion switch position
Cables coming out from the right side.	NORM
Cables coming out from the left side.	INV

4.3 Remote HMI Installation

This section explains how to mount the YH8000 using mounting brackets (pipe mount (option code: /P), wall mount (option code: /W)).

The sun shield (option code: /S) for avoiding the effects of direct sunlight can also be mounted.

WARNING

The YH8000 does not have a power switch. Provide a switch on the power supply line to separate the YH8000 from the main power supply. Use labels to indicate that (1) the switch is for cutting off the power supply to the YH8000 and (2) ON/OFF switch.

Pipe mounting

The YH8000 can be mounted on a 50A (2B) pipe. Fasten the YH8000 bolts with a torque of about 5 to 6 N•m. The YH8000 can be mounted horizontally or vertically.

The pipe mount option includes short bolts that are used when a sun shield is used and long bolts that are used when a sun shield is not used.

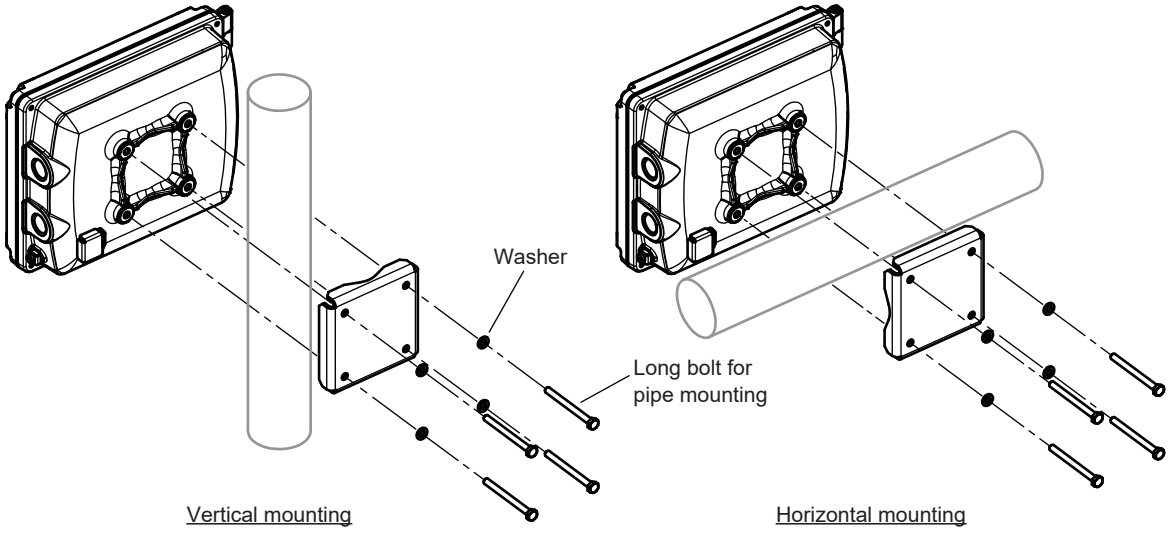


Figure 4.5 Pipe mounting

When attaching a sun shield, spacers are used to fasten the sun shield to the YH8000 before mounting on the pipe.

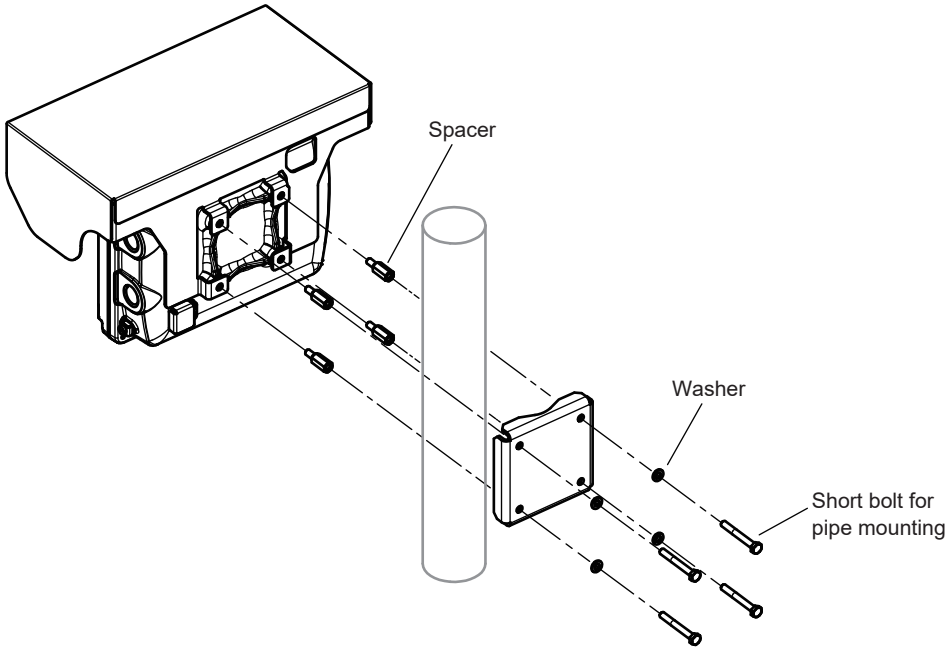


Figure 4.6 Pipe mounting when a sun shield is used (vertical mount example)

Wall mounting

For the wall mount dimensions, see “2.4 External Dimensions”.

Fasten the wall mount bracket to the YH8000 with a tightening torque of about 5 to 6 N•m.

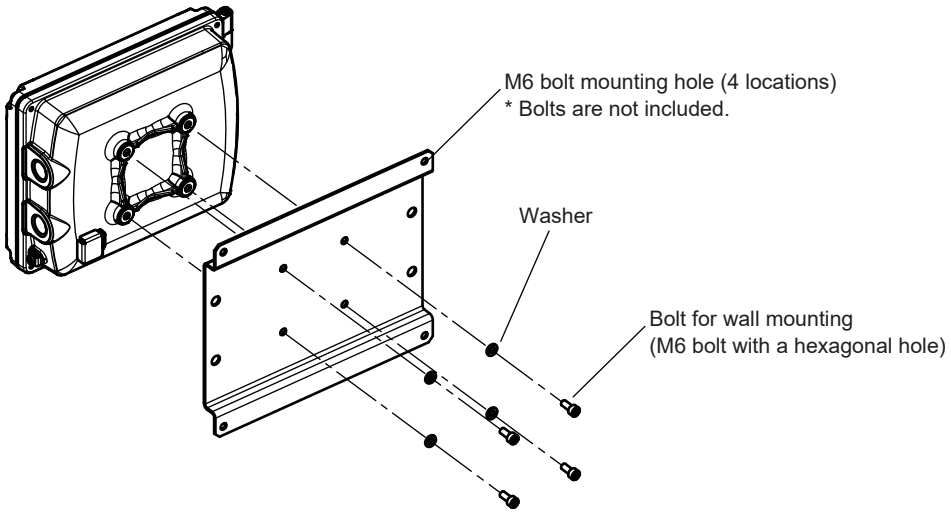


Figure 4.7 Wall mounting

When attaching a sun shield, turn the wall mount bracket so that the longer side is vertical.

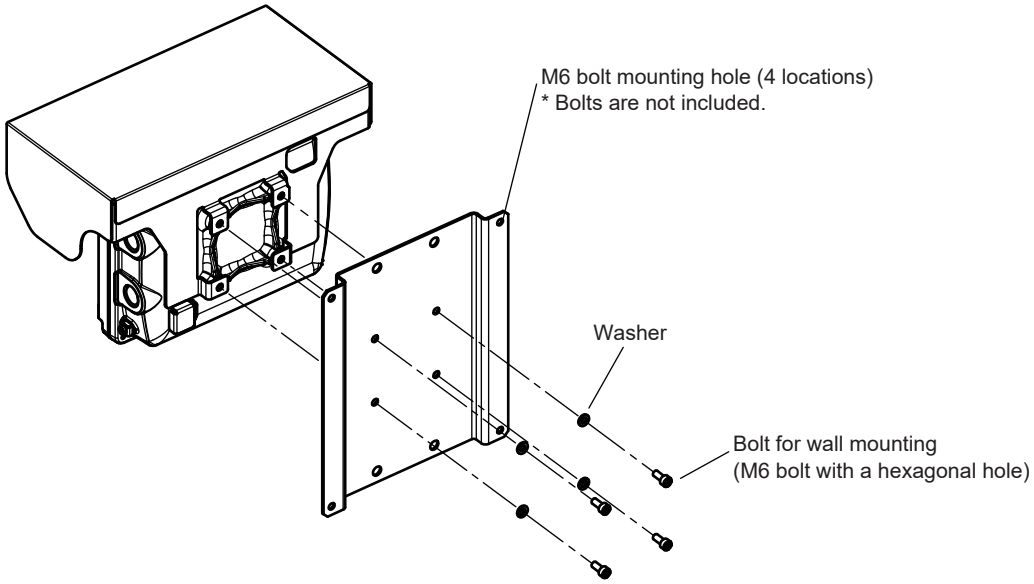


Figure 4.8 Wall mounting when a sun shield is used

4.4 Wiring for Remote HMI Installation

Wire the cables after completing the remote HMI installation.

CAUTION

Never turn on the power to the YH8000 or the devices connected to the YH8000 until all wiring is complete.

Opening the YH8000 front cover

See “4.2 Wiring for Local HMI Installation”.

Cable entries

Run the power cable through cable entry 1 shown in "4.2 Wiring for Local HMI Installation". Run the Ethernet cable through cable entry 2 after removing the plug with a hexagonal hole.

Wiring

See “4.2 Wiring for Local HMI Installation”.

CAUTION

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

Incorrectly connecting the power supply can cause a malfunction.

For the cables you need to use, see “3-11 ■ Types of Wiring and Cabling”.

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

If you want to connect the functional ground terminal inside the instrument, use a three-core power cable.

Connecting an Ethernet Cable

If you want to connect the YH8000 to TDLS8000 series through an Ethernet hub, you will need to use an Ethernet cable. The Ethernet cable connector must be crimped during the YH8000 installation.

The processing of the Ethernet cable is the same as for the TDLS8100. See”3.2.7 Connecting an Ethernet Cable”

Power supply wiring, ground wiring, and Ethernet cable connection when using the YH8000 remotely are explained below. For the terminal positions, see the wiring diagram in “4.2 Wiring for Local HMI Installation”

(1) Connect the cable to the power supply terminal with the correct polarity. Use a tightening torque of 0.22 to 0.25 N•m for the power supply terminal.

(2) Insert the RJ45 connector into Ethernet Port2 until you hear a click.

(3) Connect the shielded wire of the special cable to the ground terminal for the shielded wire.

(4) Connect a grounding cable that complies with page “3-11 ■Types of Wiring and Cabling”.

5. Startup

Refer to “3.2 Wiring” and “3.4 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 TDLS8100.

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 TDLS8100. This is to prevent unnecessary temperature changes in and placing unnecessary load on the laser device and sensor.

5.1 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 “7. HART Communication” and “Appendix 2 General View of HART DD”.

NOTE

Write protection based on password authentication is available for TDLS8100 HART communication. By factory default, the write protection is disabled. Therefore, you can change the settings simply by connecting the configuration tool. For details on how to enable write protection, see “7. HART Communication”.

5.1.1 Installing a DD File

Before using the HART configuration tool, the TDLS8100 DD (Device Description) must be installed in the configuration tool.

DD is common between TDLS8100 and TDLS8000, therefore install TDLS8000 DD in TDLS8100. In this case, each device tool shows TDLS8000 as model.

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.** **	01	01	3.06.11
		02	3.06.24
2.01.01 or above	02	01	3.08.13

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

https://partner.yokogawa.com/global/interoperability/dd-file-hart_an.htm

5.1.2 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 "3.2 Wiring". Figure 5.1 shows a wiring example.

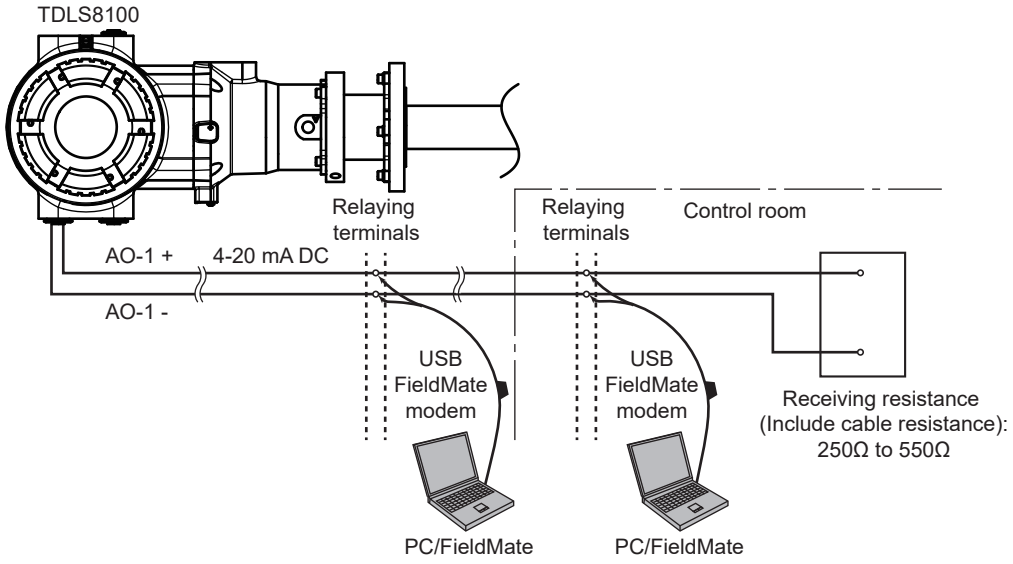


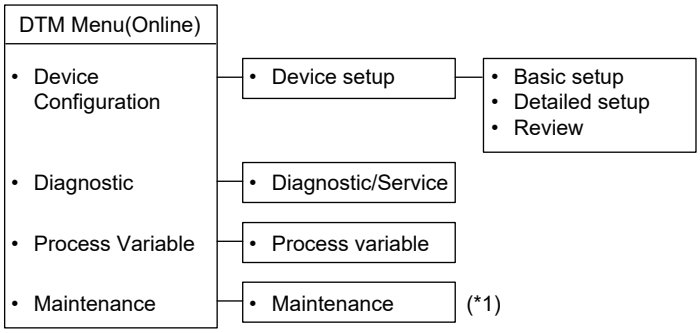
Figure 5.1 HART configuration tool wiring example

5.1.3 Basic Menu Configuration

The root menu of the menu tree displayed in the HART configuration tool is described below. For the entire menu structure, see “7.2 Menu Tree”. For the entire menu including parameter names, see “Appendix 2 General View of HART DD”.

Root menu	Description
Process variables	Displays the most recent PV-QV and measured values
Diagnosis/Service	Checks alarms and history and executes calibration, validation, and loop checks
Basic setup	Assigns PV-QV items and sets output ranges
Detailed setup	Sets TDLS8100-specific parameters
Review	Displays measured values, I/O values, and production information

On FieldMate, the top menu structure is different from the DD menu. The FieldMate root menu is “DTM Menu(Online),” and under it are the five DD root menus shown above. The lower level structure, however, is the same as DD.



*1: Of the commands in the “Diagnostic/Service” menu, the execution commands for calibration, validation, and loop check are included.

DTM root menu

NOTE

If you are using the Field Communicator 475 configuration tool, the following screen may appear depending on the factory default settings of the TDLS8100. This is a notification that the same measured value was read multiple times within the same analysis period. Since this is not a problem with the TDLS8100 operation, select “YES.” This screen will appear every time a connection is made. The analysis period is a fixed adjustment value assigned to each TDLS8100 and cannot be changed.

5.2 Connecting to the YH8000

This section describes how to connect the YH8000 HMI unit to the TDLS8100 and provides a basic description of the related screens.
For a detailed explanation of the YH8000, see “8. YH8000 HMI Unit”.

5.2.1 Initialization and Connection Procedure

If you connect the analyzer and YH8000 in a one-to-one configuration, the factory default settings can be used. The settings need to be changed when you connect the analyzer to an existing LAN network or when you connect multiple analyzers or YH8000s.

The initial IP address settings are shown in Figure 5.1.

Table 5.1 Factory default IP address settings

Model	IP address	Subnet mask	Default gateway
TDLS8100	192.168.1.10	255.255.255.0	192.168.1.254
YH8000	192.168.1.100	255.255.255.0	192.168.1.254

To change the analyzer’s IP address and subnet mask from the YH8000, follow the procedure below.

(1) Connect the YH8000 using the factory default IP settings.

(2) Change the analyzer’s IP address and subnet mask (see section 5.2.2).

(3) To change the IP address of multiple analyzers’, connect to the analyzers one at a time and change the IP address and subnet mask.

(4) If necessary, change the YH8000 IP address and subnet mask (see section 5.2.2).

(5) Change the YH8000 destination IP address (see section 5.2.3).

The procedure from turning on the YH8000 to connecting it in step (1) above is provided below. The procedure assumes that the analyzer has the factory default IP address settings. To connect to the analyzer whose IP address has been changed or to connect to multiple analyzers, see “5.2.3 Connecting to the TDLS8100”.

(1) Complete the wiring of the analyzer and YH8000 according to the instructions in “”.

(2) Power on the analyzer and YH8000.

=> The opening screen (a) is displayed for about 10 seconds.

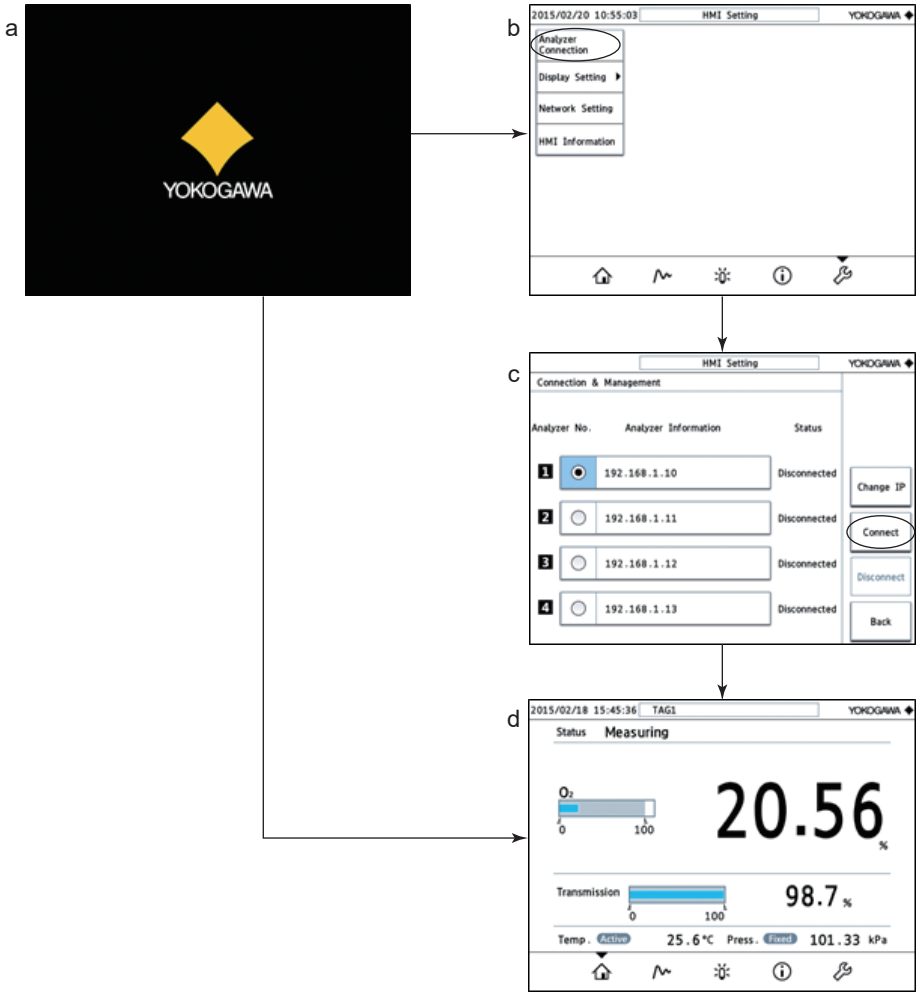
=> If they do not connect automatically, the YH8000 configuration screen (b) will appear. => Step (3)

=> If they connect automatically, the home screen (d) will appear.

(3) Tap Analyzer Connection to switch to the analyzer selection screen (c). => Step (4)

(4) Tap Connect to start a connection.

=> If a connection is established, the home screen (d) will appear.



5.2.2 Setting the IP Address

- **Setting the TDLS8100 IP address**

Configuration menu path:

"  >>Analyzer>>Configuration>>System>>Communication>>TCP/IP"

NOTE

When you change the analyzer's IP address, the analyzer automatically restarts with the new IP address. The connection to the YH8000 will be disconnected. Follow the procedure below to reconnect.

The procedure for changing the analyzer's IP address and reconnecting is as follows. If you change the analyzer's subnet mask, you will also need to change the YH8000 subnet mask as described in "Setting the YH8000 IP address" on the next page before reconnecting.

(1) Tap in the lower right of the screen.

The tag names (or the serial numbers if not assigned) of the connected analyzers appear. Select t the analyzer whose IP address you want to change.

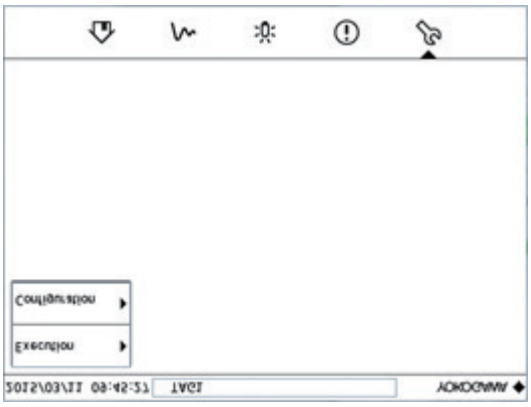
In the example in the figure, the tag name is "TAG1." Tag names are not assigned to TDLS8100s with factory default settings, so serial numbers are displayed instead.

After selecting, tap OK. A password input screen will appear.

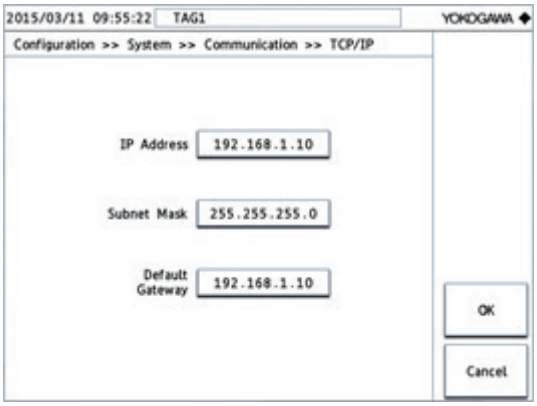
(2) Enter the password and tap Enter. A configuration screen will appear. The factory default password is "1234."

From the menu, select Configuration>>System>>Communication>>TCP/IP. A warning screen explaining that the instrument will restart if the IP address is changed appears.*1 Tap OK.

*1: The analyzer will restart after changing IP settings"

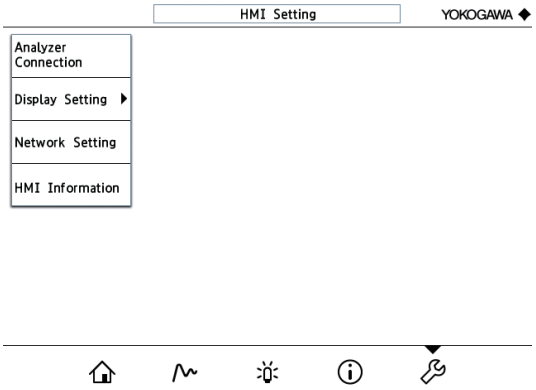


(3) Select each item and change the value. The items that you change will show an asterisk in the upper left. Tapping OK will display a confirmation screen for restarting. Tap OK again.

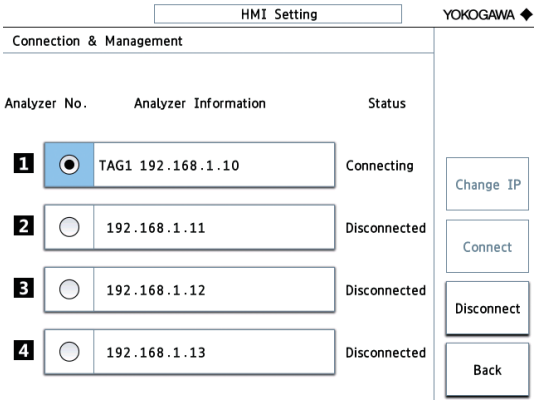


(4) A disconnection error screen will appear. Tap OK.

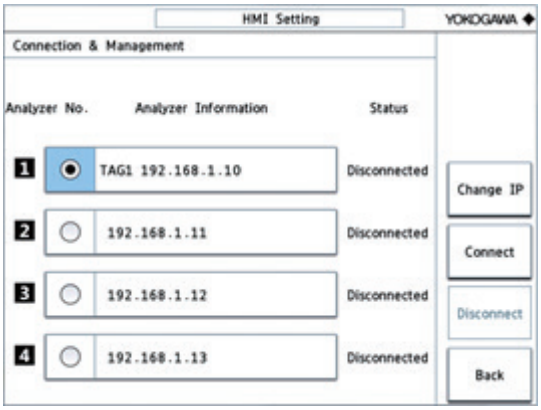
(5) The YH8000 (HMI) configuration screen will appear. Tap Analyzer Connection.



(6) The analyzer selection screen will appear. Tap Disconnect.



(7) The Change IP button becomes available. Tap Change IP, and enter the new destination IP address.



(8) Tap Connect to connect to the analyzer.

NOTE

The analyzer's IP address can also be changed via HART communication.

Configuration menu path:

"Detailed setup>>System>>Communication>>TCP/IP>>Set IP settings"

● Setting the YH8000 IP address

Configuration menu path: "  >>HMI>>Network Setting"

NOTE

When you change the YH8000 IP address, the YH8000 automatically restarts with the new IP address, disconnecting the current connection with the analyzer.

5.2.3 Connecting to the TDLS8100

This section explains the analyzer selection screen on the YH8000. From the YH8000 screen, you can connect in the following ways.

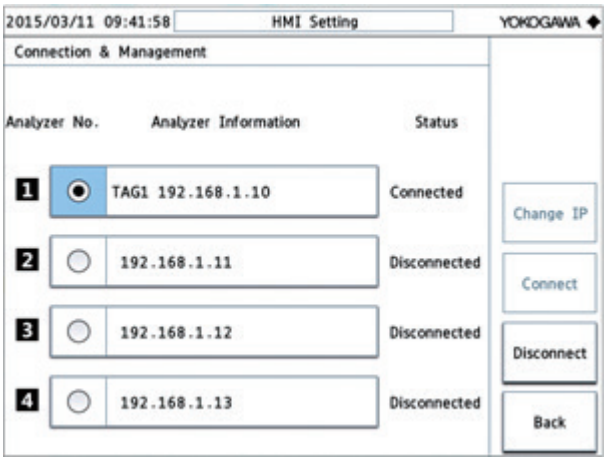
- Connect to the analyzer with any IP address
- Connect the maximum of four analyzers from a single YH8000
- Connect to the analyzer with an unknown IP address in the same network by searching

The YH8000 assigns the analyzer number from 1 to 4 to each connected analyzer. In the case of a one-to-one connection, analyzer number 1 is used. On the analyzer selection screen, you can assign TDLS8100s to analyzer numbers by specifying the IP address.

Path to the analyzer selection screen "  >>HMI>>Analyzer Connection"

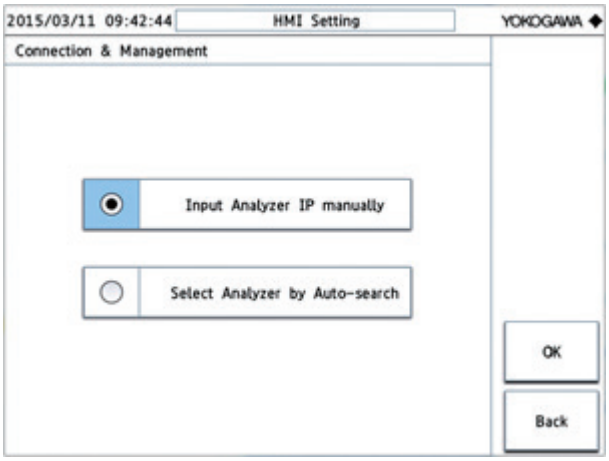
The procedure to add a connection destination is shown below.

(1) Open the analyzer selection screen (the figure below), and select the analyzer number that you want to set under the Analyzer No. column.



(2) Tap Change IP to open the IP address configuration screen (the figure below).

If the selected analyzer number is already connected (Status is Connected), tap Disconnect to enable the Change IP button.



(3) Specify the analyzer's IP address using either method below.

- Input Analyzer IP manually

  Manually enter the IP address of the analyzer you want to connect to.

- Select Analyzer by Auto-search

  Select from the analyzer IP addresses automatically found. Up to 32 TDLS8000 series in the same subnet can be detected. Detection may not be possible depending on the network configuration or condition.

Select either option, tap OK, and specify the IP address you want to connect to.

(4) Tap Connect to connect to the TDLS8100.

Description of the analyzer selection screen

Analyzer No. column

Shows analyzer numbers 1 to 4. You can select a number and assign an IP address to connect to the corresponding analyzer

NOTE

If YH8000 connects to only a single analyzer, connect it to analyzer number 1. If you connect it other number, you need to reset the display items when displaying the trend waveform.

Analyzer Information column

Shows the analyzer IP addresses and tag names. For analyzers that have not been connected before, tag names do not appear. If the analyzer is connected but its tag name is not assigned, a serial number will be displayed.

Status column

Shows analyzer's connection status.

Connected

Connecting

Disconnected

Change IP button

Switches to the IP address configuration screen. This button is not available if the analyzer is connected.

Connect button

Starts a connection with the analyzer. This button is available when the analyzer is disconnected.

Disconnect button

Disconnects from the analyzer that is connected or is in the process of establishing a connection.

NOTE

Once a connection is established between the YH8000 and the analyzer, the connection information is saved. Therefore, the next time the power is turned on or after restarting, the connection will be established automatically.

NOTE

Up to two YH8000 can connect to a single analyzer.

5.2.4 Handling Connection Failures

If a connection to the analyzer fails, check the following items.

(1) Check that the Ethernet cable is connected properly.

- Check that LED5 on the circuit board is lit or blinking.

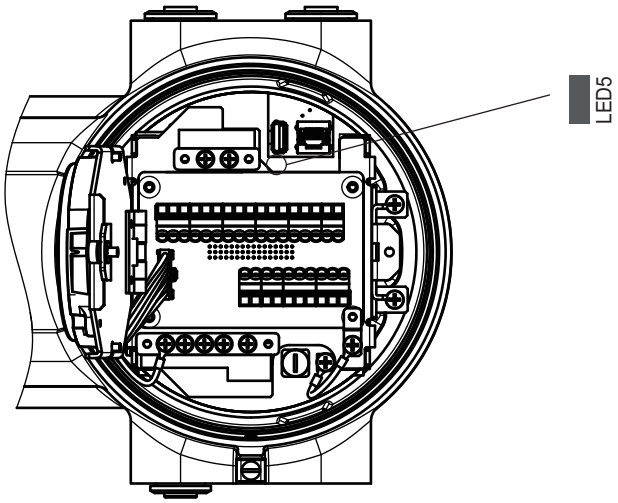


Figure 5.2 Front view of the analyzer part

- Check that the green LED of the YH8000 Ethernet port is lit or blinking.

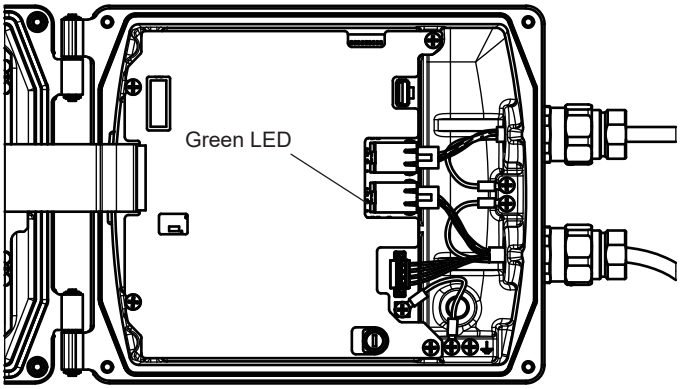


Figure 5.3 Top view of the inside of the YH8000

(2) Check that the IP addresses are set properly.

- Check that unique IP addresses are assigned to each YH8000 and analyzer.

  => You can view the analyzer's IP addresses on the LCD display.
  For details, see "1.2 Name and Function of Each Part".

- Check that the subnet addresses and subnet masks are set properly.
- If the instruments are connected via a router or the like, check that it is configured properly with your network administrator.

5.2.5 Basic Screen Configuration

This section provides an overview of the home screen that appears when a connection is established with the analyzer and the buttons. For a detailed explanation, see "8.2 Home Screen".

The screen shown in Figure 5.4 appears when a single analyzer is connected to the YH8000. This screen is called *Home screen*.

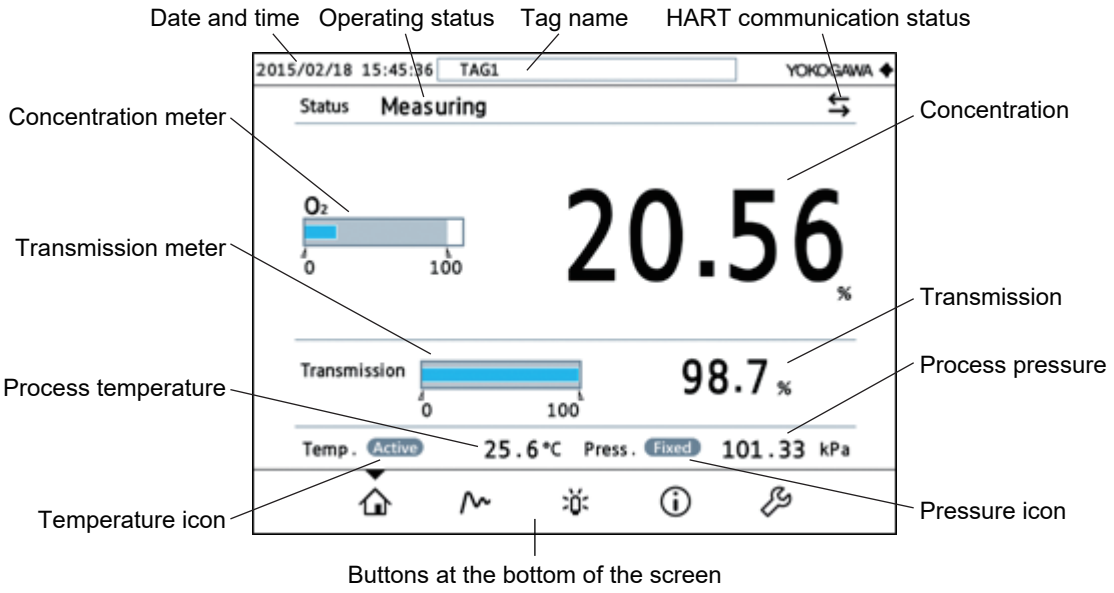


Figure 5.4 Home screen

If several analyzers are connected to the YH8000, tabs for switching between the home screens of each analyzer appears on the right. The tab numbers represent analyzer numbers. Selecting a tab shows the information of the analyzer corresponding to the tab number. Further, the ▪▪ tab shows the information of all connected analyzers This screen is called the *overall screen*.

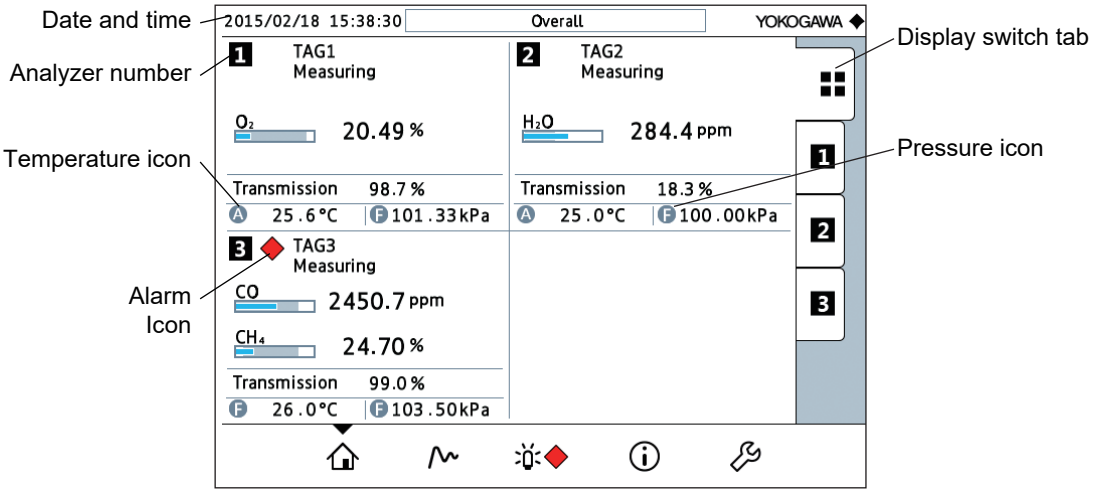


Figure 5.5 Overall screen

Functions of the buttons at the bottom of the screen

These buttons are used to show other screens.

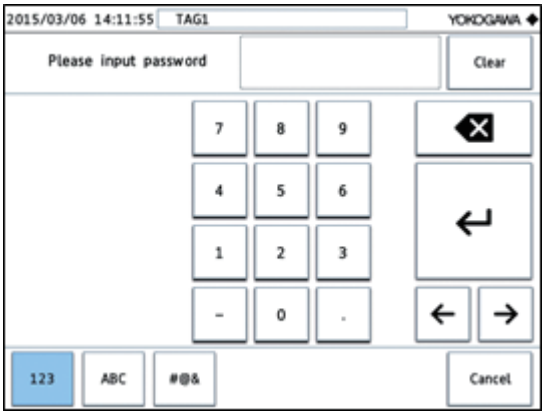
Button	Button name	Description
	Home button	Displays the home screen.
	Trend display button	Displays the trend screen. You can view the measurement trends of multiple analyzers on the same screen.
	Alarm information button	Displays alarm screen of a connected analyzers
	Configuration display button	Displays the current settings of connected analyzer, I/O values, alarm history, and so on.
	Configuration button	Executes configuration, calibration of connected analyzer. Changes the YH8000 connection destination, IP settings, etc..

How to open the analyzer configuration screen

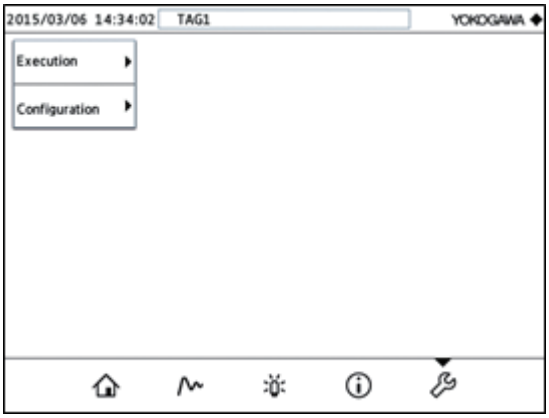
(1) Tap to show a screen for selecting the analyzer you want to configure. Analyzer's tag names (serial numbers if tag names are not assigned) are displayed.

Select a target analyzer, and tap OK.

(2) A user password input screen will appear. The factory default password is "1234."



(3) When password authentication is successful, the analyzer's configuration screen will appear.



NOTE

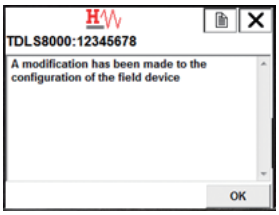
If you just want to view the settings, you can tap ⓘ to display the information screen. You don't need to enter a password to display this screen.

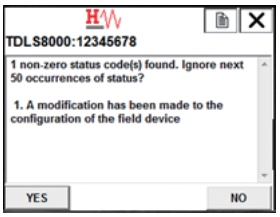
5.3 Setting Basic Parameters

This section explains how to set the basic parameters necessary to start measurements. Field Communicator 475 will be used as an example of a HART configuration tool to introduce the operation procedure. If you are using FieldMate or other tool, perform the equivalent procedure.

NOTE

When configuration changes are made with a Field Communicator 475, the following screen will appear. This warning screen is to indicate that the TDLS8100 settings have been changed. Since this is not a problem with the TDLS8100 operation, select OK and then YES.





5.3.1 Setting the Date and Time

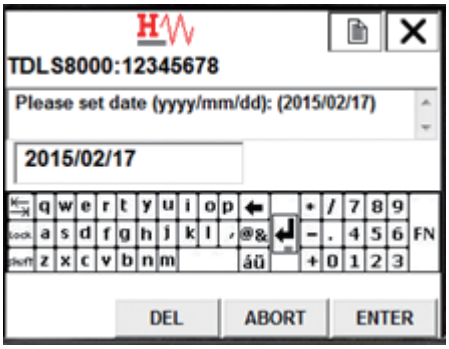
Set the current date and time on the TDLS8100. The date and time will be retained through battery power even when the power is turned off.

● Setup procedure using HART

(1) Select “Detailed setup>>System>>Date/time>>Set date/time” and press the right arrow button to display the following screen.

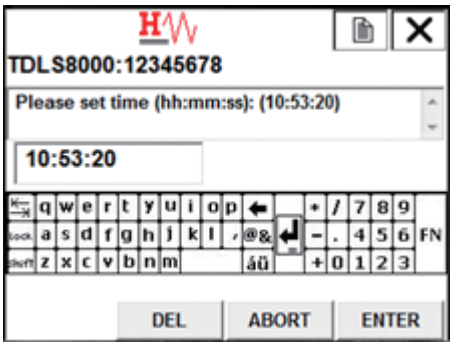
(2) The current time will appear. If you want to change it, tap OK. The following screen will appear. If you do not need to change it, tap ABORT to abort the setup.

Enter the current date in yyyy/mm/dd format, and then tap ENTER.



(3) Enter the current time in hh:mm:ss format, and then tap ENTER. To enter a colon, tap the @& key.

Note: The time you enter here is reflected in the TDLS8100 when you tap OK in step (4).

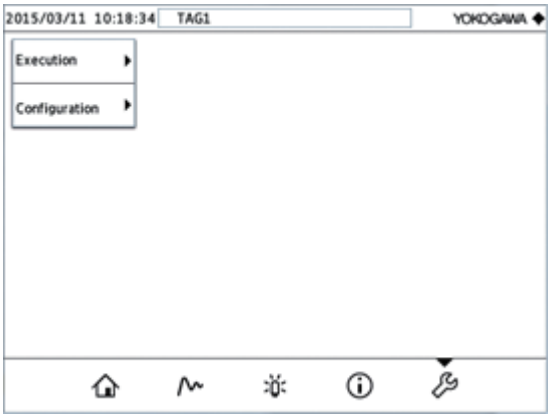


(4) A screen appears for you to confirm the date and time that will be applied to the TDLS8100. To proceed, tap OK. The time will be reflected in the TDLS8100. To abort the setup, tap ABORT.

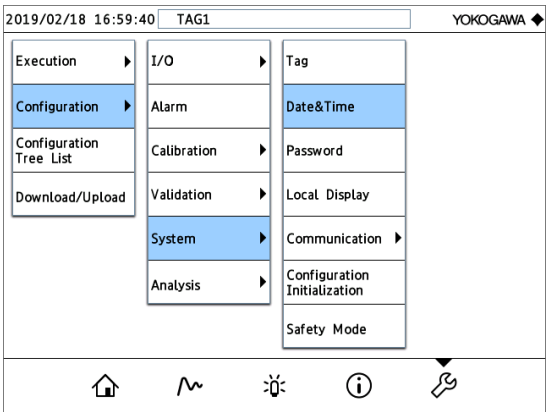
Setup procedure using YH8000

(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.

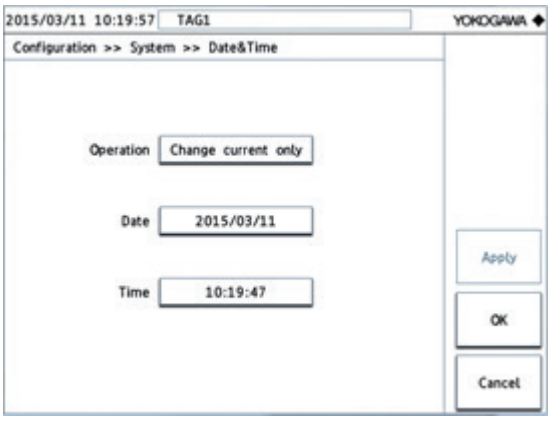
(2) A password input screen will appear. Enter the password and tap Enter. A configuration screen will appear.



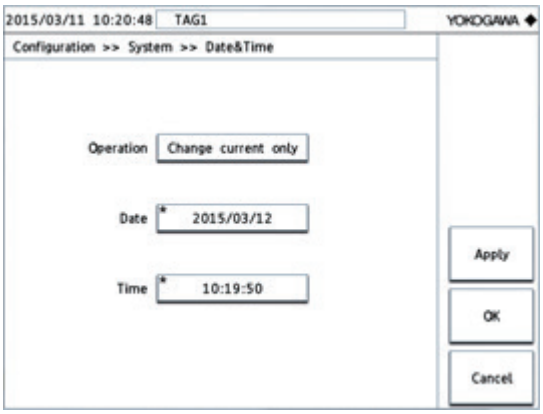
(3) Select “Configuration>>System>>Date&Time” as shown in the following figure.



(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.



5.3.2 Setting the Process Optical Path Length

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

The process optical path length of TDLS8100 is twice the length of insertion length of the process gas into 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.

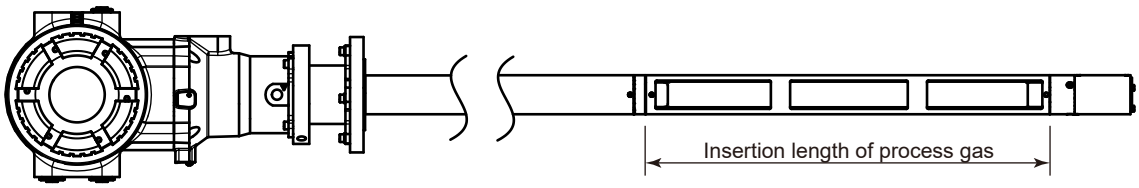
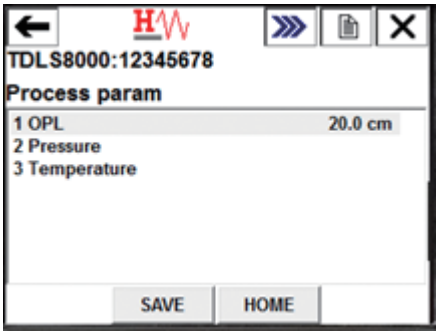


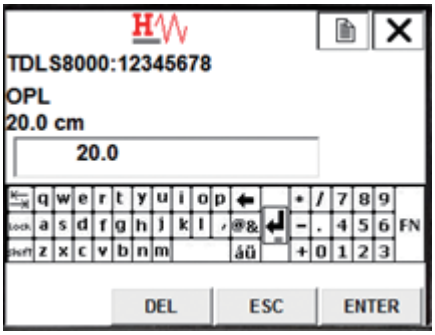
Figure 5.6 Process optical path length definition

● Setup procedure using HART

(1) From the menu, select “Detailed setup>>Analysis>>Process param.” The following screen will appear. Select “OPL” and press the right arrow button.



(2) Enter the process optical path length, and tap ENTER to execute writing to the TDLS8100. To abort, tap ESC.



● Setup procedure using YH8000

Configuration menu path:

“ >>Configuration>>Analysis>>Process Parameters>>Path Length”

NOTE

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

5.3.3 Setting the Process Pressure

This section explains the pressure value of the measurement process when the input mode is analog input (AI-1). When using other input modes, see “6.1.2 Process Pressure”.

Configuration menu path:

[HART] “Detailed setup>>Analysis>>Process param>>Pressure”

[YH8000] “  >>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 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 pressure values corresponding to 4 mA and 20 mA.

Configuration menu path:

[HART] “Detailed setup>>I/O condition>>Analog input>>AI-1(Pressure)”

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

5.3.4 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 “6.1.3 Process Temperature” .

Configuration menu path:

[HART] “Detailed setup>>Analysis>>Process param>>Temperature”

[YH8000] “  >>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:

[HART] “Detailed setup>>I/O condition>>Analog input>>AI-2(Temperature)”

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

5.3.5 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 “6.4.2 Output Hold”.

Configuration menu path:

[HART] “Detailed setup>>I/O condition>>Analog output”

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

(1) Select the output item for each channel.

On HART, the AO-1 and AO-2 output items are displayed as “PV is” and “SV is,” respectively. 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
Component 1 gas concentration	Concentration 1	(*2)
Component 2 gas concentration (*1)	Concentration 2	(*2)
Transmission	Transmission	Transmission
Temperature	Temperature	Temperature
Pressure	Pressure	Pressure

*1: Selectable only with two-gas measurement specifications
*2: Displays the name of the gas component being measured.
Example: If the component being measured is oxygen: O_2 concentration

(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.

5.3.6 Setting Process Alarms

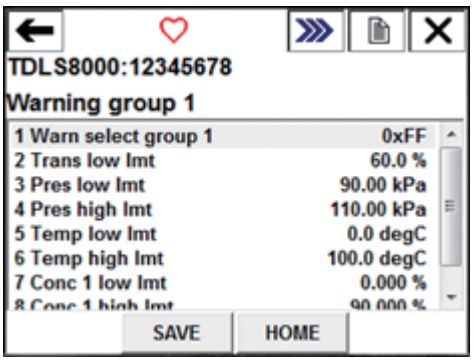
You can set threshold values of the high/low limit alarm (warning) for process measurement values. The following table shows the types of warnings that you can specify. For each type of warning, you can set the threshold values and select whether to enable the detection. For details on warnings, see “10.2 Warning Display and Handling” described later.

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

● Setup procedure using HART

(1) From the menu, select “Detailed setup>>Alarm>>Warning>>Warning group 1.”

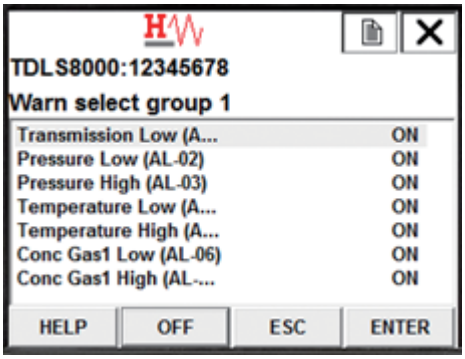
The following screen will appear.



(2) "Warn select group 1" is used to enable or disable the warnings. By factor default, all warnings are enabled.

Select "Warn select group 1" and press the right arrow button to display the following screen. Here, you can enable or disable each warning.

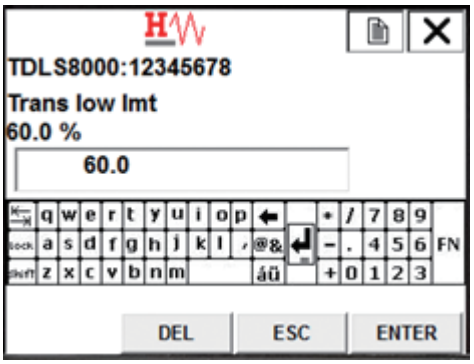
ON means enabled. To switch between ON and OFF, tap OFF (center-left at the bottom of the screen). When you are finished, tap ENTER.



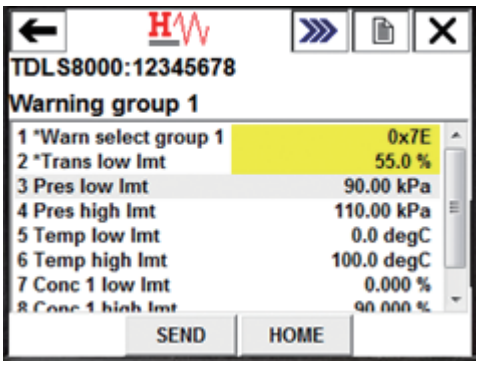
(3) Set the high and low limit threshold values of each warning.

For example, to change the lower limit alarm threshold value for transmission, select "Trans low lmt," and press the right arrow button. The following screen will appear.

Enter the value, and press ENTER.



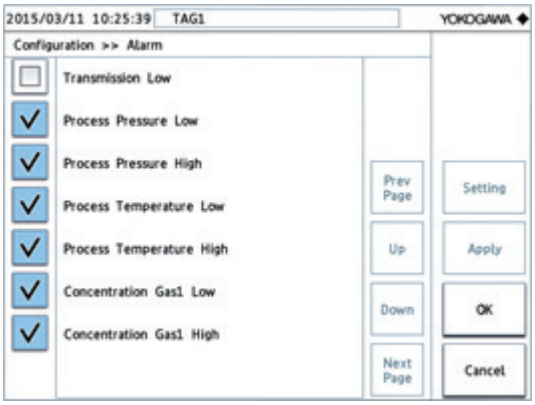
(4) Tap SEND to execute writing to the TDLS8100.



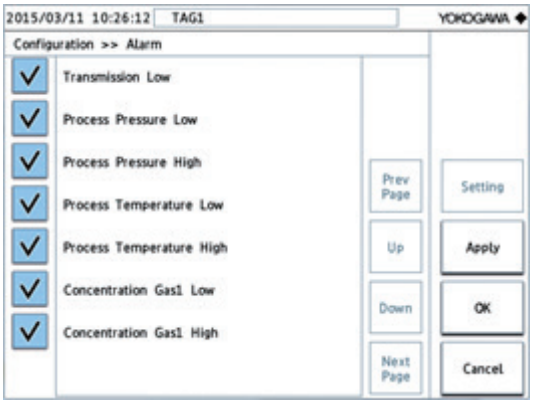
(5) For two-gas measurement, select “Detailed setup>>Alarm>>Warning>>Warning group 1,” and set the gas concentration low limit alarm for component 2. Then select “Detailed setup>>Alarm>>Warning>>Warning group 2,” and set the gas concentration high limit alarm.

Setup procedure using YH8000

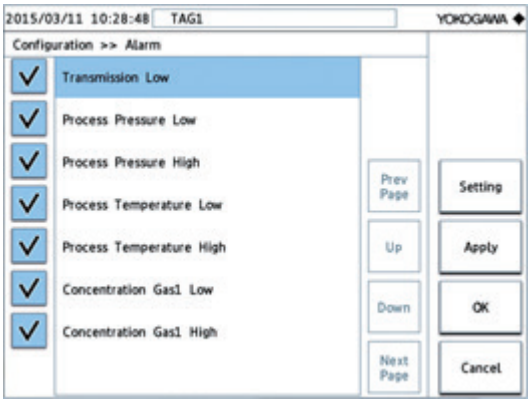
(1) From the menu, select “ >>Configuration>>Alarm” to display the following screen.



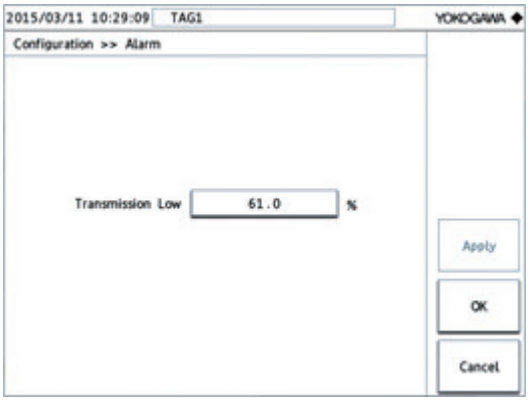
(2) You can enable or disable each warning by tapping the check mark on the left side. In the following example, the “Transmission Low” check box is selected to enable the transmission low limit alarm. Touch Apply to apply the settings to the TDLS8100.



(3) Change the threshold values of each warning. In the following example, to set the threshold value of the transmission low limit alarm, select “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 TDLS8100.



5.4 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.

5.4.1 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] “Diagnosis/Service>>Loop check”

[YH8000] “  >>Execution>>Loop Check”

NOTE

If you turn off the TDLS8100 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.

- **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”).

5.4.2 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 specified values are retained even after the power is turned off.

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6. Configuration

This chapter provides details of all the setting items and shows the locations of the setting menus of the TDLS8100. However, the setting items related to calibration and validation are described in "9. Inspection and Maintenance".

The setting menus of the YH8000 can be opened by performing the operation of “>> Select analyzer >>Configuration” but the location is shown as just being under “Configuration” in this chapter for simplicity.

6.1 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.

6.1.1 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, see5.3.2 Setting the Process Optical Path Length Setup menu path:

[HART] “Detailed setup>>Analysis>>Process param>>OPL”

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

6.1.2 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:

[HART] “Detailed setup>>Analysis>>Process param>>Pressure”

[YH8000] “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 TDLS8100 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 (AI-1).

  "Field Communication" is Modbus input. For details on the Modbus function, see "11. Modbus".

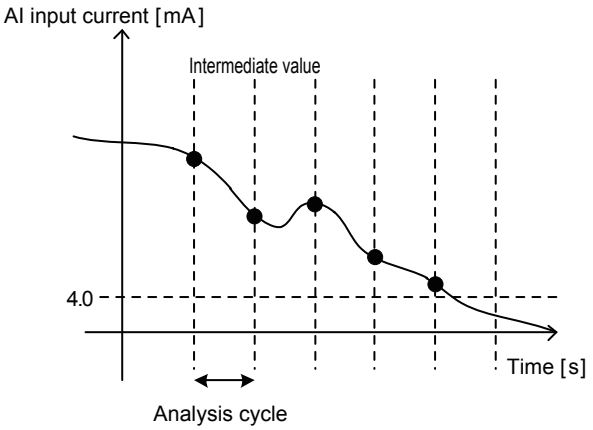
- Backup mode: When "Active input" is selected, set the pressure value to use for the concentration calculation when an input value from the sensor is out of range.

  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 TDLS8100 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 TDLS8100 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:

[HART] “Detailed setup>>I/O condition>>Analog input>>AI-1(Pressure)”

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

6.1.3 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:

[HART] “Detailed setup>>Analysis>>Process param>>Temperature”

[YH8000] “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 TDLS8100 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 TDLS8100 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 6.1.2. Read “pressure” as “temperature” and “AI-1” as “AI-2” when configuring the settings.

When “Active ambient” is selected

Set the temperature 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:

[HART] “Detailed setup>>I/O condition>>Analog input>>AI-2(Temperature)”

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

6.2 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,” and you can select from the following units for each of them.

When Only SI unit (-J) is assigned to TDLS8100, non SI Unit will not be displayed.

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

Setup menu path:

[HART] “Detailed setup>>Analysis>>Unit”

[YH8000] “Configuration>>Analysis>>Units”

6.3 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):

[HART] “Detailed setup>>I/O condition>>Analog input>>AI-1(Pressure)”

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

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

[HART] “Detailed setup>>I/O condition>>Analog input>>AI-2(Temperature)”

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

NOTE

For how to set the pressure values and temperature values for analog input, see and 6.1.2 Process Pressure and "6.1.3 Process Temperature".

6.4 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 TDLS8100.

6.4.1 Normal Range Output

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

Setup menu path:

[HART] “Detailed setup>>I/O condition>>Analog output>>AO-1 or AO-2”

[YH8000] “Configuration>>I/O>>Analog Output>>AO-1 or AO-2>>Output”

Output items and range settings

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

Output Item	HART Display Name	YH8000 Display Name
1st component gas concentration	Concentration 1	(*2)
2nd component gas concentration (*1)	Concentration 2	(*2)
Transmission	Transmission	Transmission
Temperature	Temperature	Temperature
Pressure	Pressure	Pressure

*1: Only selectable for two-gas measurement specification
*2: Displays the gas name of the measurement component
(Example) When the measurement component is oxygen: O_2 Concentration

(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 (LVR) 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 TDLS8100 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).

6.4.2 Output Hold

Output hold is a function to fix (hold) analog output to a set value when the TDLS8100 is in the following specific states.

Setup menu path:

[HART] “Detailed setup>>I/O condition>>Analog output>>AO-1 or AO-2>>Hold menu for each specific state”

[YH8000] “Configuration>>I/O>>Analog Output>>AO-1 or AO-2>>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 and validation	State when either the calibration or validation 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 TDLS8100.

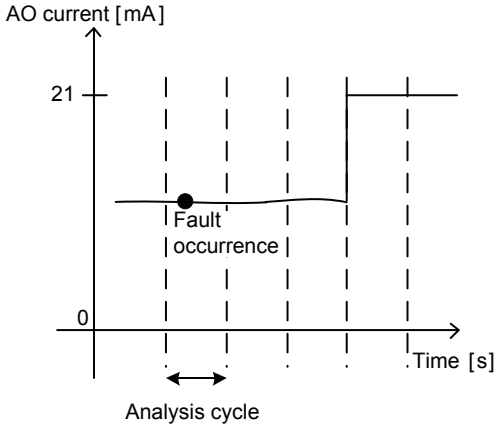
Output hold mode

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

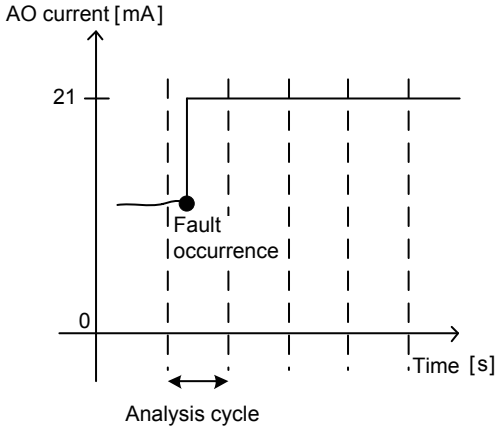
Setting Mode	Description
Preset hold	Holds output to any output value within 3.8 to 20.5 mA. * Any value within 3.0 to 21.6 mA can be set for during warning occurrence and during fault occurrence. Furthermore, the holding of output to any value can be delayed for a period of up to five analysis cycles (*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 4 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 and validation
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.

6.5 Digital Output Settings

This function is for turning on digital output when the TDLS8100 enters the following specific states.

6.5.1 DO Contact (DO-1)

Setup menu path:

[HART] “Detailed setup>>I/O condition>>Digital output>>DO-1(DO)”

[YH8000] “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 6.4.2 Output Hold.

- During warning occurrence
- Calibration and validation
- 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 4 What Is an Analysis Period?”

6.5.2 Fault Contact (DO-2)

Setup menu path:

[HART] “Detailed setup>>I/O condition>>Digital output>>DO-2(Fault)”

[YH8000] “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 App.4-1 Appendix 4 What Is an Analysis Period?

6.6 Process Alarm Settings

Of the alarms of the TDLS8100, 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 "10.2 Warning Display and Handling".

Alarm No.	Alarm Name
1	Transmission low
2	Pressure low
3	Pressure high
4	Temperature low
5	Temperature high
6	Concentration gas1 low
7	Concentration gas1 high
8	Concentration gas2 low (analyzer 2 only)
9	Concentration gas2 high (analyzer 2 only)

Setup menu path:

[HART] “Detailed setup>>Alarm”

[YH8000] “Configuration>>Alarm”

For details on the setting procedure, see "5.3.6 Setting Process Alarms".

6.7 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:

[HART] “Detailed setup>>I/O condition>>Digital input>>DI-1 or DI-2”

[YH8000] “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
Zero Calibration	Executes automatic zero calibration.	Edge
Span Calibration	Executes automatic span calibration.	Edge
Zero + Span Calibration	Continuously executes automatic zero calibration and automatic span calibration.	Edge
Offline Validation 1	Executes automatic offline validation 1.	Edge
Offline Validation 2	Executes automatic offline validation 2.	Edge
Offline Validation 1 + 2	Continuously executes automatic offline validation 1 and 2.	Edge
Online Validation 1	Executes automatic online validation 1.	Edge
Online Validation 2	Executes automatic online validation 2.	Edge
Stream 1	Switches the valve to stream 1.	Status
Stream 2	Switches the valve to stream 2.	Status
Stream 3	Switches the valve to stream 3.	Status

Note: The items of the above selection options that have been disabled by the “Valve usage setting” are not displayed. For details, see “6.8.2 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.

6.8 Valve Stream Settings

This section describes the procedure to automatically control multiple process gas streams according to the TDLS8100 valve control output (SV terminal). Up to three streams can be switched.

6.8.1 Definitions of Stream Numbers

Implement the valve operation of the TDLS8100 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 TDLS8100 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 6.1 by switching the streams.

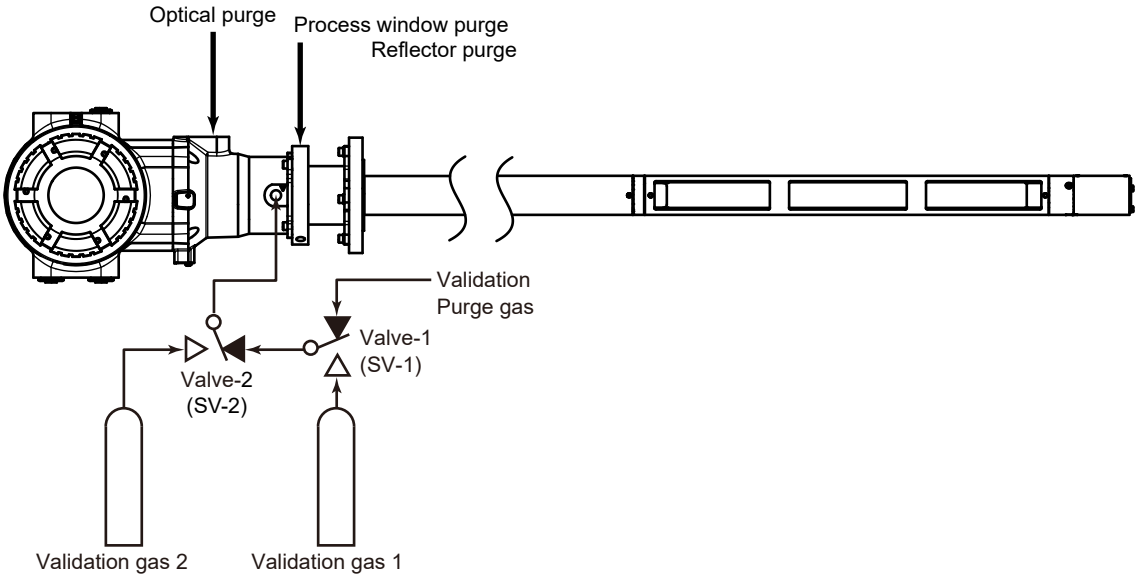


Figure 6.1 Piping diagram for switching streams

6.8.2 Valve Usage Setting

Set the valve usage purpose for automatically controlling the valves according to the SV terminal. “3 Streams Switching,” “2 Streams & Cal Val),” and “Cal/Val” can be selected.

If “3 Streams Switching” is selected, three process gases can be switched and measured in order. In the case of 2 stream switching, a calibration gas or check gas can be connected to the remaining stream (stream 3) so that it can be used for calibration or validation.

Setup menu path to Valve usage:

[HART] “Detailed setup>>I/O condition>>Valve control>>Set valve usage”

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

NOTE

The stream switching and automatic calibration and validation items that can be executed according to the TDLS8100 valve control output (SV terminal) are limited depending on the “Valve usage” setting.

- Cal/Val Usage

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

  To switch the process gas, do it manually.

- 2 Streams & Cal/Val Usage

  Sets only stream 3 to be used for automatic calibration and validation. The following automatic calibration and validation cannot be executed because they would use stream 2. Calibration and validation can only be executed manually.

  - Zero calibration
  - Offline validation 1
  - Online validation 1

- 3 Streams Switching Usage

  All streams are set to be used for stream switching. None of the automatic calibration or validation can be executed. Calibration and validation can only be executed manually.

NOTE

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

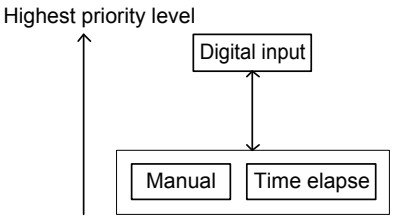
- The time execution setting (Time initiate) of all automatic calibration and validation is set to “Disable.”
- If remote execution of automatic calibration and validation is set for digital input, it is set to “Disable.”
- If stream switching is set for digital input, it is set to “Disable.”
- The “Current stream” setting is set to “Stream 1.”
- The “Initial stream” setting is set to “Stream 1.”

6.8.3 Stream Settings

There are the following three stream switching methods.

Manual	Specify a stream and then switch to it from an YH8000 or HART screen.
Time elapse	Switches to the next stream automatically when the specified time elapses after a stream has been switched. When switching is performed manually or when switching to the initial stream is performed after the power of the TDLS8100 is turned on, counting of the specified time begins. This function does not work for switching by digital input.
Digital input	Switches to the specified stream while the digital input is closed. The specified stream is switched to giving priority over the stream switched to with the manual or time elapse method. When the digital input returns to the open state, the stream returns to that switched to with the manual or time elapse method. The following figure shows the priority order.

The following figure shows the priority order. The manual and time elapse methods have the same priority level, and operation of the digital input is given higher priority.



Switching by manual operation

Setup menu path:

[HART] “Detailed setup>>I/O condition>>Valve control>>Current stream”

[YH8000] “Configuration>>I/O>>Valve Control>>Current”

To switch the stream manually, select the stream you wish to switch to in “Current stream.”

Switching by time elapse

If “3 Streams Switching” or “2 Streams & Cal Val” is selected for the “Valve usage” setting, the valve open duration and the stream to switch to can be set for each stream. Enter the duration to open the valve (duration for gas to flow to the target stream) in “Duration” and specify the stream you wish to switch to next in “Switch to.” Setting the next stream in “Switch to” in the same way for the stream that is switched to enables switching again to that stream after the specified time elapses.

Setup menu path:

[HART] “Detailed setup>>I/O condition>>Valve control>>Stream time switch”

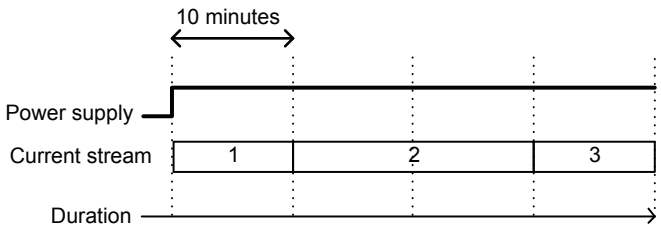
[YH8000] “Configuration>>I/O>>Valve Control”

[Example of stream switching]

When “Valve usage” = “3 Streams Switching” and the settings are as follows:

Stream	Current	Switch to	Duration	Initial
1	■	Stream 2	10	■
2	□	Stream 3	20	□
3	□	Disable	30	□

The transition to the current stream will be as shown in the figure below.



Switching by digital input

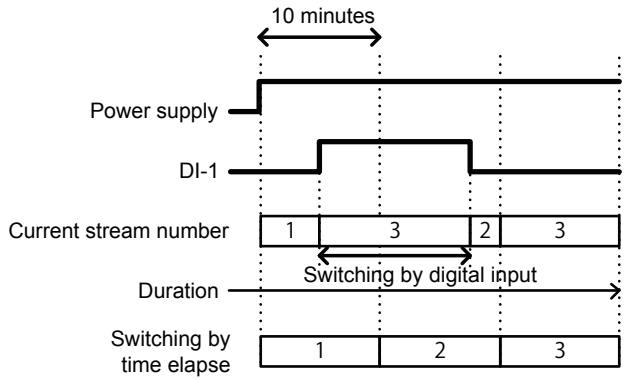
Set the function to switch the stream upon digital input. For the setting procedure, see “6.7 Digital Input Settings”.

[Example of switching by digital input]

When “Valve usage” = “3 Streams Switching,” “DI-1 Mode” = “Stream 3,” and the settings are as follows:

Stream	Current	Switch to	Duration	Initial
1	■	Stream 2	10	■
2	□	Stream 3	10	□
3	□	Disable	10	□

“Current stream number” in the following figure refers to the final stream. Priority is given to switching by digital input so the stream is switched to stream 3 while DI-1 is closed. However, since counting and stream switching by the time elapse method continues to be performed internally (bottommost line in the figure), the stream switches to stream 2 at the point when DI-1 returns to the closed state.



6.8.4 Initial Stream (Stream at Startup)

When the power of the TDLS8100 is turned on, the current stream is switched to the stream set as the initial stream. The settable range of the “Initial stream” setting is only a stream selected for stream switching usage in the “Valve usage” setting. The streams that can be set as the initial stream are indicated by ○ in the table below.

Valve usage	Stream 1	Stream 2	Stream 3
Cal/Val usage	○	×	×
2 Streams & Cal/Val usage	○	○	×
3 Streams Switching usage	○	○	○

Setup menu path:

[HART] “Detailed setup>>I/O condition>>Valve control>>Initial stream”

[YH8000] “Configuration>>I/O>>Valve Control>>Initial”

NOTE

If switching the stream by time elapse is set for the stream number of the initial stream, counting of the switching time begins from after the power is turned on.

6.9 Other Settings

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

6.9.1 Tag

This is a tag of up to 32 ASCII characters for identifying individual TDLS8100. It is displayed when you connect to the TDLS8100 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] “Detailed setup>>System>>Long tag”

[YH8000] “Configuration>>System>>Tag”

6.9.2 Date and Time

Set the current date and time. For a detailed description of the setting screen, read “5.3.1 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 “8.7.3 Setting the Date and Time on Analyzer”.

Setup menu path:

[HART] “Detailed setup>>System>>Date/time>>Set date/time”

[YH8000] “Configuration>>System>>Date&Time”

6.9.3 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.

Setup menu path:

[YH8000] “Configuration>>System>>Password”

6.9.4 Display

Configure settings related to the LU display and SCU display.

- **Brightness adjustment of LU display**

Set the brightness to any of 11 levels.

Setup menu path:

[HART] “Detailed setup>>System>>Local display>>LU LED display”

[YH8000] “Configuration>>System>>Local Display>>LU”

- **Brightness adjustment of SCU display**

Adjust backlight brightness and contrast to any of 11 levels.

Setup menu path:

[HART] “Detailed setup>>System>>Local display>>SCU LCD display”

[YH8000] “Configuration>>System>>Local Display>>SCU”

Spectrum display of LCD display

Set whether or not to display the spectrum screen.

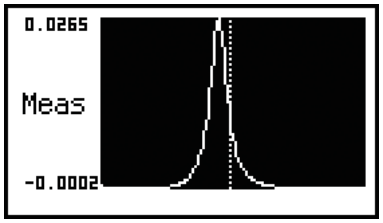
Setup menu path:

[HART] “Detailed setup>>System>>Local display>>SCU LCD display”

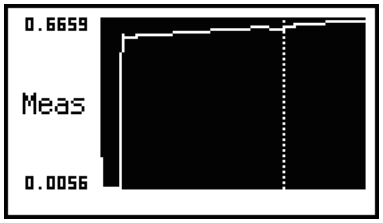
[YH8000] “Configuration>>System>>Local Display>>SCU”

<table>
<tr><th>Selection Option (HART Display Name)</th><th>Description</th></tr>
<tr><td>Hide</td><td>A spectrum is not displayed.</td></tr>
<tr><td>During alarm mode</td><td>• 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.
<table>
<tr><th>No.</th><th>Alarm</th></tr>
<tr><td>49</td><td>warning: detector signal high</td></tr>
<tr><td>50</td><td>fault: peak center out of range</td></tr>
<tr><td>52</td><td>warning: absorption too high</td></tr>
<tr><td>53</td><td>fault: transmission lost</td></tr>
<tr><td>57</td><td>fault: laser unit failure</td></tr>
</table>
• 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.)
<table>
<tr><th>No.</th><th>Alarm</th></tr>
<tr><td>51</td><td>fault: reference peak height low</td></tr>
<tr><td>54</td><td>fault: reference transmission low</td></tr>
<tr><td>55</td><td>fault: reference peak height high</td></tr>
</table></td></tr>
<tr><td>Periodic</td><td>After display of the 6th display item on the screen is complete, the measurement spectrum is displayed for 4 seconds.</td></tr>
<tr><td>Each measurement spectrum</td><td>The received optical signal and absorption spectrum of the measured gas are always displayed alternately in a 4-second cycle.</td></tr>
<tr><td>Each reference spectrum</td><td>The received optical signal and absorption spectrum of the reference cell are always displayed alternately in a 4-second cycle.</td></tr>
</table>

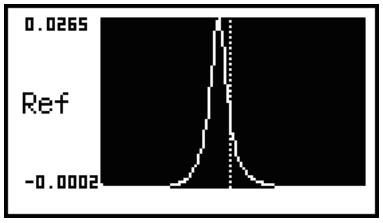
The following shows the display image of each spectrum screen.



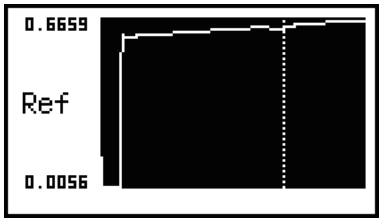
Measurement absorption spectrum



Measurement received optical signal



Reference cell absorption spectrum



Reference cell received optical signal

6.9.5 Communication Address Setting

Configure the address settings for TDLS8100 and HART communication.

- **IP address setting of TDLS8100**

Setup menu path:

[HART] “Detailed setup>>System>>Communication>>TCP/IP>>Set IP settings”

[YH8000] “Configuration>>System>>Communication>>TCP/IP”

NOTE

When the IP address is changed, the TDLS8100 restarts automatically.

NOTE

When the IP address of the TDLS8100 is changed via the YH8000, the YH8000 connection settings need to be configured again. For details, see “5.2.3 Connecting to the TDLS8100”.

- **HART address setting**

Setup menu path:

[HART] “Detailed setup>>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 “7.5.1 Multidrop Mode”.

6.9.6 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 4 What Is an Analysis Period?”

Setup menu path:

[HART] “Detailed setup>>Analysis>>Averaging”

[YH8000] “Configuration>>Analysis>>Average”

6.9.7 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:

[HART] “Detailed setup>>Analysis>>Zero offset”

[YH8000] “Configuration>>Analysis>>Zero Offset”

6.9.8 Safety Mode

Safety Mode secures TDLS8100 operation in the safety instrumented system. The following table shows how configuration of Safety Mode affects the operation.

See “Appendix 5 Safety Instrumented System Installation”.

Setup menu path:

[HART] “Detailed setup>> System >>Safety mode”

[YH8000] “Configuration>>System >>Safety Mode”

Safety mode / Effect on	Enable	Disable (default)
Condition of fault clearance	Fault stays until the system reboots.	Once the problem is solved, the fault is cleared.
Threshold of Fault: Transmission Lost	Detector sensitivity becomes high	Detector sensitivity becomes standard
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 Fault reset	=0 mA	normal operation

6.10 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.

6.10.1 Initialization Procedure

Execution menu path:

[HART] “Detailed setup>>System>>Initialize config”

[YH8000] >>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 (HART)	Initialization target
Setting data	All parameters settable from YH8000 and HART (All parameters in section 6.11.2 except for “User info.”)
AI/AO cal data	Input/output calibration data of AI/AO
Calibration data	Zero/span calibration data
User info	TDLS8100 tag, IP settings, HMI (YH8000) user password, HART address, HART 8-character short tag, write protect password

NOTE

When initialization is executed, the TDLS8100 restarts automatically.

6.10.2 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)	0.660[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
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]

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 calibration/validation		Preset hold		Select in the screen
Preset hold value during calibration/validation		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	Cal/Val	Select in the screen
Initial stream	Stream 1	Select in the screen
Next stream of stream switching by time duration	Disable	Select in the screen
Time duration of next stream	60[min]	1 – 1,440[min]

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	Disable		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.
Polling address	0	0 – 63
Loop current mode	Enable	Select in the screen
Write protect password	All space	ASCII 8 characters
Short tag	All space	8 characters (*1)
TV item	Temperature	Select in the screen
QV item	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)
Trim Who/Trim Desc/Trim Loc	All space	ASCII 16 characters
Date/Trim date	1900/01/01	1900/01/01 – 2155/12/31
Configuration locked status mask	Off	Select in the screen

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

Zero calibration

Parameter	Initial value	Min. – Max.
Auto zero calibration time initiate	Disable	Select in the screen
Auto zero calibration time initiate cycle (day)	0 (=Disable)	0 – 999
Auto zero calibration time initiate cycle (hour)	0 (=Disable)	0 – 23
Auto zero calibration time initiate base clock	2010/01/01 00:00:00	2010/01/01 00:00 – 2068/01/18 13:14
Auto zero calibration gas purge time	600[s]	0 – 10,000[s]
Auto zero calibration process purge time	600[s]	0 – 10,000[s]
Auto valve control for manual zero calibration	Disable	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)
Gas type for span calibration	Gas 1	Select in the screen
Auto span calibration time initiate	Disable	Select in the screen
Auto span calibration time initiate cycle (day)	0 (=Disable)	0 – 999
Auto span calibration time initiate cycle (hour)	0 (=Disable)	0 – 23
Auto span calibration time initiate base clock	2010/01/01 00:00:00	2010/01/01 00:00 – 2068/01/18 13:14
Auto span calibration gas purge time	600[s]	0 – 10,000[s]
Auto span calibration process purge time	600[s]	0 – 10,000[s]
Auto valve control for manual span calibration	Disable	Select in the screen

*1: Zero is not allowed.

Zero + span calibration

Parameter	Initial value	Min. – Max.
Auto zero + span calibration time initiate	Disable	Select in the screen
Auto zero + span calibration time initiate cycle (day)	0 (=Disable)	0 – 999
Auto zero + span calibration time initiate cycle (hour)	0 (=Disable)	0 – 23
Auto zero + span calibration time initiate base clock	2010/01/01 00:00:00	2010/01/01 00:00 – 2068/01/18 13:14

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)
Gas type for offline validation 1	Gas 1	Select in the screen
Auto offline validation 1 time initiate	Disable	Select in the screen
Auto offline validation 1 time initiate cycle (day)	0 (=Disable)	0 – 999
Auto offline validation 1 time initiate cycle (hour)	0 (=Disable)	0 – 23
Auto offline validation 1 time initiate base clock	2010/01/01 00:00:00	2010/01/01 00:00 – 2068/01/18 13:14
Auto offline validation 1 gas purge time	600[s]	0 – 10,000[s]
Auto offline validation 1 process purge time	600[s]	0 – 10,000[s]
Auto valve control for manual offline validation 1	Disable	Select in the screen
Auto offline validation 1+2 time initiate	Disable	Select in the screen
Auto offline validation 1+2 time initiate cycle (day)	0 (=Disable)	0 – 999
Auto offline validation 1+2 time initiate cycle (hour)	0 (=Disable)	0 – 23
Auto offline validation 1+2 time initiate base clock	2010/01/01 00:00:00	2010/01/01 00:00 – 2068/01/18 13:14

*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]
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.”

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]

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7. 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
- Checking alarms and calibration history

This chapter explains matters specific to HART communication.

7.1 Connection

For the method of connecting a HART setting tool to the TDLS8100, see "5.1 Connecting the HART Configuration Tool".

7.2 Menu Tree

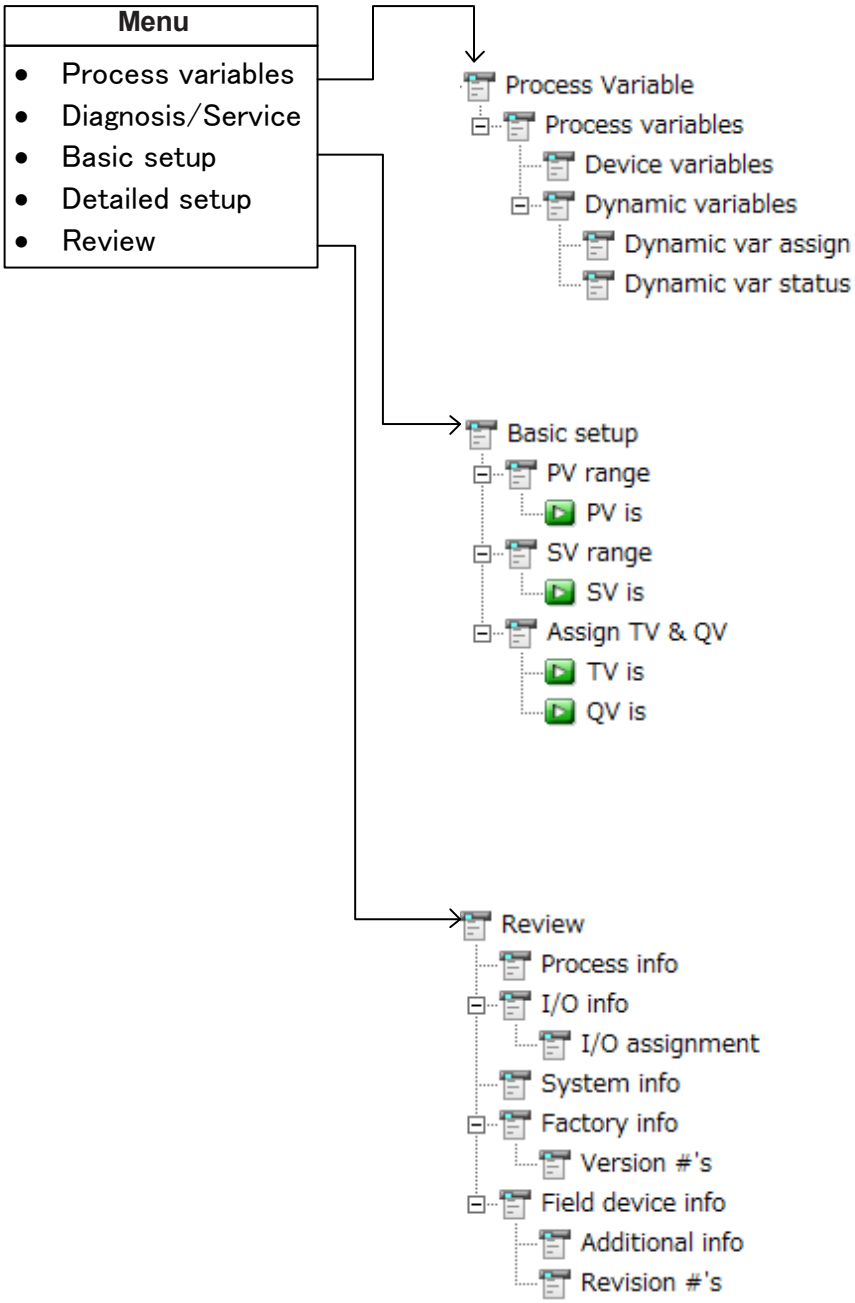
This section shows the hierarchal configuration of the DD menu. For the whole configuration containing all parameters, see “Appendix 2 General View of HART DD”.

7.2.1 DD Menu

The root menu (top menu) is as follows.

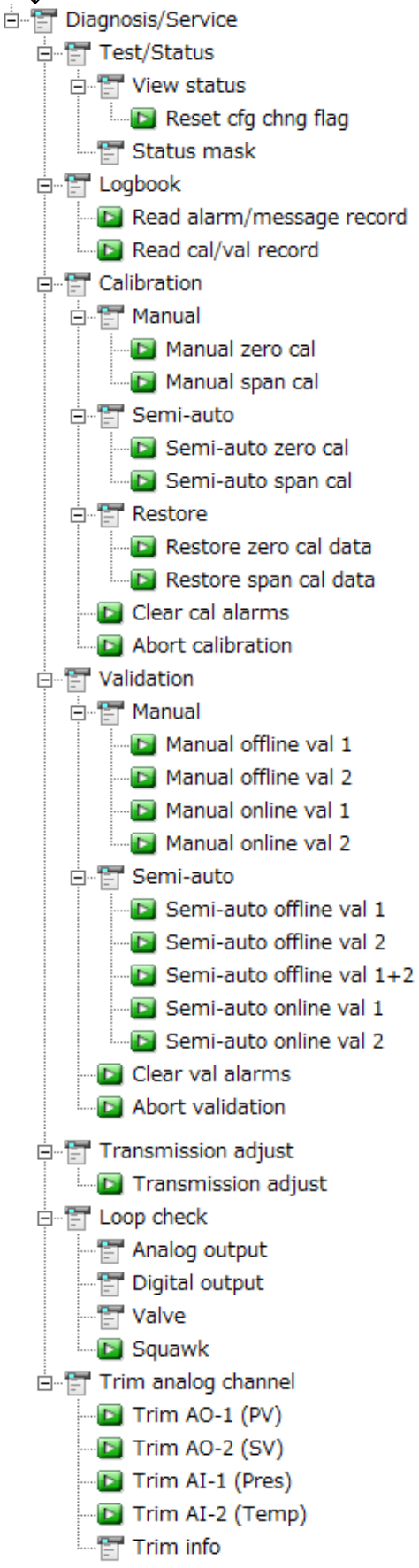
Root menu	Description
Process variables	Displays the latest values of PV-QV and measurements.
Diagnosis/Service	Checks alarms and history; performs calibration, validation, and loop check
Basic setup	Assigns PV-QV items; sets output ranges
Detailed setup	Sets parameters specific to the TDLS8100
Review	Displays measurements, I/O values, and manufacturing information

The menus in the second and lower layers are as follows.


Menu
Process variables
Diagnosis/Service
Basic setup
Detailed setup
Review
Process Variable
Process variables
Device variables
Dynamic variables
Dynamic var assign
Dynamic var status
Basic setup
PV range
PV is
SV range
SV is
Assign TV & QV
TV is
QV is
Review
Process info
I/O info
I/O assignment
System info
Factory info
Version #'s
Field device info
Additional info
Revision #'s

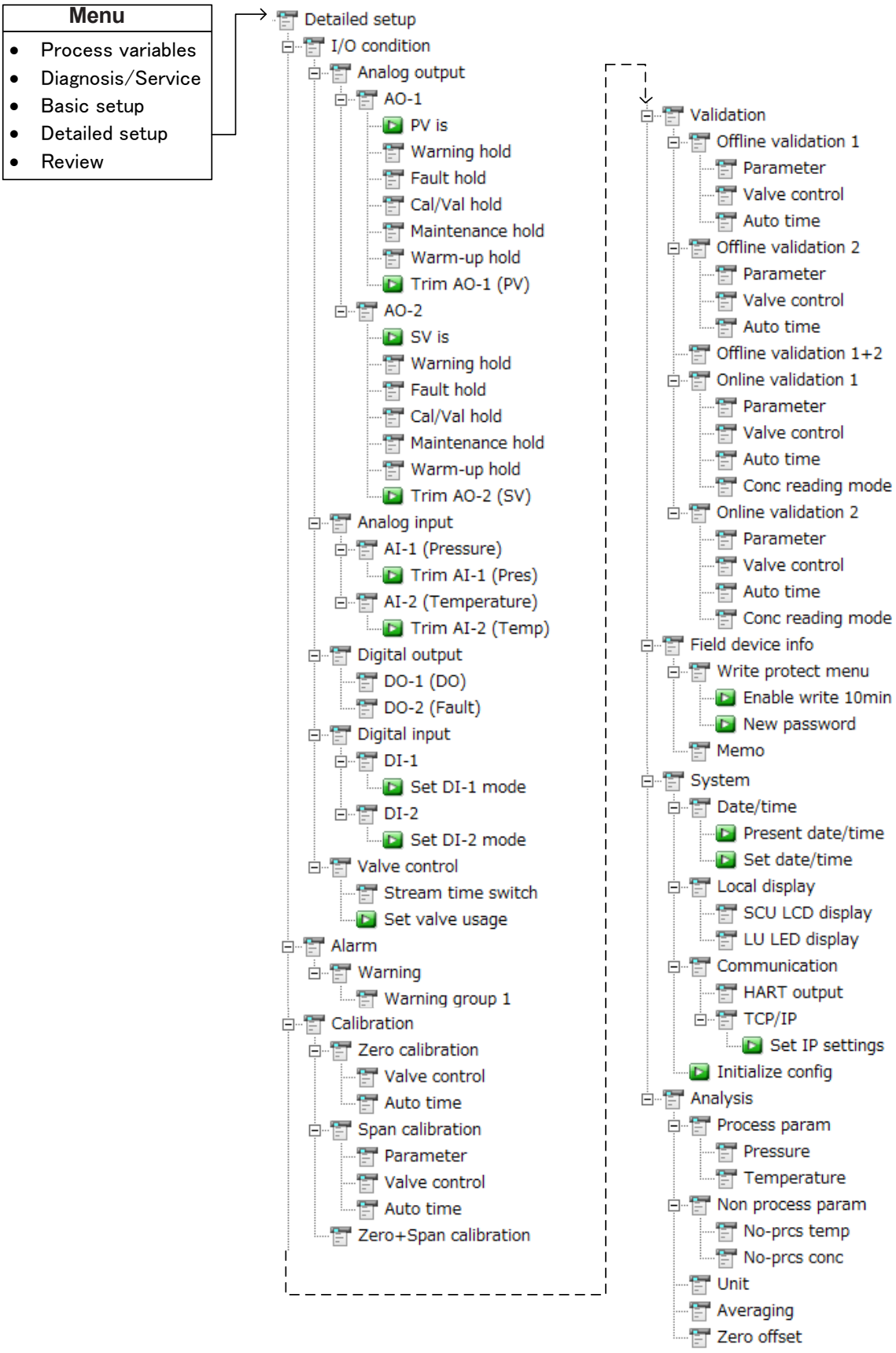
Menu

- Process variables
- Diagnosis/Service
- Basic setup
- Detailed setup
- Review



Menu

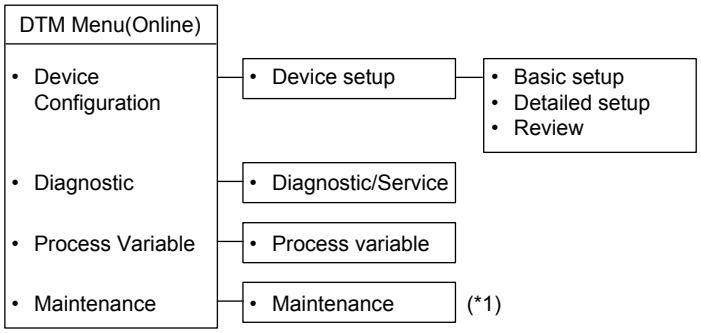
- Process variables
- Diagnosis/Service
- Basic setup
- Detailed setup
- Review



7.2.2 DTM Menu (FieldMate)

FieldMate is Yokogawa's HART setting tool that runs on PCs. The menu displayed on FieldMate slightly differs from the DD menu.

As shown in the figure below, the root menu (top menu) of FieldMate is "DTM Menu (Online)", under which the DD menu comes as five sub-menus (see 7.2.1). The configuration under the sub-menus is the same as that of the DD menu.



*1: Of the commands in the "Diagnostic/Service" menu, the execution commands for calibration, validation, and loop check are included.

7.3 Write Protection

The write protection via HART communication is a double protection architecture: a hardware-switch protection and software-authenticated protection. When both protections are released, the data can be written to the TDLS8100.

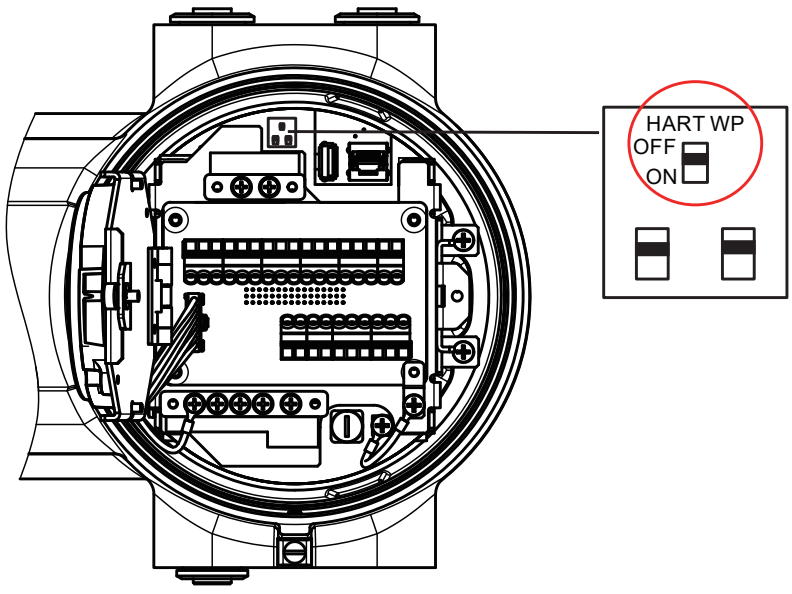
The current protection status can be confirmed from the value of "Yes" or "No" of the "Write protect" parameter, which is retrieved by either of the following menus.

- "Review>>Field device info"
- "Detailed setup>>Field device info>>Write protect menu"

7.3.1 Hardware Write Protection

By turning the switch ON the analyzer part, write protection is enabled. The default setting is OFF.

Switch position	Write protection
OFF	Disabled
ON	Enabled



7.3.2 Software Write Protection

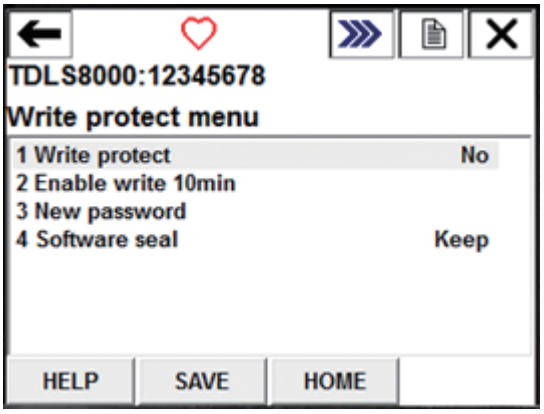
By setting a password (eight alphanumeric characters), write protection is enabled. The password can be set and changed on the “New password” screen. When a password has been set and it is entered in the “Enable write 10min” screen, the protection is disabled for 10 minutes. When any data is written to the TDLS8100, the disabled time will be extended for another 10 minutes. This means that the protection is enabled 10 minutes after the last writing.

To disable software write protection indefinitely, enter 8 character spaces in the “New password” screen. As the default, protection is disabled (8-character spaces have been entered).

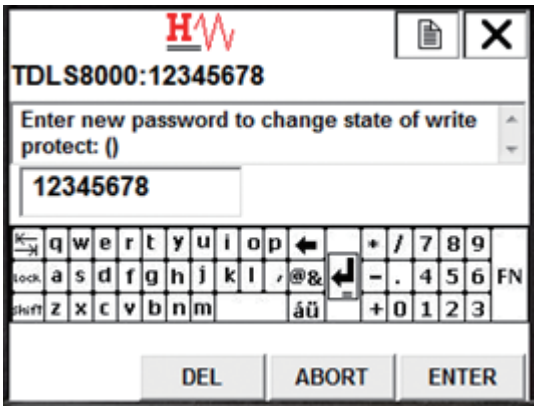
● How to set a password

How to set a password will be explained using the character string “12345678” as an example.

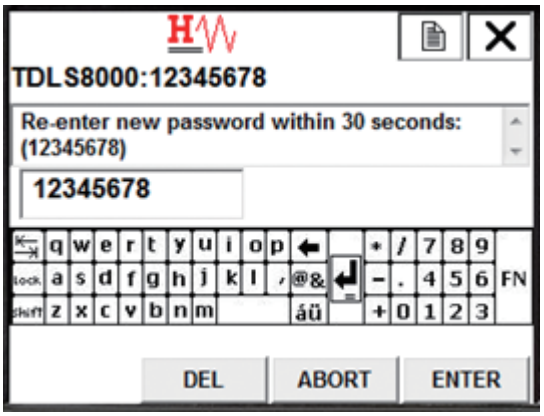
(1) Go down the menu to Write protect menu: “Detailed setup>>Field device info>>Write protect menu”. The screen shown below will appear. Select the “New password” line.



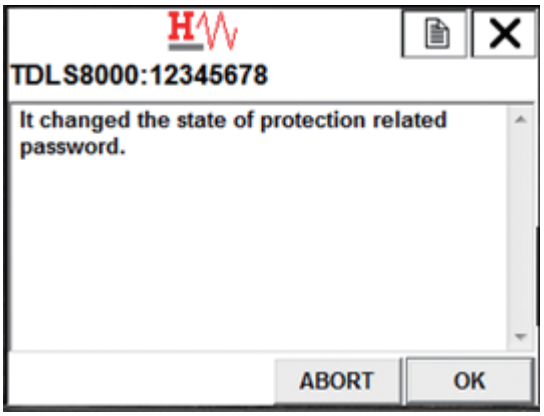
(2) Enter “12345678” and click “ENTER”.



(3) Confirm that “12345678” has been entered and click ENTER within 30 seconds.



(4) When the new password is set, the following screen will appear. Click “OK”.



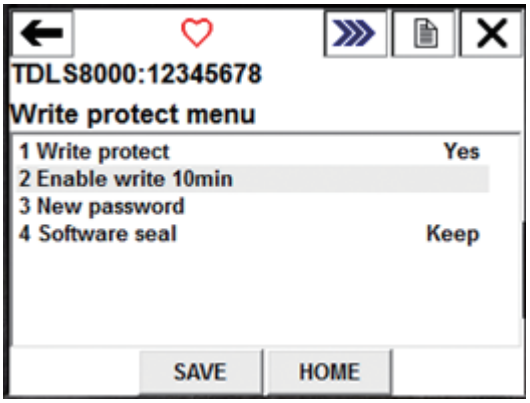
NOTE

When the TDLS8100 is in either of the following statuses, writing via HART communication is not allowed even if write protection is disabled.

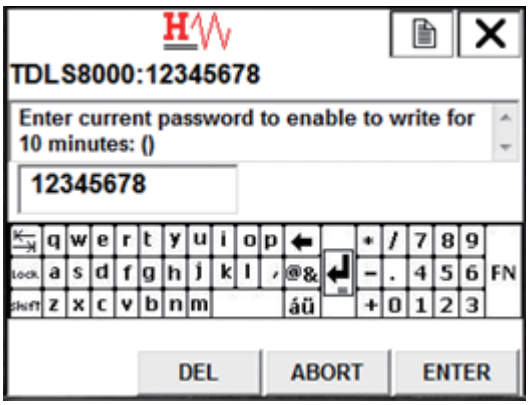
- A password for maintenance has been entered on the YH8000 and the setting change is enabled (during maintenance)
- Calibration and validation are being performed.

How to disable protection for 10 minutes

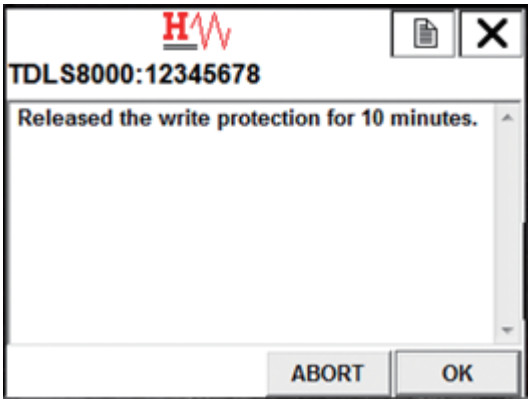
(1) Go down the menu to Write protect menu: “Detailed setup>>Field device info>>Write protect menu”. The following screen will appear. Select the “Enable write 10min” line.



(2) Enter “12345678” and click “ENTER”.



(3) After successful verification, the following screen will appear. Click “OK”. Click “OK” again on the next screen.



7.3.3 Device Configuration Locked

The TDLS8100 in the write protection status is recognized by some host systems as being in the “Device Configuration Locked” status, which is defined in HART communication, indicating that the TDLS8100 is in an abnormal condition. A window may pop up on a field communicator to prompt confirmation.

To avoid this, the TDLS8100 has a function to mask this status. By setting this mask to ON, the “Device Configuration Locked” status will not occur even in the write protection status. The default setting is OFF. The setting will be maintained even after the power is turned off.

Menu: “Diagnosis/Service>>Test/Status>>Status mask>>Dev cfg locked mask”

7.4 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: “Diagnosis/Service>>Test/Status>>View status”

Group	Status	Attribute	Description
Group 1	Transmission Low (AL-01)	Warning	*1
	Pressure Low (AL-02)		
	Pressure High (AL-03)		
	Temperature Low (AL-04)		
	Temperature High (AL-05)		
	Conc Gas1 Low (AL-06)		
	Conc Gas1 High (AL-07)		
	Conc Gas2 Low (AL-08)		
Group 2	Conc Gas2 High (AL-09)		
	LU Temp Low (AL-10)		
	LU Temp High (AL-11)		
	SCU Temp Low (AL-12)		
	SCU Temp High (AL-13)		
	Validation Required (AL-14)		
	Validation Error (AL-15)		
	Zero Cal Error (AL-16)		
Group 3	Span Cal Error (AL-17)		
	Non Process Alarm (AL-19)		
	AI-1 (Pres) Low (AL-20)		
	AI-1 (Pres) High (AL-21)		
	AI-2 (Temp) Low (AL-22)		
	AI-2 (Temp) High (AL-23)		
	External Alarm (AL-24)		
Group 4	Clock Adj Required (AL-25)		
	Setting File Error (AL-26)		
	Calib File Error (AL-27)		
Group 6	Laser Md Temp Low (AL-45)	Fault	*2
	Laser Md Temp High (AL-46)		
	Laser Temp Low (AL-47)		
	Laser Temp High (AL-48)		
Group 7	Detect Signal High (AL-49)	Warning	*1
	Peak Center OOR (AL-50)	Fault	*2
	Ref Peak Height Low (AL-51)		
	Absorption High (AL-52)	Warning	*1
	Transmission Lost (AL-53)	Fault	*2
	Ref Trans Low (AL-54)		
	R Peak Height High (AL-55)		
	Outlier Reject Lmt (AL-56)	Warning	*1
Group 8	Laser Unit Fail (AL-57)	Fault	*2
	Inter Comm Fail (AL-58)		
	Laser Module Error (AL-59)		
	File Access Error (AL-60)		
	EEPROM Error (AL-61)		
	LU Connect Error (AL-62)		
	FPGA Failure (AL-63)		
	Program Error (AL-64)		
Group 9	Warm-up	Status	Warming-up
	Maintenance mode		Maintenance
Group 10	Zero Cal		Zero calibration
	Span Cal		Span calibration
	Offline Val		Off-line validation
	Online Val		Online validation
	AI-1 (Pres) Cal		AI-1 (pressure input) calibration
	AI-2 (Temp) Cal		AI-2 (temperature input) calibration

*1 See “10.2 Warning Display and Handling”.
*2 See “10.1 Fault Display and Handling”.

7.5 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 TDLS8100 only for HART communication.

7.5.1 Multidrop Mode

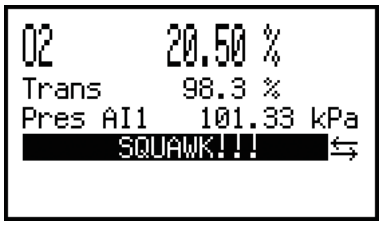
In the multidrop mode, multiple HART communication devices can be connected to a single HART communication line. Set “Poll addr” to a value of 0 to 63 so that each device has a different address.

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”.

Configuration menu: “Detailed setup>>System>>Communication>>HART output”

7.5.2 Squawk

This function identifies any unit of the TDLS8100 that is connected via HART communication. “SQUAWK !!!” will appear on the SCU display of the TDLS8100 as shown below.



- **How to use the Squawk function**

(1) Go down the menu to Squawk: “Diagnosis/Service>>Loop check>>Squawk”.

(2) Choose an operation of Squawk among the following.

Option	Operation
Off	Disables Squawk
On	Enables Squawk. Continues the display until “Off” is chosen or the TDLS8100 is turned off.
Squawk Once	Enables squawk for 10 seconds.

7.5.3 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 TDLS8100. 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: “Diagnosis/Service>>Calibration>>Abort calibration”

For validation: ”Diagnosis/Service>>Validation>>Abort validation”

The following shows how to abort manual span calibration.

(1) During the span calibration, go down the menu to Abort calibration:

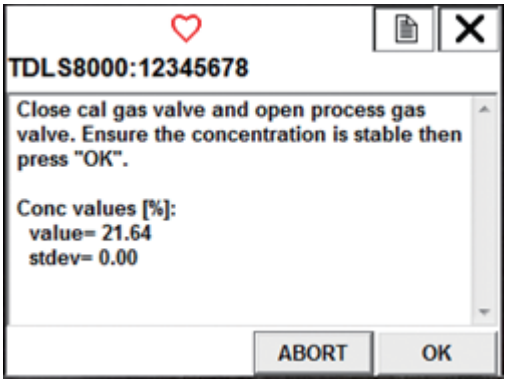
"Diagnosis/Service>>Calibration>>Abort calibration"

(2) After clicking "OK" on the warning screen, the screen shown below will appear.

If calibration is not being performed, an error message will appear. Confirm that the abortion target is span calibration, and select "Yes".

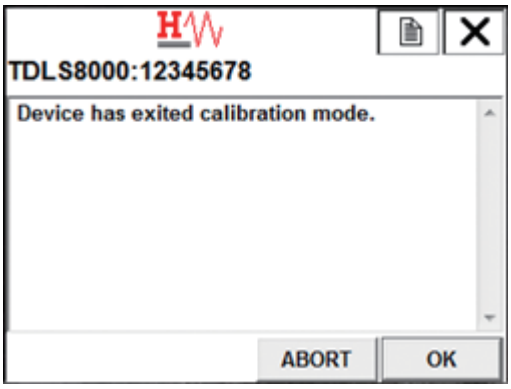
(3) The process gas injection screen will appear.

When automatic valve control is disabled, manually open the valve and purge the calibration cell with process gas. After confirming that the process gas concentration has stabilized, click "OK".



(4) The screen shown below appears and the abortion of span calibration will finish.

Click "OK" to return to the menu.



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8. YH8000 HMI Unit

The YH8000 HMI unit is an HMI (Human Machine Interface) option for the TDLS8000 series laser gas analyzer (hereinafter called “analyzer”). This chapter explains how to use the YH8000.

CAUTION

To prevent damaging the touch panel, do not use pointed objects (e.g., ballpoint pen, pencil), objects with narrow tips, hard objects, and the like when you use the touch panel.

Also, to prevent erroneous operation, touch the center of controls.

Avoid applying strong load on the screen to prevent damage or malfunction.

8.1 Connection

For details on how to connect the YH8000 HMI unit to the TDLS8100 Tunable Laser Spectrometer, see “5.2 Connecting to the YH8000”

8.2 Home Screen

The home screen shown in Figure 8.1 or Figure 8.2 is the YH8000 main screen. Tapping  at the bottom of the screen shows the home screen.

If none of the analyzer is connected to the YH8000, switching to the home screen is not possible.

If multiple TDLS8100s are connected, you can select to show the overall display. For details on the overall display, see “8.7.1 Overall Display”.

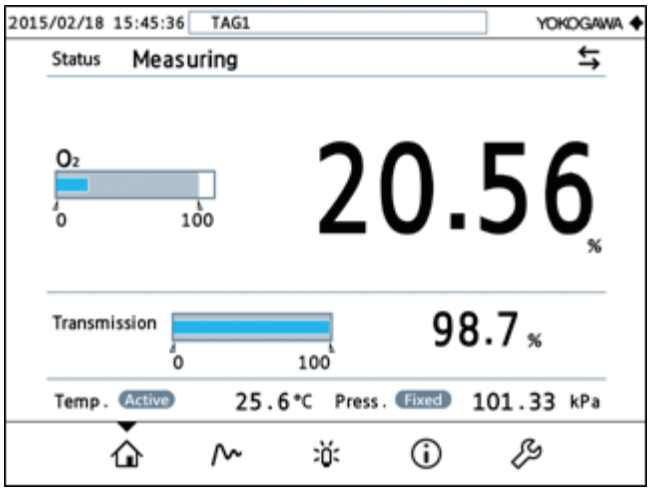


Figure 8.1 Home screen (when a single analyzer is connected)

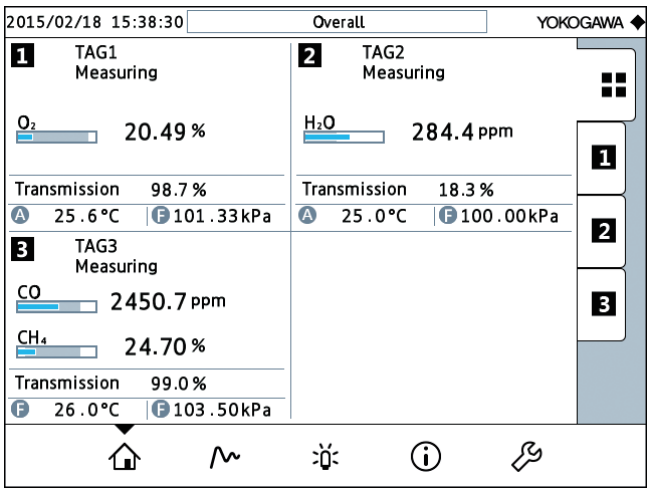


Figure 8.2 Home screen (overall display when three analyzers are connected)

8.2.1 Home Screen Display Items

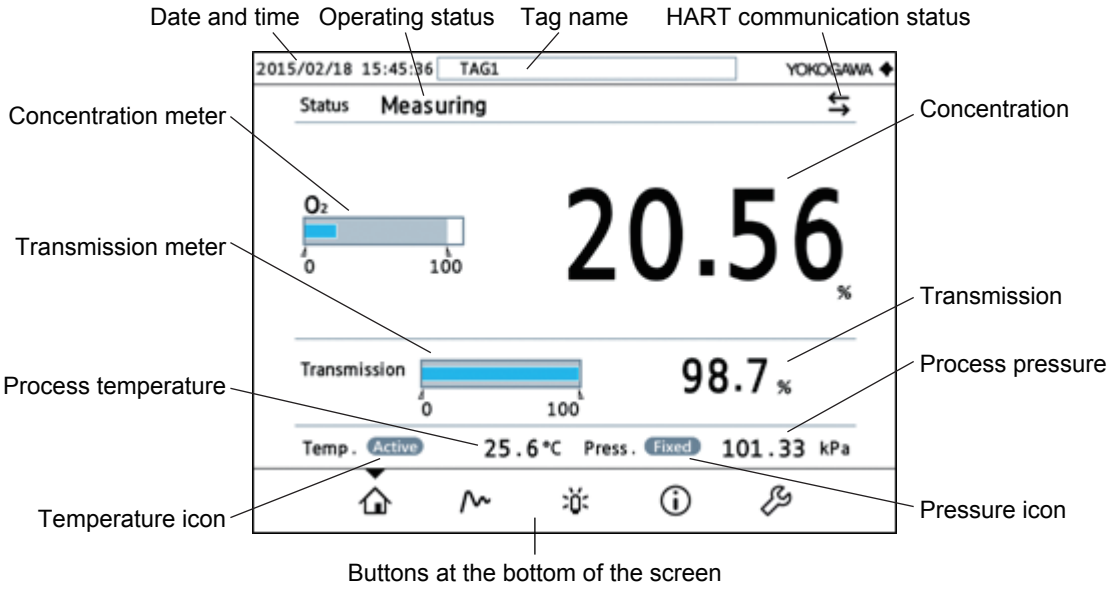


Figure 8.3 Home screen display items

Date and time

Shows the date and time set on the analyzer.

Tag

Shows the analyzer's tag name.

If the overall display is shown, "Overall" is displayed.

Operating status

Shows the analyzer's operating status.

Display	Meaning
Measuring	Measuring (normal operation)
Warm-up	Warming up
Maintenance	Maintenance in progress
Zero Calibration	Zero calibration in progress
Span Calibration	Span calibration in progress
Offline Validation	Offline validation in progress
Online Validation	Online validation in progress

HART communication in progress

An icon appears when a HART command is received.

Concentration

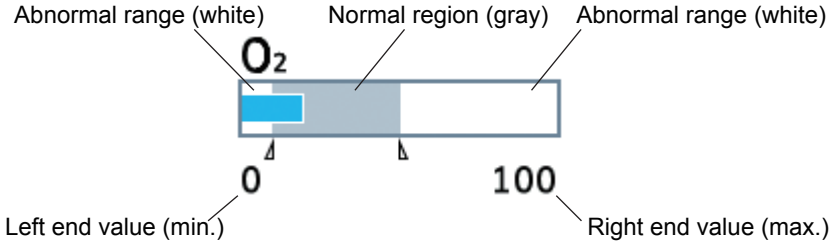
Shows the concentration.

If any of the following alarms are occurring, "***" is displayed because the concentration cannot be calculated.

Alarm number	Alarm name
49	Detector Signal High
50	Peak Center Out of Range
52	Absorption too High
53	Transmission Lost
56	Outlier Rejection Limit

Concentration meter

Shows the concentration with a meter.



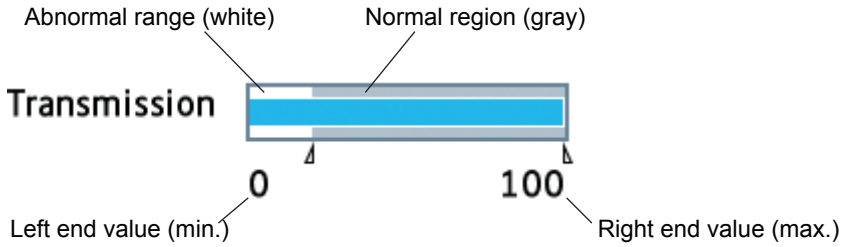
The white area indicates outside the concentration high/low limit alarm range. For details on high/low concentration limit alarm, see "6.6 Process Alarm Settings". For details on how to set the meter display range, see "8.2.3 Setting the Meter Range".

Transmission

Shows the laser beam transmission.

Transmission meter

Shows the transmission with a meter.



The white area indicates outside the transmission low limit alarm range. For details on transmission low limit alarm, see "6.6 Process Alarm Settings". The display range is fixed to 0 to 100% and cannot be changed.

Process temperature and process pressure

Shows the process temperature and process pressure.

Temperature icon and pressure icon

Shows the process temperature and process pressure input modes.

Fixed: Fixed value

Active: Non-fixed value

Buttons at the bottom of the screen

Selects different screens.

Button	Button name	Description
	Home button	Displays the home screen.
	Trend display button	Displays the trend screen. You can view the measurement trends of multiple TDLS8100s on the same screen.
	Alarm information button	Displays the TDLS8100 alarm screen.
	Configuration display button	Displays the current TDLS8100 settings. The button can also be used to display I/O values, alarm history, and so on.
	Configuration button	Executes TDLS8100 configuration, calibration, and the like. It can also be used to change the YH8000 connection destination, IP settings, and so on.

8.2.2 Selecting the Style

There are two home screen display styles: Bar meter and Arc meter. Select the style of your liking. The factory default setting is Bar meter.

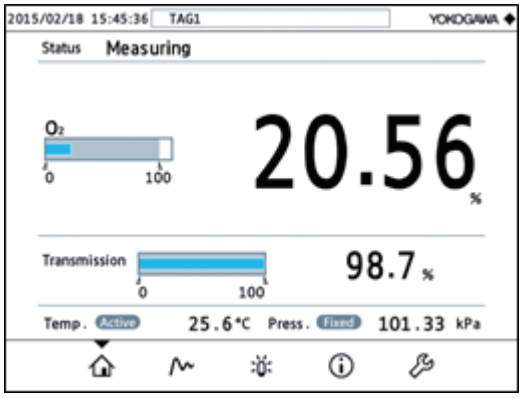
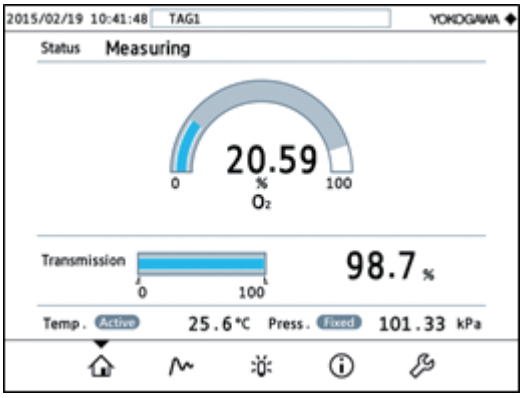


Figure 8.4 Bar meter style



Arc meter style

Configuration menu path:

"  >>HMI>>Display Setting>>Home Style"

8.2.3 Setting the Meter Range

You can set the concentration meter display range. The available range and default values are shown in the following table.

	Lower limit	Upper limit	Default value
Left end value (min.)	0% 0ppm	Right end value	0% 0ppm
Right end value (max.)	Left end value	100% 1000000ppm	100% 10000ppm

Configuration menu path:

"🔧>>HMI>>Display Setting>>Meter Range"

NOTE

Changing the meter display range will not change the analog output range of the analyzer.

8.2.4 Alarm Indicator

If an alarm is occurring on the analyzer, an icon is displayed to the left of the tag name at the top of the screen and to the right of 💡 at the bottom of the screen. Also, the area related to the alarm is enclosed in a frame.

These alarm indicators remain blinking until you check the information on the alarm screen. The indicators also start blinking when a new alarm occurs. If the alarm ceases, the alarm icons disappear.

There are two types of alarm icons: a red icon indicating 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) and a yellow icon indicating a warning (occurs when the various types of diagnostic information being monitored by the self-diagnostics function are outside the normal range).

Alarm icon types

Icon	Color	Meaning
◆	Red	Fault
□	Yellow	Warning

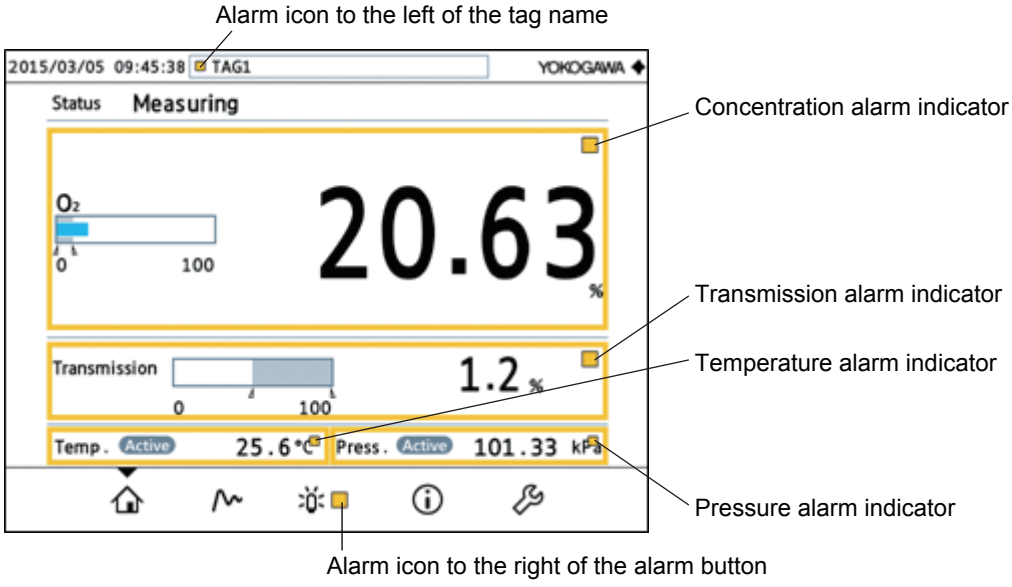


Figure 8.5 Alarm Indicator

Alarm icon to the left of the tag name

Indicates that an alarm is occurring on the applicable TDLS8000 series.

Alarm icon to the right of the alarm button

Indicates that an alarm is occurring on the connected TDLS8000 series.

Concentration alarm indicator

Indicates that one of the following alarms has occurred.

Alarm number	Alarm name
6	Concentration Gas1 Low
7	Concentration Gas1 High
8	Concentration Gas2 Low
9	Concentration Gas2 High

Transmission alarm indicator

Indicates that one of the following alarms has occurred.

Alarm number	Alarm name
1	Transmission Low
53	Transmission Lost

Temperature alarm indicator

Indicates that one of the following alarms has occurred.

Alarm number	Alarm name
4	Process Temperature Low
5	Process Temperature High

Pressure alarm indicator

Indicates that one of the following alarms has occurred.

Alarm number	Alarm name
2	Process Pressure Low
3	Process Pressure High

8.3 Trend Screen

Tapping  at the bottom of the screen shows the trend screen. The trend screen displays the trend waveforms of four items. The items that can be displayed include concentration, transmission, process temperature, and process pressure.

If there is no connected TDLS8100, switching to the trend screen is not possible.

8.3.1 Trend Screen Display Items

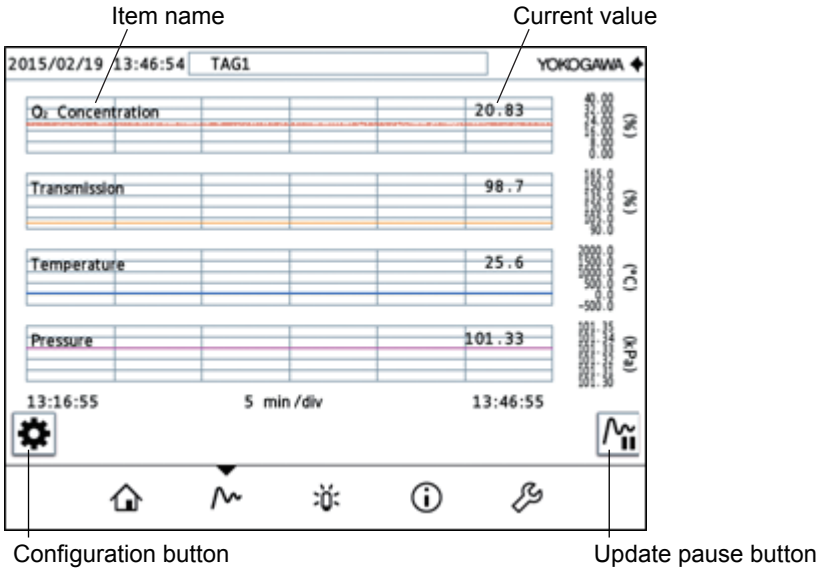


Figure 8.6 Trend Screen

Item name

Shows the item of the displayed trend waveform.

If multiple TDLS8100s are connected, analyzer numbers are added in front of item names as shown below.

Current value

Shows the current value of the displayed item.

Configuration button

Tapping  at the bottom of the screen shows the trend configuration screen.

Update pause button

Tapping  pauses the updating of the trend waveforms. Tapping it again resumes the updating.

 Being updated <=>  Paused

8.3.2 Selecting the Items to Display

Press ⚙ on the trend screen to display the trend configuration screen.

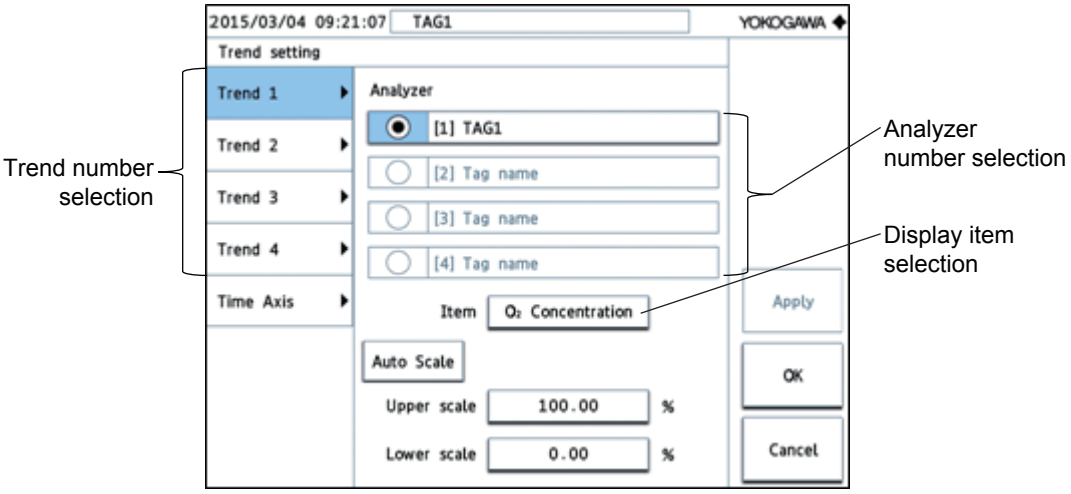


Figure 8.7 Trend configuration screen

(1) Select the trend number you want to change.

(2) Select a analyzer number. (When multiple TDLS8000 series are connected)

(3) Select the display item.

You can select from the following display items for the trend waveforms.

Trend display items

Available option	Description
Gas1 Concentration	Component 1 gas concentration
Gas1 STDEV	Standard deviation of component 1 gas concentration
Gas2 Concentration	Component 2 gas concentration (selectable only for two-gas measurement)
Gas2 STDEV	Standard deviation of component 2 gas concentration (selectable only for two-gas measurement)
Transmission	Transmission
Temperature	Process temperature
Pressure	Process pressure
None	Nothing

The factory default settings are shown in the following table.

Factory default display items

Trend number	Description
Trend 1	Gas1 Concentration
Trend 2	Transmission
Trend 3	Temperature
Trend 4	Pressure

8.3.3 Setting the Displayed Time

Press ⚙ on the trend screen to display the trend configuration screen.

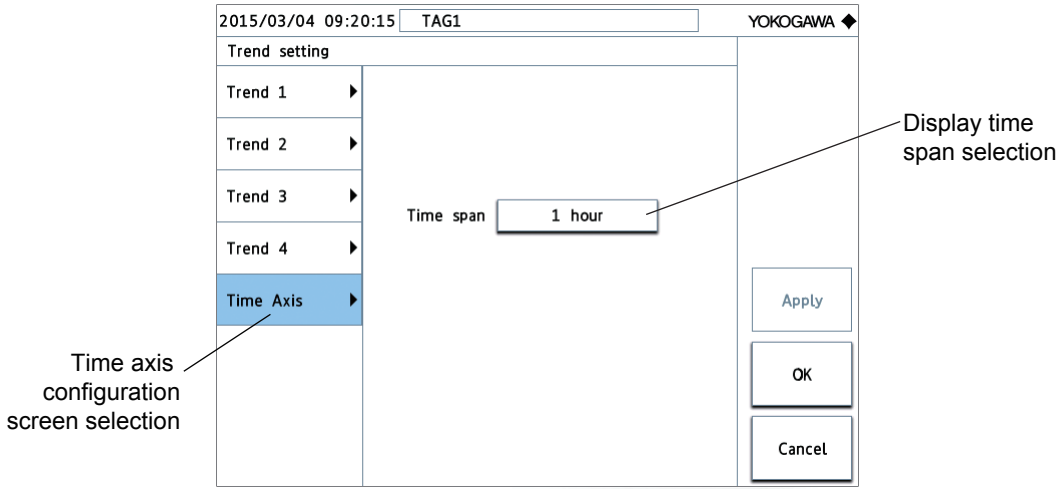


Figure 8.8 Trend time axis configuration screen

(1) Switch to the time axis configuration screen.

(2) Set the display time span.

You can select the display time span of the trend graph from the available options in the following table.

Trend display items

Available option	Description
1 min	1 minute
3 min	3 minutes
5 min	5 minutes
10 min	10 minutes
30 min	30 minutes
1 hour	1 hour
3 hour	3 hours
6 hour	6 hours
12 hour	12 hours

The factory default setting is 30 min.

8.3.4 Setting the Vertical Scale

Press ⚙ on the trend screen to display the trend configuration screen.

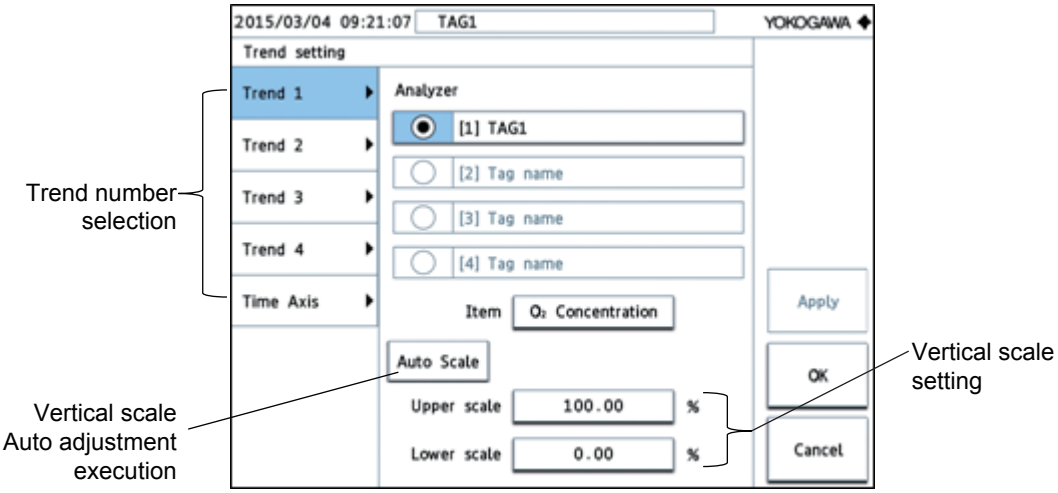


Figure 8.9 Trend configuration screen

(1) Select the trend number you want to change.

(2) Tapping Auto Scale automatically sets the most suitable value for that instant.

(3) To specify the scale manually, set the upper scale and lower scale.

8.4 Alarm Screen

Tapping 💡 at the bottom of the screen shows the alarm screen. The alarm screen displays a list of alarms that are currently occurring. For the meanings of alarms and correct actions, see “10. Troubleshooting”.

NOTE

When multiple analyzers are connected to the YH8000, tapping 💡 displays analyzer selection screen first. Selecting the target analyzer and touching OK will display the alarm screen of the selected analyzer.

For details, see “8.7.2 Selection Screen”.

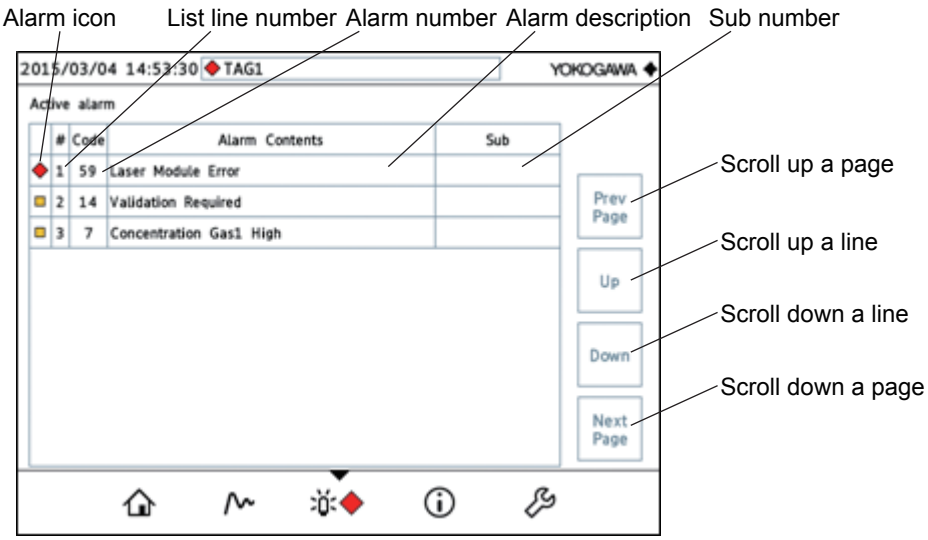


Figure 8.10 Alarm Screen

NOTE

The sub number is a number that indicates the details of the alarm. It is a number that Yokogawa service representatives use for troubleshooting.

8.5 Information Screen

You can view various types of analyzer information on the information screen.

Tapping ⓘ at the bottom of the screen shows the information screen.

NOTE

When multiple analyzers are connected to the YH8000, tapping ⓘ displays analyzer selection screen first. Selecting the target analyzer and touching OK will display the information screen of the selected analyzer.

For details, see “8.7.2 Selection Screen”.

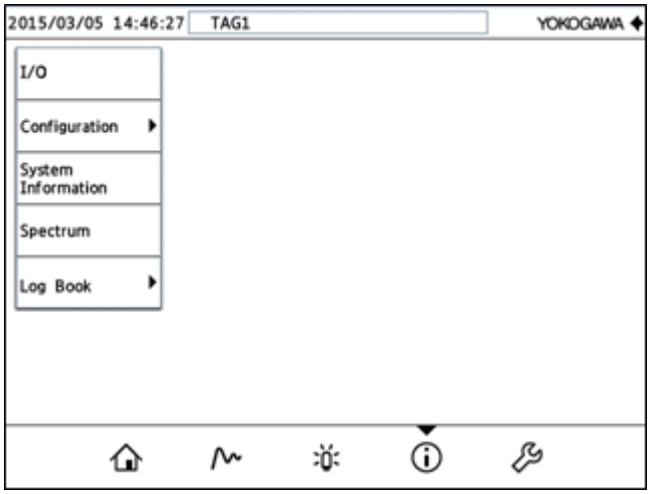


Figure 8.11 Information Screen

8.5.1 I/O List Screen

The I/O list screen displays the status of analog I/O, digital I/O, valve control power output, and analyzer internal temperatures (unit temperature). Tapping the I/O button on the ⓘ information screen displays the I/O list screen.

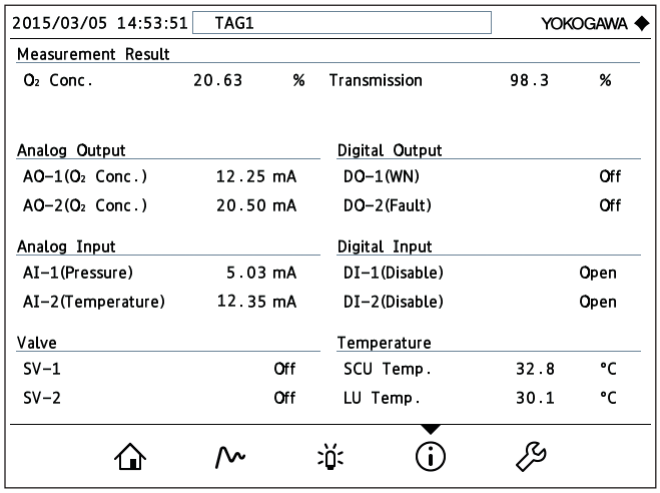


Figure 8.12 I/O list

8.5.2 Configuration View Screen

On the configuration view screen, you can view the analyzer settings. Tapping the Configuration button on the ⓘ information screen displays the following menu. For details on the menu tree, see under Configuration in “Appendix 3 YH8000 Menu Tree”.

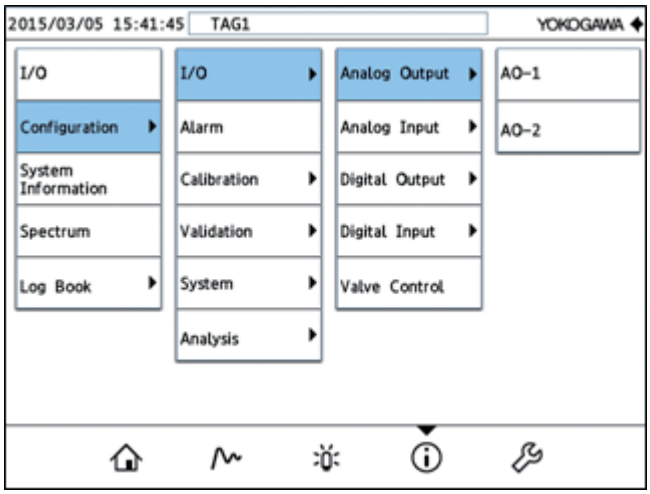


Figure 8.13 Configuration View Screen

NOTE

You cannot change the settings on the configuration view screen. To change them, see “8.6 Configuration Screen”.

8.5.3 System Information Screen

The system information screen displays the analyzer's tag name, serial number, IP address, MAC address, HART device ID, software version, and analysis period and the laser module's serial number. Tapping the System Information button on the ⓘ information screen displays the system information screen.

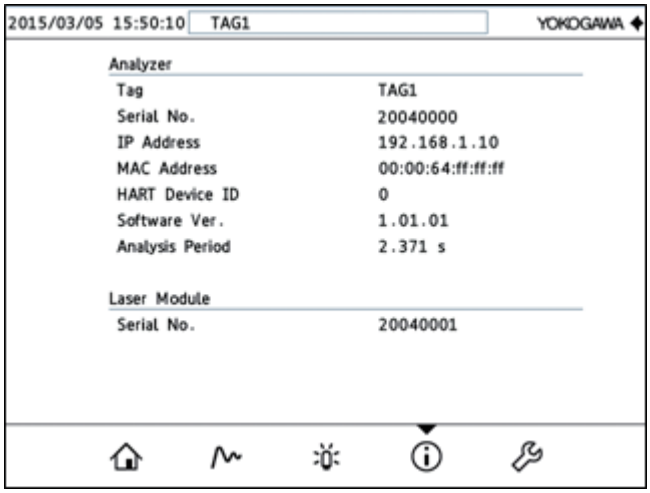


Figure 8.14 System Information Screen

8.5.4 Spectrum Screen

The spectrum screen displays the spectrum being measured. Tapping the Spectrum button on the ⓘ information screen displays the spectrum screen.

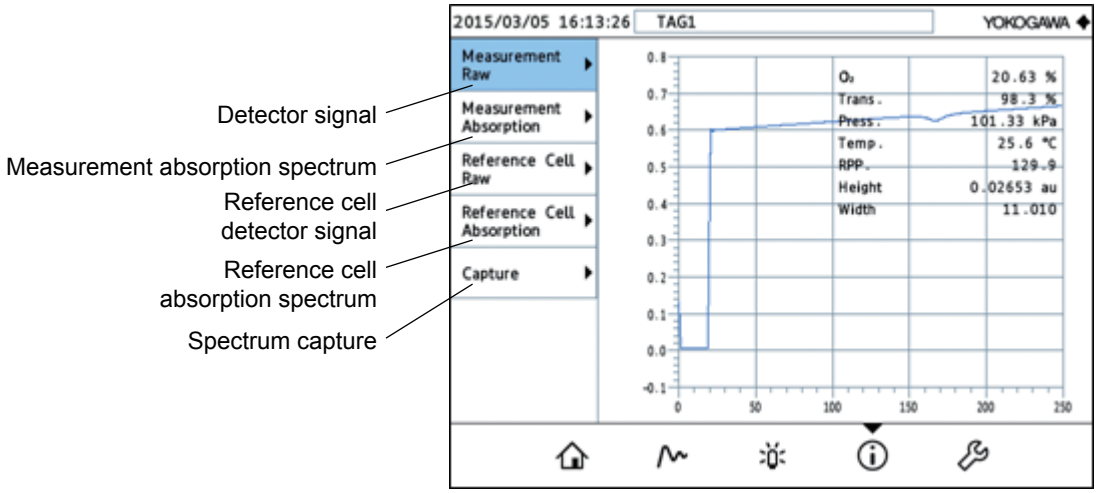


Figure 8.15 Spectrum Screen

Detector signal

Shows the detector signal on the measured gas side.

Measurement absorption spectrum

Shows the absorption spectrum of the measured gas.

Reference cell detector signal

Shows the detector signal of the reference cell. This can be shown only on the analyzer with a valid reference cell.

Reference cell absorption spectrum

Shows the absorption spectrum of the reference cell. This can be shown only on the analyzer with a valid reference cell.

Spectrum capture

Records spectrum waveform data to the TDLS8100 internal storage. Do not use this under normal circumstances. Use it only if you receive a request from your Yokogawa service representative.

NOTE

The spectrum screen is used by Yokogawa service representatives for troubleshooting purposes. You may be asked to check this screen depending on the situation. In such a case, please operate the screen according to their instructions.

8.5.5 Alarm History Screen

The alarm history screen can be used to check alarms and messages that occurred in the past.

Tapping Log Book on the ⓘ information screen and then Alarm History displays the alarm history screen.

The maximum number of history events that you can view on the YH8000 is 99. For details on alarms, see “10. Troubleshooting”. For details on messages, see “9.12 Alarm History”.

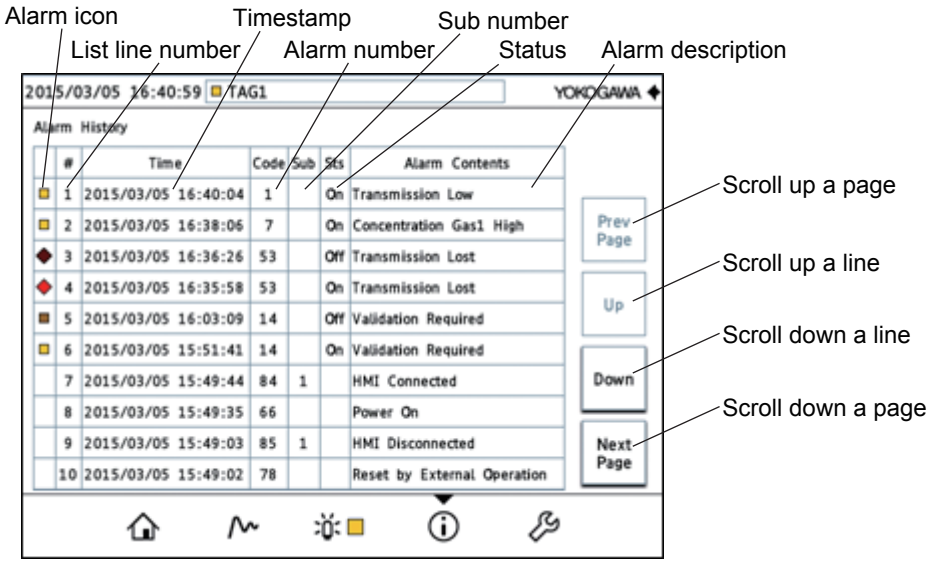


Figure 8.16 Alarm History Screen

Alarm icon

Nothing is displayed for messages. While the alarm is active, the icon appears bright. When the alarm is cleared, the icon changes to a dark indication.

Status

“On” is displayed when the alarm is active, and “Off” when it is cleared.

8.5.6 Cal/Val History Screen

The Cal/Val history screen can be used to view the results of calibrations and validations that have been executed in the past. Tapping Log Book on the ⓘ information screen and then Cal/Val History displays the Cal/Val history screen.

The maximum number of history events that you can view on the YH8000 is 99.

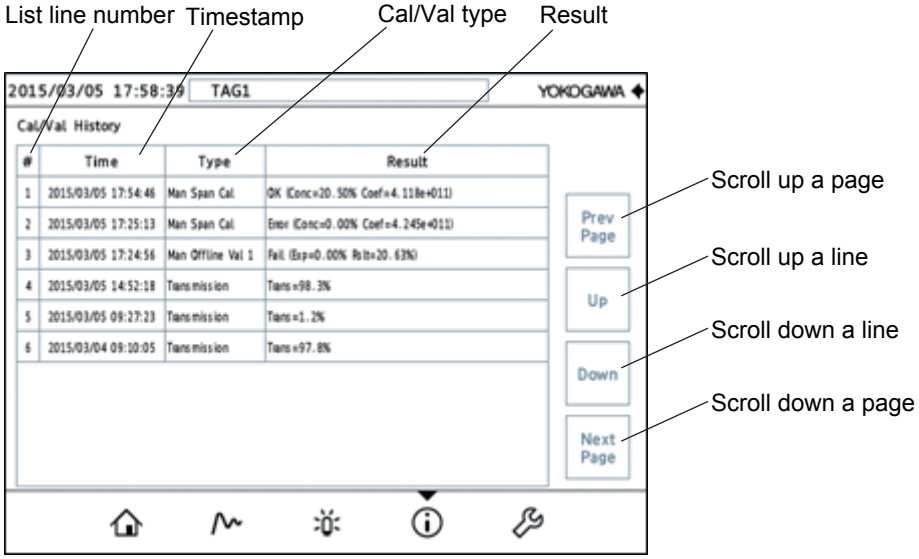


Figure 8.17 Cal/Val History Screen

The result column displays the following information depending on the Cal/Val type.

Information displayed in Cal/Val history

Cal/Val type	Result	
Man Zero Cal Auto Zero Cal	Successful: OK Unsuccessful: Error	(Max Absorption=<maximum absorption>)
Man Span Cal Auto Span Cal	Successful: OK Unsuccessful: Error	(Conc=<calibration gas concentration>Coef=<calibration coefficient after calibration>)
Man Offline Val Auto Offline Val Man Online Val Auto Online Val	Pass Fail	(Exp=<expected concentration>Rslt=<actual concentration>)
Transmission	Trans=<transmission after calibration>	
Zero Cal Restored	Restored to factory default settings: By Factory data Restored to previous settings: By Previous data	
Span Cal Restored	Restored to factory default settings: By Factory data Restored to previous settings: By Previous data	

8.6 Configuration Screen

The configuration screen is used to configure the analyzer and YH8000.

Tapping at the bottom of the screen shows the setup target selection screen.

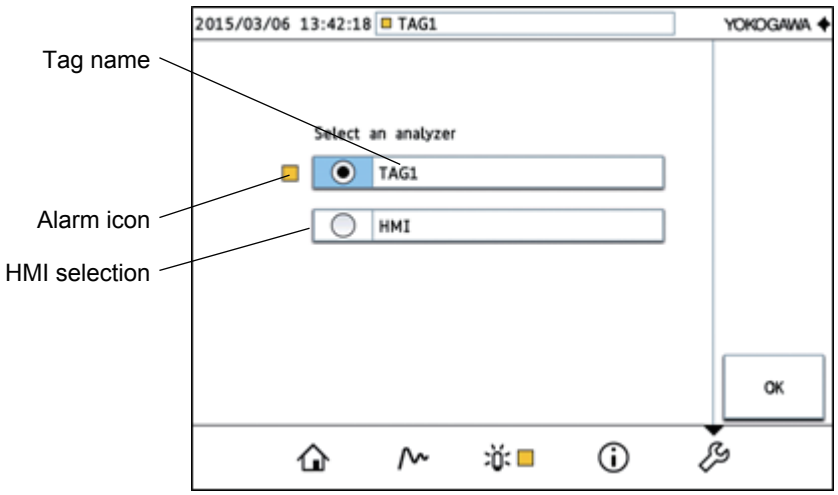


Figure 8.18 Setup target selection screen (when a single TDLS8000 series is connected)

Tag name

Shows the tag names assigned to each analyzer. Serial numbers are displayed if tag names are not assigned.

Alarm icon

If an alarm is occurring on the analyzer, an alarm icon is displayed. If both a warning and a fault are occurring, the fault icon is displayed.

HMI selection

To switch to the YH8000 configuration screen, select the HMI option.

8.6.1 Analyzer configuration screen

After selecting one of the analyzers on the setup target selection screen, tap OK. A password input screen will appear.

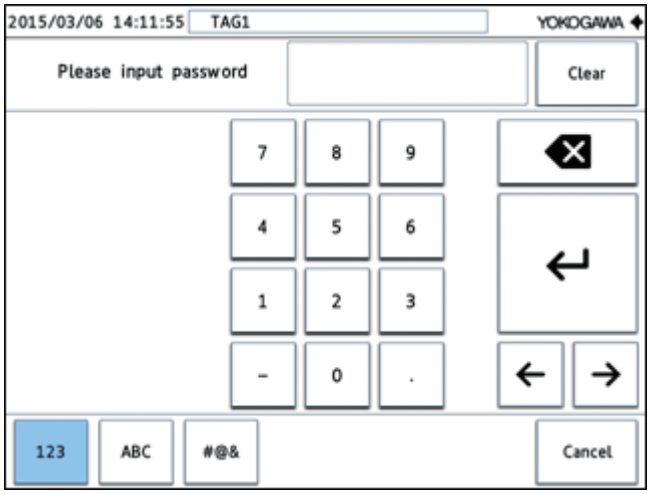


Figure 8.19 Password input screen

Enter the password on the password input screen, and tap ↵ to display the analyzer configuration screen.

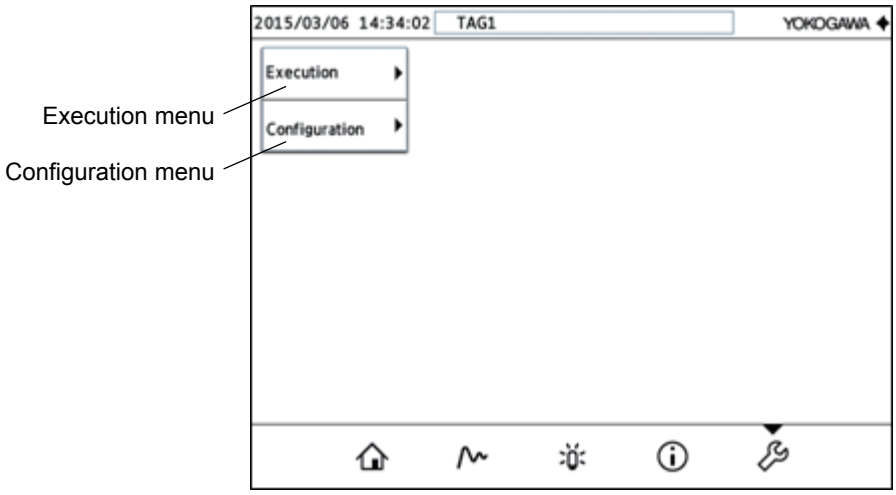


Figure 8.20 Analyzer configuration screen

Execution menu

The execution operation screens for calibration, validation, loop check, and the like are under this menu.

Configuration menu

Various settings are under this menu.

Analyzer configuration screen is arranged a menu tree structure.

- For the menu structure, see “Appendix 3 YH8000 Menu Tree”.
- For details on various settings, see “6. Configuration”.
- For details on calibration and validation, see “9. Inspection and Maintenance”.
- For details on loop check, see ”5.4 Loop Check (Simulation output)”.

NOTE

Analyzer status

When you switch to the analyzer configuration screen, the analyzer status is set to “in maintenance.” While in maintenance, the analyzer cannot be configured from other YH8000s or HART. Tap any of the buttons at the bottom of the screen to exit from the analyzer configuration screen. When you exit from the configuration screen, “in maintenance” is cleared. “In maintenance” is also cleared when the connection to the analyzer is disconnected.

NOTE

Password

The factory default password for switching to the analyzer configuration screen is “1234.” You can change the password on the following configuration screen.

“🔧>>[Analyzer]>>Configuration>>System>>Password”

For the password, you can set a character string consisting of one to eight characters of your choice.

Keep the password in a safe place.

NOTE

If you forget the password

If you forget the password, contact your nearest Yokogawa representative.

If you can use a HART configuration tool, you can initialize the user information to reset the password to the factory default setting. However, other settings will also be initialized. For details, see “6.10.1 Initialization Procedure”.

8.6.2 YH8000 Configuration Screen

After selecting an HMI on the setup target selection screen, tap OK to display a YH8000 configuration screen. If no analyzer is connected, only the YH8000 configuration screen will be displayed.

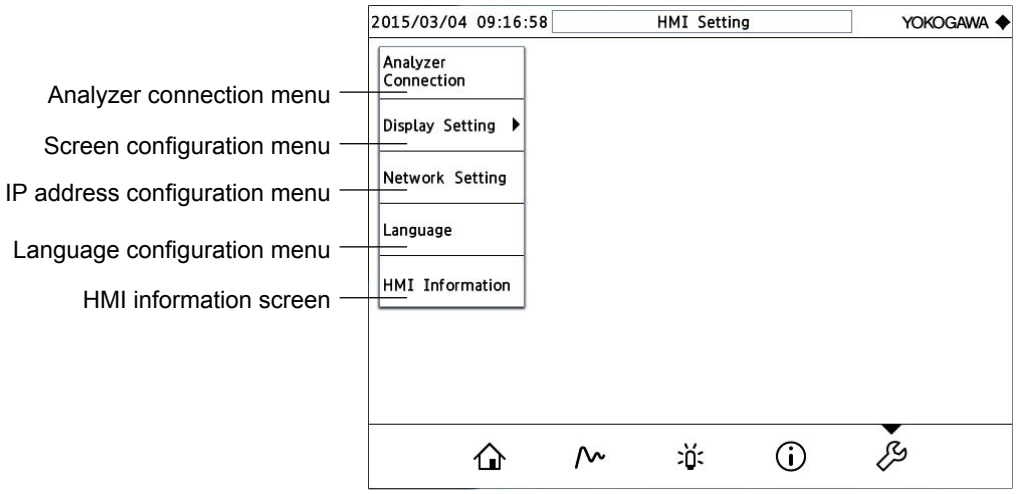


Figure 8.21 YH8000 (HMI) configuration screen

Analyzer connection menu

Switches to the TDLS8100 selection screen. For details, see “5.2.3 Connecting to the TDLS8100”.

Screen configuration menu

Switches to the configuration screen for setting the home screen display style, meter range, and backlight. For the display styles, see “8.2.2 Selecting the Style” For the meter range, see “8.2.3 Setting the Meter Range”. For backlight settings, see “8.6.3 Setting the YH8000 Backlight”.

IP address configuration menu

Switches to the YH8000 IP address configuration screen. For details, see “5.2.2 Setting the IP Address”.

Language configuration menu

Shows the language displayed on the YH8000.

HMI information screen

Shows the YH8000 IP address, MAC address, and software version.

8.6.3 Setting the YH8000 Backlight

This section explains how to set the brightness of the YH8000 backlight and the auto-off function.

Configuration menu path:

"  >>HMI>>Display Setting>>Backlight"

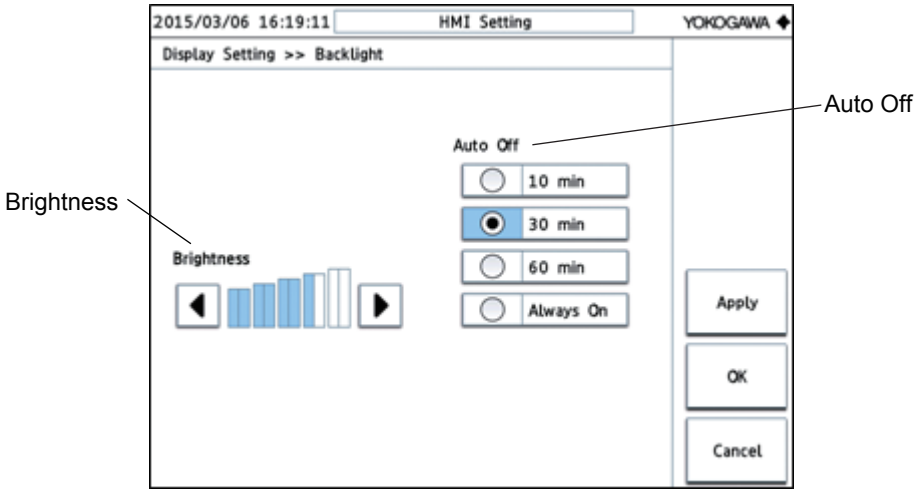


Figure 8.22 YH8000 backlight configuration screen

Brightness

You can set the backlight brightness using 11 levels. By factory default, the brightness is set to the highest level.

Auto Off

The backlight automatically turns off after a certain time of no YH8000 touch panel activity. You can set the auto-off time to any of the options in the following table.

Backlight auto-off time

Available option	Description
10 min	Turns off after 10 minutes of no activity
30 min	Turns off after 30 minutes of no activity
60 min	Turns off after 60 minutes of no activity
Always On	Disables the auto-off function (always on)

8.7 When Multiple Analyzers Are Connected

When multiple analyzers are connected to the YH8000, the display and operation is different from the case of single analyzer connection. This section explains the difference.

8.7.1 Overall Display

When multiple analyzers are connected, the information of all the analyzers can be collectively displayed on the home screen. This is called the *overall display*.

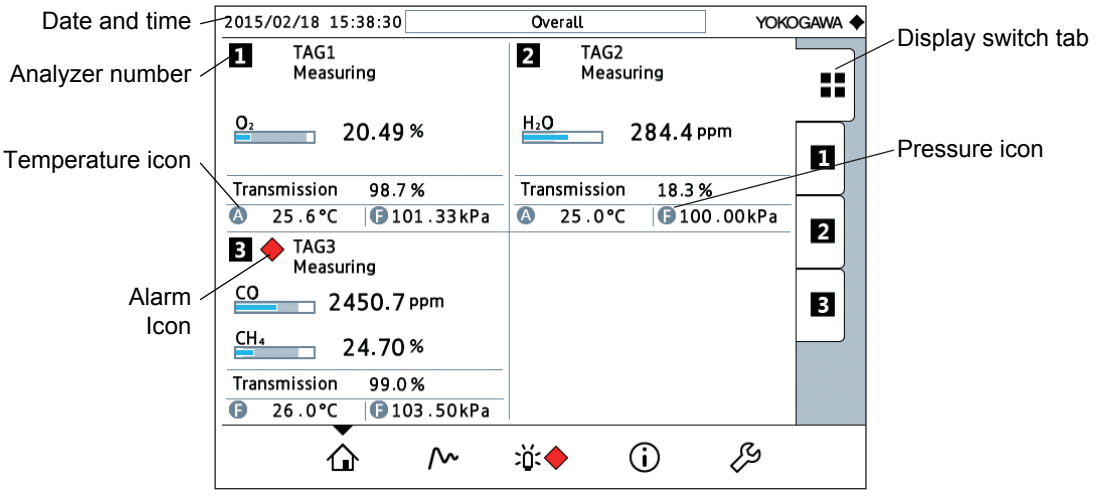


Figure 8.23 Overall display (when three analyzers are connected)

Date and time

On the overall display, the time of the analyzer with the smallest analyzer number is shown.

Analyzer number

Shows analyzer numbers 1 to 4.

Analyzer numbers are assigned using the YH8000 analyzer connection settings. For details, see “5.2 Connecting to the YH8000”.

Alarm icon

If an alarm is occurring on the analyzer, an alarm icon is displayed. If both a warning and a fault are occurring, the fault icon is displayed.

Display switch tab

Selects the analyzer to be displayed. Selecting shows the overall display.

Temperature icon and pressure icon

Shows the process temperature and process pressure mode settings.

F: Fixed value

A: Non-fixed value

8.7.2 Selection Screen

When multiple analyzers are connected, analyzer selection screen appears when switching to the alarm screen or information screen. Selecting the target analyzer and touching OK will display the alarm screen or information screen of the selected analyzer.

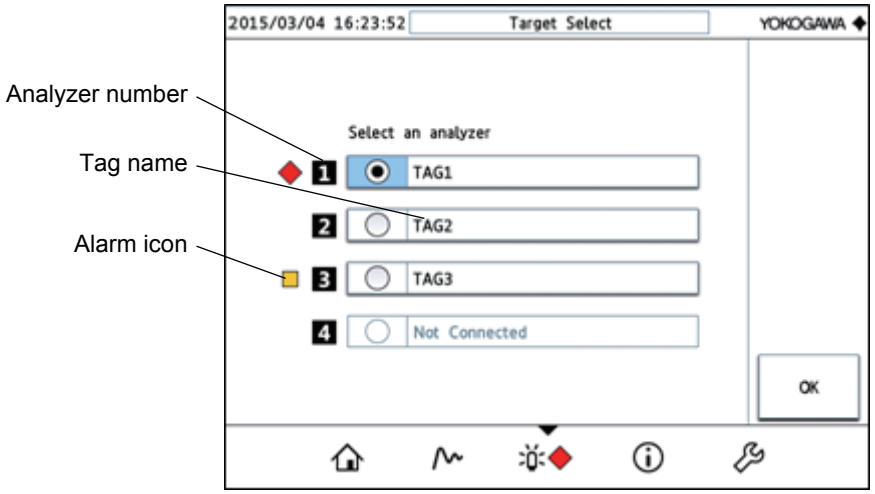


Figure 8.24 Selection screen (when three analyzers are connected)

Analyzer number

Shows analyzer numbers 1 to 4.

Tag name

Shows the tag names assigned to each analyzer. Serial numbers are displayed if tag names are not assigned.

Alarm icon

If an alarm is occurring on the analyzer, an alarm icon is displayed. If both a warning and a fault are occurring, the fault icon is displayed.

When multiple analyzers are connected, the connected analyzer are shown on the setup target selection screen when switching to the configuration screen. Selecting the target analyzer and touching OK will display the password input screen of the selected TDLS8100.

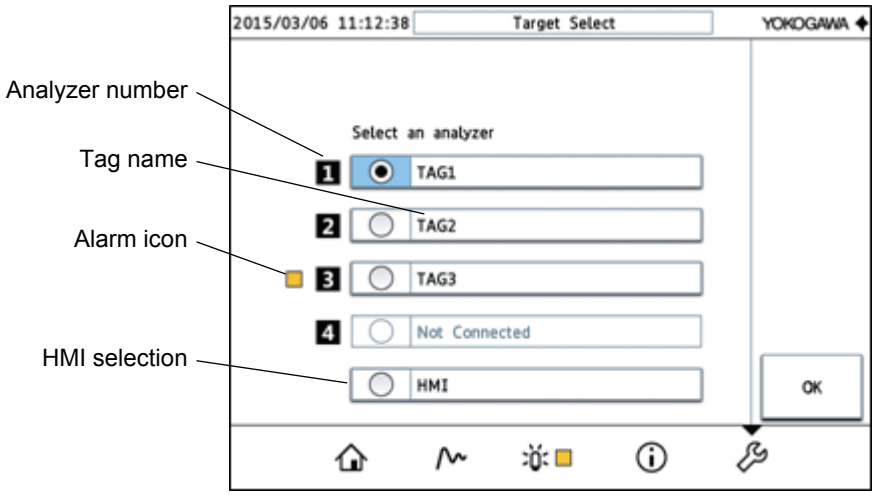


Figure 8.25 Setup target selection screen (when three analyzers are connected)

Analyzer number

Shows analyzer numbers 1 to 4.

Tag name

Shows the tag names assigned to each analyzer. Serial numbers are displayed if tag names are not assigned.

Alarm icon

If an alarm is occurring on the analyzer, an alarm icon is displayed. If both a warning and a fault are occurring, the fault icon is displayed.

HMI selection

To switch to the YH8000 configuration screen, select the HMI option.

8.7.3 Setting the Date and Time on Analyzer

If multiple analyzers are connected, the following function can be used when setting the analyzer clocks.

- Change all analyzer

  You can collectively set the clocks on all connected analyzers.
- Time synchronization

  You can synchronize the clocks of other connected analyzers with the clock of the analyzer that you are currently configuring.

Configuration menu path:

"  >>[Analyzer]>>Configuration>>System>>Date&Time>>Operation"

NOTE

The collective setting of the clocks and synchronization of the clocks do not completely synchronize the analyzer clocks. Even when these functions are used, the clocks may be off by a few seconds. The clocks may drift even further as time passes.

8.8 Software version

The table below shows the valid combination between each software version of YH8000 and TDLS8100. Check the validity of the combination and prepare appropriate version of softwares when you did not purchase YH8000 and TDLS8100 both together at a time.

		YH8000		
		1.01.xx	1.02.xx	2.01.xx
TDLS8100	1.01.xx	Can be used with the previous alarm specifications.	A portion of the alarms will not be displayed correctly.	A portion of the alarms will not be displayed correctly.
	1.02.xx	A portion of the alarms will not be displayed correctly.	Can be used correctly.	Can be used correctly.
	2.01.xx	Cannot be connected.	Cannot be connected.	Can be used correctly.

If the software version of either device is old, update the old version to the new version. For details on software updating, contact your nearest Yokogawa representative.

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9. Inspection and Maintenance

CAUTION

If you need to remove the TDLS8100 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 TDLS8100.

There are no operations that need to be performed regularly on the TDLS8100.

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

9.1 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 TDLS8100 operation, perform the required inspection and maintenance to prevent the transmission from degrading. To maximize the TDLS8100 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 “9.1.3 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.

9.1.1 Transmission Calibration

After reinstalling the TDLS8100 in the measurement location and performing optical axis adjustment according to “3.3 Optical Axis Adjustment”, perform transmission calibration.

NOTE

Optimum transmission may not be attainable if the optical axis is not adjusted correctly. Refer to “3.3 Optical Axis Adjustment”, and perform optical axis adjustment correctly.

Execution menu path:

[HART] “Diagnosis/Service>>Transmission adjust>>Transmission adjust”

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

9.1.2 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 TDLS8100 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.

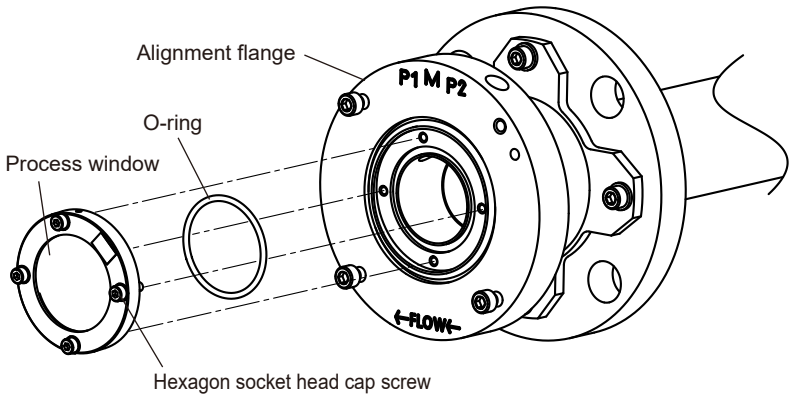


Figure 9.1 How to detach, mount the process window

9.1.3 Probe Cleaning

Under the following conditions, probe may become stained.

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

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 TDLS8100 before removing probe to perform the maintenance.

CAUTION

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

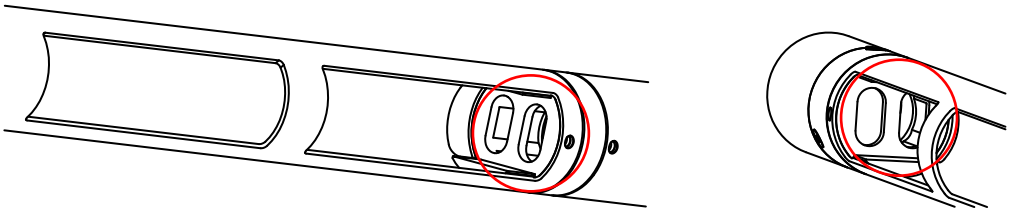


Figure 9.2 Separation wall

(1) Increase the purge rate for flushing. If the flushing does not remove the stain, take the probe apart.

(2) Power off TDLS8100.

(3) Remove piping. Apply vinyl tape or other protector to the TDLS8100 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 9.9).
- Loosen the other screws (upper left, lower left, and lower right).
- Slowly turn the TDLS81000 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 oart by following the instruction of 3.1.

If the transition is much lower than before the cleaning, readjust the optical axis.

9.1.4 Reflector Cleaning

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 TDLS8100 when doing this maintenance/inspection.

(1) Remove piping. Apply vinyl tape or other protector to the TDLS8100 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.

- Using a hex wrench (5 mm), remove only the upper right screw of the quick connector (see Figure 9.9).
- Loosen the other screws (upper left, lower left, and lower right).
- Slowly turn the TDLS81000 counterclockwise to remove the analyzer part from the probe.

(4) Take off the nuts on the process flange. Pull the TDLS8100 out of the process flange. If the analyzer part is already removed in the process (3) above, pull the probe part ouf 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.

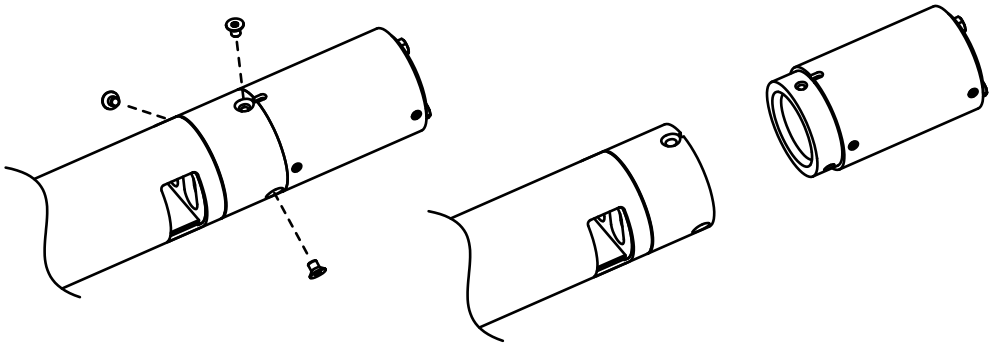


Figure 9.3 Reflector part

(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 3.1. If the transition is much lower than before cleaning, readjust the optical axis.

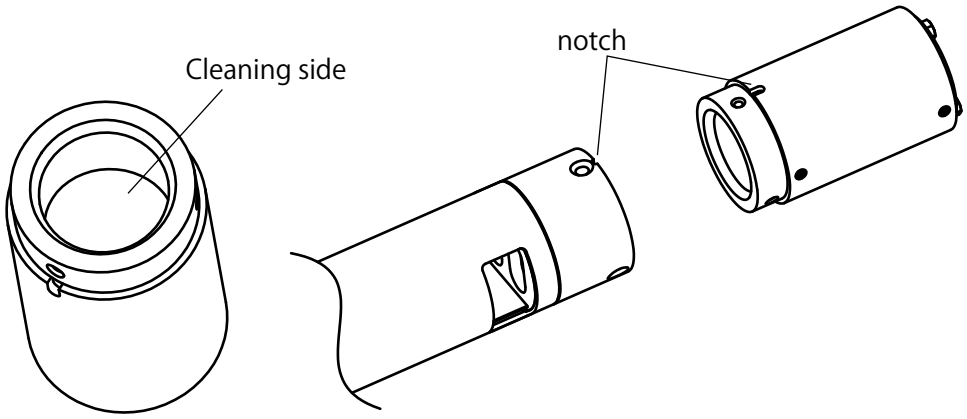


Figure 9.4 Reflector part

9.2 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 TDLS8100.
- Purge the validation cell again with the original purge gas (typically nitrogen gas).

  => “Process concentration” is recorded in the TDLS8100.

=> 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 TDLS8100 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.

9.2.1 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 9.5).

NOTE

If you want to switch the check gas stream through automatic valve control using the TDLS8100 SV terminal, you need to set the TDLS8100 valve usage to CAL/VAL. For details on valve usage, see “6.8.2 Valve Usage Setting”.

Online validation piping diagram is shown below.

When using the type of Zone1/Div1/Flameproof “d”, see “3.4.2 Optical area Purge of Zone 1/Div. 1/Flameproof “d””.

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.

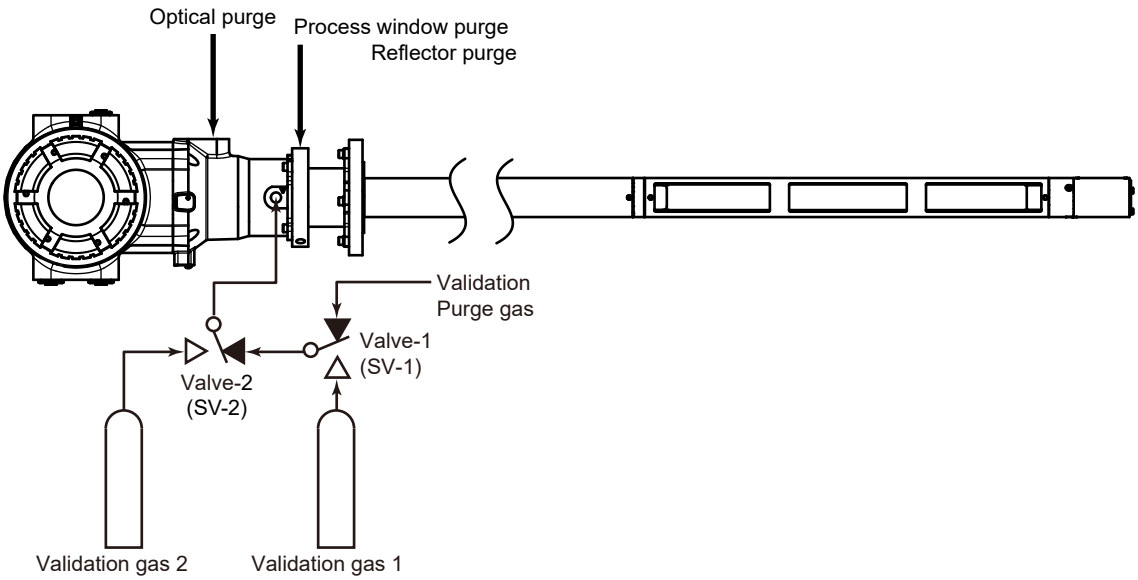


Figure 9.5 Online validation piping diagram

9.2.2 Configuration

Online validation configuration menu:

[HART] “Detailed setup>>Validation>>Online Validation #”

[YH8000] “ >>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 (two-gas measurement only)
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 Onval1 temp mode is set to Fixed
Onval1 act amb ofst	Offset Value	Enters the temperature offset for when Onval1 temp mode 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 both for general or flameproof type.

● 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.
Onval1 gas purg time	Validation gas purge time	For automatic execution. Set these when performing automatic execution (see “9.8.2 Configuration”).
Onval1 nml purg time	Normal gas purge time	

Auto time

For automatic execution. Set this when performing automatic execution (see “9.8.2 Configuration”).

Reading mode

For automatic execution.

Parameter name (HART)	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.

9.2.3 Execution

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

Execution menu path:

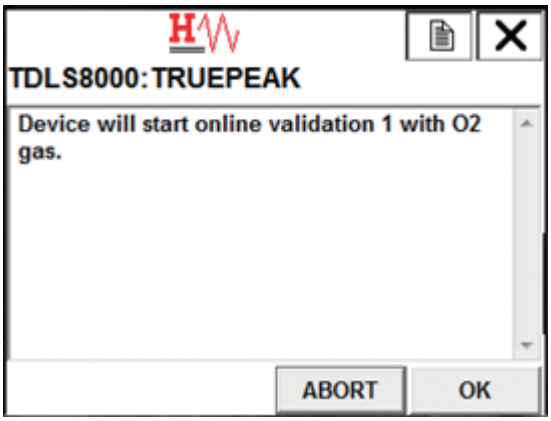
[HART] “Diagnosis/Service>>Validation>>Manual>>Manual online val 1”

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

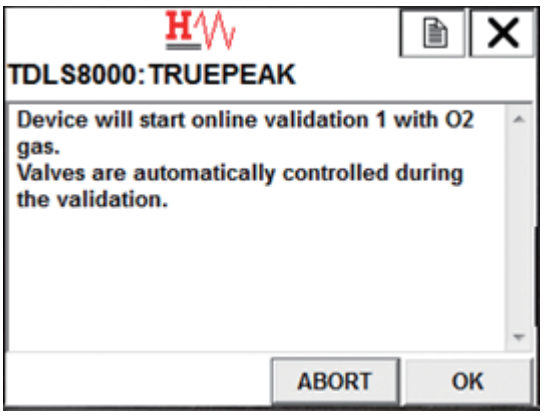
HART execution screen

(1) Starting an online validation

If automatic valve control is disabled, the following screen appears.

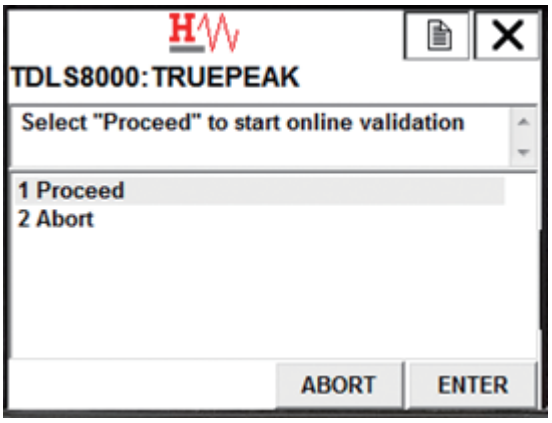


If automatic valve control is enabled, a message stating that the valves will be automatically controlled appears as follows. In this case, you do not need to manually control the valves during validation.



In either screen, check the type of gas to use as check gas, and tap OK.

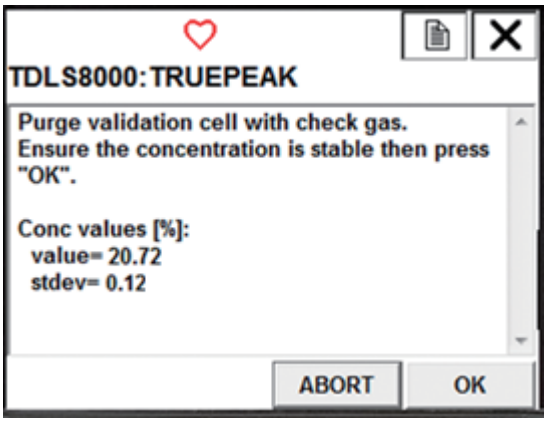
On the next screen, tap ENTER. If automatic valve control is enabled, the stream is switched, and the validation cell is purged with check gas.



(2) Purging with the check gas

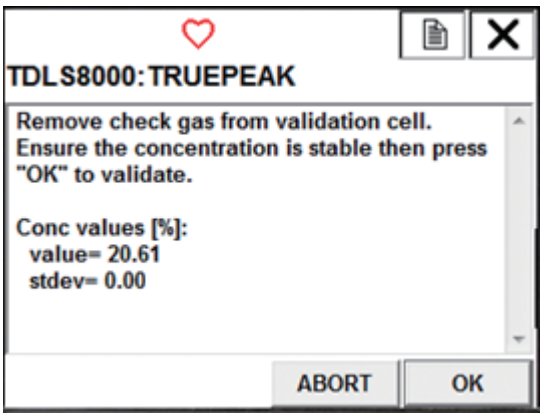
If automatic valve control is disabled, manually control the valves to purge the validation cell with the check gas. By referring to the “stdev” value, which indicates the standard deviation of concentration, check that the concentration is stable over a sufficient length of time (5 minutes as a guideline, at least 1 minute) with the validation cell filled with check gas. When stability is confirmed, tap OK.

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 normally during process measurement. By referring to the “stdev” value, which indicates the standard deviation of concentration, check that the concentration is stable, and then tap OK. The validation result is displayed.

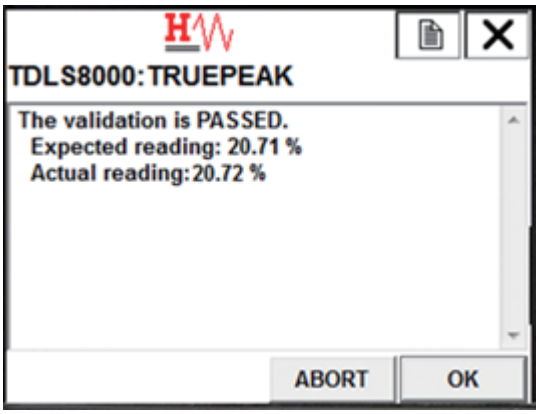


(4) Checking the online validation result

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

Expected reading:	Gas concentration (expected value) obtained by adding the check gas
Actual reading:	The actual value

Tap OK to return to the menu.



NOTE

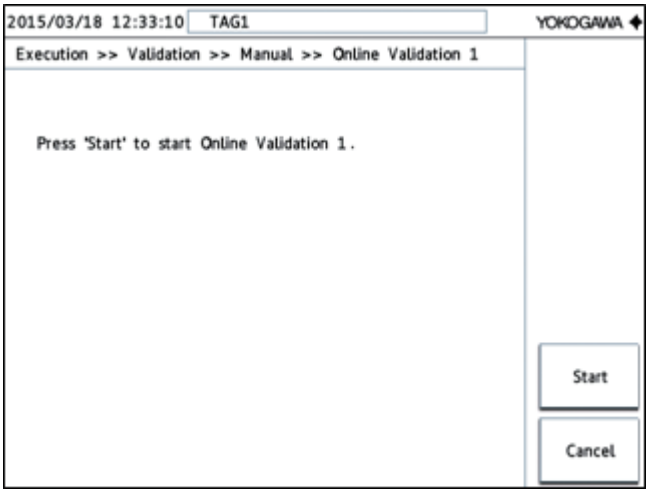
If the validation fails, the following warning will occur. For the corrective action, see “10.2 Warning Display and Handling”.

Alarm number	Alarm name
15	Validation Error

YH8000 Execution Screen

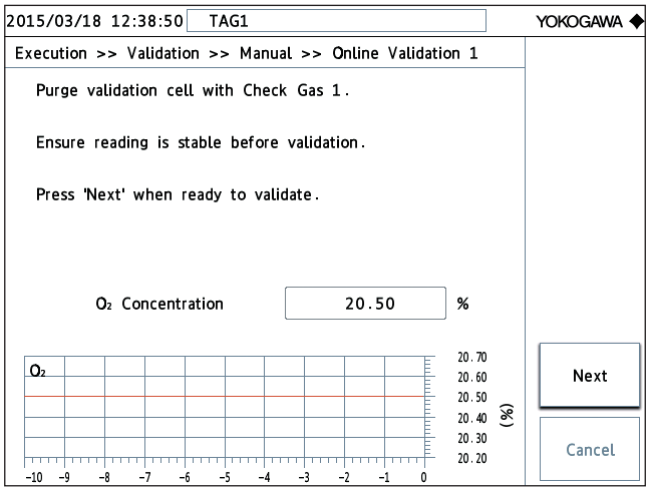
(1) Starting an online validation

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



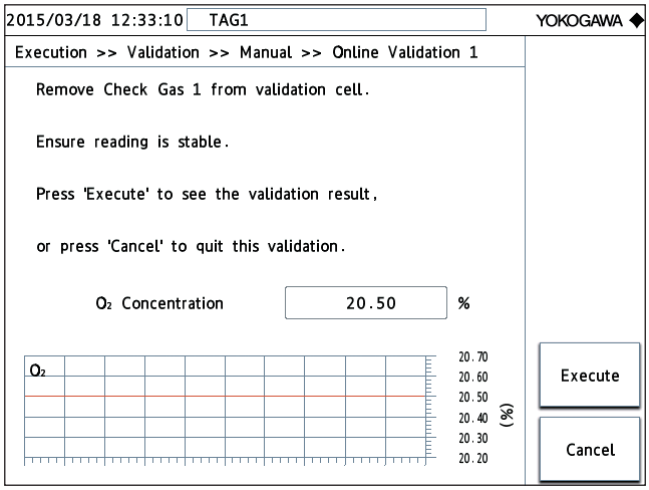
(2) Purging with the check gas

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.

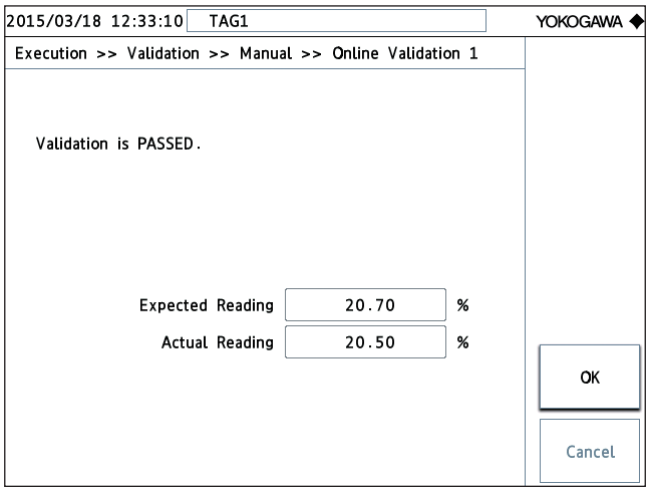


(4) Checking the online validation result

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 “10.2 Warning Display and Handling”.

Alarm number	Alarm name
15	Validation Error

9.2.4 Time Chart

The valve operation during manual online validation 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 “6.4.2 Output Hold” and “6.5.1 DO Contact (DO-1)”.

In Figure 9.6, 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.

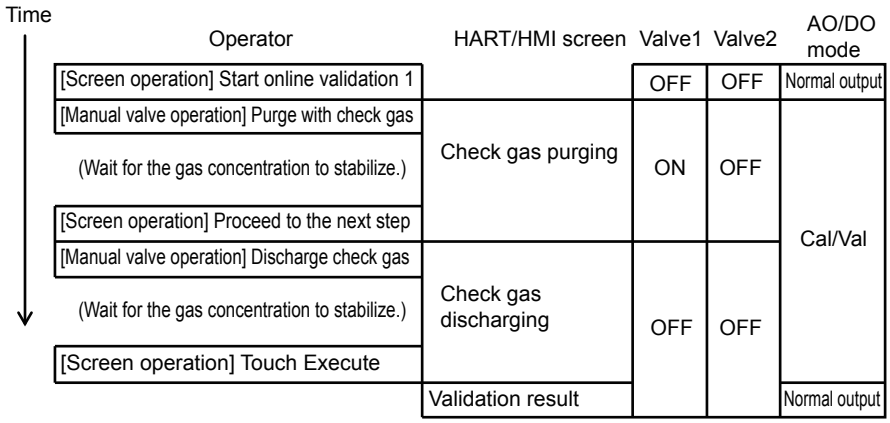


Figure 9.6 Valve and AO/DO output for manual online validation 1

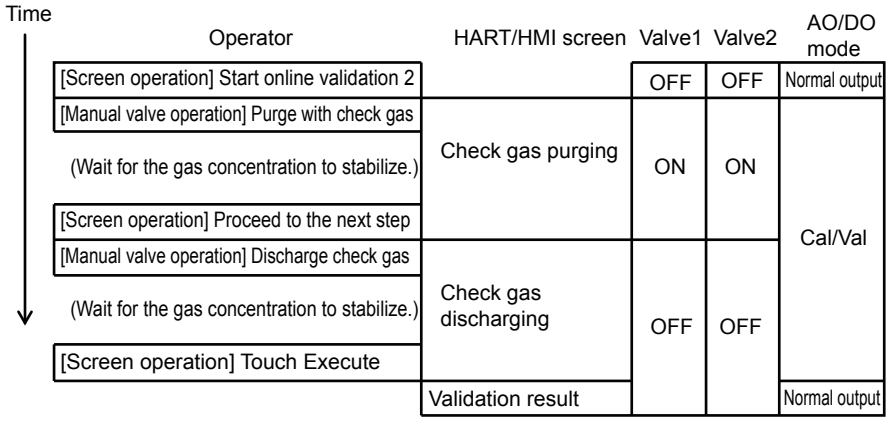


Figure 9.7 Valve and AO/DO output for manual online validation 2

9.3 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.

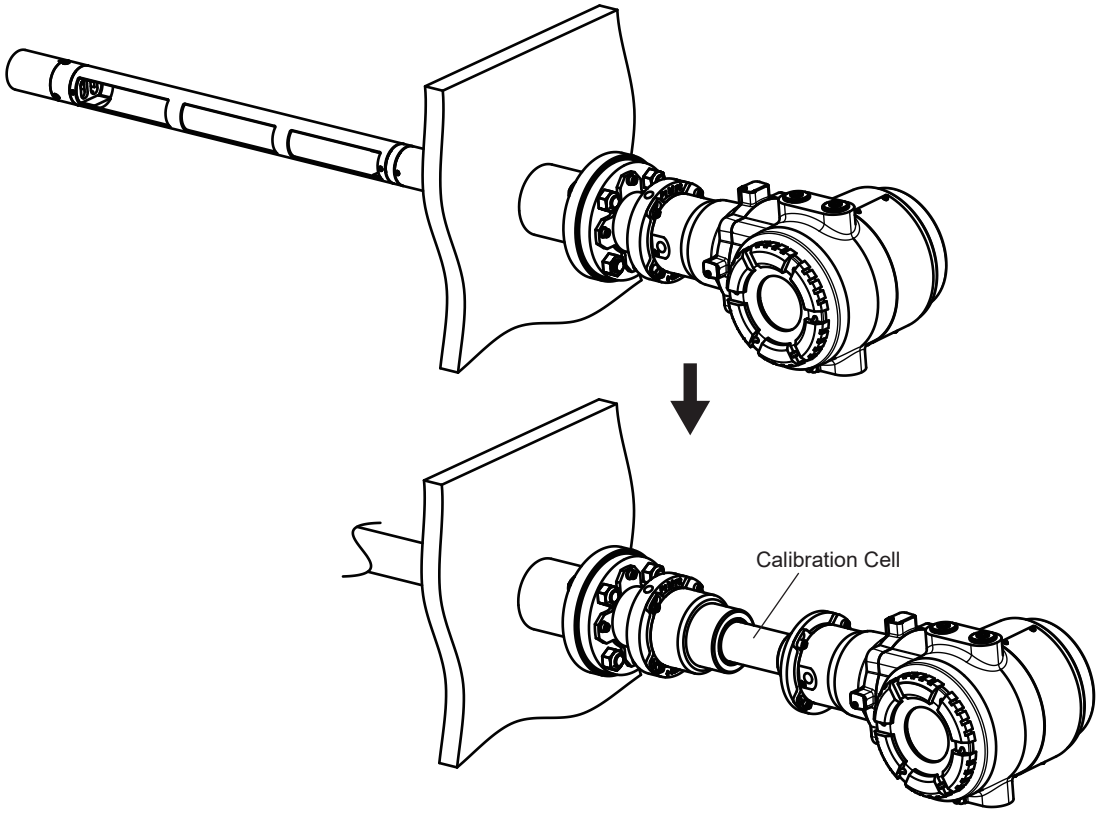


Figure 9.8 Connection example for offline work

9.3.1 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 or HART configuration tool	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 TDLS8100 purging For zero calibration
Span calibration gas	As required	For span calibration
Check gas	As required	For offline validation
Flowmeter	3	For TDLS8100 purging For zero calibration For span calibration and offline validation
Needle valve	3	For flow rate adjustment

9.3.2 Preparation Procedure

Perform the following procedure. Purge pipe connection is different for Offline validation, zero calibration, and span calibration. For details, see sections 9.4, 9.5, and 9.6.

CAUTION

- Do not apply physical shock to the TDLS8100 when relocating the TDLS8100 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 TDLS8100 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 TDLS8100 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)
- Transmission
- Process window/Reflector purge flow rate (record only when purge is stopped)

(2) Turning the TDLS8100 off

Turn the power of TDLS8100 off.

(3) Removing the analyzer part

(a) Stopping the purge gas

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

(b) Removing piping

Remove the pipes from the TDLS8100. (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 TDLS8100 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 “3.2 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 9.9).

(2) Loosen the other screws.

(3) Slowly turn the TDLS8100 counterclockwise to remove the analyzer from the probe.

For details on how to remove the YH8000, see “4. YH8000 Installation”.

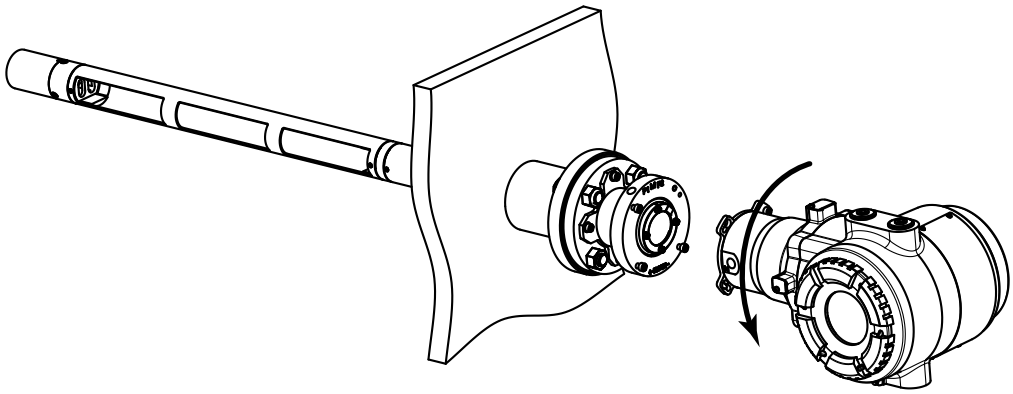


Figure 9.9 Removing from the process

(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.

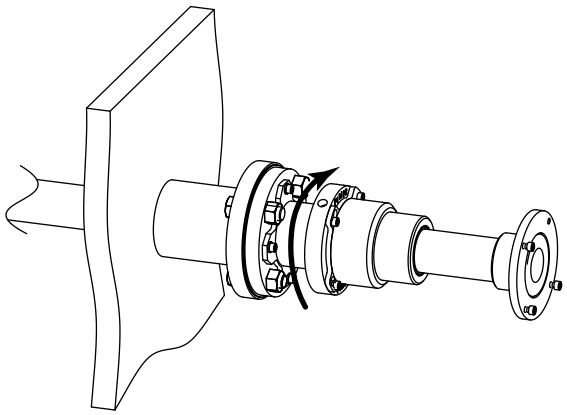


Figure 9.10 gap between calibration cell and hexagon socket head screw

(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.

(b) Wiring (When disconnecting wiring)

Connect the following cables.

- Inter-unit cable
- Power cable
- Valve drive cable (when necessary)

For details on wiring, see "3.2 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. When calibration cell being connected, use both

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.

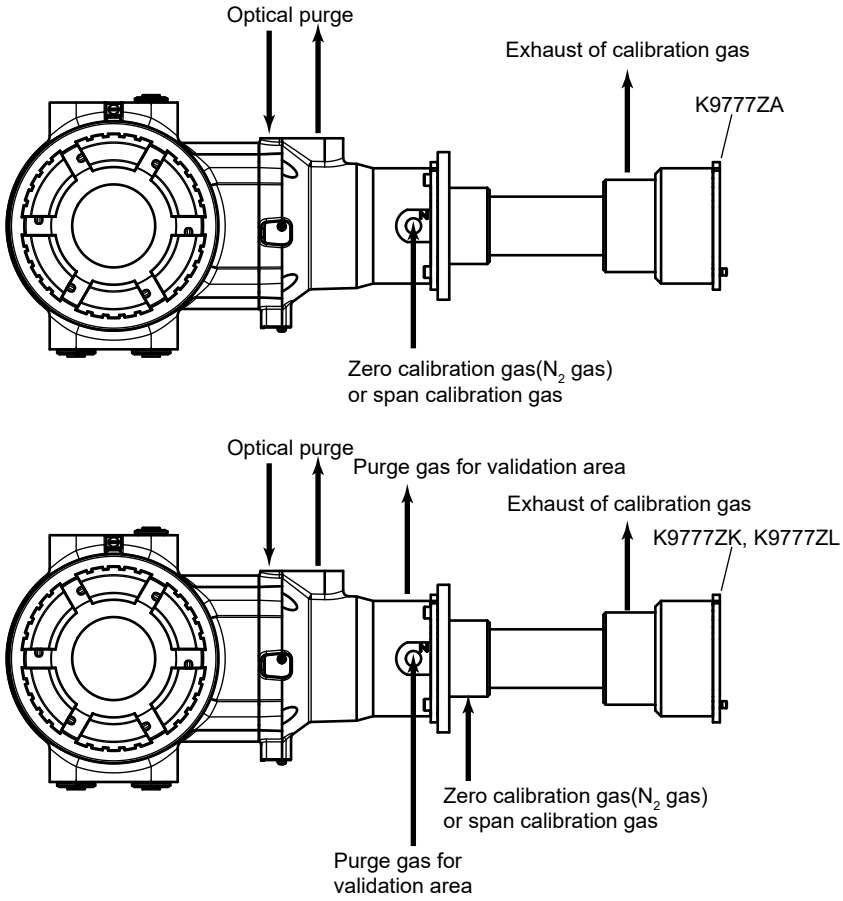


Figure 9.11 Purge gas piping diagram

When piping is complete, check for leaks such as by using Snoop. Use nitrogen gas for this purpose. For Explosionproof Type, feed the gas at 100 to 200 mL/min, no more than 0.01 MPa.

(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 TDLS8100 starts normally.

9.3.3 Performing Calibration and Offline Validation

Refer to sections 9.4, 9.5, and 9.6, and perform offline work.

For each kind of offline work, the settings may be different. Change the settings as necessary.

9.3.4 Returning the TDLS8100 to the Process

When offline work is complete, return the TDLS8100 to the process. Follow the procedure below.

NOTE

Remove piping after gas inside the calibration cell is completly 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 TDLS8100 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 TDLS8100 off

Check the above items, and then turn the TDLS8100 off.

(5) Removing wiring (as neceessarry)

Remove wiring according to the procedure of section 9.3.2 (3) (d).

(6) Removing the analyzer part from the calibration cell

Remove the analyzer part according to the procedure of section 9.3.2 (3) (e).

(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.

- Cable between the LU and SCU
- Power cable
- Valve drive cable (when necessary)
- AI/AO/DO/DI cable (when necessary)

For details on wiring, see “3.2 Wiring”.

(b) Piping

Refer to “3.4 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.

Since the internal pressure from the process window purge gas may become high when process isolation valve (ball valve) is used, open the valve immediately after starting to feed the process window purge gas.

(10) Turning the power on

Turn the power on. Check that the TDLS8100 starts normally.

(11) Optical Axis Adjustment

Refer to “3.3 Optical Axis Adjustment”, and adjust the optical axis.

(12) Checking the settings

Refer to the settings that you recorded before removing the TDLS8100, and reset them if necessary.

a) Process optical path length

b) Process pressure

c) Process temperature

d) Transmission

9.4 Offline Validation

Offline validation is a function used to verify the validity of gas concentration measurements. For the validation process, the TDLS8100 is separated from the measurement process, and a known check gas if fed through a calibration cell or flow cell.

Before performing a validation, you need to enter the following information in the TDLS8100.

- 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 flow cell 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

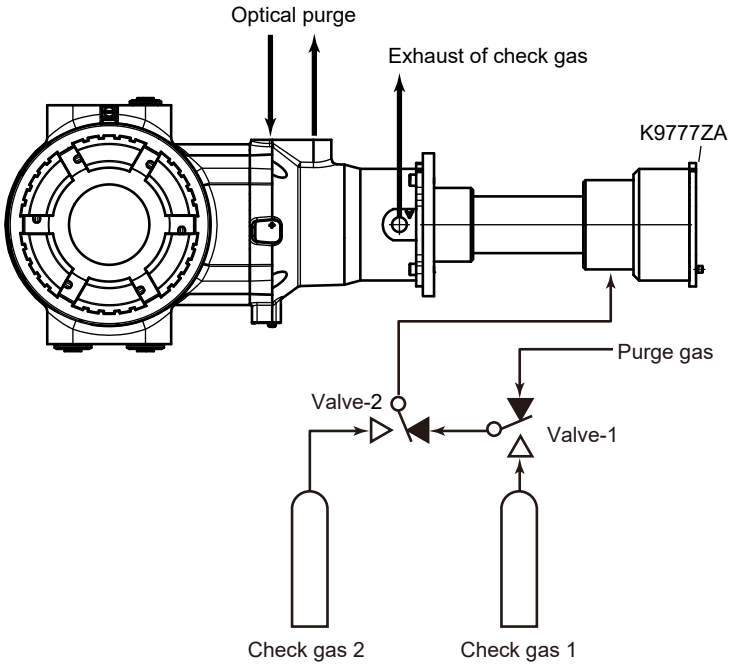
Validation is a procedure to check whether the TDLS8100 is operating properly. If there is an error in reading, implement calibration.

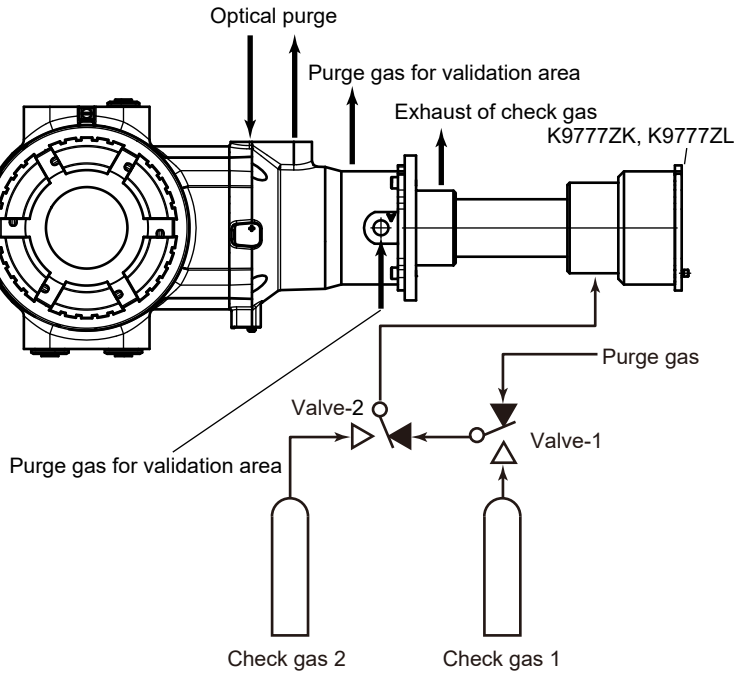
Normally, after detaching the analyzer part from process and installing on the calibration cell, Offline validation is to be performed.

9.4.1 Preparation

Follow the instructions in “9.3 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.





9.4.2 Configuration

Offline validation configuration menu:

[HART] “Detailed setup>>Validation>>Offline validation #”

[YH8000] “  >>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 (HART)	Parameter name (YH8000)	Description
Offval1 gas type	Gas type	Selects the type of validation 1 check gas (two-gas measurement only)
Offval1 gas conc	Concentration	Enters the concentration of the validation 1 check gas
Offval1 pres mode	Pressure	Selects the pressure mode for validation 1 execution (*1)
Offval1 pres fix val	Fixed Value	Enters the pressure for when Offval1 pres mode is set to Fixed
Offval1 temp mode	Temperature	Selects the temperature mode for validation 1 execution (*1)
Offval1 temp fix val	Fixed Value	Enters the temperature for when Offval1 temp mode is set to Fixed
Offval1 OPL mode	OPL	Selects the optical path length mode for validation 1 execution (*1)
Offval1 OPL fix val	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

● Valve

Parameter name (HART)	Parameter name (YH8000)	Description
Offval1 auto vlv man	Auto valve for manual validation	Selects whether to enable automatic valve control through the SV terminal during manual validation 1 execution.
Offval1 gas purg time	Validation gas purge time	For automatic execution. Set these when performing automatic execution (see “9.8.2 Configuration”).
Offval1 prc purg time	Process gas purge time	

9.4.3 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:

[HART] “Diagnosis/Service>>Validation>>Manual>>Manual offline val 1”

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

(1) Starting an offline validation

On HART or 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 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 (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 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 validation

The TDLS8100 will exit from validation mode.

*1: [HART] Valves are automatically controlled during the validation.
[YH8000] Valve for Check Gas 1 will be opened automatically.
*2: [HART] Purge validation cell with check gas.
[YH8000] Purge flow cell with Check Gas 1.
*3: [HART] Ensure check gas is completely removed from validation cell and …
[YH8000] Remove Check Gas 1 from flow cell.

NOTE

If the validation fails, the following warning will occur. For the corrective action, see “10.2 Warning Display and Handling”.

Alarm number	Alarm name
15	Validation Error

9.4.4 Time Chart

The valve operation during manual offline validation 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 “6.4.2 Output Hold” and “6.5.1 DO Contact (DO-1)”.

In the following figure, 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.

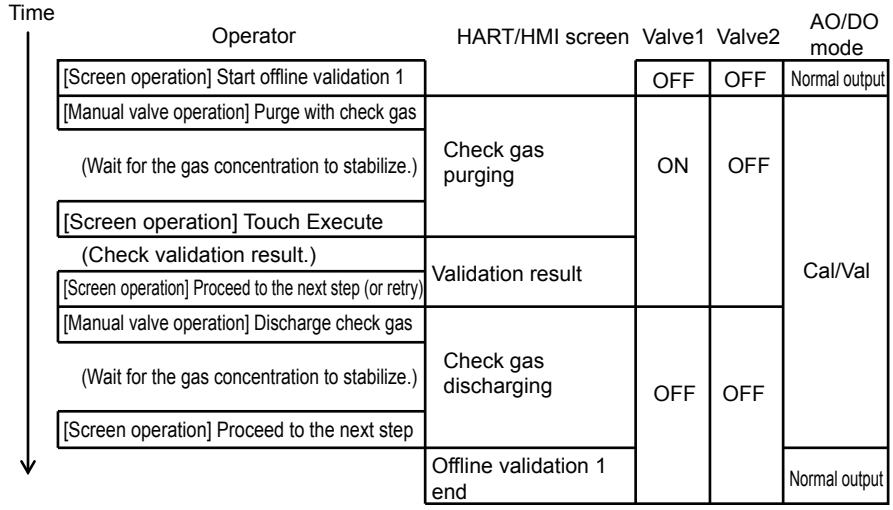


Figure 9.12 Valve and AO/DO output for manual offline validation 1

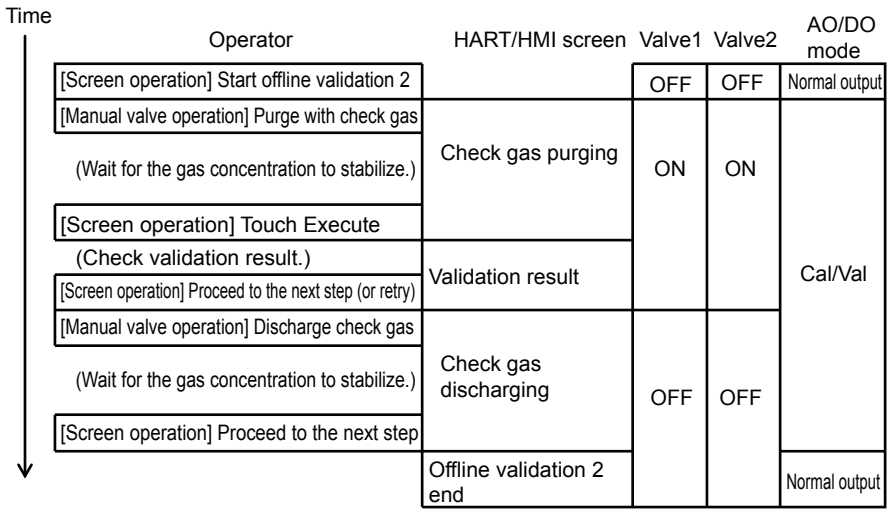


Figure 9.13 Valve and AO/DO output for manual offline validation 2

9.5 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 TDLS8100 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 or if you decide that zero calibration is necessary, perform a zero calibration by paying attention to the following items.

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

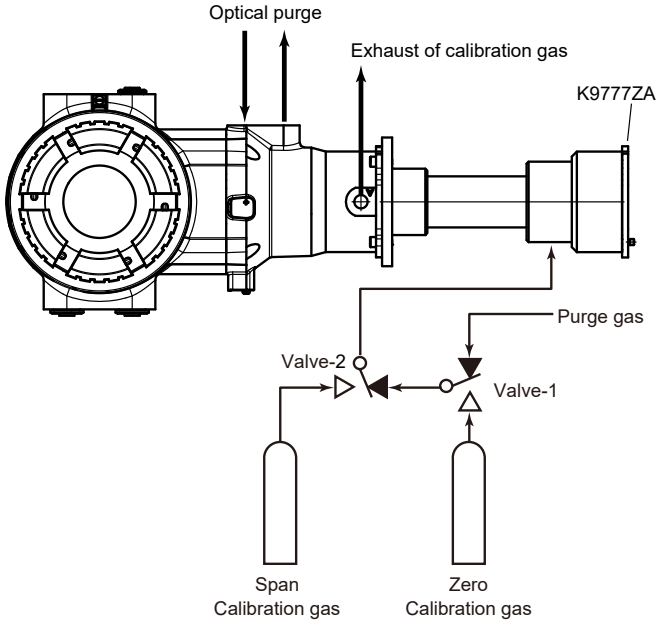
- If the purge piping leaks, correct results cannot be obtained.
- Wait at least 1 hour after turning on the power before performing calibration.

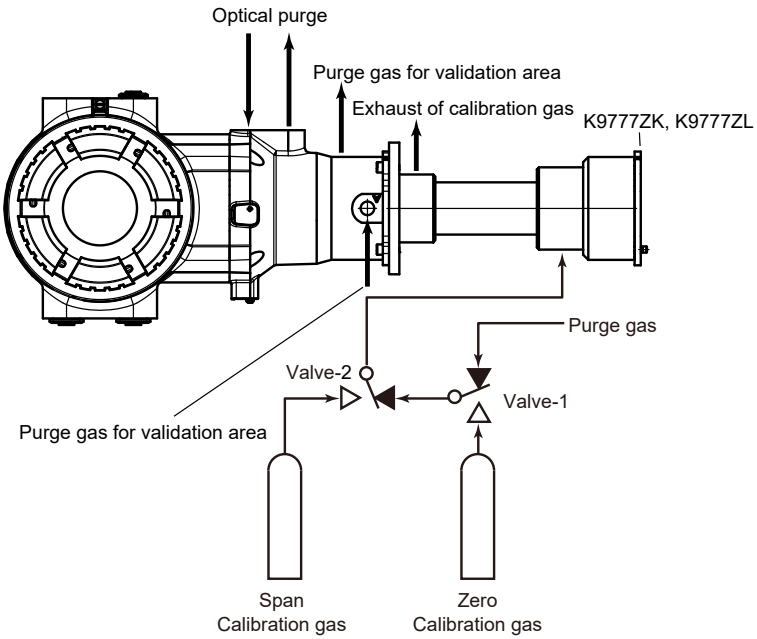
9.5.1 Preparation

Follow the instructions in “9.3 Mounting on a Calibration Cell”. The piping method is describe below.

● Zero+span calibration gas

This piping arrangement allows span calibration gas to be used in addition to zero calibration gas. Zero calibration and span calibration can be executed.





In this arrangement, automatic zero and span calibration can be executed consecutively.
There are two methods to start a consecutive execution. One is by using YH8000, Modbus, or digital input (semi-automatic execution), and the other is to start at a specified time (automatic execution). Semi-automatic execution is not possible from HART. For details on automatic and semi-automatic execution, see “9.8 Automatic and Semi-automatic Execution of Validation and Calibration”.
For details on consecutive execution, see “9.8.5 Consecutive Automatic Execution”.

If you want to switch the zero calibration gas stream through automatic valve control using the TDLS8100 SV terminal, you need to set the TDLS8100 valve usage to Cal/Val. For details on valve usage, see “6.8.2 Valve Usage Setting”.

9.5.2 Configuration

Zero calibration configuration menu:

[HART] “Detailed setup>>Calibration>>Zero calibration”

[YH8000] “  >>Configuration>Calibration>>Zero Calibration”

The setup parameters required to manually execute zero calibration are indicated for each of the above submenus (tabs on the YH8000).

- **Valve**

Parameter name (HART)	Description
Z-cal auto vlv man	Selects whether to enable automatic valve control through the SV terminal during manual zero calibration execution.

9.5.3 Execution

Before starting zero calibration, check that the piping and zero calibration settings are correct.

Execution menu path:

[HART] “Diagnosis/Service>>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 Next, if automatic valve control is enabled, a message stating that the valves will be automatically controlled will appear.*2 In this case, you do not need to manually control the valves during zero calibration.

(2) Purging with zero calibration gas

An instruction to purge the calibration cell with zero calibration gas will appear.*3 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.*4 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 TDLS8100 will exit from calibration mode.

*1: [HART] WARN-Please be careful to execute zero calibration.
[YH8000] Are you sure to start manual zero calibration?
*2: [HART] Valves are automatically controlled during the calibration.
[YH8000] Valve for Zero Gas will be opened automatically.
*3: [HART] Purge calibration cell with zero gas then …
[YH8000] Purge calibration cell with Zero Gas.
*4: [HART] Ensure zero gas is completely removed from calibration cell and …
[YH8000] Remove Zero Gas from calibration cell.

NOTE

If the zero calibration fails, the following warning will occur. For the corrective action, see “10.2 Warning Display and Handling”.

Alarm number	Alarm name
16	Zero Cal Error

9.5.4 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 “6.4.2 Output Hold” and “6.5.1 DO Contact (DO-1)”.

In the following figure, 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.

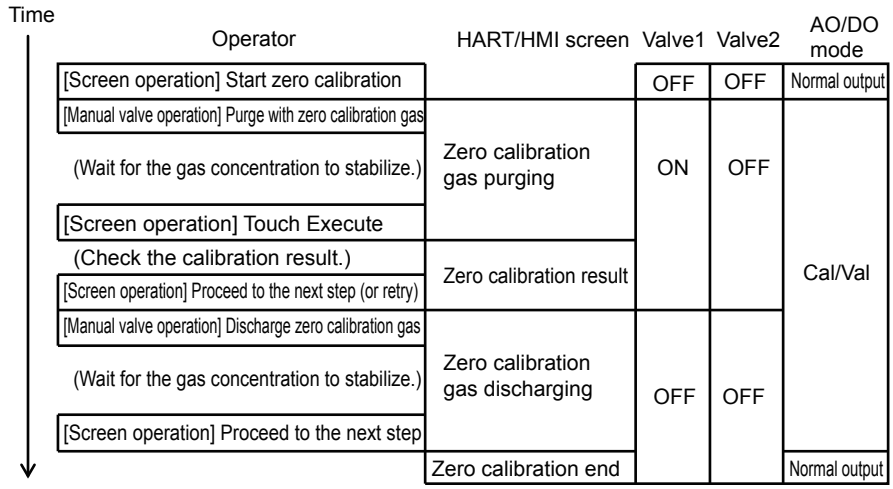


Figure 9.14 Valve and AO/DO output for zero calibration

9.6 Span Calibration

Span calibration is a function used to align the concentration calculation result of the TDLS8100 to the concentration of the calibration gas by purging a calibration cell with span calibration gas of known concentration.

Note the following items to perform span calibration correctly.

- 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

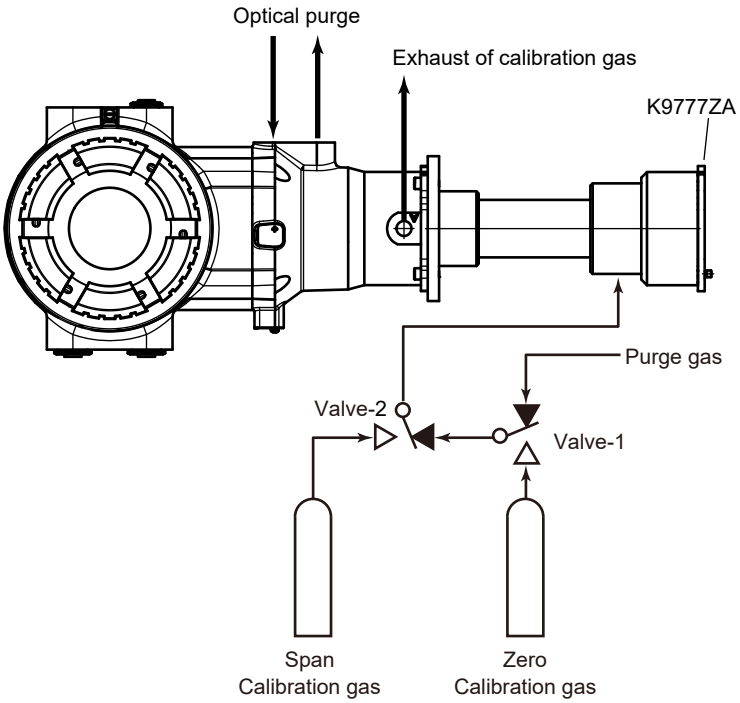
- If the purge piping leaks, correct results cannot be obtained.
- Wait at least 1 hour after turning on the power before performing calibration.
- Correct measurements may not be obtained if span calibration is performed when the reading is not stable.

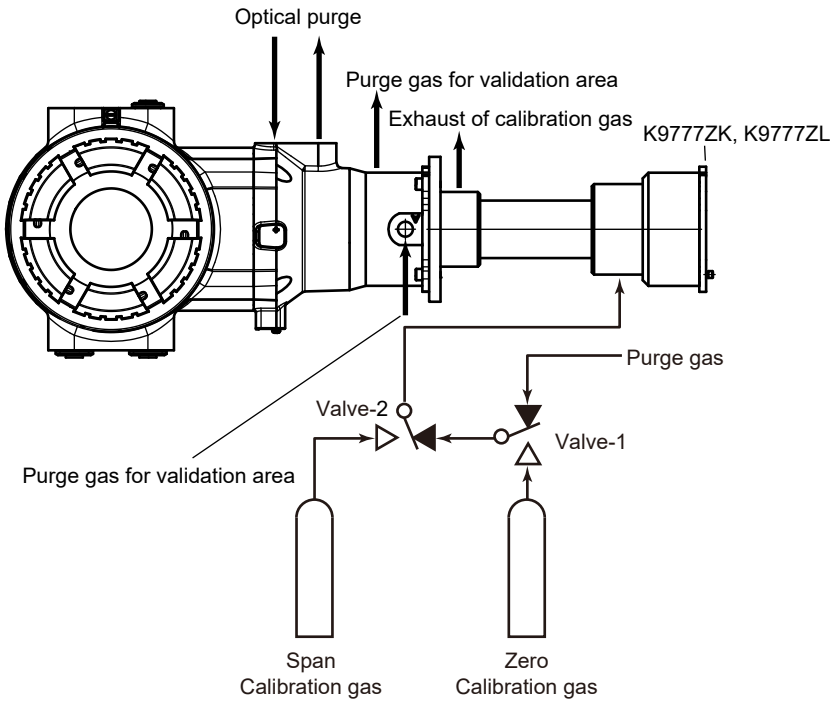
9.6.1 Preparation

Follow the instructions in “9.3 Mounting on a Calibration Cell”. There are two piping methods.

- **Zero+span calibration gas**

  A piping arrangement that allows zero calibration gas to be used in addition to span calibration gas. Zero calibration and span calibration can be executed.





In this arrangement, automatic zero and span calibration can be executed consecutively.

9.6.2 Configuration

Span calibration configuration menu:

[HART] “Detailed setup>>Calibration>>Span calibration”

[YH8000] “>>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-gas measurement, you cannot set span calibration simultaneously on two 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.

Valve

Parameter name (HART)	Parameter name (YH8000)	Description
S-cal auto vlv man	Auto valve for manual validation	Selects whether to enable automatic valve control through the SV terminal during manual span calibration execution.

9.6.3 Execution

Before starting span calibration, check that the piping and span calibration settings are correct.

Execution menu path:

[HART] “Diagnosis/Service>>Calibration>>Manual>>Manual span cal”

[YH8000] “  >>Execution>>Calibration>>Manual>>Span Calibration”

(1) Starting span calibration

On HART or YH8000, 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.*2 If automatic valve control is disabled, manually control the valves to purge the calibration cell with the span calibration gas 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.*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 span calibration

The TDLS8100 will exit from calibration mode.

*1: [HART] Valves are automatically controlled during the validation.
[YH8000] Valve for Check Gas 1 will be opened automatically.
*2: [HART] Purge calibration cell with span gas then …
[YH8000] Purge calibration cell with Span Gas.
*3: [HART] Ensure span gas is completely removed from calibration cell and …
[YH8000] Remove Span Gas from calibration cell.

NOTE

If the span calibration fails, the following warning will occur. For the corrective action, see “10.2 Warning Display and Handling”.

Alarm number	Alarm name
17	Span Cal Error

9.6.4 Time Chart

The valve operation during manual span 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 “6.4.2 Output Hold” and “6.5.1 DO Contact (DO-1)”.

In the following figure, 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.

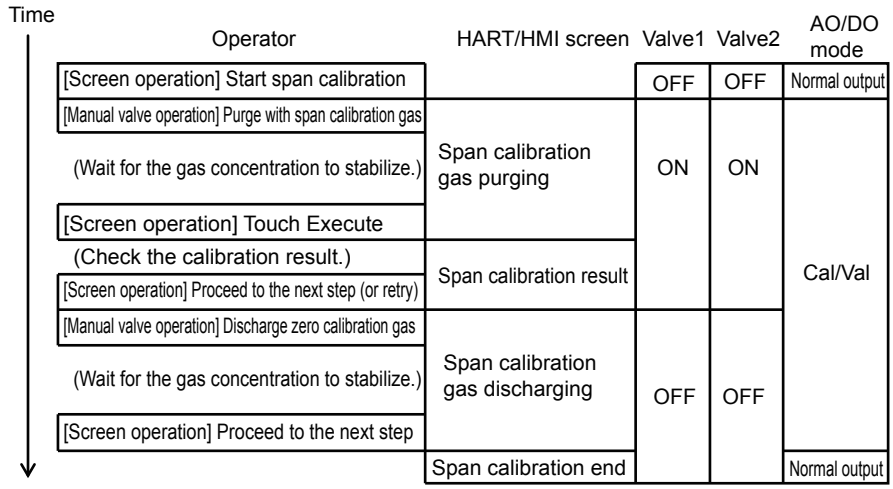


Figure 9.15

9.7 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 “8.5.6 Cal/Val History Screen”. You can view using the following menu.

[HART] “Diagnosis/Service>>Logbook>>Read cal/val record”

[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:

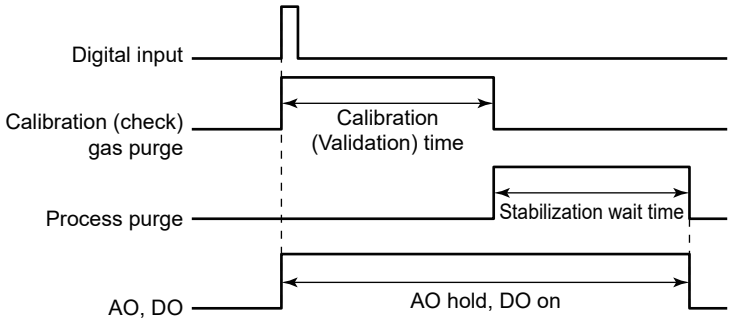
[HART] “Diagnosis/Service>>Calibration>>Restore”

[YH8000] “🔧>>Execution>>Calibration>>Restore”

9.8 Automatic and Semi-automatic Execution of Validation and Calibration

There are several methods to perform calibration and validation. One method is manual calibration and 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 calibration and validation, which are executed in response to a start instruction from the YH8000, HART, digital input, or Modbus.

Since valves are controlled automatically in automatic and semi-automatic execution, you need to set time for preparatory check gas or calibration gas purging. As shown in the following figure, the time period during which calibration gas (or check gas) purging takes place 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 wait time until the measurements stably return to normal process values. The TDLS8100 is in a Cal/Val state until the stabilization wait time is completed and holds the AO output. The following figure 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 calibration or validation is being executed. For details, see “6.4.2Output Hold” and “6.5.1 DO Contact (DO-1)”.

9.8.1 Preparation

Before automatic execution or semi-automatic execution, connect the piping properly according to the calibration or validation you want to perform. For the piping diagram, see the calibration and validation sections.

9.8.2 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 validation and calibration. 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 validation and calibration. For online validation, the menu path is as follows.

[HART] “Detailed setup>>Validation>>Online validation #”

[YH8000] “  >>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 (HART)	Parameter name (YH8000)	Description
Onval1 gas purg time	Validation gas Purge time	Enters the purge time of online validation 1 check gas. This corresponds to the validation time.
Onval1 nml purg 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 (HART)	Parameter name (YH8000)	Description
Onval1 time initiate	TIme Initiate	Enables time initiate of online validation 1
Onval1 init date	Initial time	Enters the initial execution date
Onval1 init time		Enters the initial execution time
Onval1 day cycle	Cycle (day)	Enters the cycle in days for time initiate
Onval1 hour cycle	Cycle (hour)	Enters the cycle in hours for time initiate

  For example, if the initial execution time is 12:00:00 on January 1, 2015, the day cycle is 10, and the hour cycle is 0, the execution will take place at 12:00:00 on January 11, 2015, 12:00:00 on January 21, 2015, 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 “6.7 Digital Input Settings”.
- If you are using Modbus instructions, you do not need to set the parameters. For the instruction address, see “11.2 Coil”.

9.8.3 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. Here, a semi-automatic execution procedure will be explained using online validation 1 as an example.

Semi-automatic execution menu path:

[HART] “Diagnosis/Service>>Calibration>>Semi-auto”

“Diagnosis/Service>>Validation>>Semi-auto”

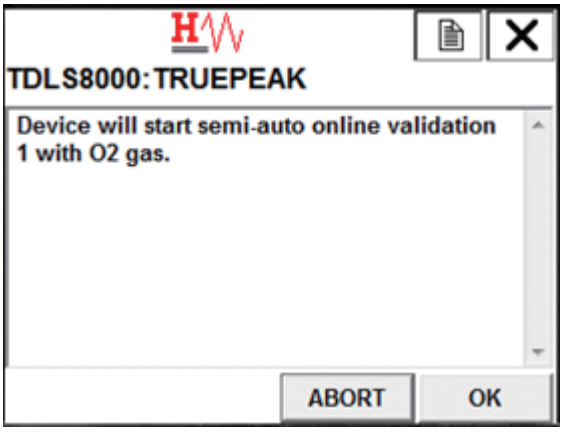
[YH8000] “  >>Execution>>Calibration>>Semi-Auto”

“  >>Execution>>Validation>>Semi-Auto”

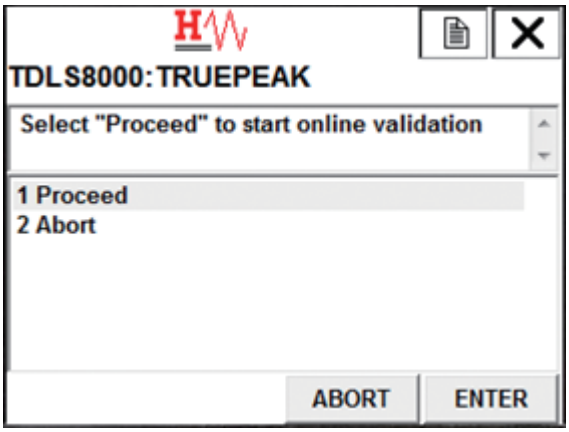
- **HART execution screen**

(1) Starting a semi-automatic online validation

Execute “Semi-auto online val 1.” Tap OK.

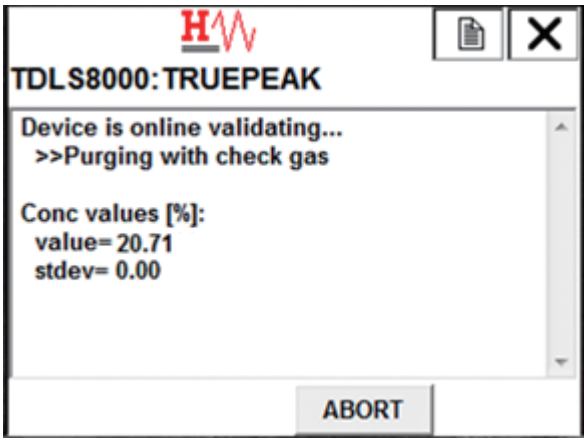


On the next screen, tap ENTER.



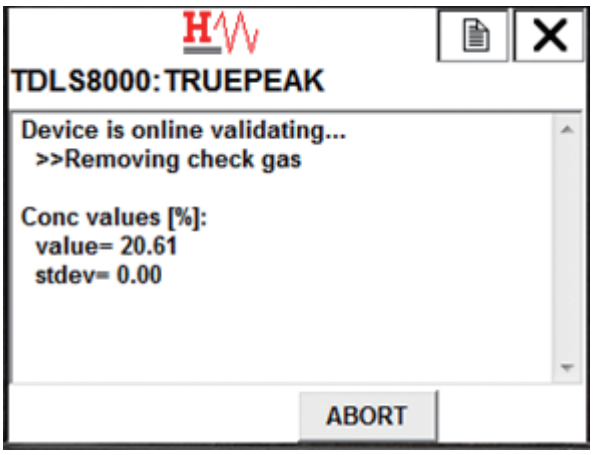
(2) Purging with check gas

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 “Onval1 gas purg time.” Tapping ABORT cancels validation.



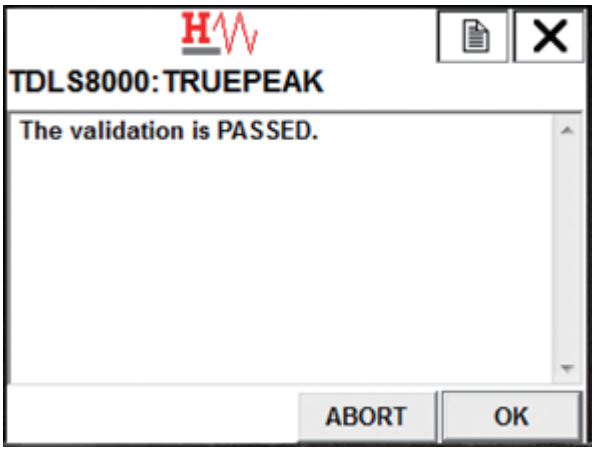
(3) Discharging the check gas (process purge)

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 “Onval1 nml purg time.” Tapping ABORT cancels validation.



(4) Checking the validation result

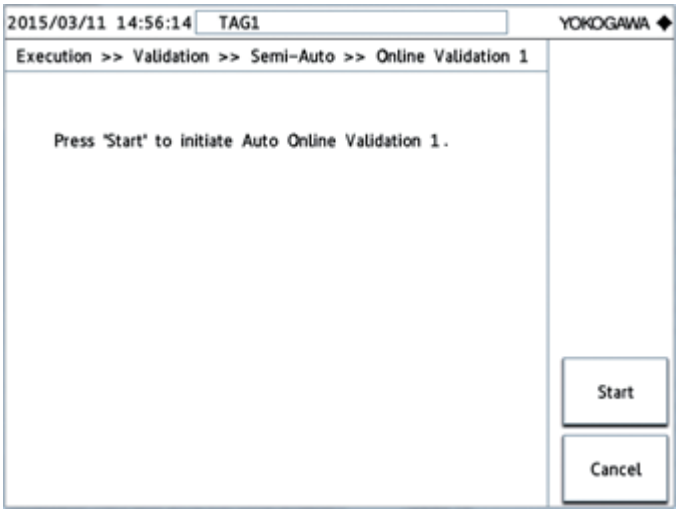
The validation result is displayed as “PASSED” or “FAILED,” and validation ends. If validation is unsuccessful, a warning will occur (see “9.2.3 Execution”). Tap OK to return to the menu.



YH8000 Execution Screen

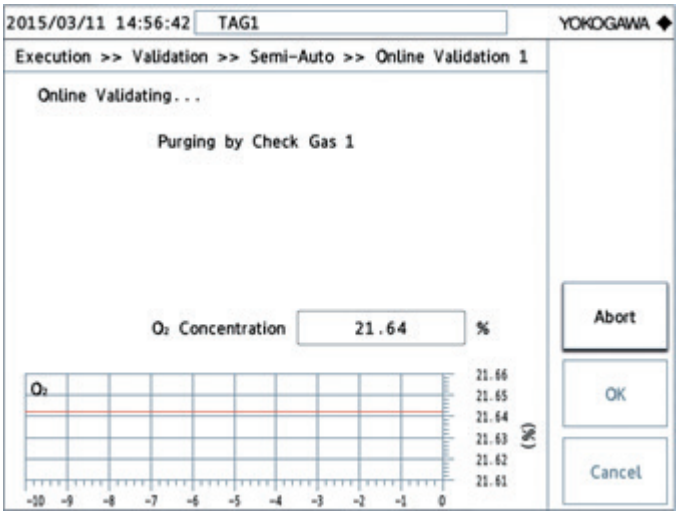
(1) Starting validation

Execute “Semi-Auto Online Validation 1.” Tap Start to begin.



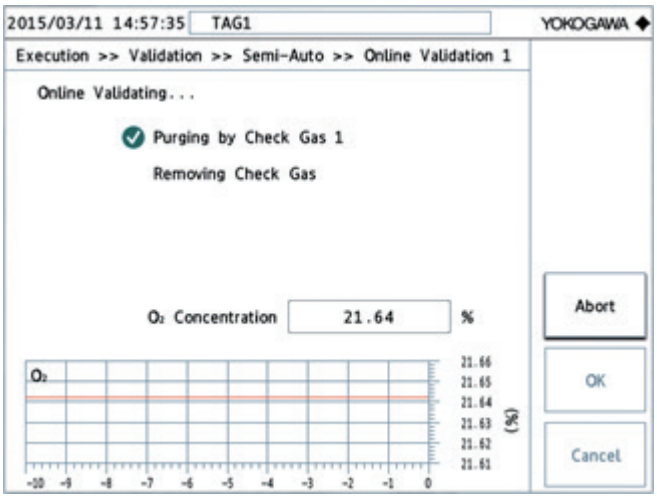
(2) Purging with the check gas

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.



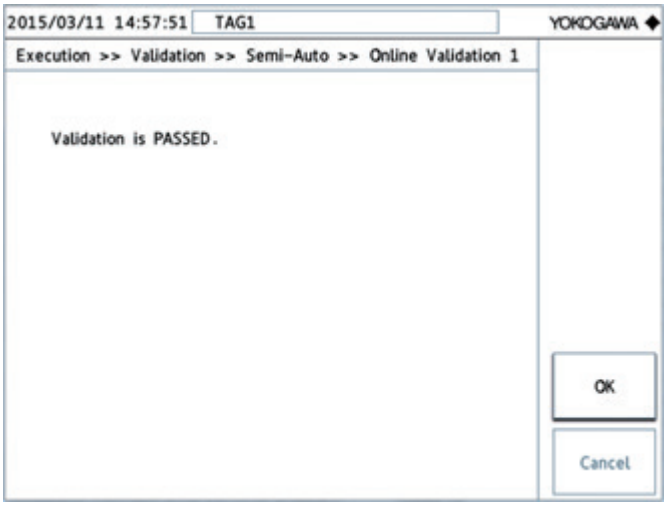
(3) Discharging the check gas (process purge)

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 “9.2.3 Execution”). Tap OK to return to the configuration menu.



9.8.4 Aborting the Stabilization Wait Time for Automatic or Semi-automatic Execution

The stabilization wait time during which process purging takes place in an automatic or semi-automatic execution of calibration or validation is a wait time until the measurements are stably restored. It does not affect the calibration or validation results. Therefore, when you decide that the process measurements have been stably restored, you can abort the stabilization wait time to end calibration or validation. This avoids having to wait longer than needed for measurements to stabilize. For details on the stabilization wait time, see “9.8 Automatic and Semi-automatic Execution of Validation and Calibration”.

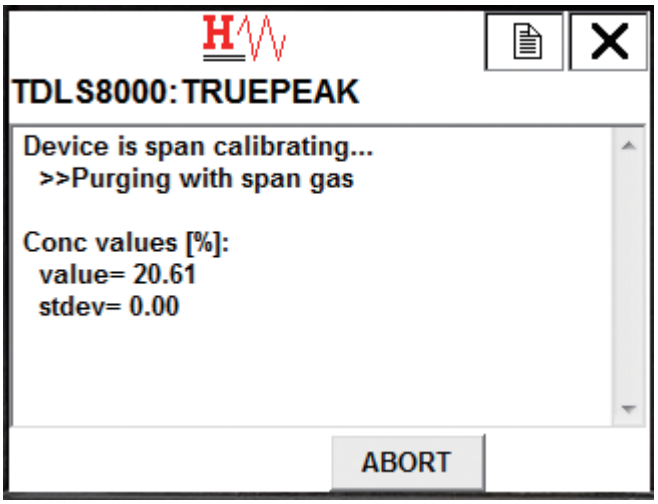
NOTE

For online validation only, the stabilization wait time cannot be aborted because the measurements in the normal process condition are used in the validation result. If you abort, validation itself will be aborted, and the results will not be displayed.

As an example, the procedure to abort process purging for semi-automatic span calibration is explained below.

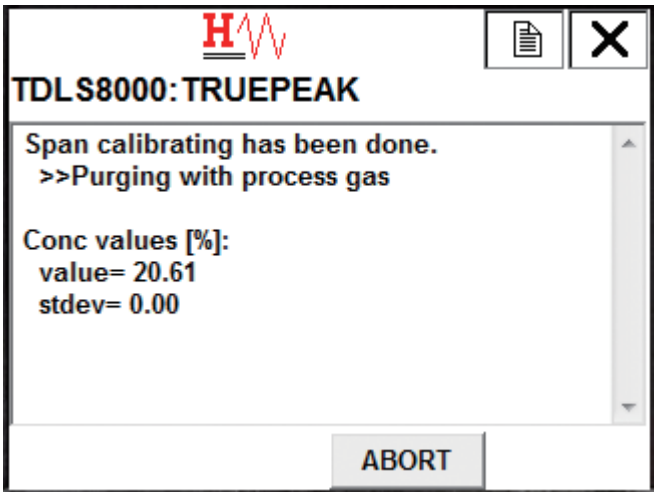
(1) Purging with span calibration gas

When you execute semi-automatic span calibration, span calibration gas purging begins. Note that touching ABORT at this point will abort the span calibration.



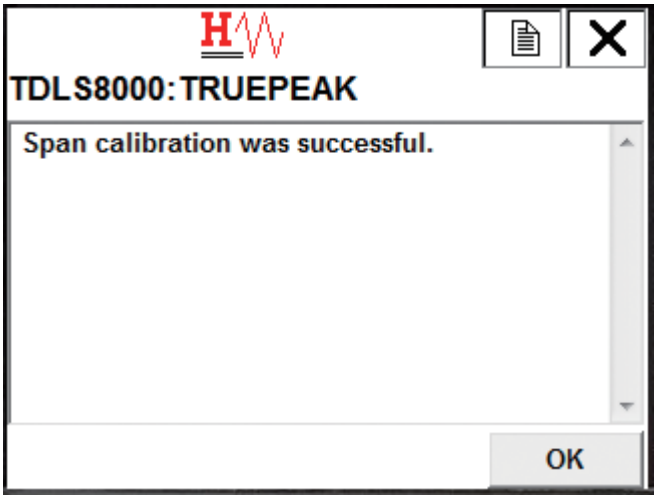
(2) Purging with process gas

Immediately after the span calibration gas purge time elapses, the TDLS8100 calculates the span calibration result. Then, process gas purging takes place. Since span calibration is already completed at this point, you can view the span calibration result even if you abort the stabilization wait time. Check that the concentration has stabilized, and then touch ABORT.



(3) Checking the calibration result

The span calibration result is displayed. Tap OK to return to the menu.



9.8.5 Consecutive Automatic Execution

It is possible to execute zero calibration and span calibration consecutively in automatic execution or semi-automatic execution. It is also possible to execute offline validation consecutively using check gas 1 and then check gas 2.

The combinations that can be executed consecutively are shown below.

- Zero calibration and span calibration (zero+span calibration)
- Offline validation 1 and offline validation 2 (offline validation 1+2)

To perform consecutive automatic execution, you need to make the following preparations.

Piping: Connect the piping so that both automatic calibration and validation can be executed.

Configuration: Configure the automatic calibration and validation settings.

Automatic execution configuration: Refer to “9.8.2 Configuration”.

The settings and detailed operation of each consecutive automatic execution are explained below.

● Zero+span calibration

Piping: Connect the piping for zero+span calibration provided in “9.5.1 Preparation”.

Configuration: Configure the zero calibration (see “9.5.2 Configuration”) and span calibration (see “9.6.2 Configuration”.

Automatic execution configuration: Configure from the following menu as necessary.

[HART] “Detailed setup>>Calibration>>Zero+Span calibration”

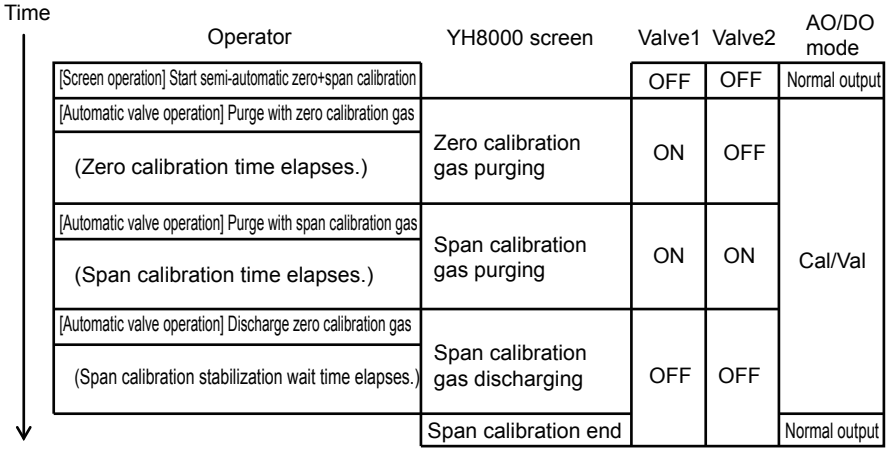
[YH8000] “  >>Configuration>>Calibration>>Zero + Span Calibration”

Semi-automatic execution menu path:

[HART] (Cannot be executed from HART)

[YH8000] “  >>Execution>>Calibration>>Semi-Auto>>Zero + Span Calibration”

Time chart: The valve operation during zero+span calibration execution and the timing when the AO/DO output switches to Cal/Val mode are shown below. The following figure shows an example for semi-automatic execution.



Offline validation 1+2

Piping: Connect the piping as described in “Offline validation exclusive” in section 9.4.1.

Configuration: Configure the offline validation (see section 9.4.2) for validation 1 and 2.

Automatic execution configuration: Configure from the following menu as necessary.

[HART] “Detailed setup>>Validation>>Offline validation 1+2”

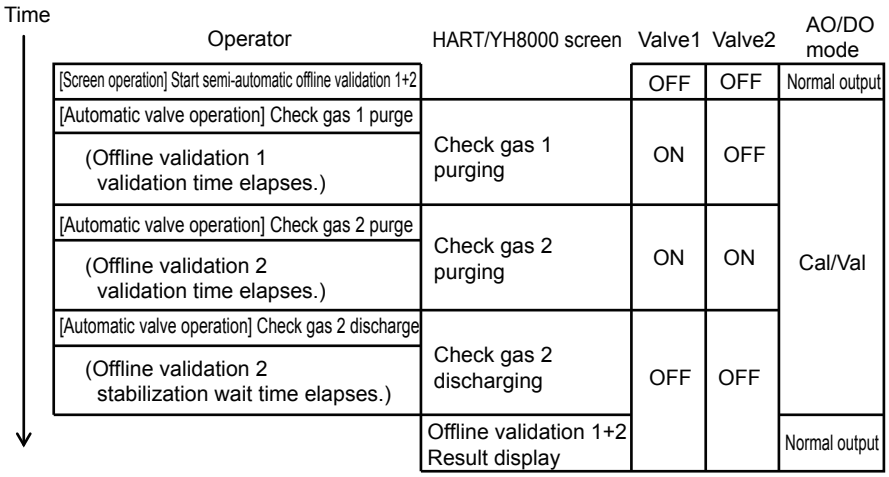
[YH8000] “ >>Configuration>>Validation>>Offline Validation 1 + 2”

Semi-automatic execution menu path:

[HART] “Diagnosis/Service>>Validation>>Semi-auto>>Semi-auto offline val 1+2”

[YH8000] “ >>Execution>>Validation>>Semi-Auto>>Offline Validation 1 + 2”

Time chart: The valve operation during offline validation 1+2 execution and the timing when the AO/DO output switches to Cal/Val mode are shown below. The following figure shows an example for semi-automatic execution.



9.9 Analog Input Calibration

This section explains analog-digital conversion calibration of the analog input terminal (AI). Since the TDLS8100 is calibrated before shipment, you normally do not need to calibrate.

CAUTION

Analog input must be calibrated with Passive AI

Check the setting on 3.2.3. If Active A is on, power down first and switch to “Passive A”

Execution menu path:

[HART] “Diagnosis/Service>>Trim analog channel>>Trim AI-1 (Pres)”

“Diagnosis/Service>>Trim analog channel>>Trim AI-2 (Temp)”

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

“  >>Configuration>>I/O>>Analog Input>>AI-2(Temperature)>>Calibration”

The calibration procedure is as follows.

(1) From HART or 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 “5.3.3 Setting the Process Pressure”.

CAUTION

To return to process, confirm Active A or Passive A are selected then turn the power on.

9.10 Analog Output Calibration

This section explains digital analog conversion calibration of the analog output terminal (AO). Since the TDLS8100 is calibrated before shipment, you normally do not need to calibrate.

Execution menu path:

[HART] “Diagnosis/Service>>Trim analog channel>>Trim AO-1 (PV)”

“Diagnosis/Service>>Trim analog channel>>Trim AO-2 (SV)”

[YH8000] “  >>Configuration>>I/O>>Analog Output>>AO-1>>Calibration”

“  >>Configuration>>I/O>>Analog Output>>AO-2>>Calibration”

The calibration procedure is as follows.

(1) Connect ammeter to the AO terminal.

(2) From HART or YH8000, 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.

9.11 Loop Check

See “5.4 Loop Check (Simulation output)”.

9.12 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 9.1 occurs, it is recorded as a message.

Menu path:

[HART] “Diagnosis/Service>>Logbook>>Read alarm/message record”

[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 HART and the YH8000.

You can view up to 30 events using HART and 99 events using the YH8000. For an explanation of the YH8000 alarm history screen, see “8.5.5 Alarm History Screen”.

For details on faults and warnings, see “10. Troubleshooting”.

Items recorded as messages are shown in the following table.

Table 9.1

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.

9.13 Access to stored data in TDLS8100

Plugging a USB flash drive into USB port on TDLS8100 or YH8000 enables downloading data stored in TDLS8100 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
	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/

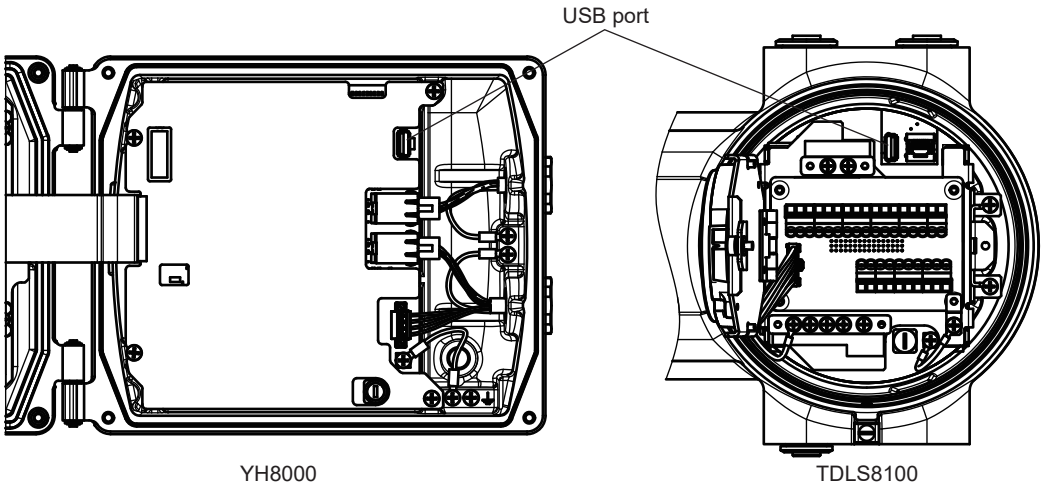
How to download data

1: Plug an empty USB flash drive* into USB port on TDLS8100 or YH8000.

2: Plugging a flash drive into USB port on TDLS8100 starts downloading files automatically. Plugging into YH8000 starts downloading by following the instruction on the panel.

3: After "Download complete" is displayed on TDLS8100 panel, remove the USB flash drive. Remove the flash drive from YH8000 by following the direction displayed on the panel.

*: 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.



10. Troubleshooting

This chapter explains the faults and warnings that the TDLS8100 may detect. It also explains how to inspect and restore the TDLS8100 when other problems occur.

10.1 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 TDLS8100 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 “7.4 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. Except for a portion of the faults, executing Clear Latched Alarms clears them, but if the cause of the fault is still present, the fault will occur again. If this happens, the device may have malfunctioned, so contact your Yokogawa service representative.

Execution menu path:

[HART] “Diagnosis/Service>>>System>>Clear latched alarms”

[YH8000] “  >>Execution>>System>>Clear Latched Alarms”

No.	Displayed name (HART)	Description	Corrective action
45	Laser Md Temp Low	The optical module temperature is too low.	Check the analyzer’s ambient temperature. Contact your Yokogawa service representative.
46	Laser Md Temp High	The optical module temperature is too high.	Check the analyzer’s ambient temperature. Contact your Yokogawa service representative.
47	Laser Temp Low	The laser temperature is too low.	Contact your Yokogawa service representative.
48	Laser Temp High	The laser temperature is too high.	Contact your Yokogawa service representative.
50	Peak Center OOR	The absorption peak position is outside the range.	Contact your Yokogawa service representative.
51	Ref Peak Height Low	The reference peak height is too low.	Contact your Yokogawa service representative.

No.	Displayed name (HART)	Description	Corrective action
53	Transmission Lost	The transmission is too low to continue measurements.	Check that the alignment is correct. Check whether the laser beam is being blocked. Check whether the process window is stained. For details, see “9.1 Maintaining the Laser Beam and Transmission”.
54	Ref Trans Low	The reference cell transmission is too low.	Contact your Yokogawa service representative.
55	R Peak Height High	The reference cell peak height is too high.	Contact your Yokogawa service representative.
57	Laser Unit Fail	The analyzer unit failed.	Contact your Yokogawa service representative.
58	Inter Comm Fail	Internal communication error occurred.	Contact your Yokogawa service representative.
59	Laser Module Error	The analyzer module failed.	Contact your Yokogawa service representative. (*1)
60	File Access Error	File access error.	Contact your Yokogawa service representative. (*1)
61	EEPROM Error	EEPROM error.	Contact your Yokogawa service representative. (*1)
62	LU Connect Error	An error occurred in the analyzer connection.	Check that the laser unit connection cable is not loose. Contact your Yokogawa service representative.
63	FPGA Failure	FPGA failure.	Contact your Yokogawa service representative. (*1)
64	Program Error	Internal error occurred.	Contact your Yokogawa service representative. (*1)

*1: Cannot be cleared using Clear Latched Alarms. If the fault occurs again even if you restart the TDLS8100, contact your Yokogawa service representative.

10.2 Warning Display and Handling

A warning occurs when the various types of diagnostic information being monitored by the TDLS8100 self-diagnostics function are outside the normal range. If a warning occurs, the TDLS8100 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 “5.3.6 Setting Process Alarms”.
- The DO LED (yellow) lights.
- The alarm indicator blinks on the YH8000 display.
- Alarm information is indicated over HART communication (see “7.4 Alarm Definition (Status group)”).
- Alarm information is shown on the SCU 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 SCU 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 (HART)	Description	Corrective action
1	Transmission Low	The transmission is less than the low limit.	Check that the alignment is correct. Check whether the laser beam is being blocked. Check whether the process window is stained. Check the low limit alarm threshold value. For details, see “9.1 Maintaining the Laser Beam and Transmission”.
2	Pressure Low	The 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 low limit alarm threshold value. For details, see “5.3.6 Setting Process Alarms”.
3	Pressure High	The process pressure is greater 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 high limit alarm threshold value. For details, see “5.3.6 Setting Process Alarms”.
4	Temperature Low	The process temperature is less 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 low limit alarm threshold value. For details, see “5.3.6 Setting Process Alarms”.
5	Temperature High	The process temperature is greater 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 high limit alarm threshold value. For details, see “5.3.6 Setting Process Alarms”.
6	Conc Gas1 Low	The component 1 gas concentration is less than the low limit.	Check the component 1 gas concentration. Check the low limit alarm threshold value. For details, see 5.3.6 Setting Process Alarms.
7	Conc Gas1 High	The component 1 gas concentration is greater than the high limit.	Check the component 1 gas concentration. Check the high limit alarm threshold value. For details, see “5.3.6 Setting Process Alarms”.
8	Conc Gas2 Low	The component 2 gas concentration is less than the low limit.	Check the component 2 gas concentration. Check the low limit alarm threshold value. For details, see “5.3.6 Setting Process Alarms”.
9	Conc Gas2 High	The component 2 gas concentration is greater than the high limit.	Check the component 2 gas concentration. Check the high limit alarm threshold value. For details, see “5.3.6 Setting Process Alarms” .
10	LU Temp Low	The analyzer temperature is too low.	Check the analyzer’s ambient temperature. Contact your Yokogawa service representative.
11	LU Temp High	The analyzer temperature is too high.	Check the laser unit’s ambient temperature. Contact your Yokogawa service representative.
12	SCU Temp Low	The analyzer temperature is too low.	Check the analyzer’s ambient temperature. Contact your Yokogawa service representative.
13	SCU Temp High	The sensor control unit temperature is too high.	Check the sensor control unit’s ambient temperature. Contact your Yokogawa service representative.
14	Validation Required	Validation is required for verifying the measurement accuracy.	Execute validation. Or, if you confirm that validation is not required, clear the alarm. (*1)
15	Validation Error	Validation failed.	Verify the check gas. Check whether the validation settings are correct. For details, see “9.2 Online Validation” and “9.4 Offline Validation”. (*1)
16	Zero Cal Error	Zero calibration failed.	Check the zero calibration gas. Check whether the zero calibration settings are correct. For details, see “9.5 Zero Calibration”. (*2)
17	Span Cal Error	Span calibration failed.	Check the span calibration gas. Check whether the span calibration settings are correct. For details, see “9.6 Span Calibration”. (*2)
19	Non Process Alarm	The non-process reference peak height is too low.	Check whether the purge gas is running. Check the purge gas concentration. Contact your Yokogawa service representative.
20	AI-1 (Pres) Low	The 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. For details, see “6.3 Analog Input Settings”.
21	AI-1 (Pres) High	The 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. For details, see “6.3 Analog Input Settings”.

No.	Displayed name (HART)	Description	Corrective action
22	AI-2 (Temp) Low	The 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. For details, see “6.3 Analog Input Settings”.
23	AI-2 (Temp) High	The 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. For details, see “6.3 Analog Input Settings”.
24	External Alarm	An alarm triggered by digital input occurred.	Check the external alarm status.
25	Clock Adj Required	The real-time clock is not synchronized.	Set the current time.
26	Setting File Error	Restored from backup due to a setup file corruption.	Configure the settings again, and restart.
27	Calib File Error	Restored from backup due to a calibration file corruption.	Calibrate again, and restart.
49	Detect Signal High	The detector signal level is too high.	Contact your Yokogawa service representative.
52	Absorption High	The absorption signal level is too high.	Contact your Yokogawa service representative.
56	Outlier Reject Lmt	The detector signal level is abnormal.	Contact your Yokogawa service representative.

*1: For validation alarms, you can manually clear the alarm without re-executing validation.
Menu path:
[HART] “Diagnosis/Service>>Validation>>Clear val alarms”
[YH8000] “ >>Execution>>Validation>>Clear Validation Alarm”

*2: For calibration alarms, you can manually clear the alarm without re-executing calibration.
Menu path:
[HART] “Diagnosis/Service>>Calibration>>Clear cal alarms”
[YH8000] “ >>Execution>>Calibration>>Clear Calibration Alarm”

10.3 Handling Degraded Laser Transmission

For the TDLS8100 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 TDLS8100.

(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 “9.1 Maintaining the Laser Beam and Transmission”, normally optical axis adjustment and transmission calibration are performed after the TDLS8100 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 “3.3 Optical Axis Adjustment”.

If the transmission does not improve even when the optical axis adjustment described in section 3.3 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 “9.3 Mounting on a Calibration Cell” on how to mount calibration cell.

10.4 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 “9.1.2 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 “10.4.2 Process Window Replacement Procedure”. When you replace a process window, be sure to also replace the O-ring.

10.4.1 Replacement Parts (Process window)

If you need to replace a process window, prepare the relevant parts in Table 10.1.

Table 10.1 Replacement parts

No.	Parts no.	Parts name	Purpose *	Quantity
1	K9776GA	Process window unit	For purge block (for -X1)	1
2	K9777GB	Process window unit	For purge block (for -C2, -C3, -c4)	
3	K9772TH	Process window unit	For process window attached to purge block	

*: Codes in parenthesis represent Gas Parameter on Model and Suffix Codes of TDLS8100.

10.4.2 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 installed in the alignment flange, 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 10.4. Firmly mount the O-ring in the O-ring groove.

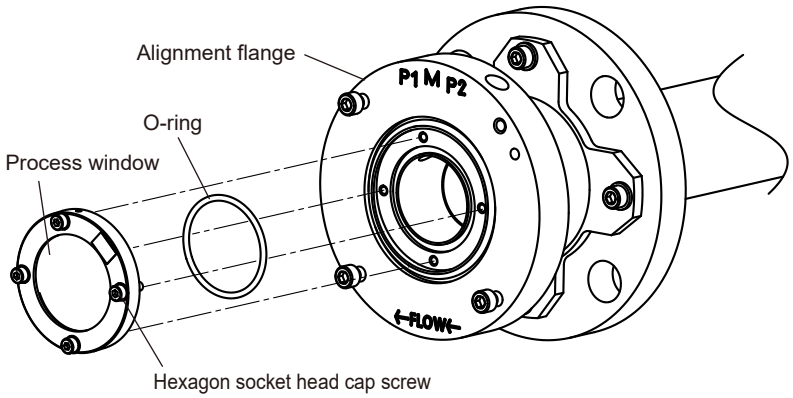


Figure 10.1 Replacing the process window and O-ring of an alignment flange

(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.

10.5 Reflector Replacement

Refer to “9.1.4 Reflector Cleaning” to remove/replace reflector unit.

10.6 Fuse Replacement

(1) To safely replace the fuse, shut off the external circuit breaker to stop the power supply to the TDLS8100.

(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.

Be careful because the fuse for the analyzer is 3.15 A and that for the YH8000 is 2.5 A.

(4) If the new fuse blows immediately, there may be a problem with the circuitry. Contact your Yokogawa representative.

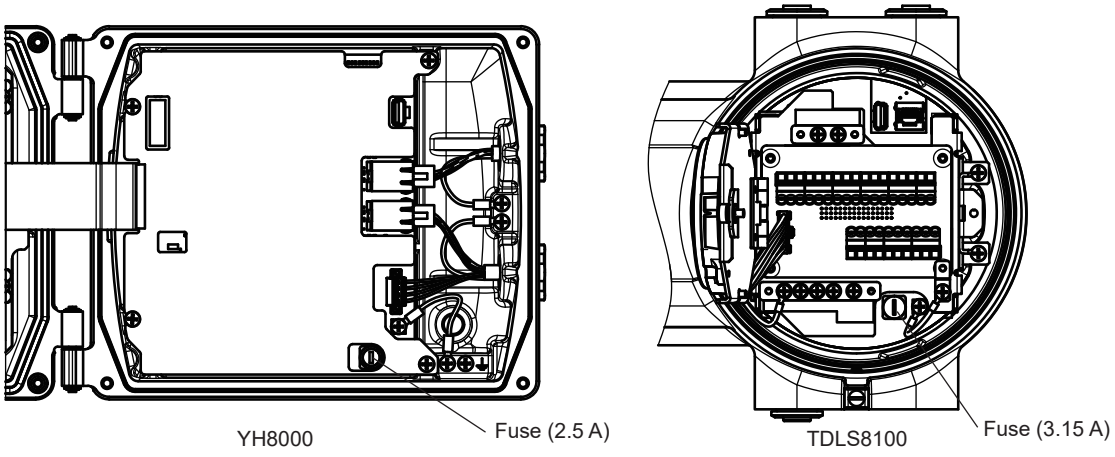


Figure 10.2 Fuse replacement

10.7 Communication Interruption during Manual Calibration and Validation

If the communication between HART or YH8000 and the TDLS8100 is disconnected while performing manual calibration or validation from HART or YH8000, take the following corrective action.

- **HART**

  See “7.5.3 Aborting Calibration and Validation”.

- **YH8000**

  (1) Reconnect.

  (2) Tap  to enter the TDLS8100 configuration screen. The screen for the calibration or validation in progress automatically recovers. You can continue the calibration or validation.

11. Modbus

Modbus protocol can be used for TDLS8000 DCS communication. This section explains the Modbus communication specifications that apply to the TDLS8000.

The main uses of Modbus communication on the TDLS8000 are shown below. Only a portion of the TDLS8000 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)

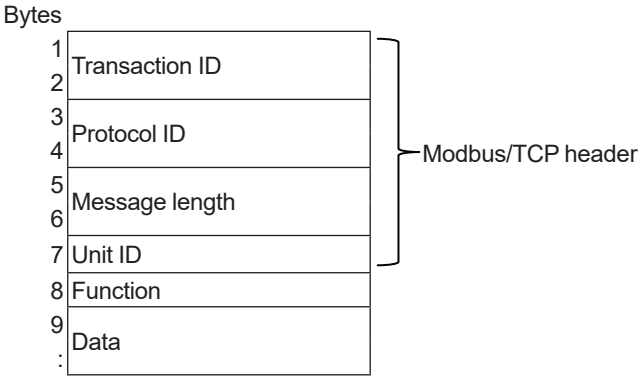
11.1 Communication Specifications

The TDLS8000 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

11.1.1 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	"TDLS8000"
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

11.1.2 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.

11.2 Coil

Coil name	Address	Action performed when “1” is set
Automatic zero calibration execution	00001	Remotely execute an automatic zero calibration
Automatic span calibration execution	00002	Remotely execute an automatic span calibration
Automatic offline validation 1 execution	00004	Remotely execute automatic offline validation 1
Automatic offline validation 2 execution	00005	Remotely execute automatic offline validation 2
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)
Automatic zero+span calibration execution	00009	Remotely execute an automatic zero+span calibration
Automatic offline validation 1+2 execution	00010	Remotely execute automatic offline validation 1+2

11.3 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 fixed output	10003	Both AO-1 and 2 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
Zero calibration in progress	10006	Zero calibration in progress when set to 1
Span calibration in progress	10007	Span calibration in progress when set to 1
Offline validation in progress	10009	Offline validation in progress when set to 1
Online validation in progress	10010	Online validation in progress when set to 1
Warming up	10013	Warming up when set to 1
Normal measurement in progress	10014	Normal measurement in progress when set to 1
Measurement update notification	10015	Set to 1 after measurement is updated. Reading this address resets the value to 0. (*1)
Alarm update	10016	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	10017	Set to 1 when an instruction by a coil fails. Reading this address or a successful next instruction resets the value to 0. (*1)
Manual Zero Calibration	10031	Calibration (validation) in progress when set to 1
Manual Span Calibration	10032	
Automatic Zero Calibration	10034	
Automatic Span Calibration	10035	
Manual Offline Validation 1	10037	
Manual Offline Validation 2	10038	
Manual Online Validation 1	10039	
Manual Online Validation 2	10040	
Automatic Offline Validation 1	10041	
Automatic Offline Validation 2	10042	
Automatic Online Validation 1	10043	
Automatic Online Validation 2	10044	
Digital input state	10051	DI-1 contact state (0: Open, 1: Closed)
	10052	DI-2 contact state (0: Open, 1: Closed)
Digital output state	10061	DO contact (DO-1) state (0: Off, 1: On)
	10062	Fault contact (DO-2) state (0: Off, 1: On)

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: Sensor control unit temperature high (AL-13)	10113	
Warning: Validation required (AL-14)	10114	
Warning: Validation failure(AL-15)	10115	
Warning: Zero calibration error (AL-16)	10116	
Warning: Span calibration error (AL-17)	10117	
Warning: Non process alarm (AL-19)	10119	
Warning: AI Ch1 (pressure) low (AL-20)	10120	
Warning: AI Ch1 (pressure) high (AL-21)	10121	
Warning: AI Ch2 (temperature) low (AL-22)	10122	
Warning: AI Ch2 (temperature) high (AL-23)	10123	
Warning: External alarm (AL-24)	10124	
Warning: Clock adjustment required (AL-25)	10125	
Warning: Setting file corrupted (AL-26)	10126	
Warning: Calibration file corrupted (AL-27)	10127	
Fault: Laser module temperature low (AL-45)	10145	
Fault: Laser module temperature high (AL-46)	10146	
Fault: Laser temperature low (AL-47)	10147	
Fault: Laser temperature high (AL-48)	10148	
Warning: Detector signal high (AL-49)	10149	
Fault: Peak center out of range (AL-50)	10150	
Fault: Reference peak height low (AL-51)	10151	
Warning: Absorption too high (AL-52)	10152	
Fault: Transmission lost (AL-53)	10153	
Fault: Reference transmission low (AL-54)	10154	
Fault: Reference peak height high (AL-55)	10155	
Warning: Outlier rejection limit (AL-56)	10156	
Fault: Laser unit failure (AL-57)	10157	
Fault: Internal communication failure (AL-58)	10158	
Fault: Laser module error (AL-59)	10159	
Fault: File access error (AL-60)	10160	
Fault: EEPROM error (AL-61)	10161	
Fault: Laser Unit Connection Error (AL-62)	10162	
Fault: FPGA Failure (AL-63)	10163	
Fault: Program error (AL-64)	10164	

*1: If this address is read from two sessions, the first access has priority.

11.4 Hold register

Name	Address	Setting details
Valve stream setting	40001	Sets the current stream 0: Stream 1 1: Stream 2 2: Stream 3 *: Note that via Modbus, exclusion check on the writing of the current stream according to the valve usage setting is not performed. For details on exclusion, see “6.8.2 Valve Usage Setting”. *: Writing is not possible when maintenance is in progress.
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 TDLS8000 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 “6.1.2 Process Pressure”

11.5 Input register

<table>
<tr><th>Input register name</th><th>Address</th><th>Description</th></tr>
<tr><td>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></td><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>Transmission value</td><td>30007, 30008</td><td>Transmission [%], IEEE754 float format (*1)</td></tr>
<tr><td>Temperature value</td><td>30011, 30012</td><td>Temperature value, IEEE754 float format (*1)
The unit follows to the temperature unit setting.</td></tr>
<tr><td>Pressure value</td><td>30015, 30016</td><td>Pressure value, IEEE754 float format (*1)
The unit follows to the pressure unit setting.</td></tr>
<tr><td>AI value</td><td>30019, 30020</td><td>AI-1 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td></td><td>30021, 30022</td><td>AI-2 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td>AO value</td><td>30025, 30026</td><td>AO-1 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td></td><td>30027, 30028</td><td>AO-2 current value [mA], IEEE754 float format (*1)</td></tr>
<tr><td>Calibration/validation execution state</td><td>30031</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>
</table></td></tr>
<tr><td>Active alarm state value</td><td>30035 to 30038</td><td>Indicates active alarm states.
A value in unsigned long format (Big-endian arrangement in four registers). Bit numbers corresponding to alarm numbers in which warning or fault is occurring are set to 1. 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:
30035: 0x0010$3
30036: 0x0000$3
30037: 0x0000$3
30038: 0x0001$3</td></tr>
<tr><td>SCU temperature</td><td>30051 to 30052</td><td>[degC] temperature of Sensor Control Unit (SCU) , IEEE754 float(*1)</td></tr>
<tr><td>LU temperature</td><td>30053 to 30054</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 Constructing Local HMI Connection Cables

To connect a YH8000 HMI unit as a local HMI to the TDLS8100 analyzer part, use the special YH8000 option cable (option code: /C).

This section explains how to terminate this cable.

NOTE

- Before performing cable termination, pass the cable through cable glands. After crimping the network 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.
- To maintain the TDLS8100 performance and functionality, be sure to use the optional dedicated cable.

Required components and tools

- Wire cutter
- Pliers

Pretreatment

Before terminating the special cable, pass the cable through cable glands (for 1/2NPT or M20). Apply the cable glands from the unterminated end of the exclusive cable.

After crimping the network connector (RJ45 modular plug), the cable cannot be passed through the cable glands.

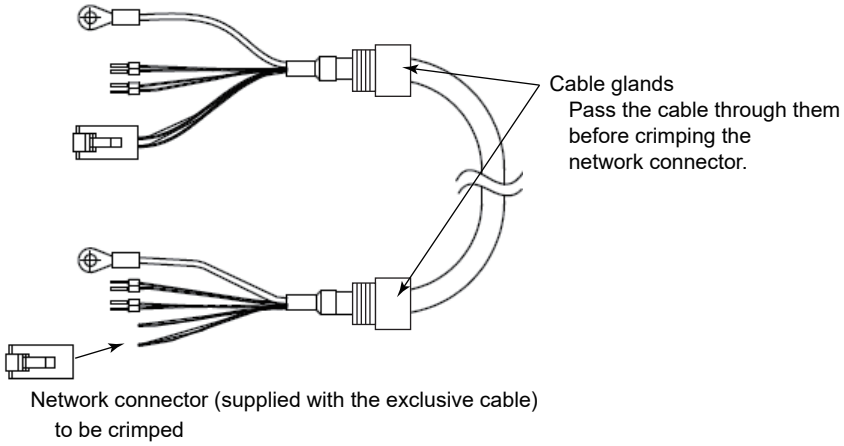
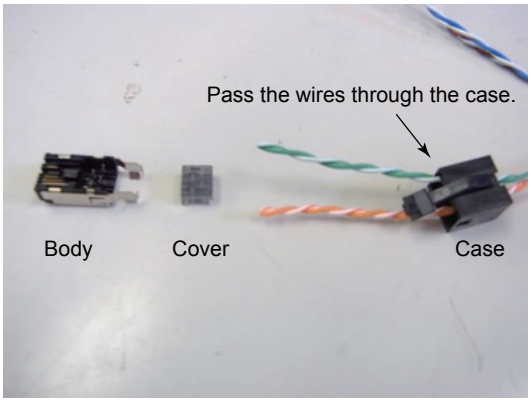


Figure 1 Local HMI connection cable

Attaching the communication connector

Crimp a communication connector (RJ45 modular plug) to one end of the dedicated cable (the end without the communication connector). Use the communication connector supplied with the dedicated cable.

(1) Pass the wires (two pairs: orange-white and green-white) through the communication connector case.

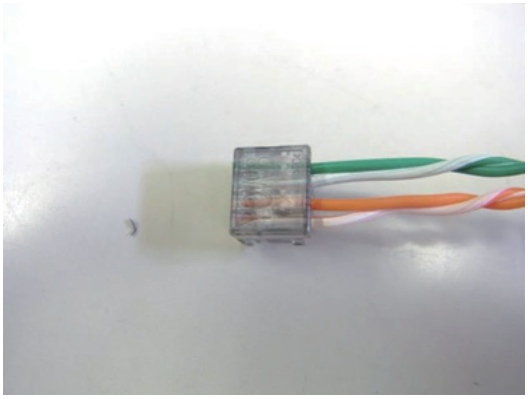


Passing the wires through the communication connector case

(2) Insert the wires (two pairs: orange-white and green-white) into the communication connector cover. Separate the ends of the twisted-pairs with a nipper or similar tool, and insert each wire in the connector cover according to Table 1.

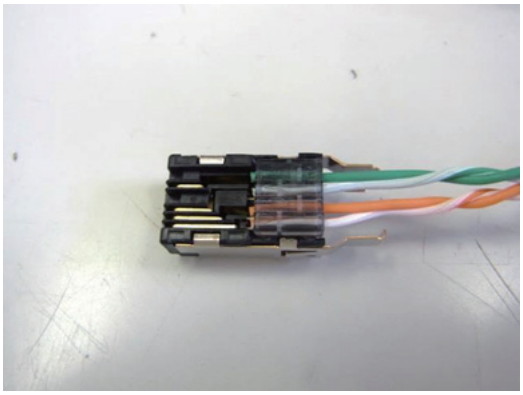
Table 1 Where to insert the wires

Cover marking	Wire color
B	Green
W	White-green stripe
O	Orange
Y	White-orange stripe



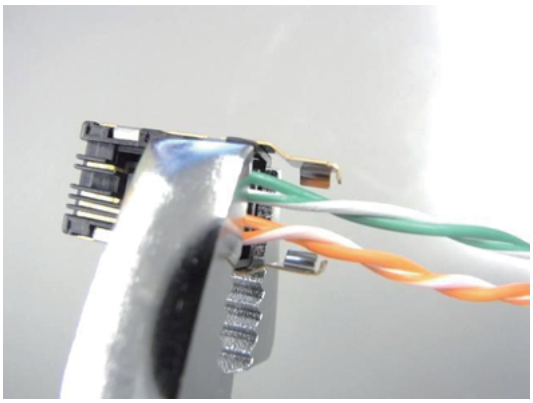
Inserting the cable wires into the connector cover

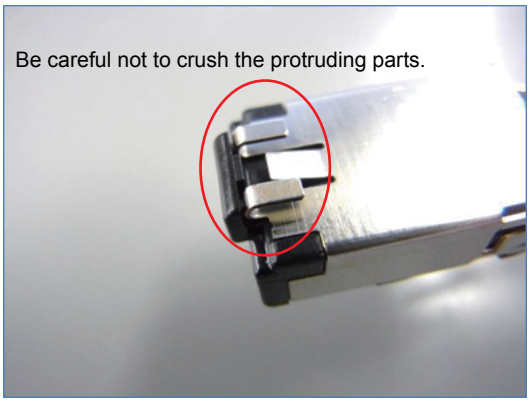
(3) Insert the cover with the wires into the connector body until you hear it click.



(4) Crimp the cover to the connector body using a pair of pliers or a similar tool.

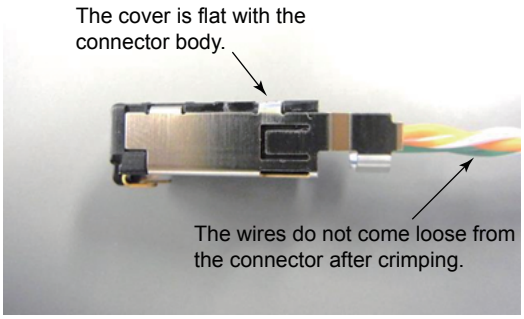
Be sure not to crush the protruding parts of the connector.





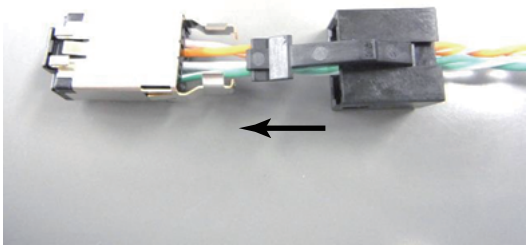
Crimping the cover to the connector body

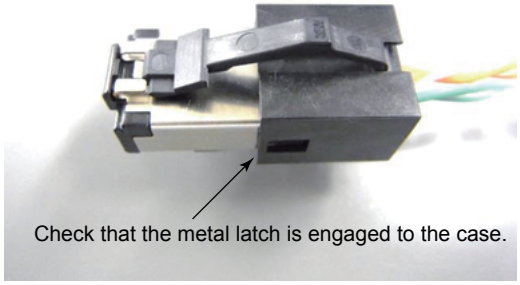
(5) After the cover has been crimped completely into the connector body, view the connector from the side. Check that the cover is flat and that wires do not come loose from the connector.



Checking the crimping

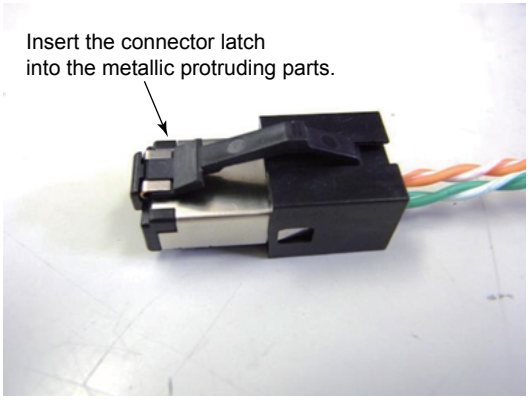
(6) Place the case over the connector body. Check that the metallic latch on the side of the connector engages.





Placing the case over the connector body

(7) Insert the connector latch into the metal protruding parts of the connector body. Make sure the metallic protruding parts at the end of the connector is not crushed.



This completes the communication connector attachment procedure.

Appendix 2 General View of HART DD

The entire structure of the DD menu including parameter arrangement is listed below. The menu for a TDLS8000 with two-gas measurement specification is indicated here. Therefore, the list includes menus and parameters that do not appear in a TDLS8000 with one-gas measurement specification.

Note that the top menu structure is different on FieldMate. For details, see “7.2.2 DTM Menu (FieldMate)”. Furthermore, the labeling of some parameters is different as follows.

- Dynamic variable label names such as “PV” and “SV” are replaced with assigned item names (e.g., “Concentration 1”).
- “PV Loop current” is displayed as “PV AO” (SV is also similar).
- “PDQ” and “LS” are displayed as “Data Quality” and “Limit Status,” respectively.

1st	2nd	3rd	4th	5th	Item
Process variables	Device variables				Concentration 1
					Conc 1 gas type
					Concentration 2
					Conc 2 gas type
					Transmission
					Temperature
					Pressure
	Dynamic variables				PV
					PV Loop current
					SV
					SV Loop current
					TV
					QV
		Dynamic var assign			PV is
					SV is
					TV is
					QV is
		Dynamic var status			PV PDQ
					PV LS
					SV PDQ
					SV LS
					TV PDQ
					TV LS
					QV PDQ
					QV LS

1st	2nd	3rd	4th	5th	Item
Diagnosis/ Service	Test/Status	View status			Status group 1
					Status group 2
					Status group 3
					Status group 4
					Status group 6
					Status group 7
					Status group 8
					Status group 9
					Status group 10
					Device status
					Ext dev status
					Device Diagnostic Status 0
					AO saturated
					AO fixed
					Cfg chng count
					Reset cfg chng flag
		Status mask			Dev cfg locked mask
	Logbook				Read alarm/message record
					Read cal/val record
	Calibration	Manual			Manual zero cal
					Manual span cal
		Semi-auto			Semi-auto zero cal
					Semi-auto span cal
		Restore			Restore zero cal data
					Restore span cal data
					Clear cal alarms
					Abort calibration
	Validation	Manual			Manual offline val 1
					Manual offline val 2
					Manual online val 1
					Manual online val 2
		Semi-auto			Semi-auto offline val 1
					Semi-auto offline val 2
					Semi-auto offline val 1+2
					Semi-auto online val 1
					Semi-auto online val 2
					Clear val alarm
					Abort validation
	Transmission adjust				Transmission
					Transmission adjust
	Loop check				Tst auto release time
		Analog output			AO-1 loop chk mode
					AO-1 chk output
					AO-2 loop chk mode
					AO-2 chk output
		Digital output			DO-1 loop chk mode
					DO-1 chk output
					DO-2 (Flt) loop chk mode
					DO-2 (Flt) chk output
		Valve			Vlv-1 loop chk mode
					Vlv-1 chk output
					Vlv-2 loop chk mode
					Vlv-2 chk output
					Squawk
	Trim analog channel				Trim AO-1 (PV)
					Trim AO-2 (SV)
					Trim AI-1 (Pres)
					Trim AI-2 (Temp)
		Trim info			Trim Who
					Trim Date
					Trim Loc
					Trim Desc
	System				Clear latched alarms

1st	2nd	3rd	4th	5th	Item
Basic setup					Tag
					Long tag
	PV range				PV is
					PV LRV
					PV URV
					PV unit
	SV range				SV is
					SV LRV
					SV URV
					SV unit
	Assign TV & QV				TV is
					QV is

1st	2nd	3rd	4th	5th	Item
Detailed setup	I/O condition	Analog output	AO-1		PV is
					PV LRV
					PV URV
				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 hold	AO1 calval hld mode
					AO1 calval hld level
				Maintenance hold	AO1 maint hld mode
					AO1 maint hld level
				Warm-up hold	AO1 w-up hld mode
					AO1 w-up hld level
					Trim AO-1 (PV)
			AO-2		SV is
					SV LRV
					SV URV
				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 hold	AO2 calval hld mode
					AO2 calval hld level
				Maintenance hold	AO2 maint hld mode
					AO2 maint hld level
				Warm-up hold	AO2 w-up hld mode
					AO2 w-up hld level
					Trim AO-2 (SV)
		Analog input	AI-1 (Pressure)		Pres val at 4mA
					Pres val at 20mA
					Trim AI-1 (Pres)
			AI-2 (Temperature)		Temp val at 4mA
					Temp val at 20mA
					Trim AI-2 (Temp)
		Digital output	DO-1 (DO)		DO-1 output item
					DO-1 output delay
			DO-2 (Fault)		DO-2 output item
					DO-2 output delay
		Digital input	DI-1		DI-1 mode
					Set DI-1 mode
					DI-1 filter time
			DI-2		DI-2 mode
					Set DI-2 mode
					DI-2 filter time
		Valve control			Current stream
					Initial stream
					Stream 1 vlv pattern
					Stream 2 vlv pattern
					Stream 3 vlv pattern
			Stream time switch		Switch stream1 to
					Stream1 duration
					Switch stream2 to
					Stream2 duration
					Switch stream3 to
					Stream3 duration
					Valve usage
					Set valve usage
	Alarm	Warning	Warning group 1		Warn select group 1
					Trans low lmt
					Pres low lmt
					Pres high lmt
					Temp low lmt
					Temp high lmt
					Conc 1 low lmt
					Conc 1 high lmt
					Conc 2 low lmt
			Warning group 2		Warn select group 2
					Conc 2 high lmt

1st	2nd	3rd	4th	5th	Item
(Detailed setup)	Calibration	Zero calibration	Valve control		Z-cal gas purg time
					Z-cal proc purg time
					Z-cal auto vlv man
			Auto time		Z-cal time initiate
					Z-cal init date
					Z-cal init time
					Z-cal day cycle
					Z-cal hour cycle
		Span calibration	Parameter		S-cal gas type
					Set 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
			Valve control		S-cal gas purg time
					S-cal proc purg time
					S-cal auto vlv man
			Auto time		S-cal time initiate
					S-cal init date
					S-cal init time
					S-cal day cycle
					S-cal hour cycle
		Zero+Span calibration			Z+S cal time initiate
					Z+S cal init date
					Z+S cal init time
					Z+S cal day cycle
					Z+S cal hour cycle
	Validation	Offline validation 1	Parameter		Offval1 gas type
					Set offval1 gas type
					Offval1 gas conc
					Offval1 pres mode
					Offval1 pres fix val
					Offval1 temp mode
					Offval1 temp fix val
					Offval1 OPL mode
					Offval1 OPL fix val
			Valve control		Offval1 gas purg time
					Offval1 prc purg time
					Offval1 auto vlv man
			Auto time		Offval1 time initiate
					Offval1 init date
					Offval1 init time
					Offval1 day cycle
					Offval1 hour cycle
		Offline validation 2	Parameter		Offval2 gas type
					Set offval2 gas type
					Offval2 gas conc
					Offval2 pres mode
					Offval2 pres fix val
					Offval2 temp mode
					Offval2 temp fix val
					Offval2 OPL mode
					Offval2 OPL fix val
			Valve control		Offval2 gas purg time
					Offval2 prc purg time
					Offval2 auto vlv man
			Auto time		Offval2 time initiate
					Offval2 init date
					Offval2 init time
					Offval2 day cycle
					Offval2 hour cycle
		Offline validation 1+2			Offval1+2 time init
					Offval1+2 init date
					Offval1+2 init time
					Offval1+2 day cycle
					Offval1+2 hour cycle

1st	2nd	3rd	4th	5th	Item
(Detailed setup)	(Validation)	Online validation 1	Parameter		Onval1 gas type
					Set 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 gas purg time
					Onval1 nml purg time
					Onval1 auto vlv man
			Auto time		Onval1 time initiate
					Onval1 init date
					Onval1 init time
					Onval1 day cycle
					Onval1 hour cycle
			Conc reading mode		Onval1 read mode
					Onval1 output factor
		Online validation 2	Parameter		Onval2 gas type
					Set 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 gas purg time
					Onval2 nml purg time
					Onval2 auto vlv man
			Auto time		Onval2 time initiate
					Onval2 init date
					Onval2 init time
					Onval2 day cycle
					Onval2 hour cycle
			Conc reading mode		Onval2 read mode
					Onval2 output factor
	Field device info				Descriptor
					Message
					Date
					Final asmbly num
		Write protect menu			Write protect
					Enable write 10min
					New password
					Software seal
		Memo			Memo 1
					Memo 2
					Memo 3
	System				Long tag
		Date/time			Present date/time
					Set date/time
		Local display	SCU LCD display		LCD spect disp mode
					LCD backlight bright
					LCD contrast
			LU LED display		LED brightness
		Communication	HART output		Poll addr
					Loop current mode
					Num req preams
					Num resp preams
			TCP/IP		IP address
					Subnet mask
					Default gateway
					Set IP settings
					Initialize config
					Safety mode

1st	2nd	3rd	4th	5th	Item
(Detailed setup)	Analysis	Process param			OPL
			Pressure		Pres mode
					Pres fix mode val
					Pres active type
					Pres backup mode
					Pres backup set val
			Temperature		Temp mode
					Temp fix mode val
					Temp active type
					Temp backup mode
					Temp backup set val
					Temp act amb ofst
		Non process param			No-prcs OPL
					No-prcs pres
			No-prcs temp		No-prcs temp mode
					No-prcs temp fix val
					No-prcs act amb coef
			No-prcs conc		No-prcs conc 1
					No-prcs conc 2
		Unit			OPL unit
					Pres unit
					Temp unit
		Averaging			Averaging number
					Averaging time
		Zero offset			Zero offset 1
					Zero offset 2

1st	2nd	3rd	4th	5th	Item
Review	Process info				Concentration 1
					Conc 1 STDEV
					Concentration 2
					Conc 2 STDEV
					Transmission
					Temperature
					Pressure
					Conc 1 gas type
					Conc 2 gas type
					Temp mode
					Pres mode
	Advanced info				SCU temp
					LU temp
	I/O info				AI-1 (pres)
					AI-2 (temp)
					PV Loop current
					SV Loop current
					DI-1
					DI-2
					DO-1
					DO-2 (Fault)
					Valve-1
					Valve-2
		I/O assignment			PV is
					SV is
					DI-1 mode
					DI-2 mode
					DO-1 output item
	System info				Long tag
					IP address
					Subnet mask
					Default gateway
	Factory info				Model name
					Analyzer SN
					Laser module SN
					SI unit control
					Analysis period
		Version #'s			Software ver
	Field device info				Write protect
					Poll addr
					Loop current mode
					Num req preams
					Num resp preams
					Dev id
					Tag
					Long Tag
					Descriptor
					Message
					Date
		Additional info			Distributor
					Final asmbly num
					Max dev vars
					Device Profile
		Revision #'s			Universal rev
					Fld dev rev
					Software rev

Appendix 3 YH8000 Menu Tree

This section provides the tree structure of the setup and execution menus of the YH8000 HMI unit.

(1)TDLS8000 Tunable Diode Laser Spectrometer operation panel

The TDLS8000 setup and execution menu tree is shown below. The menu for a TDLS8000 with two-gas measurement specification is indicated here. Therefore, some items will not appear in a TDLS8000 with one-gas measurement specification.

 => Select analyzer => Input password =>

1st	2nd	3rd	4th	Tab	Item
Execution	Calibration	Manual	Zero Calibration		Zero Calibration
			Span Calibration		Span Calibration
		Semi-Auto	Zero Calibration		Zero Calibration
			Span Calibration		Span Calibration
			Zero + Span Calibration		Zero + Span Calibration
		Restore	Zero Calibration		Restore Zero Calibration data
			Span Calibration	Gas1	Restore Span Calibration data (Gas1)
				Gas2	Restore Span Calibration data (Gas2)
		Clear Calibration Alarm			Clear Calibration Alarm
	Validation	Manual	Offline Validation 1		Offline Validation 1
			Offline Validation 2		Offline Validation 2
			Online Validation 1		Online Validation 1
			Online Validation 2		Online Validation 2
		Semi-Auto	Offline Validation 1		Offline Validation 1
			Offline Validation 2		Offline Validation 2
			Offline Validation 1+2		Offline Validation 1+2
			Online Validation 1		Online Validation 1
			Online Validation 2		Online Validation 2
		Clear Validation Alarm			Clear Validation Alarm
	Transmission Adjustment				Transmission Adjustment
	Loop Check			Analog Output	AO-1 Loop check mode
					AO-1 Check output
					AO-2 Loop check mode
					AO-2 Check output
				Digital Output	DO Loop check mode
					DO Check output
					Fault Loop check mode
					Fault Check output
				Valve	SV-1 Loop check mode
					SV-1 Check output
					SV-2 Loop check mode
					SV-2 Check output
				Auto Release	Auto release time
	System	Clear Latched Alarms			Clear Latched Alarms

1st	2nd	3rd	4th	Tab	Item
Configuration	I/O	Analog Output	AO-1	Output	Item
					4 mA
					20 mA
				Hold mode	Warning
					Delay
					Fault
					Delay
					Cal/Val
					Maintenance
					Warm-up
				Calibration	Execute AO-1 Calibration
			AO-2	Output	Item
					4 mA
					20 mA
				Hold mode	Warning
					Delay
					Fault
					Delay
					Cal/Val
					Maintenance
					Warm-up
				Calibration	Execute AO-2 Calibration
		Analog Input	AI-1 (Pressure)	Scaling	4mA value
					20mA value
				Calibration	Execute A1-1 Calibration
			AI-2 (Temperature)	Scaling	4mA value
					20mA value
				Calibration	Execute A1-2 Calibration
		Digital Output	DO-1 (DO)		Output item
					Output delay
			DO-2 (Fault)		Output delay
		Digital Input	DI-1		Mode
					Filter time
			DI-2		Mode
					Filter time
		Valve Control			Valve Usage
					Current
					Stream 1 Switch to
					Stream 1 Duration
					Stream 2 Switch to
					Stream 2 Duration
					Stream 3 Switch to
					Stream 3 Duration
					Initial
	Alarm				Transmission Low
					Process Pressure Low
					Process Pressure High
					Process Temperature Low
					Process Temperature High
					Concentration Gas1 Low
					Concentration Gas1 High
					Concentration Gas2 Low
					Concentration Gas2 High
	Calibration	Zero Calibration		Valve	Calibration gas Purge time
					Process gas Purge time
					Auto Valve for Manual Cal.
				Auto Time	Time Initiate
					Initial time
					Cycle(day)
					Cycle(hour)

1st	2nd	3rd	4th	Tab	Item
(Configuration)	(Calibration)	Span Calibration		Parameters	Gas type
					Concentration
					Pressure
					Fixed value
					Temperature
					Fixed value
					OPL
					Fixed value
				Valve	Calibration gas Purge time
					Process gas Purge time
					Auto Valve for Manual Cal.
				Auto Time	Time Initiate
					Initial time
					Cycle(day)
					Cycle(hour)
		Zero + Span Calibration		Auto Time	Time Initiate
					Initial time
					Cycle(day)
					Cycle(hour)
	Validation	Offline Validation 1		Parameters	Gas type
					Concentration
					Pressure
					Fixed value
					Temperature
					Fixed value
					OPL
					Fixed value
				Valve	Validation gas Purge time
					Process gas Purge time
					Auto Valve for Manual Val.
				Auto Time	Time Initiate
					Initial time
					Cycle(day)
					Cycle(hour)
		Offline Validation 2		Parameters	Gas type
					Concentration
					Pressure
					Fixed value
					Temperature
					Fixed value
					OPL
					Fixed value
				Valve	Validation gas Purge time
					Process gas Purge time
					Auto Valve for Manual Val.
				Auto Time	Time Initiate
					Initial time
					Cycle(day)
					Cycle(hour)
		Offline Validation 1+2		Auto Time	Time Initiate
					Initial time
					Cycle(day)
					Cycle(hour)
		Online Validation 1		Parameters	Gas type
					Concentration
					Pressure
					Temperature
					Offset Value
					Fixed Value
					OPL
				Valve	Validation gas Purge time
					Normal gas Purge time
					Auto Valve for Manual Val.
				Auto Time	Time Initiate
					Initial time
					Cycle(day)
					Cycle(hour)
				Reading mode	Mode
					Output Factor

1st	2nd	3rd	4th	Tab	Item
(Configuration)	(Validation)	Online Validation 2		Parameters	Gas type
					Concentration
					Pressure
					Temperature
					Offset Value
					Fixed Value
					OPL
				Valve	Validation gas Purge time
					Normal gas Purge time
					Auto Valve for Manual Val.
				Auto Time	Time Initiate
					Initial time
					Cycle(day)
					Cycle(hour)
				Reading mode	Mode
					Output Factor
	System	Tag			Tag
		Date & Time			Current Password
					New Password
					Confirm New Password
		Password			Operation
					Date
					Time
		Local Display		SCU	Spectrum
					Brightness
					Contrast
				LU	Brightness
		Communication	TCP/IP		IP Address
					Subnet Mask
					Default Gateway
			HART		HART Address
					Loop Current Mode
		Configuration Initialization			Setting data
					Calibration data for AO and AI
					Zero/Span Calibration data
					Tag, Network setting, Password
		Safety Mode			Safety Mode
	Analysis	Process Parameters		Path Length	Path Length
				Pressure	Mode
					Active Type
					Fixed Mode Value
					Backup Mode
					Backup Set Value
				Temperature	Mode
					Active Type
					Fixed Mode Value
					Backup Mode
					Backup Set Value
					Offset value
		Non-Process Parameter		Path Length	Path Length
				Pressure	Pressure
				Temperature	Mode
					Fixed Value
					Ambient Coefficient
				Concentration	Gas1
					Gas2
		Units			Path Length
					Pressure
					Temperature
		Average			Average number
					Average time
		Zero Offset			Zero offset for Gas1
					Zero offset for Gas2

(2)YH8000 HMI unit operation panel

The YH8000 HMI unit setup and execution menu tree is shown below.

=> HMI =>

1st	2nd	3rd	4th	Tab	Item
Analyzer Connection					Change IP
					Input Analyzer IP manually
					Select Analyzer by Auto-search
					Connect
					Disconnect
Display Setting	Home Style				Meter Type
	Meter range			Analyzer 1	Gas1 Min
					Gas1 Max
					Gas2 Min
					Gas2 Max
				Analyzer 2	Gas1 Min
					Gas1 Max
					Gas2 Min
					Gas2 Max
				Analyzer 3	Gas1 Min
					Gas1 Max
					Gas2 Min
					Gas2 Max
				Analyzer 4	Gas1 Min
					Gas1 Max
					Gas2 Min
					Gas2 Max
	Backlight				Brightness
					Auto Off
Network Setting					IP Address
					Subnet Mask
					Default Gateway
HMI Information					

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Appendix 4 What Is an Analysis Period?

The TDLS8000 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 TDLS8000, 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.

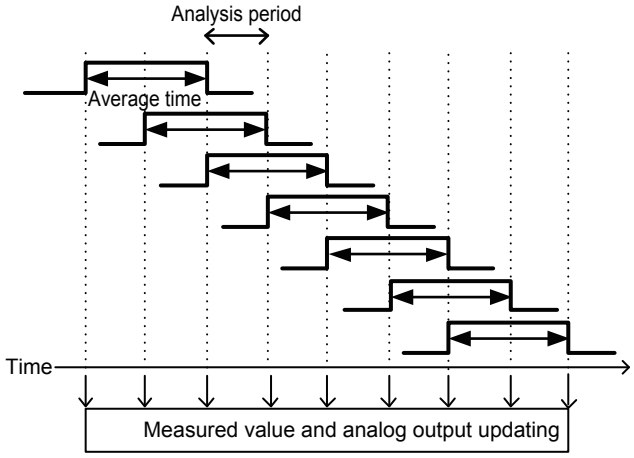
Average time = (analysis period × basic average number) × average number)

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.

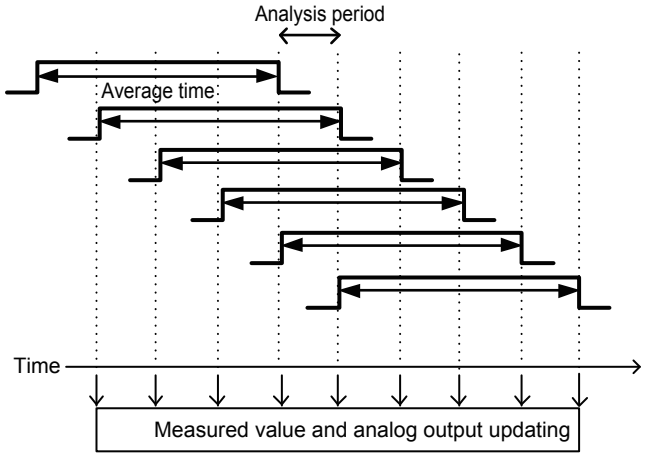
When the average number is 1

(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.

[HART] “Review>>Factory info>>Analysis period”

[YH8000] “ⓘ>>System Information>>Analysis Period”

For instructions on how to set the average number and how to view the average time, see "6.9.6 Moving Average Count for Analysis Values"

Appendix 5 Safety Instrumented System Installation

WARNING

When using TDLS8100 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 TDLS8100 in order to maintain the level of safety designed for using the TDLS8100 in a Safety Instrumented System application. It also provides an overview of the operation. The topics discussed in this section are the TDLS8100's proof test, repairs, and replacement; safety data; service life; environmental and application limitations; and parameter settings.

Using the TDLS8100 in a Safety Instrumented System Application

Safety accuracy

The following table shows the TDLS8100 safety accuracy. When an error caused by an internal component failure exceeds the safety accuracy, the TDLS8100 is considered to have malfunctioned.

Measured gas		Safety accuracy
O_2		+/-0.2 % O_2 or 15 % of reading, whichever is greater.
CO(ppm)		+/-50 ppm CO or 15% of reading, whichever is greater.
CO+CH_4	CO	+/-50 ppm CO or 15% of reading, whichever is greater.
	CH_4	+/- 1% CH_4 or 15% of reading, whichever is greater.
NH_3		+/-10 ppm NH_3 or 15% of reading, whichever is greater.
HCl (ppm)		+/-3 ppm HCl or 15% of reading, whichever is greater.

Diagnostic response time

The TDLS8100 can indicate an internal malfunction within 30 seconds.

I/O Restriction

Only analog output AO-1, AO-2 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 TDLS8100

When online, do not open or close the cover. If you need to open and close the TDLS8100 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 TDLS8100, check that the range and unit are set correctly. Calibrate the TDLS8100 after setting the parameters.

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	YOGOGAWA YTA series
Pressure Transmitter	YOKOGAWA EJX, EJA series

Setting required parameters

To maintain the appropriate level of safety, set the following parameters.

Parameter	Description
Warm-up current setting	Using the HART configuration tool or the YH8000 HMI Unit, set the output of AO-1 and AO-2 during warm-up to Preset hold and the output value to 3.8mA Preset hold.
Warning-in-effect current setting	Using the HART configuration tool or the YH8000 HMI unit, it is recommended to set the output of AO-1 and AO-2 for when a warning is in effect to Non-hold. If you need to specify Preset hold, set a value different from the fault-in-effect current value (burnout current) to distinguish this value from the output for when a fault occurs.
Fault-in-effect current setting	Using the HART configuration tool or the YH8000 HMI unit, set the output of AO-1 and AO-2 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.
Safety mode setting	Using the HART configuration tool of the YH8000 HMI unit, set the Safety Mode to Enable
Hardware write protection switch	Disable the HART write function.

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 “6.9.3 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 TDLS8100.

The proof test interval is determined by the safety calculation that is performed for each safety instrumented function, including the TDLS8100. 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 two test methods described below, then conduct it accordingly. The one is Extended Proof Test which is included the integrity verification of piezo actuator and the analyzer calibration at 2 points to achieve high coverage rate. Integrity verification of piezo actuator must be done by service person who is certified by Yokogawa.

Please prepare appropriate calibration cell for your analyzer.

The other is Abbreviated Proof Test which is performing 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 TDLS8100 must have a thorough knowledge of the operation of Safety Instrumented Systems, including the bypass procedure, TDLS8100 maintenance, and change procedures.

Test method		Required tools	Estimated result
Extended Proof Test			
1	Bypass the safety functions, and perform appropriate measures to prevent malfunction.	HART Configuration tool or YH8000	Proof Test coverage : 89.5%
2	Conduct insulation resistance test for Piezo then confirm the result is within the criteria to verify the integrity of Piezo actuator. This Test must be done by service person who is certified by Yokogawa.		
3	Install the calibration cell to the analyzer.		
4	Use the HART Configuration tool or YH8000 to properly execute all diagnostics by performing below tests and collect the results.		
5	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.		
6	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.		
7	Thoroughly check for leakages and visible damages and stains.		
8	Perform two-point calibration over the entire operating range.		
9	Remove the calibration Cell from the analyzer.		
10	Release the bypass, and restore normal operation.		

Abbreviated Proof Test			
1	Bypass the safety functions, and perform appropriate measures to prevent malfunction.	HART Configuration tool or YH8000	Proof Test coverage : With Reference Cell : 66.8% Without Reference Cell : 67.5%
2	Use the HART Configuration tool or YH8000 to properly execute all diagnostics by performing below tests 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	Conduct Online Validation.		
7	Release the bypass, and restore normal operation.		

* For the detail of PFDavg, please refer to FMEDA No. YEC19-03-008 R001 V2R5 Nov. 10, 2021.

Repair and replacement

To repair the TDLS8100 while the process is online, bypass the TDLS8100. You must perform the bypass procedure correctly. If a fault is detected, please consult with Yokogawa. TDLS8100 replacement must be performed by a trained engineer.

Startup time

TheTDLS8100 sends valid signal within 5 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 TDLS8100 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 TDLS8100 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. YEC19-03-008 R001 V2R5 Nov. 10, 2021.

Lifetime limitation

The expected lifetime of the TDLS8100 is 10 years. The reliability data in the FMEDA report is valid to 10 years. It is assumed that the failure rates of the TDLS8100 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 TDLS8100 is defined in this manual.

Application limitation

If the TDLS8100 is used in an application outside the limits defined in this manual, the reliability data is void.

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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Appendix 6 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 TDLS8100-J1 and YH8000-J2.

Refer to Korean User's manual for TDLS8100-K1 and YH8000-K2.

Refer to Russian User's manual for YH8000-R2.

Refer to Portuguese User's manual for YH8000-U2.

Refer to Chinese User's manual for YH8000-N2.

CAUTION

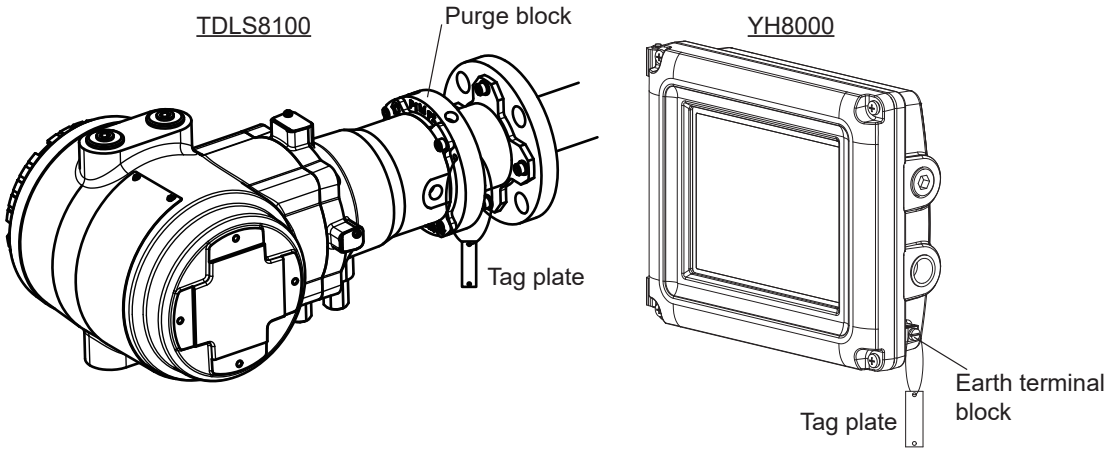
TDLS8100 and YH8000 has been tested and certified as being explosion proof. Please note that severe restrictions apply to these instruments's construction, installation, external wiring, maintenance and repair. A failure to abide by these restrictions could make the instrument a hazard to operate.

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 TDLS8100 or YH8000 shall be hung by a wire and the wire shall be tightly bound to non-painted metal part such as purge block of TDLS8100 or earth terminal block of the enclosure of YH8000 not to insulate electrically and to avoid electrostatic charging.



Example of Tag plate attachment

TDLS8100

TDLS8100-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
  ANSI/UL 50E: 2015
  NEMA 250: 2014
  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/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

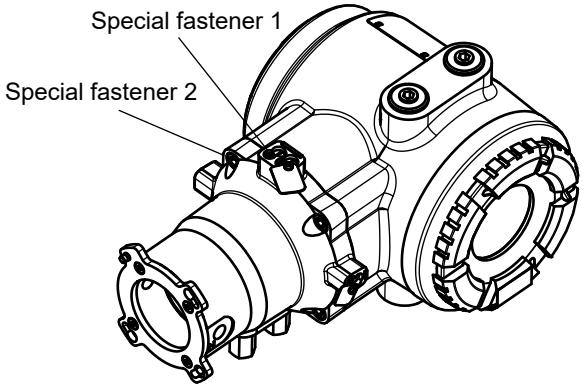
    -20 to +55°C

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 TDLS8100 is mounted in an area where the use of EPL Db equipment is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating burst 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 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

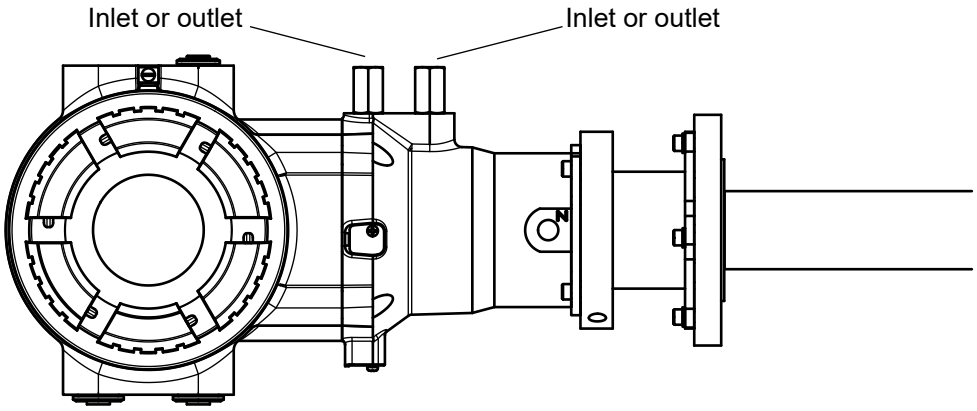
Refer to chapter 3 for other than that described below.

- 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. 2.0Nm (M5) or 1.2Nm (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 EPL Db 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

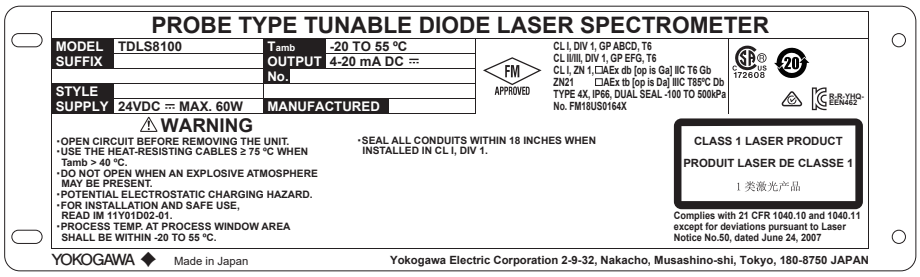
- Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Dual seal

TDLS8100 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. FM16US0189
- Warning:

  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 11Y01D02-01.

  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

TDLS8100-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

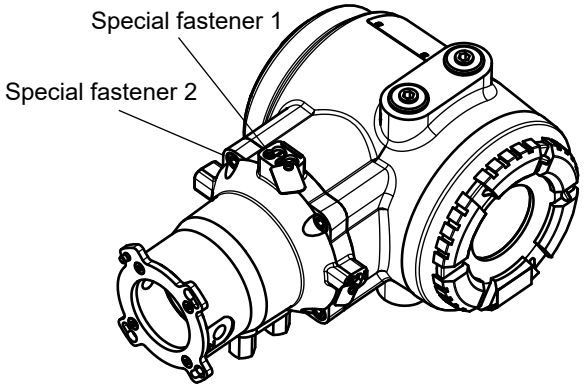
Note: “□” is the checkbox for selecting type of protection. Select the type of protection and check one of “□” on the nameplate. Once the type of protection is selected, it shall not be changed.

- 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 TDLS8100 is mounted in an area where the use of EPL Db equipment is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating burst 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 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 fastners

Installation

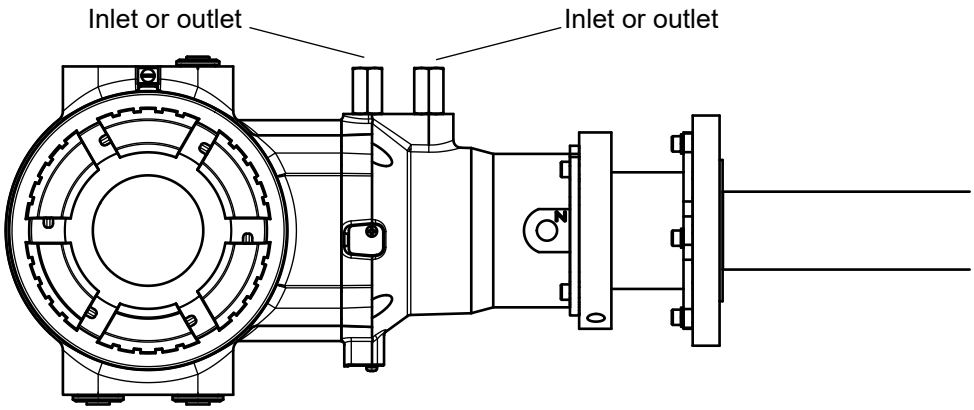
Refer to chapter 3 for other than that described below.

- 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. 2.0Nm (M5) or 1.2Nm (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 EPL Db 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

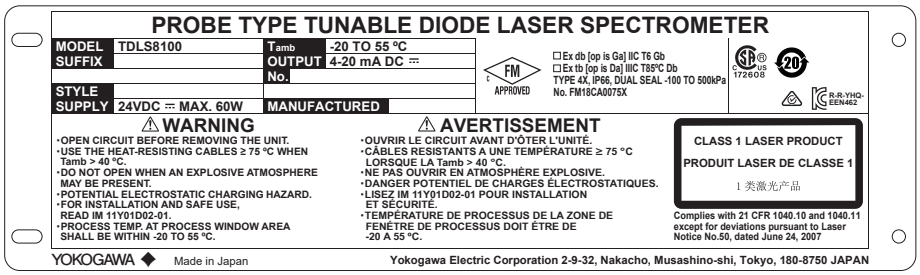
Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Dual seal

TDLS8100 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:

  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 11Y01D02-01.

  PROCESS TEMP. AT PROCESS WINDOW AREA SHALL BE WITHIN -20 TO 55°C.
- AVERTISSEMENT:

  CÂBLES RESISTANTS A UNE TEMPÉRATURE ≥ 75°C LORSQUE LA Tamb > 40°C.

  NE PAS OUVRIR EN ATMOSPHÈRE EXPLOSIVE.

  DANGER POTENTIEL DE CHARGES ÉLECTROSTATIQUES.

  POUR INSTALLATION ET SÉCURITÉ, LISEZ INSTRUCTIONS.

  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

TDLS8100-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

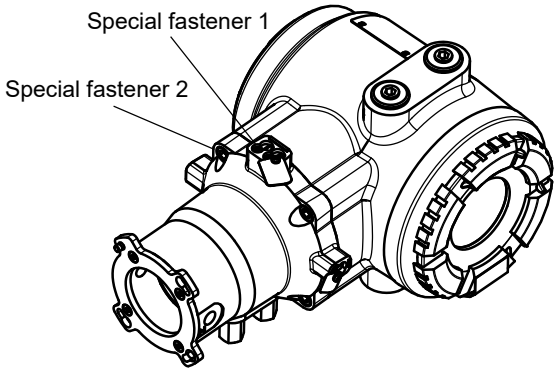
Note: "□" is the checkbox for selecting type of protection. Select the type of protection and check one of "□" on the nameplate. Once the type of protection is selected, it shall not be changed.

- 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 TDLS8100 is mounted in an area where the use of EPL Db equipment is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating burst 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 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 fastners

Installation

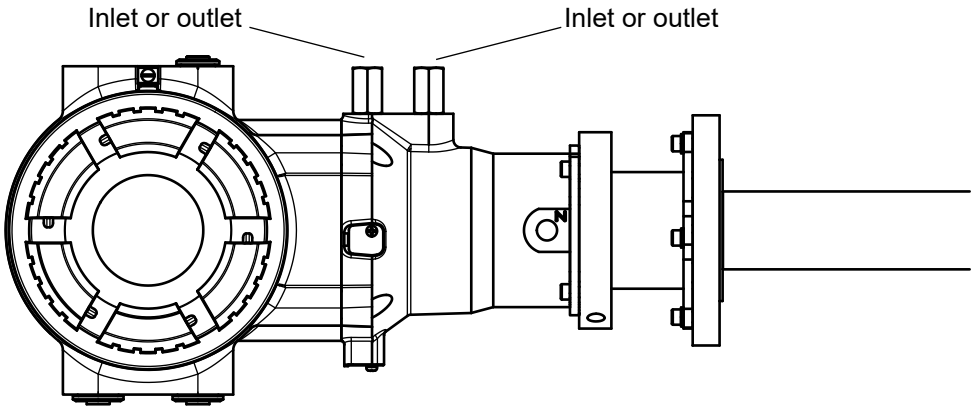
Refer to chapter 3 for other than that described below.

- 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. 2.0Nm (M5) or 1.2Nm (M4). Care must be taken not to twist the conductor.
- If the equipment is installed to EPL Db 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.

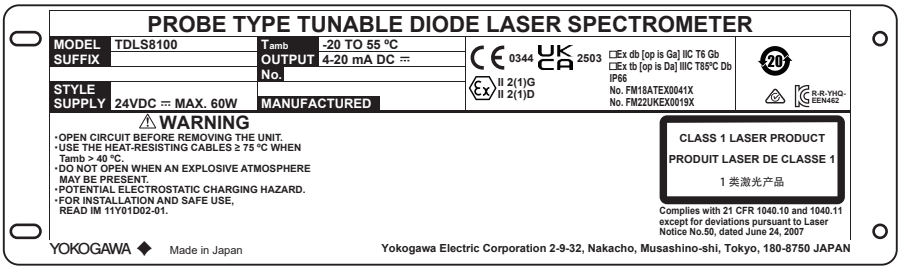


Inlet and outlet of purged compartment

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:

  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 11Y01D02-01.
- 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

TDLS8100-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

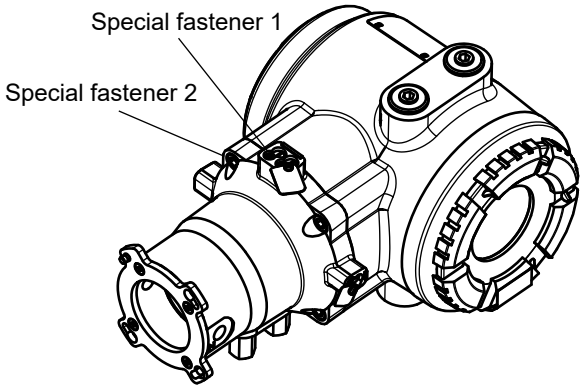
Ambient temperature

-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 TDLS8100 is mounted in an area where the use of EPL Db equipment is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating burst 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 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

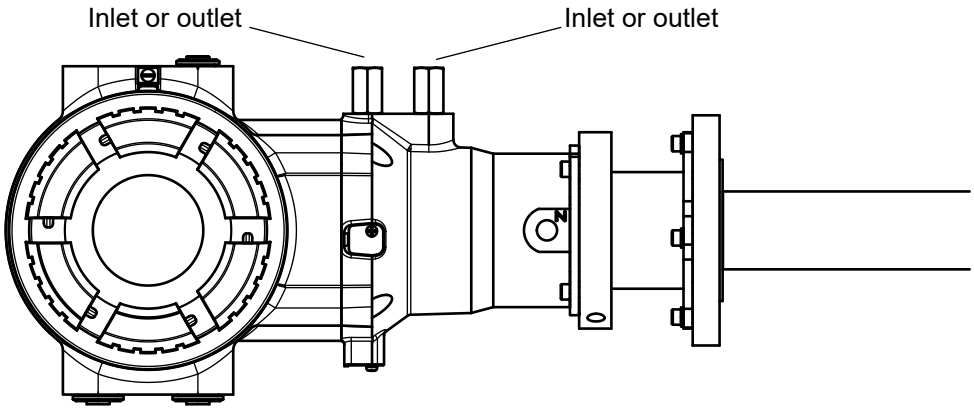
Refer to chapter 3 for other than that described below.

- 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. 2.0Nm (M5) or 1.2Nm (M4). Care must be taken not to twist the conductor.
- If the equipment is installed to EPL Db 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

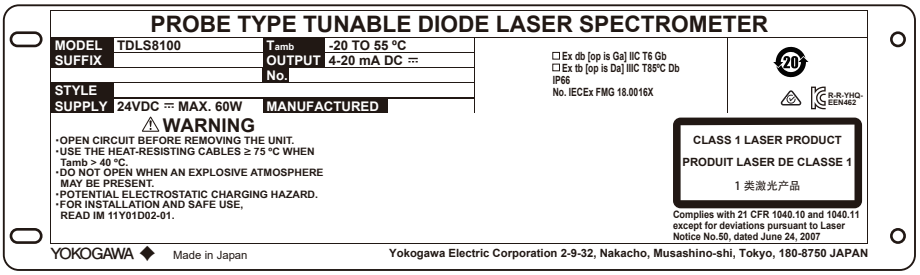


Inlet and outlet of purged compartment

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:

  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 11Y01D02-01.
- 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

TDLS8100-N1 (NEPSI)

Applicable standards

GB 3836.1-2010
GB 3836.2-2010
IEC 60079-28:2015
GB 12476.1-2013
GB 12476.5-2013

Certificate No.

GYJ19.1380X

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 tD [op is 20] A21 IP6X T85°C

  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

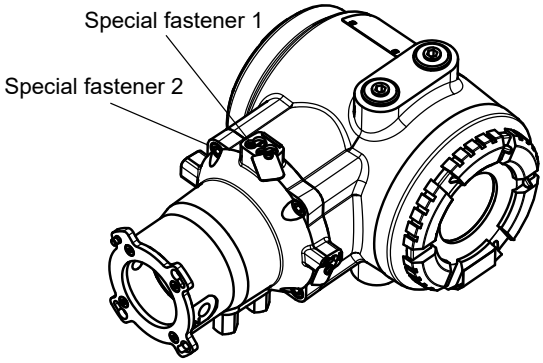
Ambient temperature

-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 TDLS8100 is mounted in an area where the use of Zone 21 is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating burst 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 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

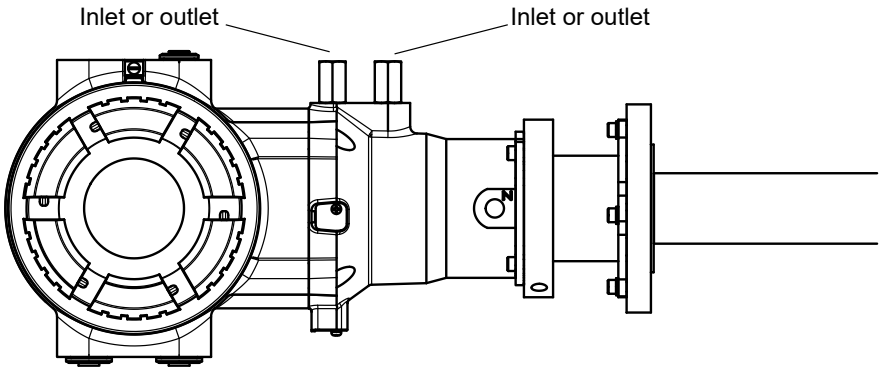
Refer to chapter 3 for other than that described below.

- 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 GB 3836.13, GB 3836.15, GB 3836.16 and GB 50257, and local electric codes and requirements.
- Cable glands, adapters and/or blanking elements with a suitable IP rating shall be of Ex d IIC/Ex tD applicable to GB standard 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. 2.0Nm (M5) or 1.2Nm (M4). Care must be taken not to twist the conductor.
- If the equipment is installed to EPL Db 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.

NOTE

For installation, use and maintenance of the product, observe following standards:

GB3836.13-2013 “Explosive atmospheres - Part 13: Equipment repair, overhaul and reclamation”

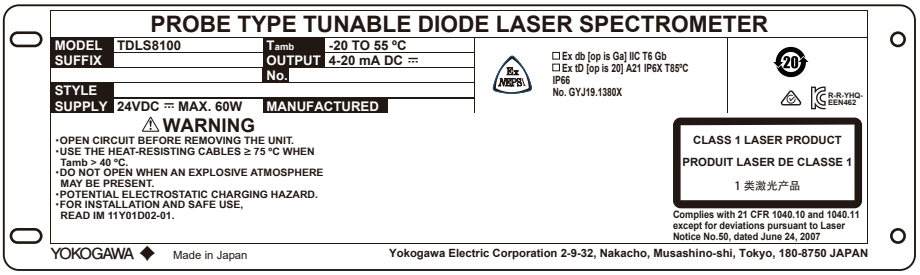
GB/T3836.15-2017 “Explosive atmospheres - Part 15: Electrical installations design, selection and erection”

GB/T3836.16-2017 “Explosive atmospheres - Part 16: Electrical installations inspection and maintenance”

GB50257-2014 ”Code for construction and acceptance of electric equipment on fire and explosion hazard electrical equipment installation engineering”

GB15577-2018 “Safety regulations for dust explosion prevention and protection”

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 tD [op is 20] A21 IP6X T85°C

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. GYJ19.1380X
- Warning:

  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 11Y01D02-01.
- 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

YH8000

YH8000-D2 (FM Approval for US)

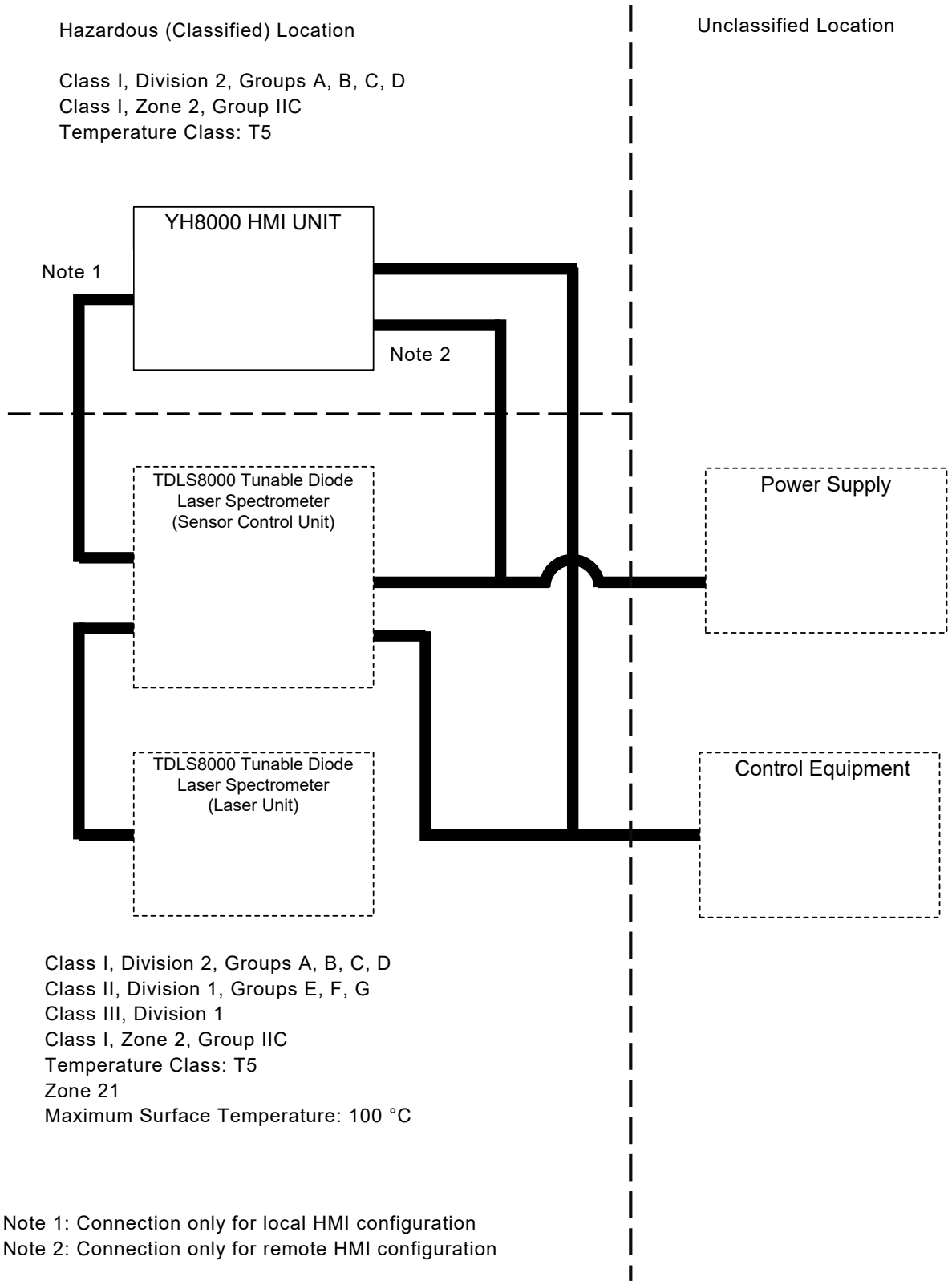
Yokogawa Electric Corporation		Model		YH8000			
Title	Instructions (US)						
No.	NFM030-A71	Page	1	Revision	2	Date	2020-11-20

Item	Descriptions
Applicable standards	FM 3600:2018 FM 3611:2018 FM 3810:2018 NEMA 250:2003 ANSI/UL 60079-0 Ed. 7 (2019) ANSI/UL 60079-11 Ed. 6 (2013) ANSI/UL 60079-15 Ed. 4 (2013) ANSI/UL 121201 Ed. 9 (2019) ANSI/UL 61010-1 Ed. 3 (2012) ANSI/IEC 60529:2004
Specific Ex marking	Nonincendive for Class I; Division 2; Groups A, B, C, D; T5 Class I, Zone 2, AEx nA ic IIC T5 Gc
Ambient temperature	−20 °C ≤ Ta ≤ +55 °C
Enclosure	Type 4X, IP65
Pollution degree	2
Power supply	24 V DC ± 10 %
Power consumption	≤ 12 W
Signals	[Ethernet] Connector: RJ-45 connector Communication Speed: 100 Mbps

Yokogawa Electric Corporation		Model		YH8000	
Title	Instructions (US)				
No.	NFM030-A71	Page	2	Revision	2

Item	Descriptions
Specific conditions of use	Precautions shall be taken to minimize the risk from electrostatic discharge of painted parts and non-metallic parts of the enclosure.
Installation and erection	Installation must be in accordance with the National Electrical Code (NFPA 70) and relevant local codes.
	Cable entry devices suitable for the thread form and the size of the cable entries must be used, according to the following marking on the equipment. Marking: A — Screw size: ANSI 1/2 NPT Marking: M — Screw size: M20 (ISO)
	Screws of the field wiring terminals must be tightened with the specified torque value: 0.22 to 0.25 Nm.
	Field wiring for ethernet communication must be in accordance with IEEE 802.3 so as to avoid overvoltage of > 119 V.
	Tag plate which is provided as an option of YH8000 shall be hung by a wire and the wire shall be tightly bound to earth terminal block of the enclosure of YH8000, not to insulate electrically and to avoid electrostatic charging.
Use and setting-up (operation)	WARNING
	DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT
	POTENTIAL ELECTROSTATIC CHARGING HAZARD
	Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.
	Take care not to generate mechanical sparking when access to the instrument and peripheral devices in hazardous locations.
Maintenance and repair	WARNING
	When opening the cover, the enclosure should be dry and clean to prevent from ingress water or dust.
	A modification of the equipment would no longer comply with the construction described in the certificate documentation.
	Only personnel authorized by Yokogawa Electric Corporation can repair the equipment
	SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR DIVISION 2

Yokogawa Electric Corporation		Model		YH8000	
Title	Instructions (US)				
No.	NFM030-A71	Page	3	Revision	2



Note 1: Connection only for local HMI configuration
Note 2: Connection only for remote HMI configuration

YH8000-C2 (FM Approval for Canada)

Yokogawa Electric Corporation		Model		YH8000			
Title	Instructions (Canada)						
No.	NFM030-A72	Page	1	Revision	2	Date	2020-11-20

Item	Descriptions
Applicable standards	CAN/CSA-C22.2 No. 94.2-07 C22.2 No. 60079-0:19 CAN/CSA-C22.2 No. 60079-11:14 CAN/CSA-C22.2 No. 60079-15:16 CAN/CSA-C22.2 No. 61010-1-12 CAN/CSA-C22.2 No. 60529:05
Certificate number	FM21CA0035X
Specific Ex marking	Ex nA ic IIC T5 Gc
Ambient temperature	−20 °C ≤ Ta ≤ +55 °C
Enclosure	TYPE 4X, IP65
Pollution degree	2
Power supply	24 V DC ± 10 %
Power consumption	≤ 12 W
Signals	[Ethernet] Connector: RJ-45 connector Communication Speed: 100 Mbps

Yokogawa Electric Corporation		Model		YH8000	
Title	Instructions (Canada)				
No.	NFM030-A72	Page	2	Revision	2

Item	Descriptions
Specific conditions of use	Precautions shall be taken to minimize the risk from electrostatic discharge of painted parts and non-metallic parts of the enclosure.
Installation and erection	The installation must be in accordance with Canadian Electrical Code Part I (C22.1) and relevant local codes.
	Cable entry devices suitable for the thread form and the size of the cable entries must be used, according to the following marking on the equipment. Marking: A — Screw size: ANSI 1/2 NPT Marking: M — Screw size: M20 (ISO)
	Screws of the field wiring terminals must be tightened with the specified torque value: 0.22 to 0.25 Nm.
	Field wiring for ethernet communication must be in accordance with IEEE 802.3 so as to avoid overvoltage of > 119 V.
	Tag plate which is provided as an option of YH8000 shall be hung by a wire and the wire shall be tightly bound to earth terminal block of the enclosure of YH8000, not to insulate electrically and to avoid electrostatic charging.
Use and setting-up (operation)	WARNING
	DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT
	POTENTIAL ELECTROSTATIC CHARGING HAZARD
	Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.
	Take care not to generate mechanical sparking when access to the instrument and peripheral devices in hazardous locations.
Maintenance and repair	WARNING
	When opening the cover, the enclosure should be dry and clean to prevent from ingress water or dust.
	A modification of the equipment would no longer comply with the construction described in the certificate documentation.
	Only personnel authorized by Yokogawa Electric Corporation can repair the equipment

YH8000-S2 (ATEX Declaration)

(1) Technical Data

- Applicable standards

  EN IEC 60079-0:2018

  EN 60079-11: 2012

  EN 60079-15: 2010

- Ratings

  Ⓔx II 3 G Ex nA ic IIC T5 Gc

- Enclosure

  IP65 (In accordance with EN 60529)

- Specific condition of use

  Precautions shall be taken to minimize the risk from electrostatic discharge of painted parts and non-metallic parts of the enclosure.

(2) Name Plate

(3) Installation

- Refer to chapter 4 for other than that described below.
- The installation must be in accordance with EN 60079-14 and relevant local codes.
- Screws of the field wiring terminals must be tightened with the specified torque value: 0.22 to 0.25 Nm.
- Field wiring for ethernet communication must be in accordance with IEEE 802.3 so as to avoid overvoltage of > 119 V.

⚠ WARNING

- DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT
- POTENTIAL ELECTROSTATIC CHARGING HAZARD
- FOR INSTALLATION AND SAFE USE, READ IM11Y01D01-01 OR IM 11Y01D02-01

(4) Operation

- Refer to chapter 4 for other than that described below.

⚠ WARNING

- Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.
- Take care not to generate mechanical sparking when access to the instrument and peripheral devices in hazardous locations.

(5) Maintenance and Repair

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

When opening the cover, the enclosure should be dry and clean to prevent from ingress water or dust.

YH8000-E2 (IECEx Certification)

(1) Technical Data

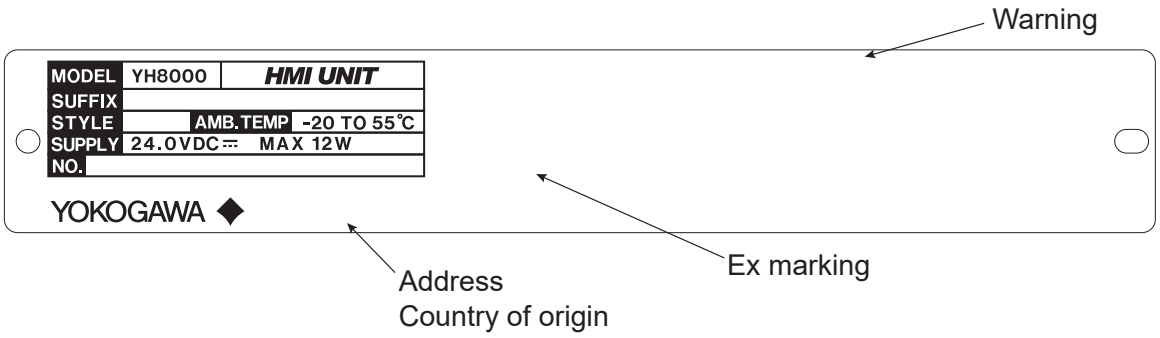
- Applicable standards
  IEC 60079-0: 2017
  IEC 60079-11: 2011
  IEC 60079-15: 2010
- Certificate No.
  IECEx FMG 15.0016X
- Ratings
  Ex nA ic IIC T5 Gc
- Enclosure
  IP65 (In accordance with IEC 60529)
- Specific condition of use
  Precautions shall be taken to minimize the risk from electrostatic discharge of painted parts and non-metallic parts of the enclosure.

(2) Name Plate

MODEL:	Specified model code
SUFFIX:	Specified suffix code
STYLE:	Specified style code
AMB.TEMP:	Specified ambient temperature range
SUPPLY:	Specified supply voltage and wattage
NO.:	Serial number
Ex marking:	Ex nA ic IIC T5 Gc IP65 No. IECEx FMG 15.0016X

Warning: DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT.
POTENTIAL ELECTROSTATIC CHARGING HAZARD.
FOR INSTALLATION AND SAFE USE, READ IM mmmm

Note: “mmmm” means document number of user’s manual.



(3) Installation

- Refer to chapter 4 for other than that described below.
- The installation must be in accordance with IEC 60079-14 and relevant local codes.
- Screws of the field wiring terminals must be tightened with the specified torque value: 0.22 to 0.25 Nm.
- Field wiring for ethernet communication must be in accordance with IEEE 802.3 so as to avoid overvoltage of > 119 V.

WARNING

- DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT
- POTENTIAL ELECTROSTATIC CHARGING HAZARD
- FOR INSTALLATION AND SAFE USE, READ IM11Y01D01-01 OR IM 11Y01D02-01.

(4) Operation

- Refer to chapter 4 for other than that described below.

WARNING

- Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of product.
- Take care not to generate mechanical sparking when access to the instrument and peripheral devices in hazardous locations.

(5) Maintenance and Repair

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

When opening the cover, the enclosure should be dry and clean to prevent from ingress water or dust.

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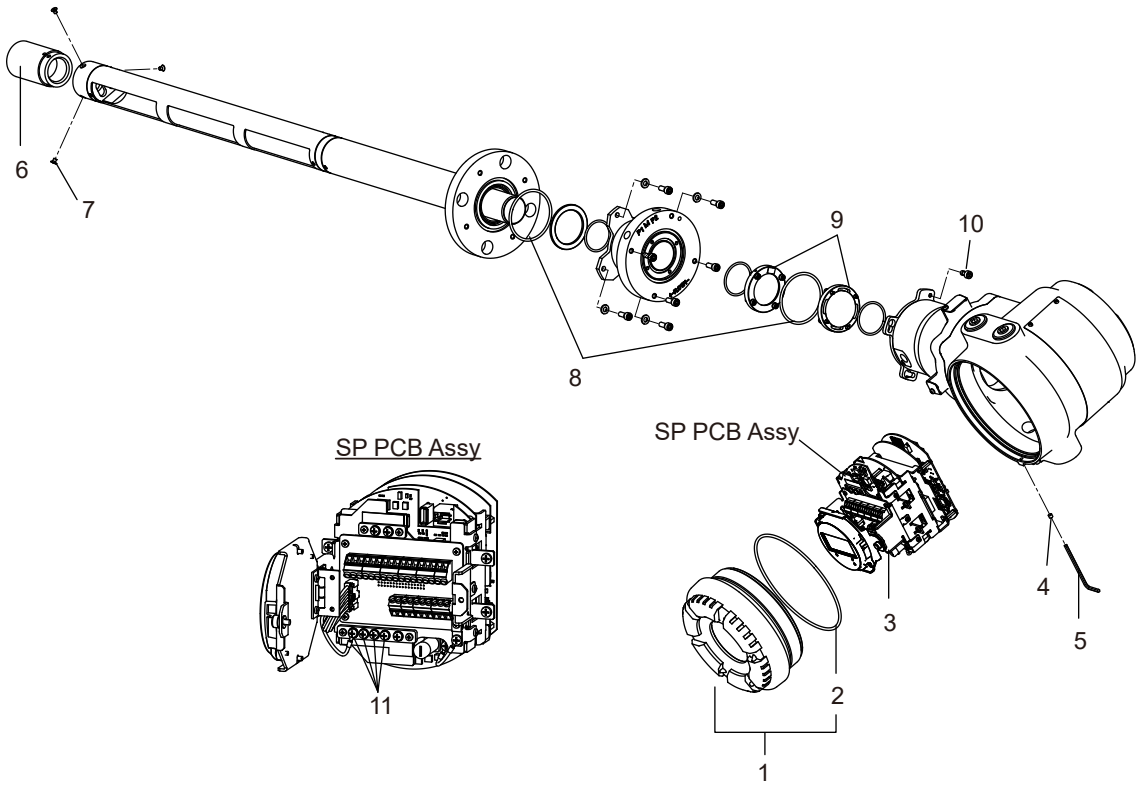
Customer Maintenance Parts List

TDLS8100
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
7	K9777XA	1	Screws (3pcs)
8	K9772TJ	2	O-ring

Item	Part No.	Qty	Description
9	—	2	Process Window Assy
	K9776GA		for O_2
	K9776GB		for CO
	K9776GC		for NH_3
	K9776GD		for HCl
10	K9771KZ	1	Captive Bolt
11	K9771KM	1	Screws for grounding terminal

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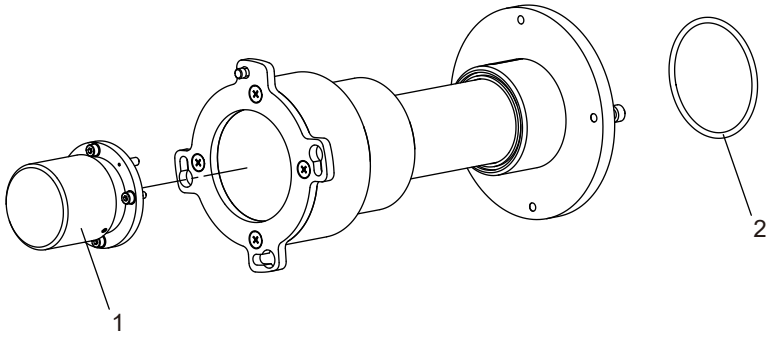
CMPL 11Y01D02-01EN
1st Edition: Mar. 2019 (YK)
2nd Edition: Jan. 2020 (YK)

Customer Maintenance Parts List

K9777ZA
Calibration Cell for TDLS8100



Item	Part No.	Qty	Description
1	K9777ZB	1	Retro Reflector Assy Cal
2	K9772TJ	1	O-ring

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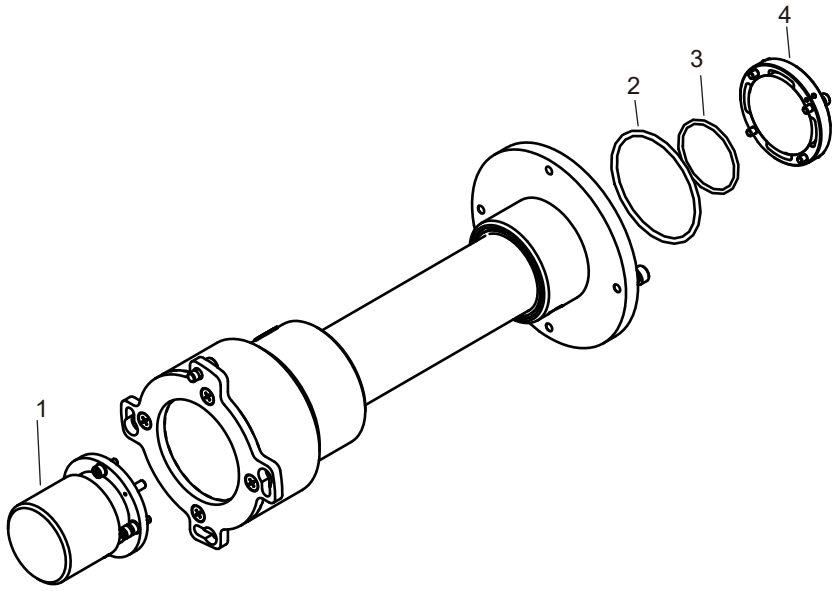
Customer Maintenance Parts List

K9777ZK, K9777ZL
Calibration Cell for TDLS8100



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

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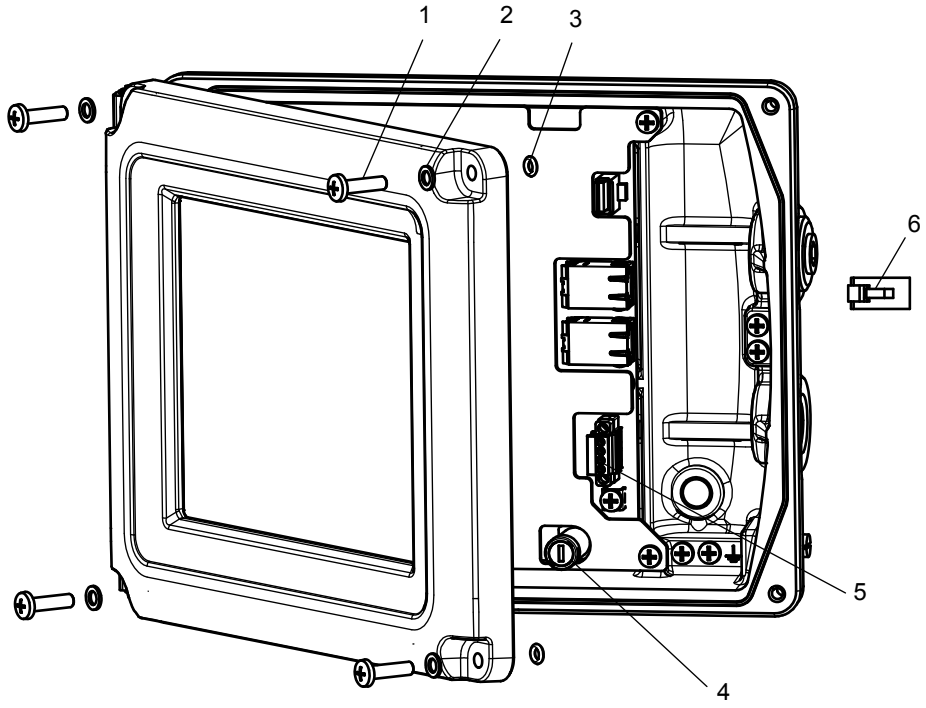
CMPL 11Y01D02-22EN
1st Edition: Jan. 2020 (YK)

Customer Maintenance Parts List

YH8000
HMI Interface Unit for TDLS8000



Item	Part No.	Qty	Description
1	K9774CR	4	Screw
2	Y9500WU	4	Washer
3	Y9102XA	4	O-ring for screw
4	A1633EF	1	Fuse
5	A3433JQ	1	Power connector
6	A1633JZ	1	RJ45 connector

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Revision Information

- Manual Title : TDLS8100 Probe Type Tunable Diode Laser Spectrometer
- Manual No. : IM 11Y01D02-01EN

Jan. 2023/9th Edition

UKCA marking conformity (P.iii, vi, vii, ix, 2-1, 2-4, 2-6, 2-8, 2-9, App. 6-10, App. 6-12)
Added Explosion proof conformity YH8000-N2 (NEPSI) (pages 2-7, 2-9, App. 6-1)

Apr. 2022/8th Edition

Added Explosion proof conformity YH8000-U2 (INMETRO) (pages 2-7, 2-9)
Revised Explosion proof conformity YH8000-K2 (Korea Ex), YH8000-J2 (Japan Ex) (page 2-7),

Dec. 2021/7th Edition

FMEDA report number was updated. (pages App.5-3, App.5-4)
Proof test coverage was updated. (page App.5-3)
Revised Explosion proof conformity YH8000-R2 (EAC) (page 2-7)

July 2021/6th Edition

Revised specification and others
RoHS conformity standards. (pages viii, 2-1, 2-8)
Hazardous area classfications.(pages 2-6, 2-9)

Jan. 2021/5th Edition

Added reference page (page 6-18)
FMEDA report number was updated (page App. 5-3, App. 5-4)
Proof test coverage was updated (page App.5-3)
Added explanation for explosion-proof (page App. 6-31, App. 6-32)

June 2020/4th Edition

Explanation deletion (page 6-17)

July. 2020/3rd Edition

Specifications ; addition of component “-A1”, “-L1” (pages 1-1, 2-1, 2-5, 2-8)
others; 2-3
SIL certification (pages 2-1, Appendix 5)
Explosionproof conformity Korea Ex “-K1”, NEPSI “-N1” Japan Ex “-J1”
(pages 2-4, 2-8, 2-10, App.6-1, App. 6-16, App. 6-17, App. 6-18)
Released new CMPL 11Y01D02-22EN
Others (pages 2-8, 2-14, 9-19, 9-22, 9-26, 9-29, 9-30, App. 6-2, App. 6-6, App. 6-10, App. 6-12, App. 6-15, App. 6-18)

June 2019/2nd Edition

Revised along with additional regulatory confotmity (ATEX, IECE, FM (US, Canada))
(pages iii, vi, vii, 2-1, 2-3, 2-4, 2-7, 2-8, 2-9, 3-9, 3-11, 3-24, 3-26, 9-19, added App.5)

Feb. 2019/1st Edition

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