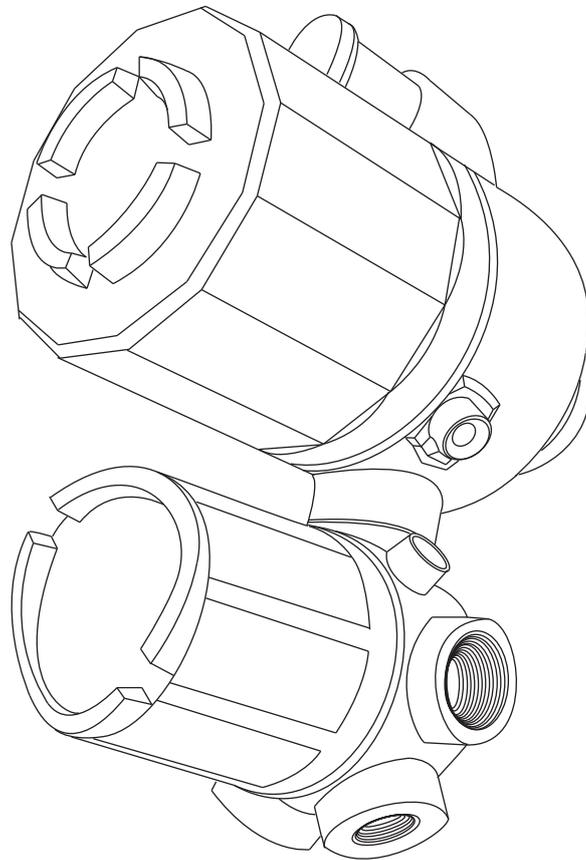
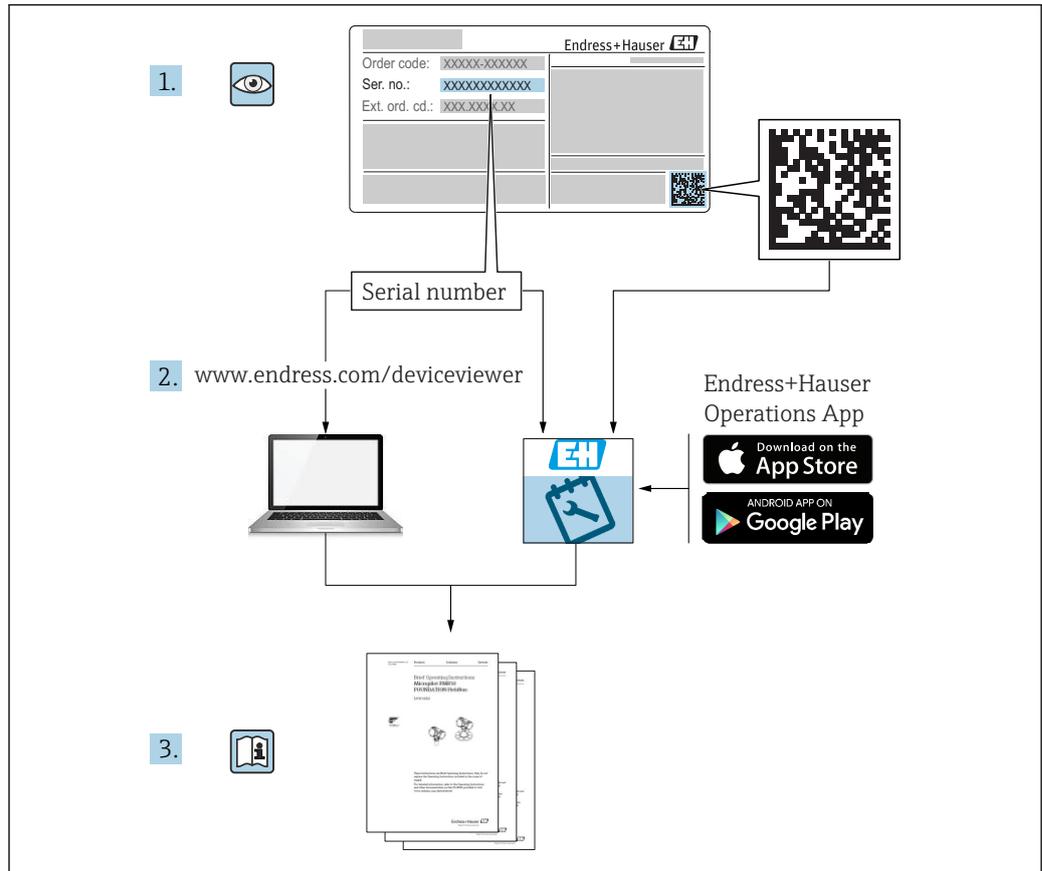


# Operating Instructions

## **TMD1000 TMD1**

Digital Transmitter Module Setting and Adjustment





A0023555

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# 1 About this document

## 1.1 Document function

These Operating Instructions contain all the information that is required during various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

## 1.2 Symbol

### 1.2.1 Safety symbols

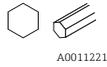
Symbol	Meaning
	<b>DANGER!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury, as well as a risk of fire or explosion.
	<b>WARNING!</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in a risk of serious or fatal injury, fire or explosion.
	<b>Note</b> This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in a risk of minor or moderate injury and damages to properties.
	<b>NOTE!</b> This symbol contains information on procedures and other facts that do not result in personal injury.

### 1.2.2 Electrical symbols

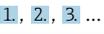
Symbol	Meaning
	Direct current
	Alternating current
	Direct current and alternating current
	<b>Ground connection</b> A grounded terminal that, as far as the operator is concerned, is grounded via a grounding system.
	<b>Protective ground connection</b> A terminal that must be connected to the ground prior to establishing any other connections.
	<b>Equipotential connection</b> This connects with the grounding system at the plant. It includes equipotential line and single point ground systems, depending on the norms of each country or company.

### 1.2.3 Tool symbols

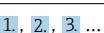
Symbol	Meaning
 A0013442	Torx screwdriver
 A0011220	Flat blade screwdriver

Symbol	Meaning
 A0011219	Phillips screwdriver
 A0011221	Allen key
 A0011222	Open-ended wrench

### 1.2.4 Symbols for certain types of information

Symbol	Meaning
	<b>Permitted</b> Procedures, processes or actions that are permitted
	<b>Preferred</b> Procedures, processes or actions that are preferred
	<b>Forbidden</b> Procedures, processes or actions that are forbidden
	<b>Tip</b> Indicates additional information
	Reference to documentation
	Reference to page
	Reference to graphic
	Notice or individual step to be observed
	Series of steps
	Result of an operation or commissioning
	Help in the event of a problem
	Visual inspection
	Operation via the local display
	Operation via operating tool
	Write-protected parameter

### 1.2.5 Symbols in graphics

Symbol	Meaning
1, 2, 3 ...	Item numbers
	Series of steps
A, B, C, ...	Graphics
A-A, B-B, C-C, ...	Cross-sections

Symbol	Meaning
	<b>Hazardous area</b> Indicates the hazardous area
	<b>Safe area (non-hazardous area)</b> Indicates the non-hazardous area

### 1.2.6 Device symbol

Symbol	Meaning
	<b>Safety instructions</b> Observe the safety instructions contained in the associated Operating Instructions.
	<b>Temperature resistance of the connection cables</b> Specifies the minimum value of the temperature resistance of the connection cables.

## 1.3 Documentation

-  For an overview of the scope of the relevant Technical Documentation included with the product, refer to the following:
- The *W@M Device Viewer*: Enter the serial number from the nameplate ([www.endress.com/deviceviewer](http://www.endress.com/deviceviewer)).
  - The *Endress+Hauser Operations App*: Enter the serial number from the nameplate.

### 1.3.1 Technical Information

The Technical Information contains all the technical data on the device and provides an overview of the accessories and other products that can be ordered for the device.

Device	Technical Information
Digital Transmitter TMD1000 TMD1	TI00463G

### 1.3.2 Operating Instructions (BA)

The Operating Instructions contain all the information that is required during various phases of the life cycle of the device: from product identification, incoming acceptance and storage, to mounting, connection, operation and commissioning through to troubleshooting, maintenance and disposal.

The Operating Instructions also contain detailed descriptions of each parameter in the operation menu. The description is aimed at those who work with the device over the entire life cycle and perform specific configurations.

Device	Operating Instructions
Digital Transmitter TMD1000 TMD1	BA00427G BA00428G BA00429G

### 1.3.3 Safety Instructions (XA)

Feature 030 "Approval"	Meaning	XA
4	TIIS Exd IIB T4	XA01072G
5	FM XP Cl.I Div.1 Gr.C-D, AEx d IIB T4	XA01089G

## 1.4 Registered trademarks

### HART®

Registered trademark of the HART Communication Foundation, Austin, USA

## 2 Basic safety instructions

### 2.1 Requirements for personnel

The personnel for installation, commissioning, diagnostics and maintenance must fulfill the following requirements:

- ▶ Be specialists who are trained and have a relevant qualification for this specific function and task.
- ▶ Be authorized by the plant owner-operator.
- ▶ Be familiar with local/national regulations.
- ▶ Before starting work, read and understand the instructions in the Operating Instructions and supplementary documentation as well as the certificates (depending on the application).
- ▶ Follow instructions and comply with basic conditions.

The operating personnel must fulfill the following requirements:

- ▶ Be instructed and authorized according to the requirements of the task by the facility's owner-operator.
- ▶ Follow the instructions in this manual.

### 2.2 Designated use

#### **Application and measured materials**

Depending on the version ordered, the device can also be used with potentially explosive, flammable, poisonous or oxidizing materials.

Devices that are used in hazardous areas have corresponding labels on their nameplates.

To ensure that the device remains in proper condition for the operation time:

- ▶ Only use the device in full compliance with the data on the nameplate and the general conditions listed in the Operating Instructions and supplementary documentation.
- ▶ Check the nameplate to verify if the device can be put to its intended use in hazardous areas.
- ▶ If the device is not operated at an atmospheric temperature, compliance with the relevant basic conditions specified in the relevant device documentation is absolutely essential.
- ▶ Protect the device permanently against corrosion from environmental influences.
- ▶ Observe the limit values in the "Technical Information".

The manufacturer is not liable for damage caused by improper or non-designated use.

### 2.3 Workplace safety

For work on and with the device:

- ▶ Wear the required personal protective equipment according to local/national regulations.

## 2.4 Operational safety

Risk of injury!

- ▶ Operate the device in proper technical conditions and fail-safe conditions only.
- ▶ The plant owner-operator is responsible for interference-free operation of the device.

### Modifications to the device

Unauthorized modifications to the device are not permitted and can lead to unforeseeable dangers:

- ▶ If modifications are nevertheless required, contact your Endress+Hauser Sales Center.

### Repair

To ensure continued operational safety and reliability:

- ▶ Carry out repairs on the device only if they are expressly permitted.
- ▶ Observe local/national regulations pertaining to repair of an electrical device.
- ▶ Use only original spare parts and accessories from Endress+Hauser.

### Ex-area

Observe the following notes to eliminate the risk of danger to persons or the facility when the device is used in Ex-areas (e.g. explosion protection, pressure equipment safety):

- ▶ Check the model nameplate to ensure that the ordered device is explosion proof.
- ▶ Observe the specifications in the separate supplementary documentation attached to these Instructions.

## 2.5 Product safety

This device was designed in accordance with GEP (Good Engineering Practice) to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate. It meets the general safety standards and legal requirements.

## 3 Product description

### 3.1 Product design

#### 3.1.1 Module types

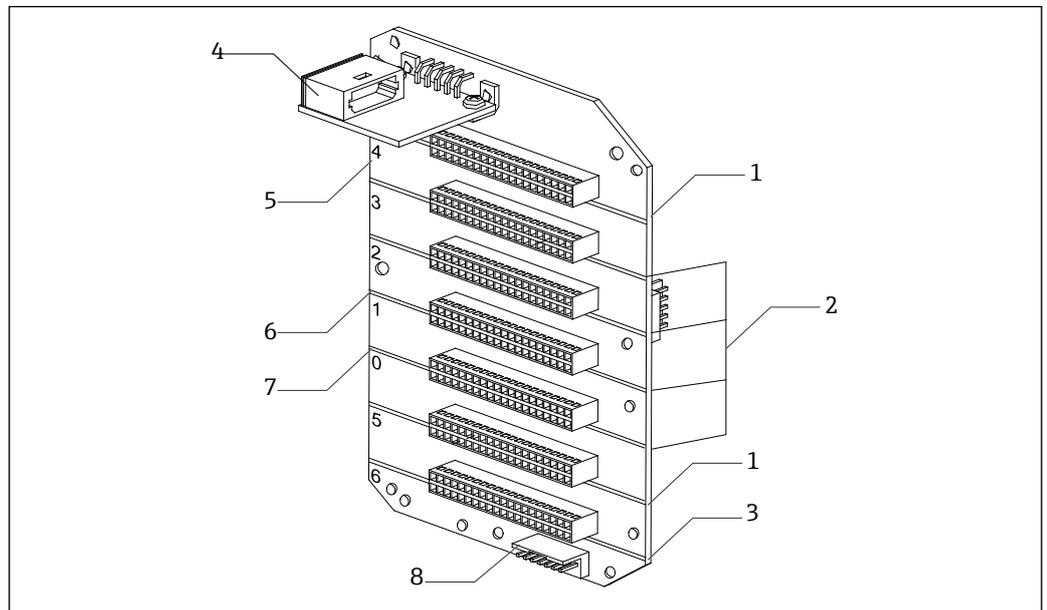
The following table lists the types of modules and the description of each of them.

Name	Functions	Size	Number of terminals for standard use	Remarks
Main CPU - B	CPU module	A	6	Be sure to install one module.
Exp - A	2-way, 2-wire serial digital pulse transmission Contact output (alarm) 4 points Contact input (status) 4 points	A	2 8 8	Transistor output
Thermo - A	Average temperature device Spot temperature device	A	12 3	For average and spot temperature devices
DAC - 1	4 to 20 mA Analog output	C	2	2 modules are available to install.
OUT- 3/4	BCD parallel output	B	18	OUT-3: Collector common OUT-4: Emitter common
ADC - 2	4 to 20 mA Analog signal input	C	2	Available only for use with a 2-wire transmission board
DRMM- A	DRM communication	C	2	
ODC-1N	Optical communication (2-way, half-duplex transmission) Optical digital pulse	C	0	
CNT-2	External operation device output	B	16	Max. 8 points
CD-688	Alarm contact output	C	8	4 points for standard (max. 8 points) Mechanical relay output

-  The size indicates how big the modules are: A (large), B (medium), C (small). There are sizes that cannot be installed depending on the slot position. Refer to the motherboard section below.
- The number of terminals for standard use indicates the actual number of exterior terminals for cable connection that are used when installing the modules. As the connections between the module connector and terminals are wired within the standard cable pattern, the number of exclusive module terminals may be limited.
- The number of terminals that can be used for entire modules is 30 terminals maximum (No.7 to No.36) for a small terminal box and 40 terminals maximum (No.7 to No.48) for a large terminal box.
- Some modules are installed in predetermined slot positions regardless of their sizes. The positions are shown in the specified slot field.

### 3.1.2 Motherboard

Each module size A, B, and C indicates the maximum size to be installed. Modules in size A, B, and C can be installed in the size A slot.

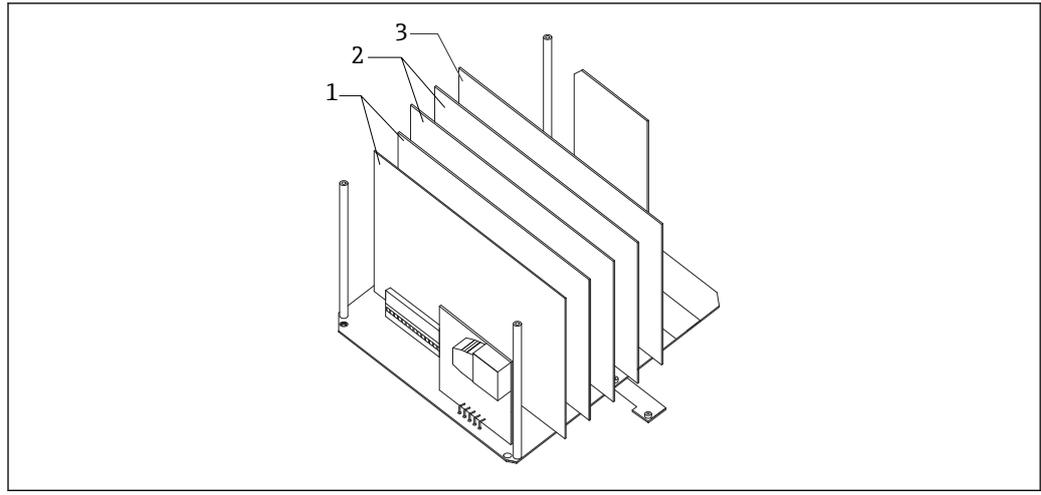


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#### 1 Configuration of the motherboard

- 1 Size B
- 2 Size A
- 3 Size C
- 4 HHT-2 optic I/F module
- 5 Slot number
- 6 Exp-A
- 7 Main CPU-B
- 8 MIF-4

- i
  - Be sure to install Main CPU-B module (CPU module) in slot 0. However, if Exp-A module is being installed in slot 5, it will be used in a pair with Main CPU-B module; therefore, it should be installed in slot 1.
  - Five slots for option modules (two CPU modules) are available. The option module cannot be installed beyond these slots.



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2 Sample of module installation

- 1 Size B
- 2 Size A
- 3 Size C

### 3.1.3 Combining modules

A maximum of five option modules can be installed. The total number of module terminal lines and limitations due to module size are as described above.

### 3.1.4 Precautions for adding and changing modules

#### Confirmation of specifications

Follow "2.3 Module Combination" if adding or changing option modules after delivery.

#### Confirmation of terminal table

Check the terminal table to determine if a module can be added or changed.

#### Confirmation of cable pattern

There are different types of cable patterns (to connect the module connectors and terminals) depending on the specifications. Confirm that the current cable pattern satisfies the specifications after changes are made.

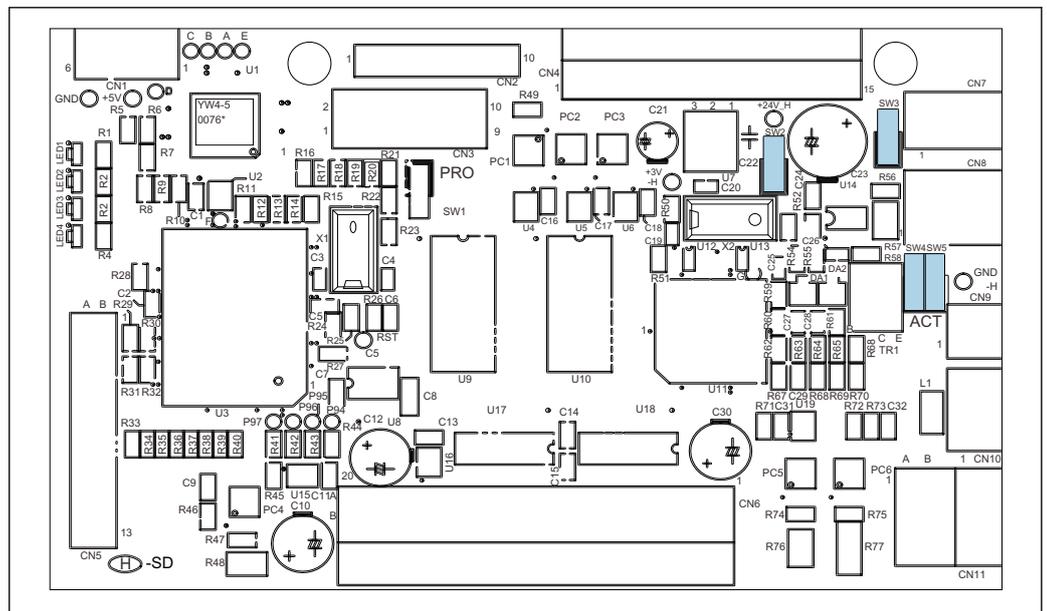
### 3.1.5 Main CPU-B

Main CPU-B is an essential component that governs TMD1's control and calculation, and therefore it is a necessity. It also has HART input and output functions. Settings are as follows:

HART operation mode (Master/Slave)	Designated use	Settings (Set on HTT2)
HART input (NMT5xx, NRF560) (Master mode)	Communication with NMT and NRF	Mode 0, turn on Item 22 or 23
HART output (Slave mode)	Communication with PLC, DCS or Wireless HART adapter	Mode 0, turn off Item 22 and 23

HART operation mode	Designated use	Settings (Set on SW2, 3, 4, 5)
HART Active	Supplying HART power from TMD1 (Always use this setting if communicating with NMT and NRF as HART Master)	 <p>Short the bottom two</p>
HART Passive	Supplying HART power externally	 <p>Short the top two</p>

**i** SW1 is irrelevant to HART operation mode. To protect the memory, do not change the default setting (short the bottom two) under any circumstances.



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**3** Main CPU-B circuit board

**i** Main CPU-B in TMD1 that was shipped as HART input or Main CPU-B that was purchased as a solo spare part are set to "Active." To use the "Passive" setting, confirm and configure the jumper position. Also, use the HART tool to set a unique Assembly No.

**Operation check by LED**

LED1 and LED 2 have different meanings.

No.	Color	Descriptions
LED1	Green	Flashing while CPU is operating.
LED2	Orange	Flashing while CPU is resetting.

LED3 and LED4 have different meanings depending on how they are combined.

No.	LED3			
LED4	N/A	OFF	ON (Orange)	Flashing
	OFF	Not used	HART error	Memory error
	ON (Orange)	ROM error	Not used	Not used
	Flashing	External 12 V error	Internal 12 V error	Not used

## 4 Installation

### 4.1 Module installation

Installation procedure

1. Turn off the main power, then open the electrical compartment lid.
2. Remove the module bracket.
3. Insert the module in the slot.
4. Install the module bracket.
5. Follow the terminal table to connect assigned connectors to modules.
6. 1 through 9 in the terminal table are clearly indicated on the connectors.
7. Close the electrical compartment lid and turn on the main power.
8. Check the module's installation condition.
9. Ensure that the module is electrically connected in HHT2.

This completes the installation procedure.



- Confirm slot positions (specified positions and restriction due to size).
- Remove CPU module first when inserting a module in slot 1 and 2.
- Be sure to connect the modules to the motherboard securely (there should be no misalignment of pin position or disconnection at the connector).

## 5 Adjustment and setting

Adjustment and operation confirmation of modules are performed with Hand Held Terminal 2 (HHT2). For details, refer to the description of each module. Also, ensure that the lid is closed when adjusting or checking modules.

### 5.1 Expansion board Exp-A

#### 5.1.1 Overview

Modules have the following built-in functions:

- Circuit driver for two-way communication: This corresponds to PDC-1 in TMD1, and TMD1's communication control module (TRC-1) function is now integrated with Main-CPU-B.
- Contact output (Alarm): Corresponds to Exp-A in TMD1
- Contact input (Status): Corresponds to Exp-A in TMD1

#### 2-way communication

Exp-A transmits data, such as level, temperature, alarm and level gauge status signal, to a receiver, by converting the data into a current module pulse. The receiver selects a slave device and transmits the level gauge operation data to Exp-A by converting them into pulse-width modulation (PWM). The former function is called the data transmit mode, and the latter function is called the select mode. Communication only for the data transmission mode is called one-way communication.

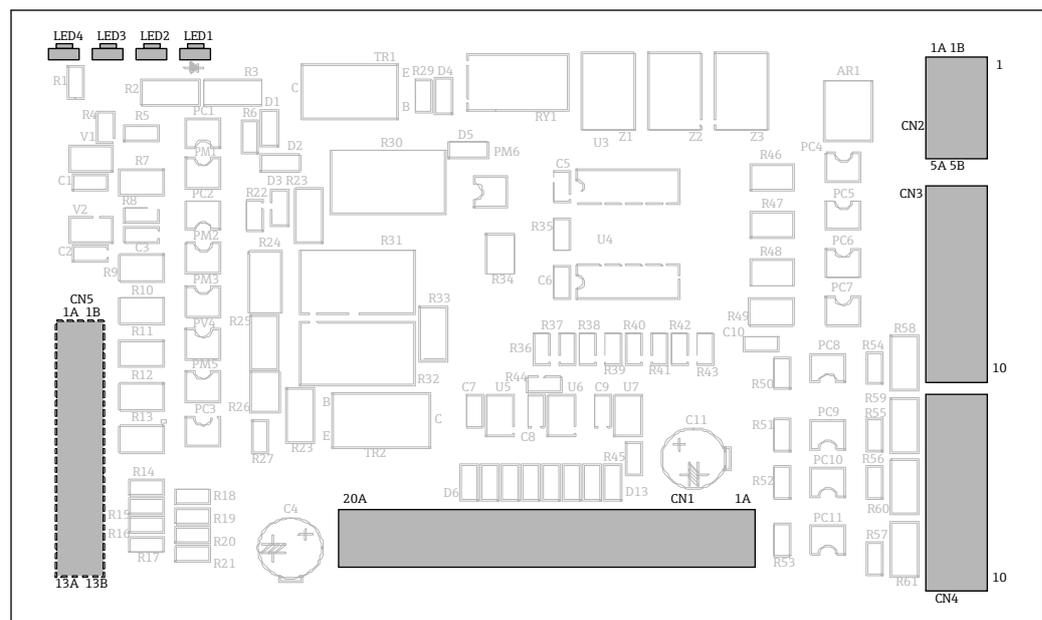
#### Contact Output (Alarm)

This is used when level or temperature alarm are output. There are 8 points for output; however, only 4 points can be used for standard internal bond wires. If 5 points or more are needed, contact your Endress+Hauser Sales Center.

#### Contact Input (Status)

This is used when transmitting status signals around a device to a receiver via 2-way communication. If 5 points or more are needed, contact your Endress+Hauser Sales Center.

#### 5.1.2 Module configuration and names



4 Exp-A module

### 5.1.3 Module setting

Exp-A is installed in slot 1 and connected to Main CPU-B with a connector.

### 5.1.4 2-way communication setting

Switch to direct access mode in a receiver and adjust Exp-A so that it can access only the correct slave devices.

#### Selection of 2-way communication type

Select a type as follows in MODE: 13, ITEM: 26:

- [2] BBB & MIC receiver
- [4] MDP receiver
- [8] V1 receiver

#### Select code setting

Set the select address (01 to FF) that a receiver has allocated to this slave device. Set to FF when selecting an MIC receiver (one-on-one 2-way receiver).

#### Line resistance value setting

As a general rule, set [7] as default.

Upper and lower limit level alarm data setting

1. Select an alarm type from below for No. 1 and No. 2 in Mode13, Item: 28.



0: No.1 = High	No.2 = Low
1: No.1 = Low	No.2 = High
2: No.1 = High	No.2 = High
3: No.1 = Low	No.2 = Low

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2. Set the No. 1 alarm level value in MODE: 13, ITEM: 06.
3. Set the No. 2 alarm level value in MODE: 13, ITEM: 07.
4. Set alarm level hysteresis range in MODE: 13, ITEM: 27.
  - ↳ Both No.1 and No.2 alarms are common values.

This completes the setting procedure.

#### Operation confirmation

- Once the adjustment procedure is complete, set the receiver to free scan mode and confirm that the corresponding slave device is receiving data properly.
- If there is a communication error (while checking with a digital oscilloscope, etc.), change or increase the receiver's clock addition value.
- Operations, such as stopping, are confirmed by hoisting them up from the receiver, but TMD1 is capable of simultaneously receiving the on-site operation switch and operation from HHT2. In order to maintain the consistency of these operations, the operations are prioritized in the descending order of on-site control switch, HHT, and receiver. Because of this, the on-site operation switch and operation from HHT2 can only be operated from the receiver when measuring levels.
- For information on how to operate from the receiver and the operable types, refer to the receiver's Operating Instructions.
- The requirements for operating from a receiver are stored inside TMD1, so the original operation condition is maintained even when the power is turned off and then back on. Because of this, follow the procedure below to disable it if you cannot measure levels due to receiver problems, etc. The requirements for operating from the receiver will be configured into the level operation by setting the MODE: 13, ITEM: 01 select code to "FF".

### 5.1.5 Operation check by LED

No.	Color	Descriptions
LED2	Orange	Flashes when transmitting data
LED3	Green	Flashing when receiving data

### 5.1.6 Adjustment and operation confirmation of contact output (alarm)

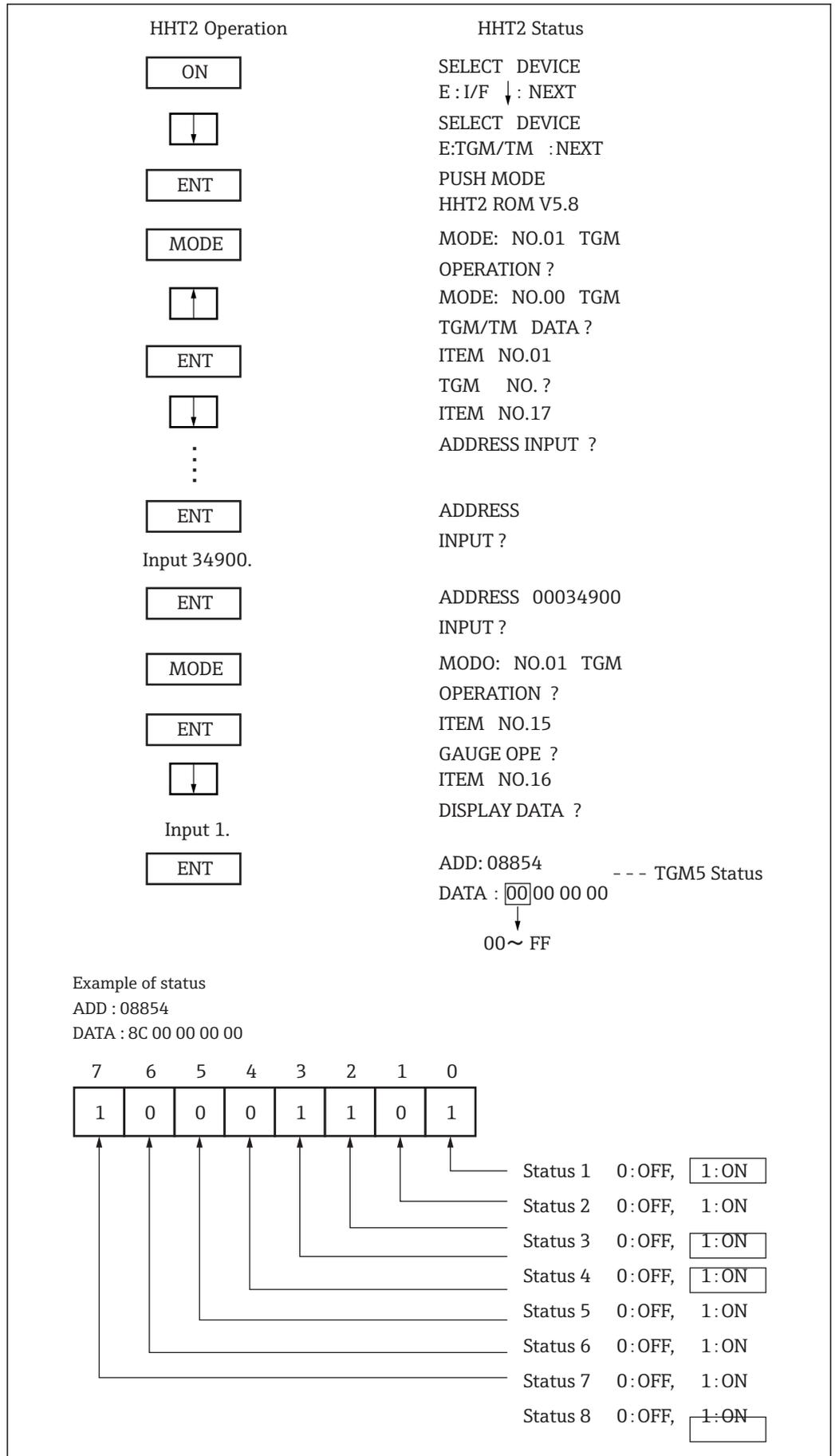
For details, refer to "5.5 Contact output (Alarm) Exp-A."

### 5.1.7 Confirmation of contact point (status) operation

Input signal logic selection

1. Select the logic with "0" or "1" as the sixth digit of MODE: 00, ITEM: 12 MEMO 1.
  - ↳ When the sixth digit is 0 (xxxxx0), there will be an input signal (logic 1) when the contact point is OFF (open).  
When the sixth digit is 1 (xxxxx1), there will be a signal (logic 1) when input signal is ON (short).  
When the sixth digit is 2 to 9, there is no signal (logic 0).
2. Set the value according to the connected device's contact specifications.

This completes the selection process.



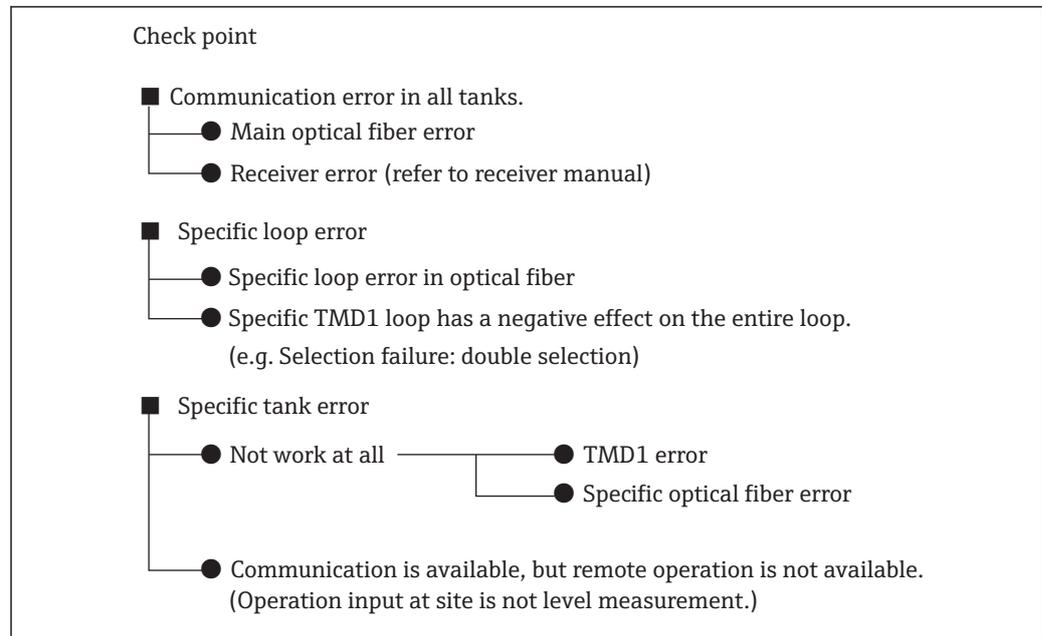
5 HHT2 operation configuration

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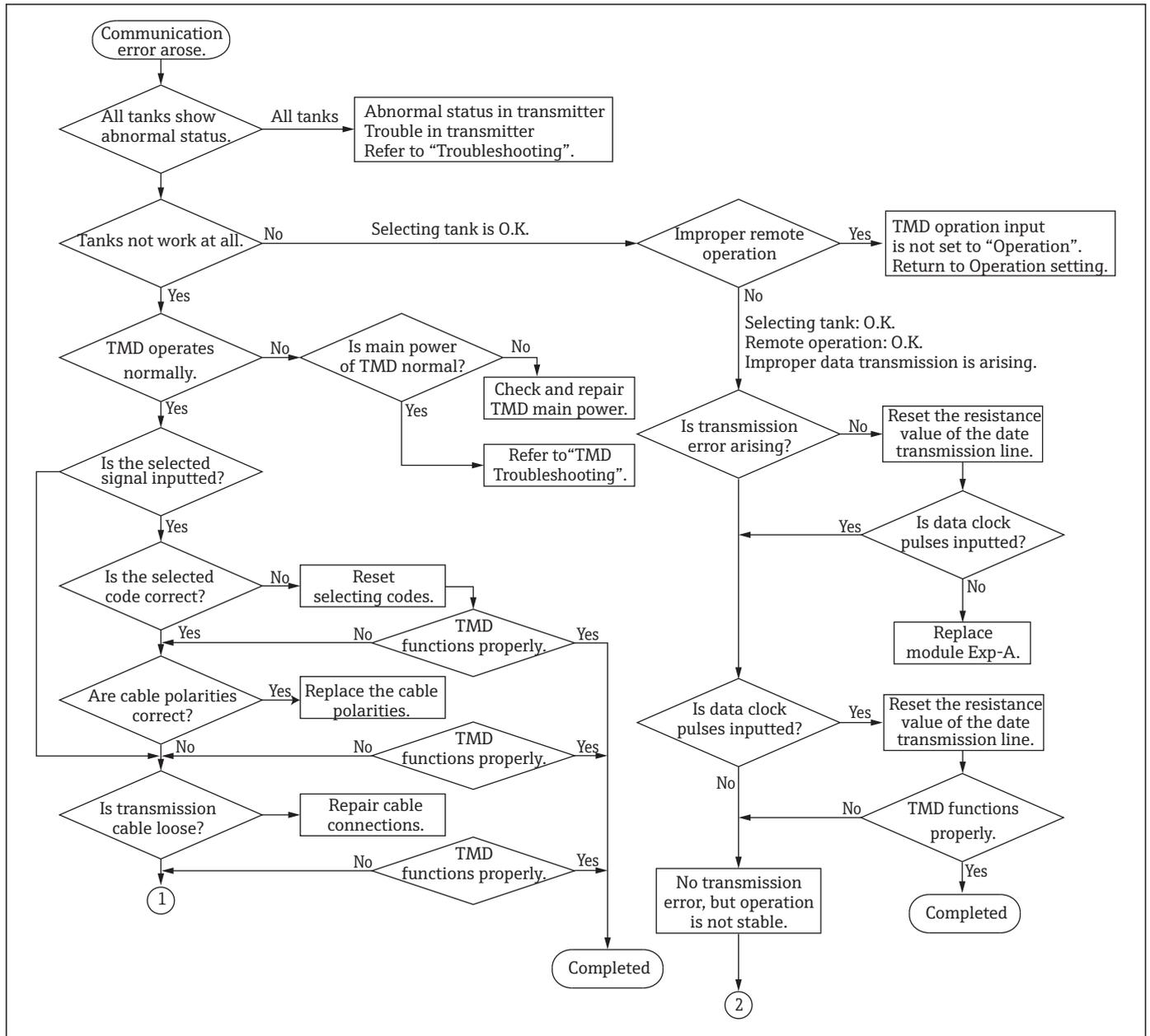
## 5.1.8 Troubleshooting

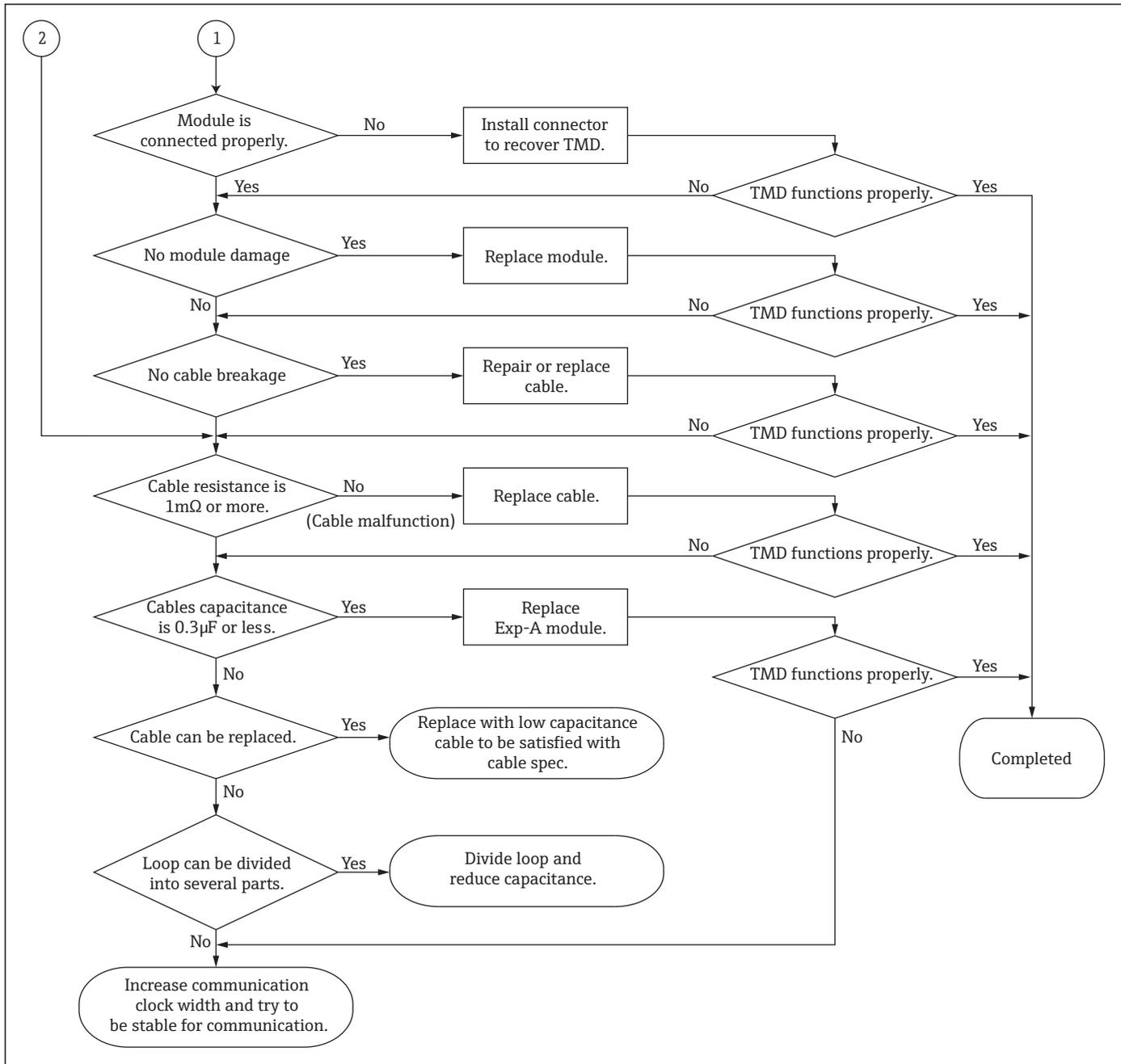
### 2-way communication

If there is a communication error, diagnose the problem by referring to the following check points and the attached flowchart. Perform this work by displaying the data and error on the receiver as well as checking TMD1's operation.



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A0038072-EN

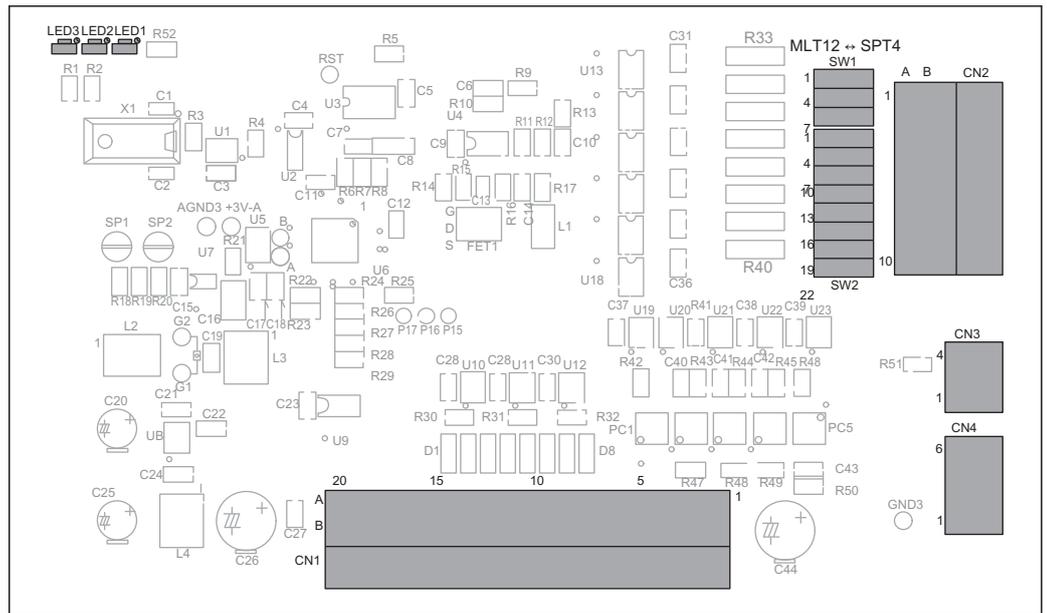
## 5.2 Temperature system Thermo-A module

### 5.2.1 Overview

Temperature system Thermo-A supports four types of temperature devices and three types of temperature elements as follows: 1) spot 1 point, 2) spot 4 points, 3) multi-element and 4) single element temperature devices; and 1) Pt 100, 2) JPt 100 and 3) Cu 100 temperature elements.

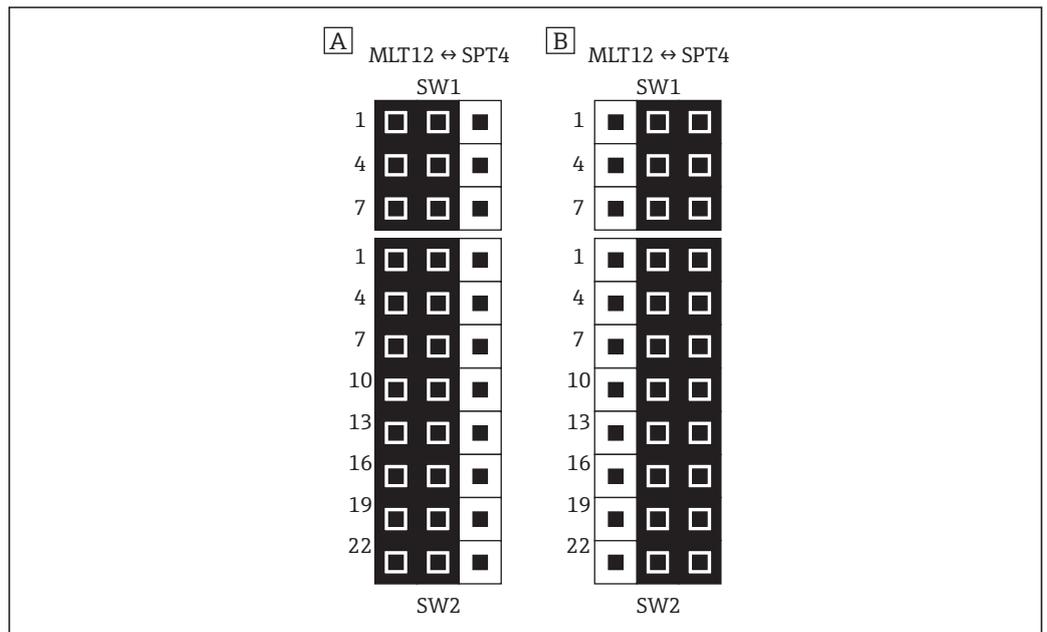
**i** Thermo-A is not available during HART input for Prothermo NMT53x.

### 5.2.2 Module configuration and names



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6 Thermo-A module



A0038073

7 SW1 and SW2 setting

- A Multi 12 points
- B Spot 4 points

### 5.2.3 Spot 1 point specifications setting

Switch the element jumper post SW1 to "spot side (SPT4)".

Setting procedure

1. Select the temperature device type "3" in MODE: 00, ITEM: 19.
2. Select a temperature element from [0]: Rt100 [1]: JPt 100 [2]: Cu 100 in MODE: 00, ITEM: 20.
3. Connect a standard resistor instead of a spot temperature device.

4. Configure a standard resistor to alternate between 0 °C resistance and 200 °C resistance, and then correct MODE: 07, ITEM: 02 so that the net temperature of MODE: 07, ITEM: 01 is  $\pm 0.1$  °C.
  - ↳ If it does not fit within 0.1 °C, it is possible that there is disconnection in the board's element input connector (CN2) pin, etc. Push in the pin completely.

This completes the setting procedure.

### 5.2.4 Spot 4 points temperature setting

Switch the element jumper post SW1 to "spot side (SPT4)".

Setting procedure

1. Select the temperature device type and set "2" in MODE: 00, ITEM: 19.
2. Select a temperature element from [0]: Pt100 [1]: JPt 100 [2]: Cu 100 in MODE: 00, ITEM: 20.
3. Connect a standard resistor instead of a 1-spot temperature device.
4. Configure a standard resistor to alternate between 0 °C resistance and 200 °C resistance, and then correct MODE: 08, ITEM: 06 so that the net temperature of MODE: 08, ITEM: 01 is  $\pm 0.1$  °C.
  - ↳ If it does not fit within  $\pm 0.1$  °C, it is possible that there is disconnection in the board's element input connector (CN2) pin, etc. Push in the pin completely.
5. For 2-point and subsequent temperatures, connect a standard resistor to the corresponding terminals, and repeat steps 3 and 4 above.

MODE and ITEM become as follows:

2nd Net Temp Point:	MODE: 08	ITEM: 02
3rd Net Temp Point:	MODE: 08	ITEM: 03
4th Net Temp Point:	MODE: 08	ITEM: 04
2nd Offset Point:	MODE: 08	ITEM: 07
3rd Offset Point:	MODE: 08	ITEM: 08
4th Offset Point:	MODE: 08	ITEM: 09

This completes the setting procedure.

### 5.2.5 Multi-element temperature setting

Switch the element jumper post SW1 to "multi side (MLT12)".

Setting procedure

1. Select a temperature device type and set "1" in MODE: 00, ITEM: 19.
2. Select a temperature element from [0]: Pt100 [1]: JPt 100 [2]: Cu 100 in MODE: 00, ITEM: 20.
3. Set the number of elements used by the multi-element temperature device in MODE: 09, ITEM: 02.

4. Select the interval of element positions (equal or unequal).
  - ↳ If the element position is equal, select "0" in MODE: 09, ITEM: 06.
  - ↳ If the element position is unequal, select "1" in MODE: 09, ITEM: 06.
5. Set the switching point for each element in MODE: 09, ITEM: 07 to 18.
  - ↳ Set the switching point to the element position plus approximately 300 mm.
  - ↳ The bottom position and element interval settings are not required
6. Set the switching point of the lowest element position (bottom position) in MODE: 09, ITEM: 03.
  - ↳ Set the switching point to element position plus approximately 300 mm.
7. Set the element position interval in MODE: 09, ITEM: 04.
8. Connect a standard resistor instead of an element that matches the current level.
9. Configure a standard resistor to alternate between 0 °C resistance and 200 °C resistance, and then correct MODE: 09, ITEM: 05 so that the net temperature of MODE: 09, ITEM: 01 is  $\pm 0.1$  °C.
  - ↳ If it does not fit within  $\pm 0.1$  °C, it is possible that there is disconnection in the board's element input connector (CN2) pin, etc. Push in the pin completely.

This completes the setting procedure.

### 5.2.6 Single element temperature setting

Switch the element jumper post SW1 to "multi side (MLT12)".

Setting procedure

1. Select a temperature device type and set "0" in MODE: 00, ITEM: 19.
2. Select the temperature elements from [0]: Pt 100 [1]: JPt 100 [2]: Cu 100 in MODE: 00, ITEM: 20.
3. Set the number of elements used by the multi-element temperature device in MODE: 10, ITEM: 15.
4. Select the interval of element positions (equal or unequal).
  - ↳ If the element position is equal, select "0" in MODE: 10, ITEM: 20.
  - ↳ If the element position is unequal, select "1" in MODE: 10, ITEM: 20.
5. Set the switching point for each element in MODE: 10, ITEM: 21 to 32.
  - ↳ Set the switching point to the element position plus approximately 300 mm.
  - ↳ The bottom position and element interval settings are not required.
6. Set the switching point of the lowest element position (bottom position) in MODE: 10, ITEM: 16.
  - ↳ Set the switching point to the element position plus approximately 300 mm.
7. Set the element position interval in MODE: 10, ITEM: 17.
8. Connect a standard resistor instead of element No.1.
9. Configure a standard resistor to alternate between 0 °C resistance and 200 °C resistance, and then correct MODE: 10, ITEM: 14 so that the net temperature of MODE: 10, ITEM: 02 is  $\pm 0.1$  °C.
  - ↳ If it does not fit within  $\pm 0.1$  °C, it is possible that there is disconnection in the board's element input connector (CN2) pin, etc. Push in the pin completely.
10. Connect a standard resistor in sequential order from element 2 instead of the last element, and check the net temperature in MODE: 20, ITEM: 22 to 32.

This completes the setting procedure.



### 5.3.3 Module setting

Refer to "3 Module Installation" for details on installation.

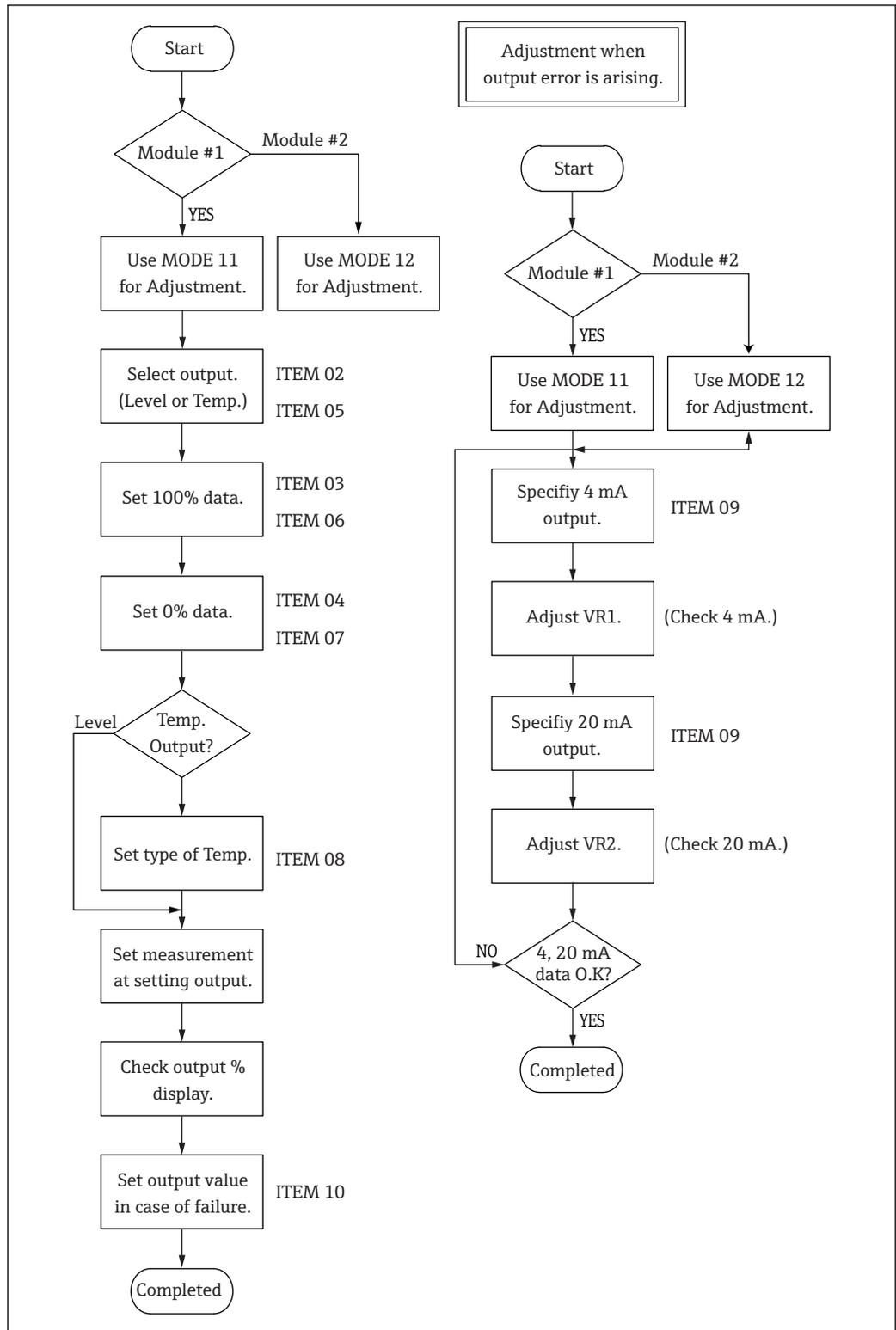
 When two modules are installed simultaneously in the main unit, the ID number for each module must be changed.

Setting procedure

1. Set the first module's ID No. to [5]. (No change is required, as this is the standard setting.)
2. Change the second module's ID No. to [6].
  - ↳ ID No. setting procedure  
Install D1 and D3 when ID: 5 (0101)  
Install D2 and D3 when ID: 6 (0110)
3. When changing current output to 0 to 20 mA DC, set Jumper Pin JP1 and JP2 to 0 to 20 mA side (the standard setting is 0 to 20 mA side).

This completes the setting procedure.

### 5.3.4 Adjustment and operation confirmation



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### 5.3.5 Adjustment and confirmation procedure

The following procedure is described only for the first module. When there is only one module, follow the steps below to adjust the module. When installing two modules, use the same steps as follows after overwriting to MODE: 12 for the second module. (If outputting 0 to 20 mA, adjust 4 mA as 0 mA.)

Adjustment and confirmation procedure

1. Select output in MODE: 11, ITEM: 02, 05 by using HHT2.
  - ↳ Level output: Select [1] in ITEM: 02.  
Temperature output: select [0] in ITEM: 02 and select [1] in ITEM: 05.  
When both 02 and 05 are set to "1", ITEM: 02 is given priority and the level will be output.
2. Set the level and temperature values when it is 100% in MODE: 11, ITEM: 03 and 06 by using HHT2.
3. Set the level and temperature values when it is 0% in MODE: 11, ITEM: 04 and 07 by using HHT2.
4. For temperature output, select the temperature type from MODE: 11, ITEM: 08 by using HHT2.
5. Specify "0: measurement output" in MODE: 11, ITEM: 09 by using HHT2.
  - ↳ As a result, 4 to 20 mA will be output with respect to the measurement values (level or temperature).
6. Confirm the percent (%) display of the output value in MODE: 11, ITEM: 01 by using HHT2.
  - ↳ The measurement value's % data with respect to 0 to 100 % setting value will be displayed.
7. If there is an error in 4 to 20 mA current value, specify "1:4 mA output specification" in MODE: 11, ITEM: 09 by using HHT2.
8. Adjust VR1 of CD-L296-1 so that the current value is 4 mA.
  - ↳ Specify "2: 20 mA output" on the same screen, and adjust VR2 so that the current value is 20 mA.

This completes the adjustment and confirmation procedure.

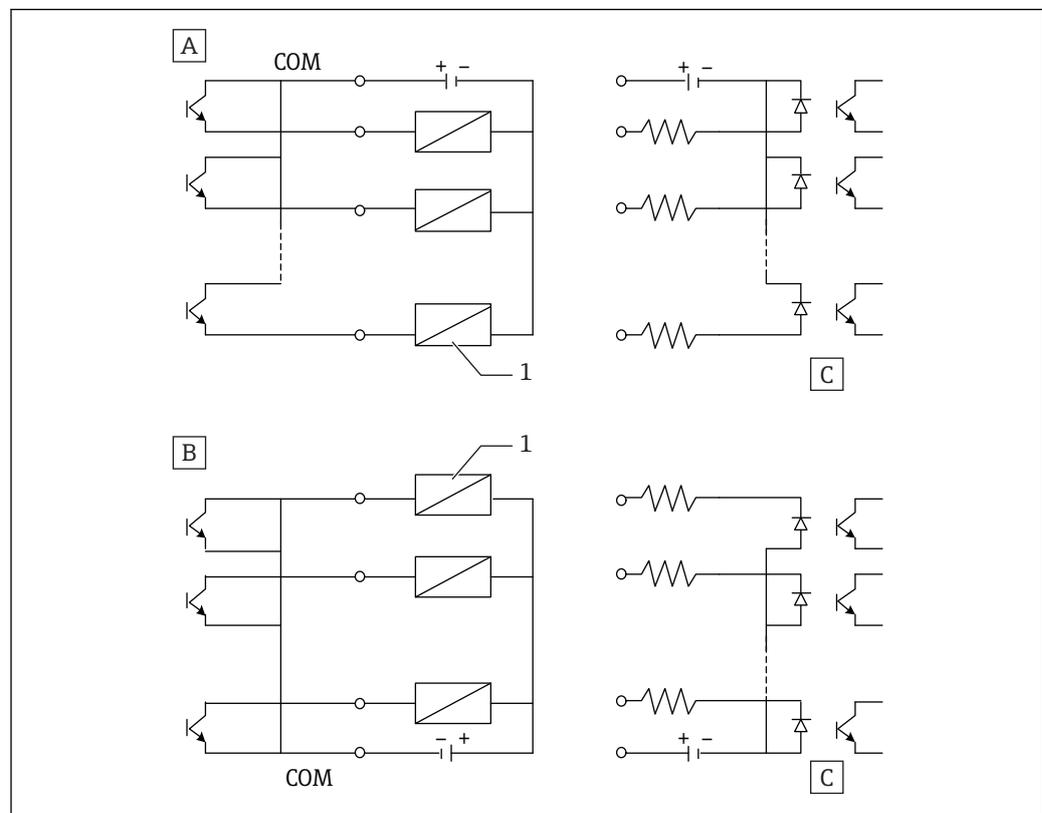
## 5.4 Parallel output OUT-3 and OUT-4 module

The three specifications of output data are as follows:

Spec.	Descriptions
LEVEL - BCD	Output level value in BCD code
LEVEL - SIG	Output level value in SAKURA code
TEMP - BCD	Output temperature value in BCD code

Confirm that the output data conforms to a connecting receiver system by using HHT2 (MODE05, ITEM01). If it does not conform, select the appropriate data in MODE: 13, ITEM: 26.

The output form is open collector transistor; however, the module is distinguished depending on the common line. Use the appropriate module corresponding to the connecting receiver system.



9 Electrical circuit

A OUT-3 (collector common)

B OUT-4 (emitter common)

C Photo coupler

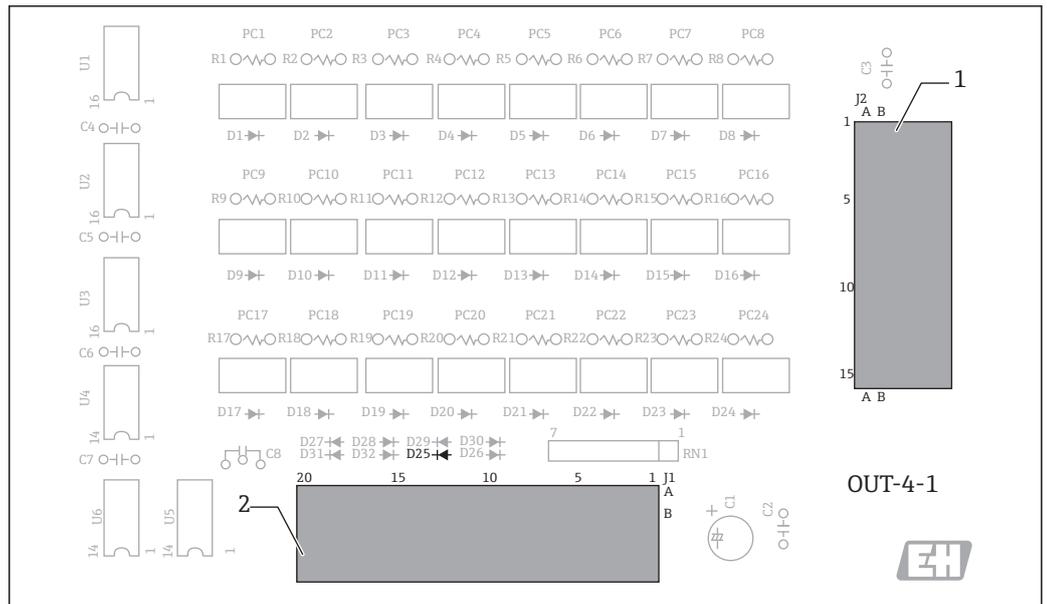
1 Relay

### 5.4.1 Overview

The parallel output module is used to output level and/or temperature data as BCD or SIC code.

The module can provide 24-bit output; however, for a standard internal connect, it is limited to 17-bit. The output signal is isolated from the internal circuit by means of photo coupler.

### 5.4.2 Module configuration and names



10 Output OUT-3 and OUT-4 module

- 1 J2 connector for parallel output
- 2 J1 motherboard connector

**i** The component layout is identical in OUT-3.

#### ID number setting

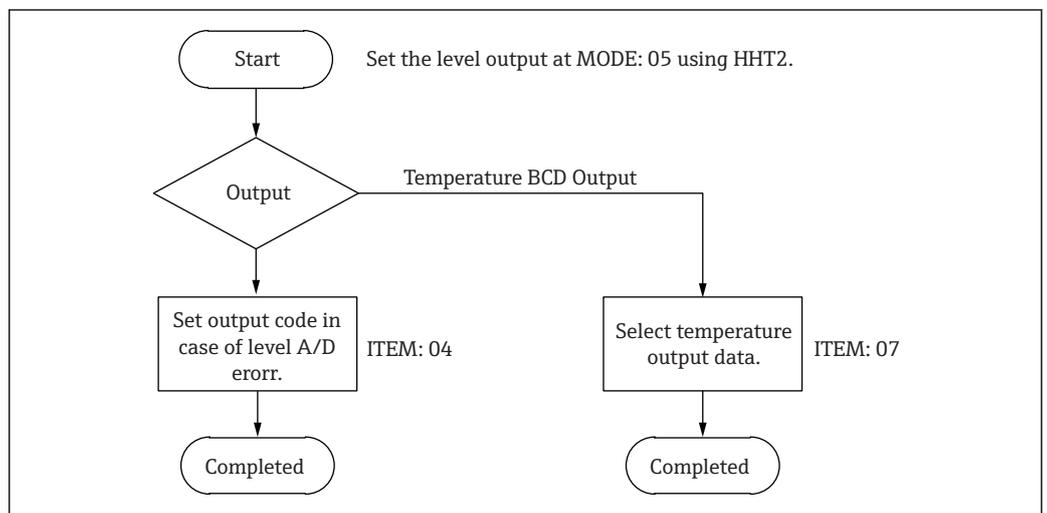
- OUT-3 ID No. 01: Only D25 is installed
- OUT-4 ID No. 02: Only D26 is installed

### 5.4.3 Module setting

Refer to "4 Module Installation" for details on installation.

#### 5.4.4 Level output setting

The setting flow process is performed in MODE05 of HHT2.



## Setting procedure

1. Set a 6-digit output code (xxxxxx) in MODE: 05, ITEM: 04 of HHT2.  
↳ 0 through F can be used to set the data for each digit.
2. Set output code in ITEM: 04 for level A/D error.

This completes the setting procedure.

 Standard cable connection has a 17-bit output (00000 to 19999 mm). None of the 10-1 digits and the top 3 bit of the 104 digits will appear on the terminal.

### 5.4.5 Temperature output setting

Select temperature output data and set it in ITEM: 07.

No.	Displays	Descriptions
0	AVE	If using an average temperature device, average temperature is output, and spot temperature is output in case of spot 1-point input.
1	S1	For multi-point temperature input, the first spot temperature data is output.
2	S2	For multi-point temperature input, the second spot temperature data is output.
3	S3	For multi-point temperature input, the third spot temperature data is output.
4	S4	For multi-point temperature input, the fourth spot temperature data is output.

### 5.4.6 Level output confirmation

## Confirmation procedure

1. Enter the level values in MODE: 03, ITEM: 04.
2. Confirm that the code output corresponds to the level value on the terminal or receiver.

This completes the confirmation procedure.

### 5.4.7 Temperature output confirmation

## Confirmation procedure

1. Read and record the temperature offset value in MODE: 07, ITEM: 02.  
↳ Reset this value once the work is complete.
2. Enter the temperature offset value in MODE: 07, ITEM: 02, and confirm the output by setting arbitrary temperature values.

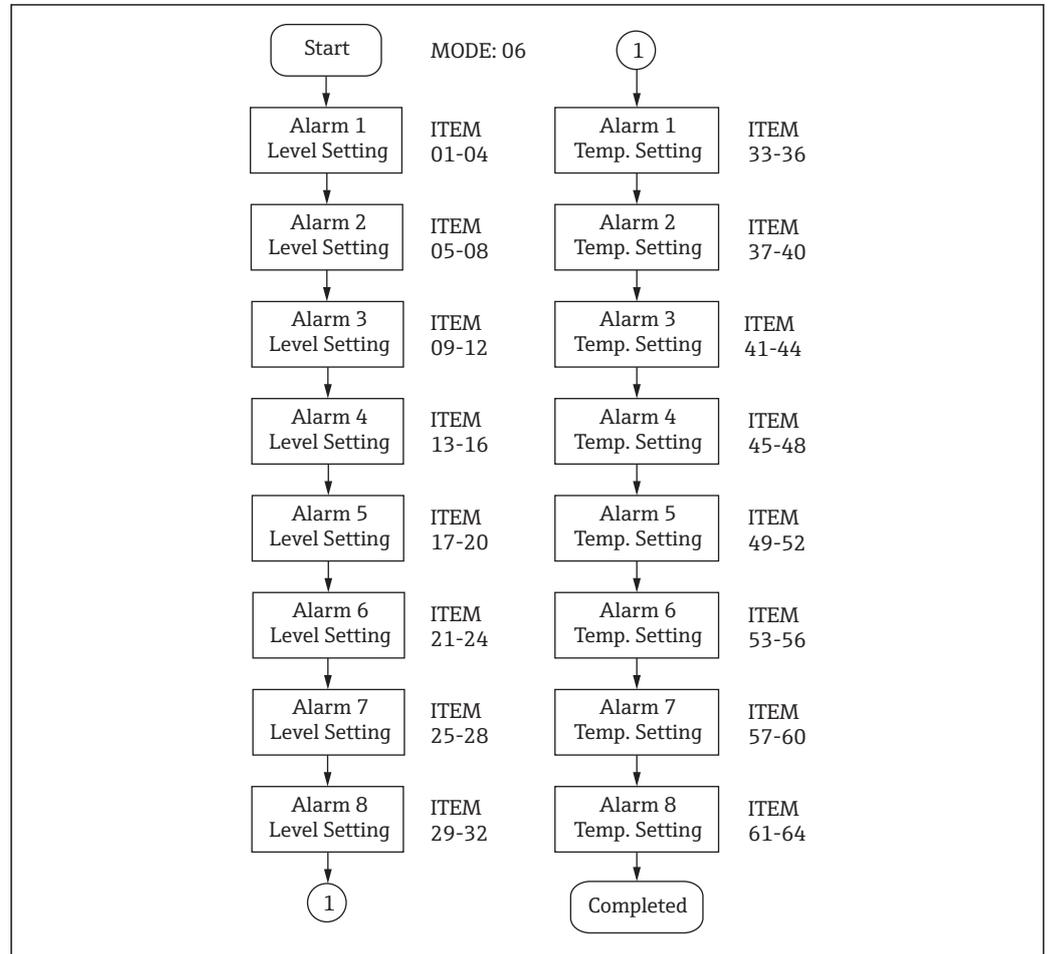
This completes the confirmation procedure.

 When checking codes on the terminal, check the conduction with common terminal. Note that the polarities of OUT-3 and OUT-4 are different.

## 5.5 Contact output (Alarm) Exp-A module

### 5.5.1 Setting flowchart

Each data is set in MODE: 06 of HHT2.



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**i** Alarm setting is prepared for 8 outputs. Each output has level and temperature settings. For more information on settings, refer to "MODE: 06 Contact output (Alarm)" in the separate "Operation and Setting of TMD1 HHT2 (Hand Held Terminal)".

The following table shows setting data configurations for corresponding alarms.

Setting data for level alarm	Setting data for temperature alarm
1 Specifying HIGH, LOW, No alarm	1 Specifying HIGH, LOW, No alarm
2 Alarm setting data	2 Alarm setting data
3 Hysteresis data	3 Hysteresis data
4 Specifying NO / NC	4 Specifying NO / NC

#### Setting procedure

1. This setting specifies the maximum and minimum alarm operation. Set the data to NON (not necessary) if the alarm is not required.
2. Use (mm) unit if the alarm setting data is for level, and use (±)0.1 °C if it is for temperature.

3. Set the hysteresis operation range, and use (mm) unit for level and 0.1 °C unit for temperature.
4. Set the normal open or normal close.

This completes the setting procedure.

- i**
- If contact output (alarm) is not necessary, select NON (no alarm) for both level and temperature data.
  - If using level alarm, set the temperature alarm to NON. If using temperature alarm, set level alarm to NON.
  - If the alarms are used for both level and temperature, level alarm will have priority.
  - If the alarm is set to NON, the following data (data for 2 to 4) does not need to be set.
  - If the temperature alarm is required, ADC-1 (temperature input module) will be necessary. Even if the temperature module is not installed, the temperature setting message ITEM: 33 to 64 will appear on HHT2.

### 5.5.2 Operation confirmation

Operation confirmation procedure for level

1. Record the level value in MODE: 03, ITEM: 04.  
↳ Reset this value once the work is complete.
2. Input an arbitrary level value in MODE: 03, ITEM: 04, and confirm the operation.

This completes the confirmation procedure.

- i** Be sure that the host device does not generate an alarm during this operation confirmation procedure.

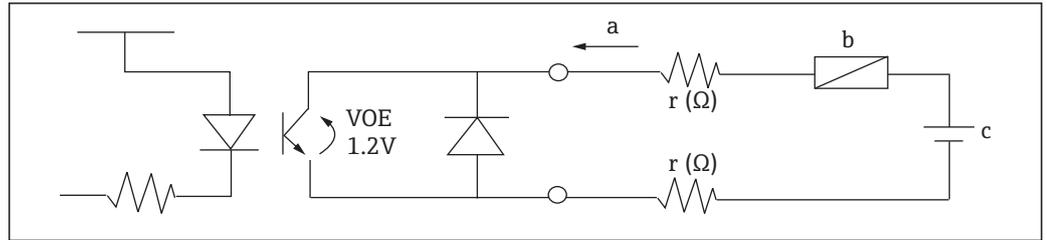
Operation confirmation procedure for temperature

1. Read and record the temperature offset value in MODE: 07, ITEM: 02.  
↳ Reset this value once the work is complete.
2. Input the temperature offset value in MODE: 07, ITEM: 02 and check the temperature alarm while setting an arbitrary temperature value.

This completes the confirmation procedure.

- i** Check contact output type (open collector or relay contact output) and confirm the procedure above. The standard setting is open collector output and the connections are as follows (refer to the following table):

Settings	Descriptions
Accuracy	±0 with respect to level or temperature
Rating	Open collector output by photo coupler
Collector current	30 mA
Voltage between collector and emitter	Max. 250 V
Dielectric voltage	1 500 Vms



A0038080

11 Permissible load impedance of TMD1 and contact output circuit

- a Max. 30 mA
- b Load  $R$  ( $\Omega$ ) / Operating current  $I_s$
- c DC current  $E$  (V)

**i** Determine  $E$  and  $R$  in order to satisfy the following equation.

$$I_s \text{ (A)} \leq \frac{E \text{ (V)} - 1.2 \text{ (V)}}{R \text{ (\Omega)} + 2r \text{ (\Omega)}} \leq 0.03 \text{ (A)}$$

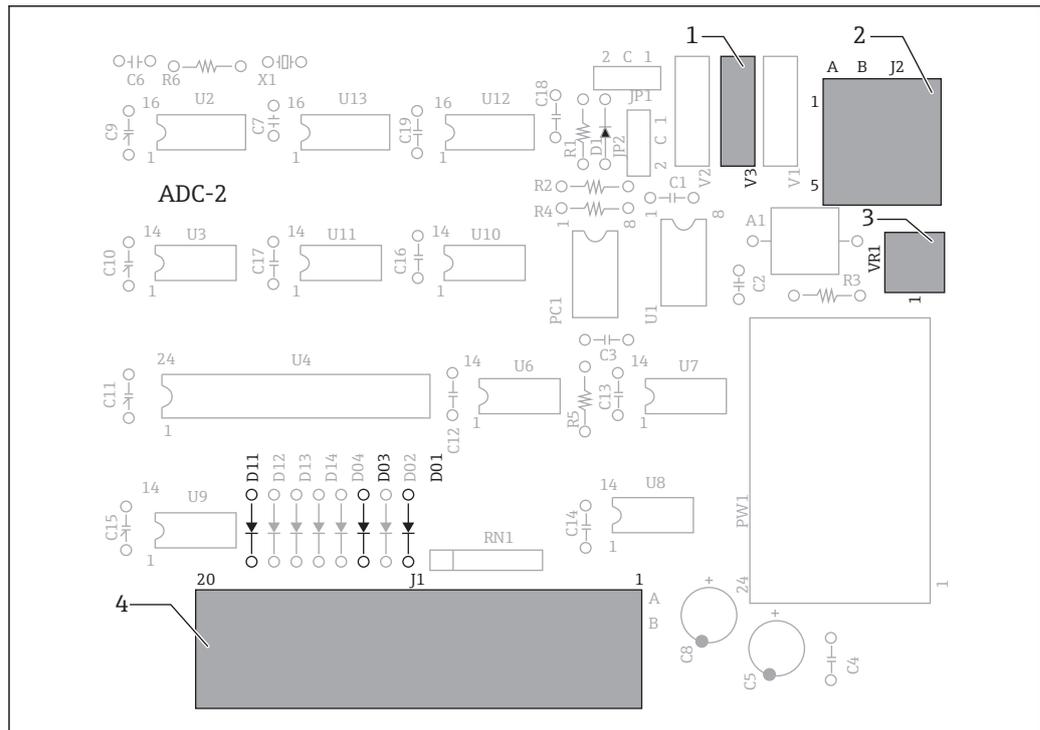
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## 5.6 4 to 20 mA input ADC-2

### 5.6.1 Overview

4 to 20 mA signal is converted to 0 to 100 % from transmitters of manometer and opening meter and then transmitted to a receiver through 2-way communication (V1 protocol).

## 5.6.2 Module configuration and names



 12 ADC-2 module

- 1 Power supply switching jumper
- 2 J2 connector for 4 to 20 mA output
- 3 Trimmer for VR1 adjustment
- 4 J1 motherboard connector

## 5.6.3 Module setting

Refer to "4 Module Installation" for details on installation.

## 5.6.4 Adjustment and operation confirmation

Setting procedure

1. Set MODE: 14, ITEM: 02 "ZERO ADJ" in HHT2to "0".
2. Set MODE: 14, ITEM: 03 "ZERO ADJ" in HHT2to "1".
3. Switch the input current from 4 to 20 mA, and set the values for ITEM: 02, 03 so that the MODE: 14, ITEM: 01 "N INPUT" value is 0, 100 %.
  - ↳ Internal calculation is as follows:  

$$N \text{ INPUT} = (G \text{ INPUT}) \times (\text{SPAN ADJ.}) \pm (\text{ZERO ADJ.})$$

This completes the setting procedure.

## 5.7 Optical communication ODC-1 module

### NOTICE

Optic fiber transmit module ODC-1 uses precision optical parts. Pay particular attention to the following:

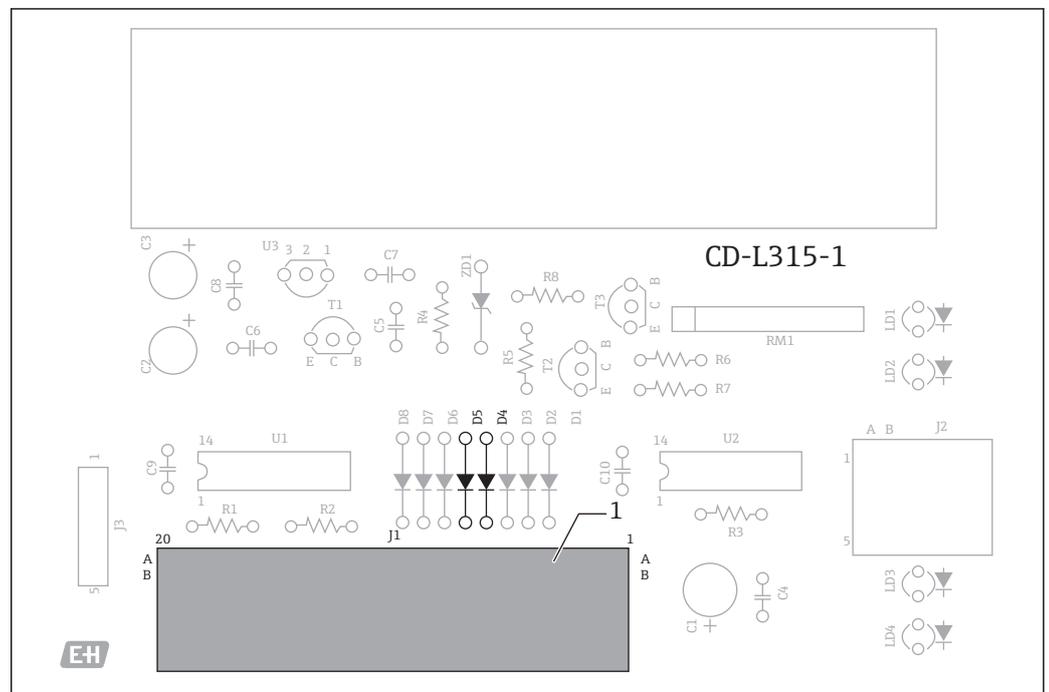
Risk of damage

- ▶ Do not subject the module to strong impact.
- ▶ Put a protection cap on the optical connector if the connector is not being used.
- ▶ Take special care not to bend or break the optical fiber (minimum bending radius: 80 R for Ø6, 10 R for fiber core).
- ▶ Do not touch the connecting face of an optical fiber connector with your hand. Do not scratch the connector and protect it from dust. If the connecting face is not clean, wipe it with gauze.

### 5.7.1 Overview

Using the ODC-1 module enables optical 2-way communication between a TMD1 and a receiver. On the ODC-1's optical communication unit (optic transmission module), a light-emitting element LED and light receiving element PD (photo diode) are optically connected by a T coupler. This enables transceiving operation using a single fiber. The receiver transmits address signals and data request signals that are assigned to the TMD1. If the TMD1 receives these signals and the address matches, data corresponding to data request will be returned to the receiver. This transceiving operation takes place within 25 mS. When the maximum connectable units (8 units) of TMD1 are used, it will perform a repetitive operation in which the 8 units are considered as one cycle, so data is collected every 200 mS.

### 5.7.2 Module configuration and names



13 ODC-1 module

1 J1 motherboard connector

### 5.7.3 Module setting

Connect J2 connector of ODC-1 and CN10 of Main-CPU-B with the included jumper connector.

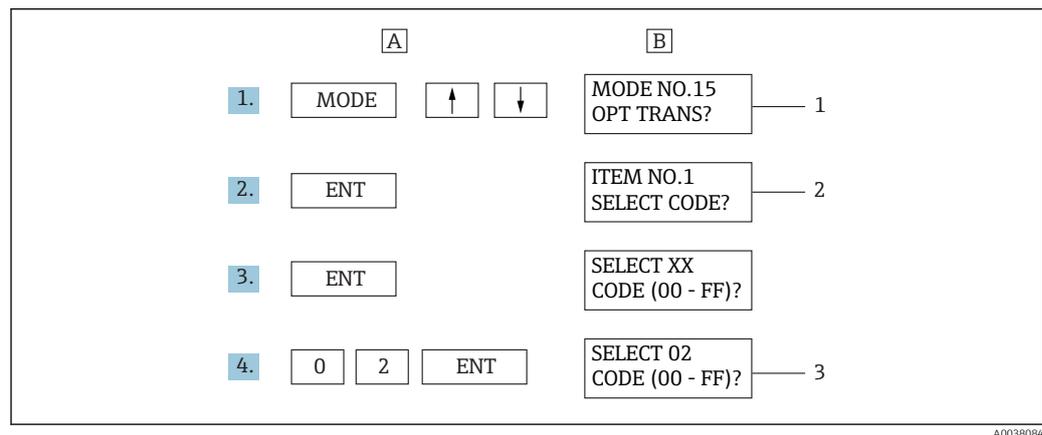
### 5.7.4 Module adjustment

Check the transmission loss of optical fiber before conducting optical communication, and confirm that the loss is within permitted range. Set the following items using HHT2 for optical communication operation:

- Select code setting
- Upper and lower alarm setting for level

### 5.7.5 Select code setting

Set the select address (00 to 07) for TMD1 assigned by a receiver. All select addresses are disabled except for this select address (00 to 07).

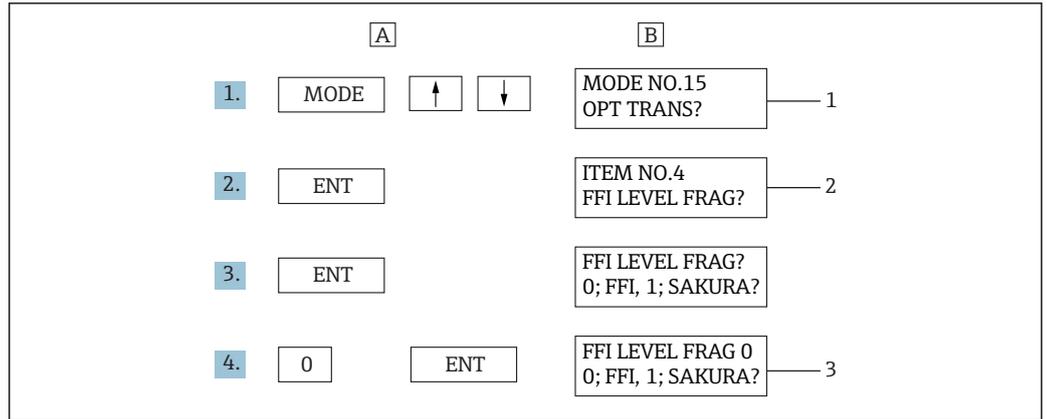


14 Example of select code 02 setting

- A HHT2 operation  
 B HHT2 display  
 1 Operation in MODE: 15  
 2 ITEM 04  
 3 Select code input

### 5.7.6 FFi level transmission method setting

Set FFi level transmission method. FFi uses +/-32 767 mm level transmission as default, but if the level exceeds 32 767 mm, it is possible to transmit up to 0 to +65 535 mm by switching to SAKURA transmission method. Transmission method is set in MODE: 15, ITEM: 04 (FFi transmission method is the default setting when it is shipped from the factory).



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15 Example of select code 02 setting

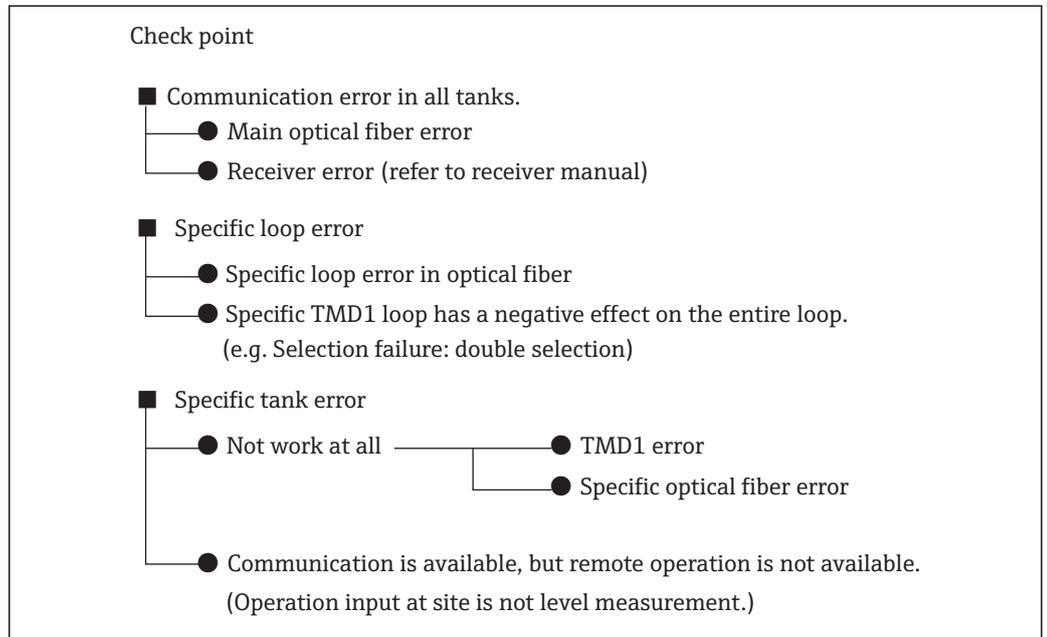
- A HHT2 operation
- B HHT2 display
- 1 Operation in MODE: 15
- 2 ITEM 04
- 3 FFi level selection

### 5.7.7 Operation confirmation

Confirm that TMD1 data can be received properly by a receiver upon completion of data setting.

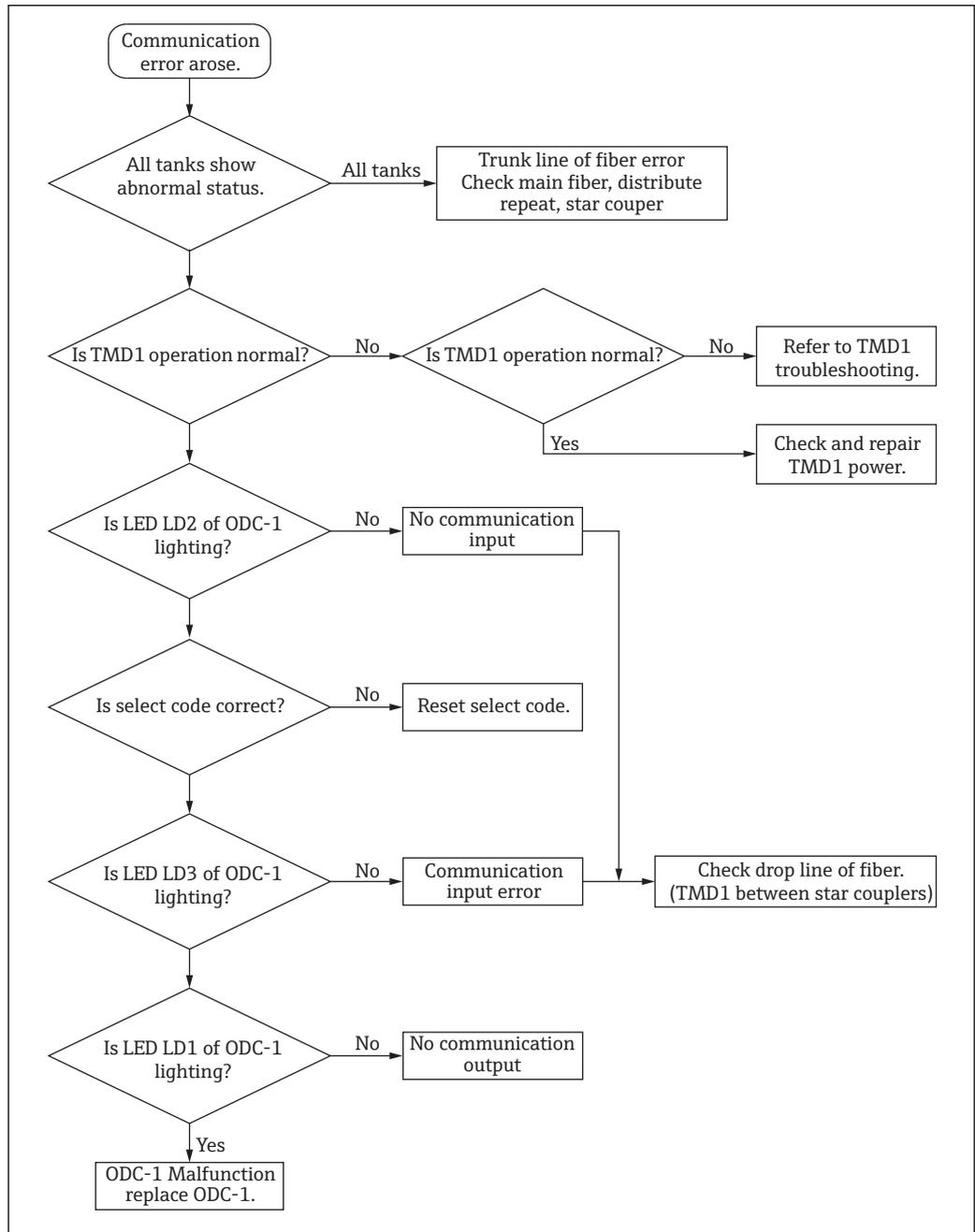
### 5.7.8 Troubleshooting

If there is a communication error, diagnose the problem by referring to the following check points and the attached flowchart. Perform this work by displaying the data and error on the receiver as well as checking TMD1's operation.



A0038086-EN

**Operation diagnosis flowchart**



A0038087-EN

**5.8 Contact input (Status) Exp-A module**

**5.8.1 Module setting**

Refer to "4 Module Installation" for details on installation.

## 5.8.2 Operation confirmation

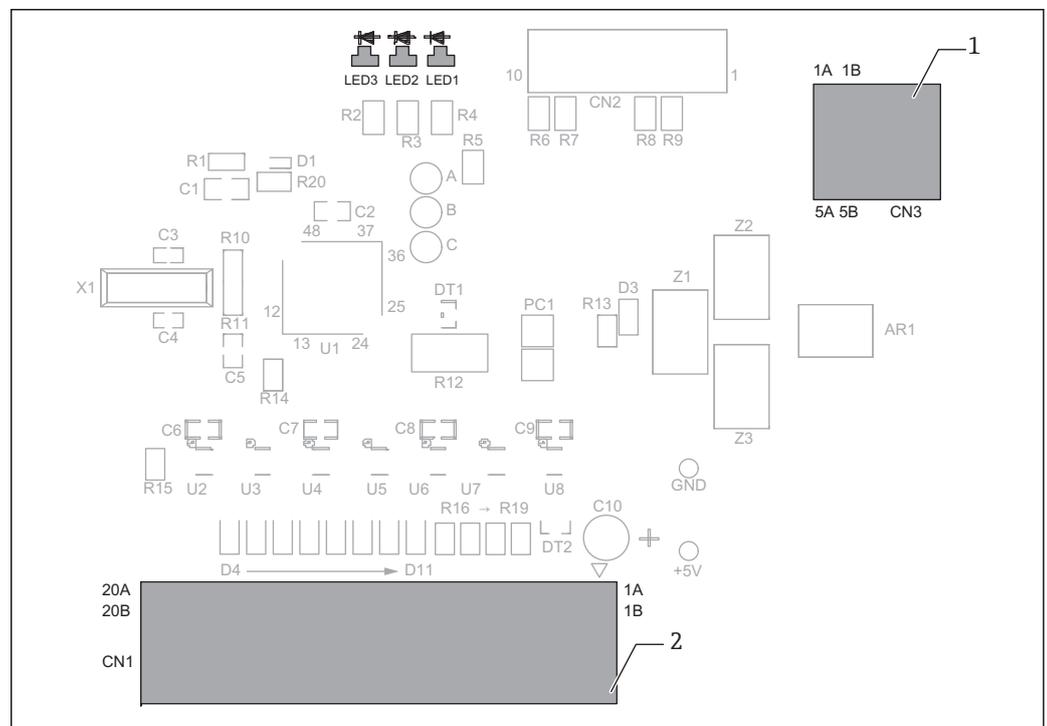
The input signal is set as contact OFF (open) and valid signal (logic "1"). Confirm that the signal can be transmitted properly to a receiver corresponding to SHORT or OPEN at signal input terminal. When checking the HHT2 data address setting, refer to "4.1.7 Contact Input (Status) Operation Confirmation".

## 5.9 DRM9700 communication DRMM-A module

### 5.9.1 Overview

DRMM-A module is used to communicate with tank gauge monitor DRM9700. The level and temperature data can be monitored remotely from TMD1 by using DRM9700 (refer to "DRM9700 Operating Instructions").

### 5.9.2 Module configuration and names



16 DRMM-A Module

1 J1 motherboard connector

2 JA connector for DRM9700

### 5.9.3 Operation confirmation

Confirm that TMD1 level and temperature data match the data displayed on DRM9700. When level data is changing rapidly due to hoisting operation, the display on DRM9700 will be delayed, but this is normal. For details on DRM9700 operation, refer to "DRM9700 Operating Instructions".

### 5.9.4 Operation check by LED

No.	Color	Descriptions
LED1	Green	Lit while TMD1 is operating.
LED2	Red	Flashing when CPU is reset.
LED3	Red	Flashing when receiving data from motherboard.

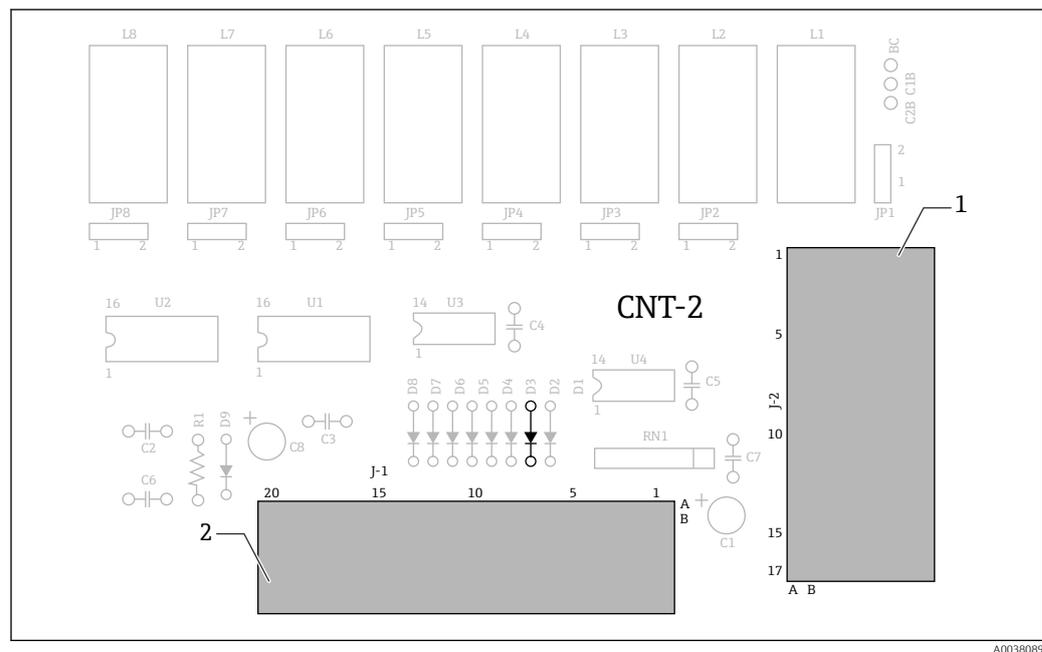
## 5.10 Output for external device operation CNT-2 module

Unless stipulated by law, etc., do not open the lid in energized state in hazardous locations.

### 5.10.1 Overview

CNT-2 module is used to output a relay (latching type) for external device (maximum: 8 points).

### 5.10.2 Module configuration and names



17 CNT-2 Module

- 1 J2 connector for output
- 2 J1 motherboard connector

### 5.10.3 Module setting

Refer to "4 Module Installation" for details on installation.

### 5.10.4 Operation confirmation

For details on each data setting, refer to "MODE: 01 Operation and Display Setting" in HHT2's Operating Instructions.

#### Rating

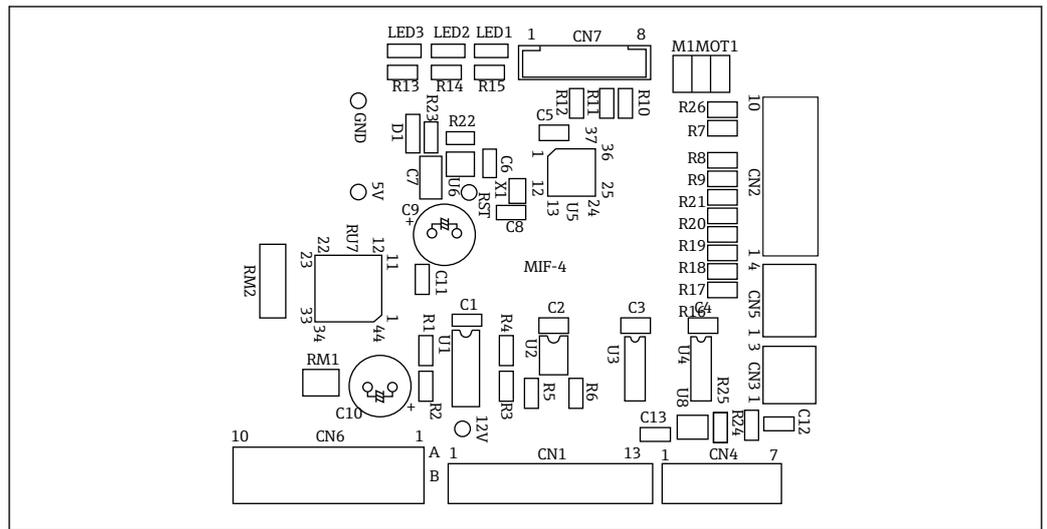
Contact capacity: DC 220 VDC/250 VAC 3 A, 60 W/125 VA

## 5.11 Level A/D conversion MIF4 module

### 5.11.1 Overview

MIF4 module is used for level A/D conversion. This circuit board reads the encoder and counter values, and after converting their values, it transmits the level value to CPU board.

### 5.11.2 Module configuration and names

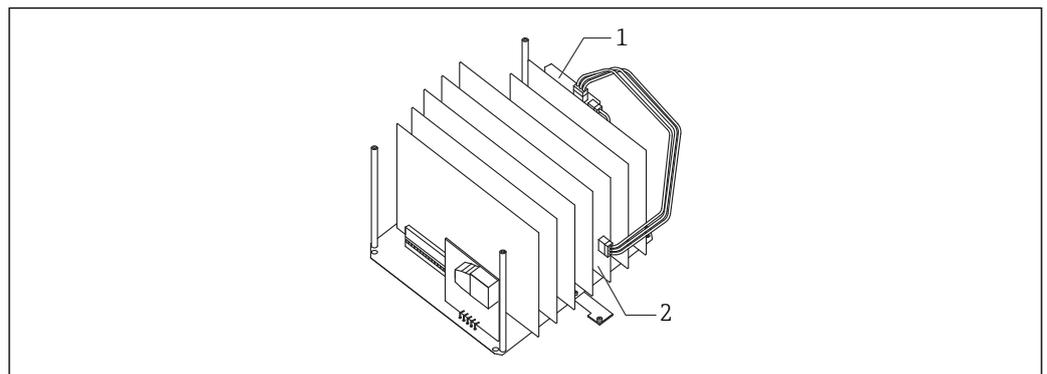


A0038090

18 MIF4 module

### 5.11.3 Module setting

Firmly insert MIF4 module in the MIF4-specific connector on the motherboard and secure the module to a bracket with a M3 screw as shown below.



A0038091

19 Module setting

- 1 MIF4 module
- 2 CPU board

### 5.11.4 Operation check by LED

No.	Color	Descriptions
LED1	Green	Flashing while CPU is operating.
LED2	Red	Lit when there is a counter error (once it occurs, it will last until the main power is cut)
LED3	Red	Lit when a level jumper error occurs (once it occurs, it will last until the main power is cut)

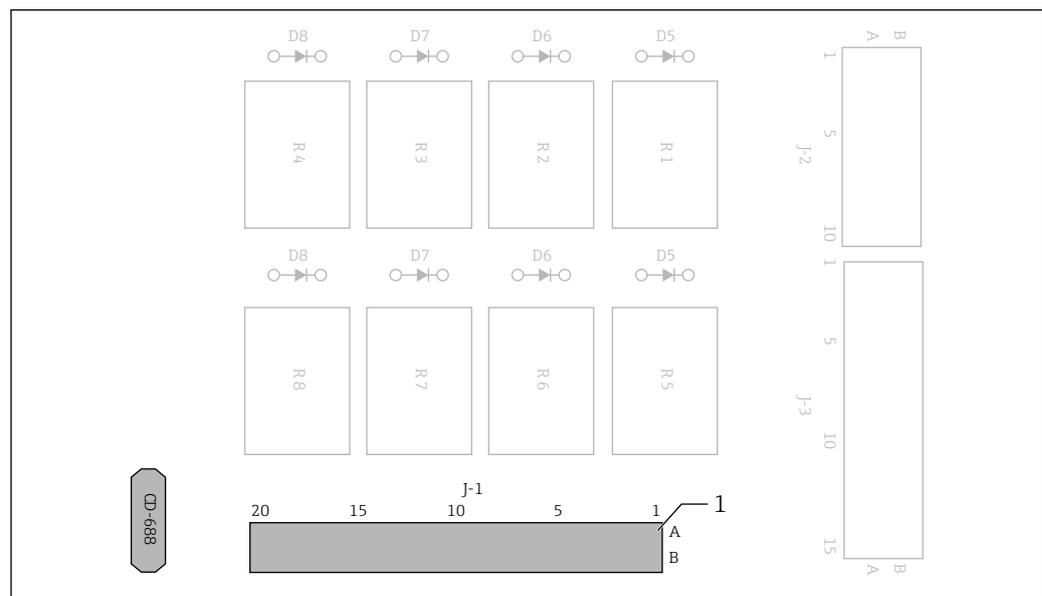
## 5.12 Alarm contact output CD-688 module

Note that the output switches ON/OFF during adjustment and operation confirmation, and the device connected to TMD1 will also operate. If this causes adverse effects on the adjustment or operation, it is recommended to disconnect the cable terminals.

This module is used in combination with Exp-A.

### 5.12.1 Overview

CD-688 is used to output level or temperature alarm. The mechanical relay is used for the output. The output configuration is 4 points. If 5 points or more are needed, contact your Endress+Hauser Sales Center.



A0038092

20 CD-688 module

1 J1 motherboard connector

### 5.12.2 Module setting

Refer to "4 Module Installation" for details on installation.

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