# General Specifications

GS 34M06H46-03E

YHLS Master Modules
YHLS Slave Units
YHLS Communication Cables
(for implementing high-speed remote I/O)

FA-M3

# Contents

YOKOGAWA ◆
Yokogawa Electric Corporation

# General Specifications

YHLS Master Modules
(F3LH01-1N and F3LH02-1N)

**FA-M3**

## General

Yokogawa High-speed Link System (YHLS) Master Module has one or two communication ports to control remote slave units. It allows easy implementation of a 1-to-N high-speed remote I/O system. Up to 32 slave units can be connected to each connector to provide for a total of 2016 I/O points per port (1008 inputs and 1008 outputs).

## Features

- One master module (F3LH02-1N) can be used to configure a remote I/O system of up to 4036 I/O points.
- Each port has two connectors allowing for wiring in two directions.
- Each port can communicate with a maximum of 63 slave units with cycle time of 0.96 ms (at 12 Mbps in full-duplex mode).
- The connector is of 2-piece European type, allowing for easy wire termination work.
- Hides complicated communications protocols from a user during implementation.

## Specifications

| Item | Specifications | |
|---|---|---|
| | **F3LH01-1N** | **F3LH02-1N** |
| **Communications mode** | 4-wire full-duplex or 2-wire half-duplex | |
| **Transmission speed** | 3 Mbps, 6 Mbps or 12 Mbps | |
| **Transmission format** | HLS compliant | |
| **Synchronization** | Bit synchronization | |
| **Transmission distance** | 300 m (at 3 Mbps), 200 m (at 6 Mbps), or 100 m (at 12 Mbps) | |
| **Error detection** | CRC-12 | |
| **Number of ports** | 1 | 2 |
| **Number of connectors** | 2 | 4 |
| **Max. number of slaves per module** | 63[*1] (32 per connector) | 126[*1] (32 per connector) |
| **Number of I/O points per module** | 1008 inputs 1008 outputs | 2016 inputs 2016 outputs |
| **Impedance** | 100 Ω | |
| **Terminating resistor** | Internal[*2] | |
| **Connector type** | European type | |
| **Recommended communication cable** | KM80 and KM81 | |
| **RAS functions** | - Automatic slave unit participation - Reset/hold outputs when CPU stops - Network quality monitoring | |
| **Current consumption** | 360 mA at 5 VDC | 480 mA at 5 VDC |
| **External dimensions** | 28.9 (W) x 100 (H) x 83.2 (D) mm[*3] | |
| **Weight** | 100 g | 105 g |

*1:  One connector can connect to a maximum of 32 slave units (one port supports up to 63 slave units). To connect 63 slave units, connect 32 slaves to one connector 31 slaves to the other connector.
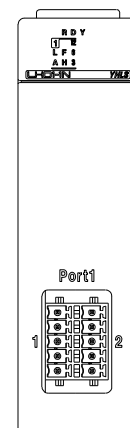
*2:  The master module has a built-in terminating resistor, which must be enabled for terminal stations of the I/O system.

*3:  Excluding protrusions (see External Dimensions for details).

## Components and Functions
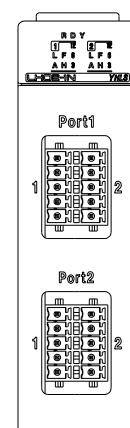
### F3LH01-1N



LED status indicators
RDY: Lit when the internal circuitry is functioning normally.
L     : Lit when communicating with one or more slave units.
A     : Lit on communications error at one or more slave units.
F     : Lit when communicating in full-duplex mode.
H     : Lit when communicating in half-duplex mode.
12    : Lit when communicating at 12 Mbps.
6     : Lit when communicating at 6 Mbps.
3     : Lit when communicating at 3 Mbps.
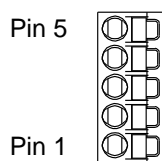
YHLS communication port

### F3LH02-1N



LED status indicators
RDY: Lit when the internal circuitry is functioning normally. (common to both ports 1 and 2)
"1": Indicates Port 1
"2": Indicates Port 2
L     : Lit when communicating with one or more slave units.
A     : Lit on communications error at one or more slave units.
F     : Lit when communicating in full-duplex mode.
H     : Lit when communicating in half-duplex mode.
12    : Lit when communicating at 12 Mbps.
6     : Lit when communicating at 6 Mbps.
3     : Lit when communicating at 3 Mbps.

YHLS Communication port

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## External Connection

### ■ Connector pin assignment

Pin 5

Pin 1

**Front View of the Connector**

**- For full-duplex communication**

| Pin No. | Full-duplex | | |
|---|---|---|---|
| | Symbol | Signal flow | |
| | | Master | Slave |
| 5 | TxD- | → | |
| 4 | TxD+ | → | |
| 3 | RxD- | ← | |
| 2 | RxD+ | ← | |
| 1 | SHIELD | ←→ | |

**- For half-duplex communication**

| Pin No. | Half-duplex | | |
|---|---|---|---|
| | Symbol | Signal flow | |
| | | Master | Slave |
| 5 | NC | | |
| 4 | NC | | |
| 3 | TRD- | ←→ | |
| 2 | TRD+ | ←→ | |
| 1 | SHIELD | ←→ | |

## Connector

2-piece European type, 3.5 mm pitch, spring latch

## Operating Environment

There is no restriction on the type of CPU modules that can be used with this module.

## Environmental Specifications

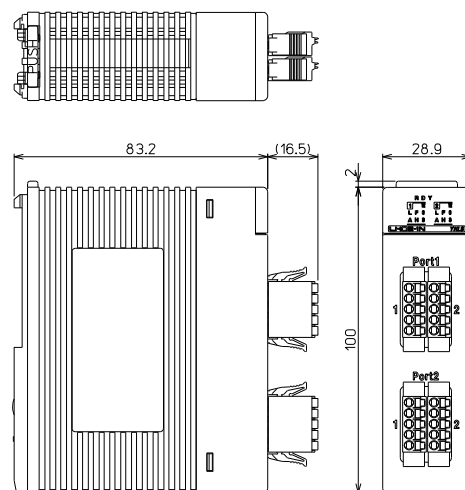| Item | Specifications |
|---|---|
| Operating ambient temperature | 0 to 55°C |
| Operating ambient humidity | 10 to 90% RH (non-condensing) |
| Operating ambient atmosphere | Must of free of corrosive gases, flammable gases and heavy dust |
| Storage ambient temperature | -20 to 75°C |
| Storage ambient humidity | 10 to 90% RH (non-condensing) |

## Model and Suffix Codes

| Model | Suffix Code | Style Code | Option Code | Description |
|---|---|---|---|---|
| F3LH01 | -1N | ... | ... | 12 Mbps max. 1 YHLS port (2 connectors) (connectors are included) |
| F3LH02 | -1N | ... | ... | 12 Mbps max. 2 YHLS ports (4 connectors) (connectors are included) |

## External Dimensions

### F3LH01-1N
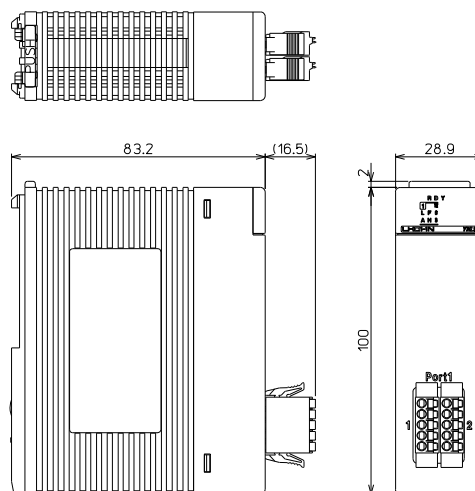


### F3LH02-1N

# General Specifications
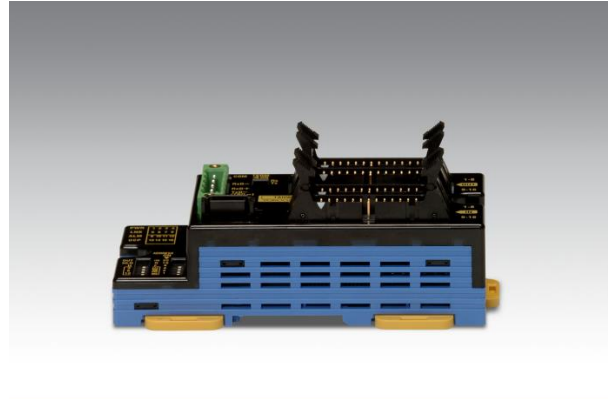
YHLS Slave Units
(TAH Series)

FA-M3

## General

The TAH series of the YHLS slave units are remote I/O units to be connected to and controlled by the YHLS master module (F3LH0□-1N). Up to 63 slave units can be connected to each port of the master module.
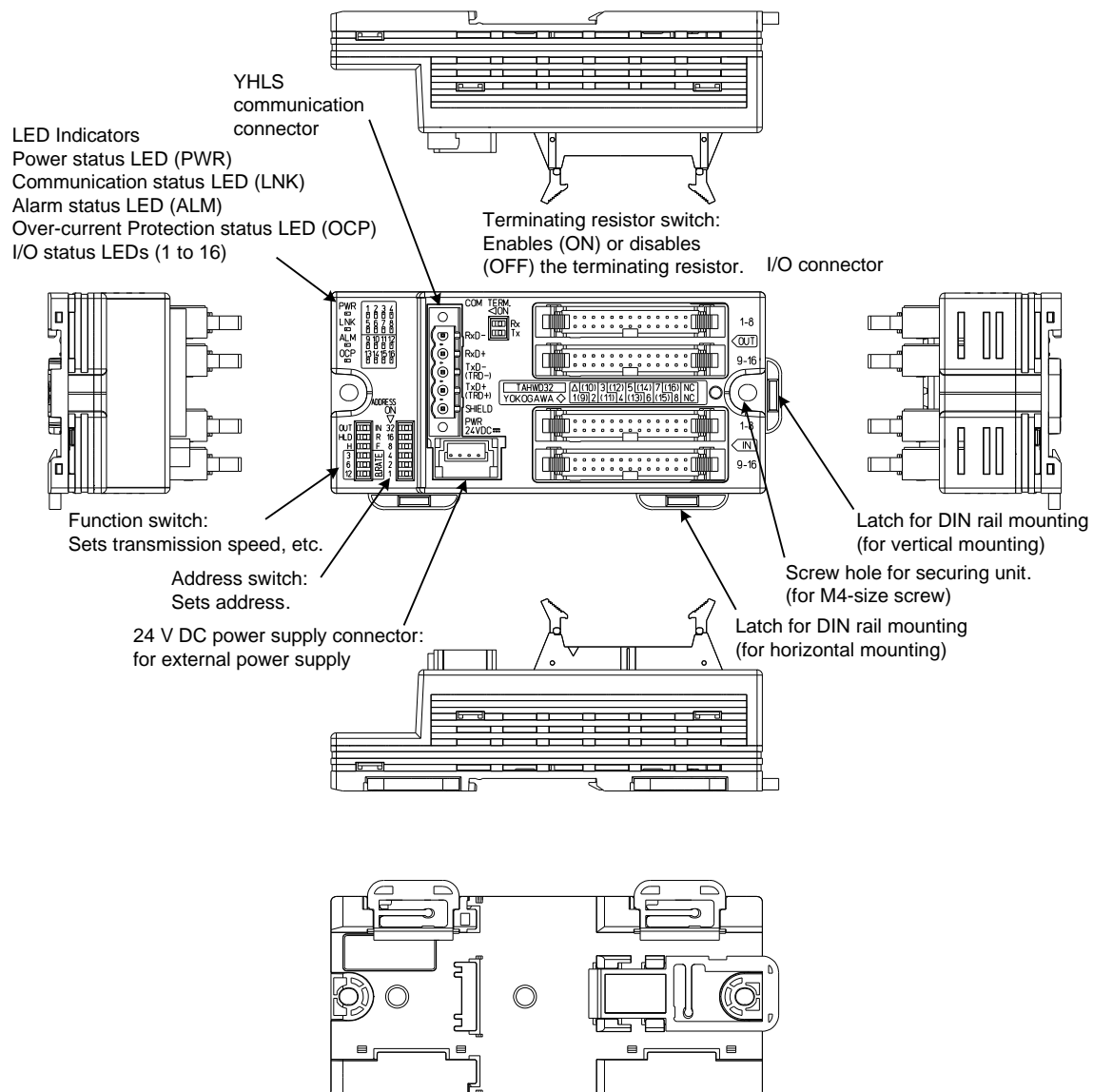
- 16-point and 32-point slave unit models are of the same size.
- I/O power supply is allocated to signals of the contact inputs and outputs. 3-wire sensors can be directly connected.
- The communication connector is of 2-piece European type (terminal block) allowing for insertion and removal of live wires.
- The short-circuit protector of the I/O power supply cuts off the voltage (current) in the event of a short circuit.
- The over-current protector and overheat protector protect against load short-circuit by cutting off the current.

The TAH series of the YHLS slave units include the following models:

- TAHWD32-3PAM
  (16 positive common inputs and 16 sink-type outputs)
- TAHWD32-3NBM
  (16 negative common inputs and 16 source-type outputs)
- TAHXD16-3PEM
  (16 positive common inputs)
- TAHXD16-3NEM
  (16 negative common inputs)
- TAHYD16-3EAM
  (16 sink-type outputs)
- TAHYD16-3EBM
  (16 source-type outputs)

# Components and Functions

YHLS communication connector

LED Indicators
Power status LED (PWR)
Communication status LED (LNK)
Alarm status LED (ALM)
Over-current Protection status LED (OCP)
I/O status LEDs (1 to 16)

Terminating resistor switch:
Enables (ON) or disables (OFF) the terminating resistor.

I/O connector

Function switch:
Sets transmission speed, etc.

Address switch:
Sets address.

24 V DC power supply connector:
for external power supply

Latch for DIN rail mounting (for vertical mounting)

Screw hole for securing unit.
(for M4-size screw)

Latch for DIN rail mounting (for horizontal mounting)

## LED Indicators

| LED Label (color) | LED Name | Description |
|---|---|---|
| PWR (green) | Power supply status LED | Lit when power supply is on. [*1] <br> Not lit when power supply is off. |
| LNK (green) | Communication status LED | Lit when the slave is communicating. <br> Not lit when there is no communication. |
| ALM (yellow) | Alarm status LED | Lit when there is a communication error. <br> Not lit when the slave is communicating normally or has never participated in communication. [*2] |
| OCP (red) | Over-current protection status LED | Normally not lit. <br> Lit when the short-circuit protector is activated. |
| 1−16 (red) | I/O status LED | IN1 to IN16     : Lit when an input is on. <br>                  Not lit when an input is off or open. <br> OUT1 to OUT16 : Lit when an output is on. <br>                  Not lit when an output is off. |

*1: The PWR LED is not lit when the supplied voltage is 15 VDC or lower but lit when the supplied voltage is 19.5 V DC or higher.
*2: The ALM LED does not light up if the LNK LED has never been lit after the unit is powered on.

## Switch Setup

### ● Address switch

| Settings | Meaning | Label | | Label | Meaning |
|---|---|---|---|---|---|
| Address setup[*3] | Address value 32 | 32 | ←→ | – | Off |
| | Address value 16 | 16 | ←→ | – | Off |
| | Address value 8 | 8 | ←→ | – | Off |
| | Address value 4 | 4 | ←→ | – | Off |
| | Address value 2 | 2 | ←→ | – | Off |
| | Address value 1 | 1 | ←→ | – | Off |

*3: The address of a slave unit is the sum total of the address values of the enabled switches. Slave address value 0 is not allowed.

### ● Function switch

| Settings | Meaning | Label | | Label | Meaning |
|---|---|---|---|---|---|
| I/O LED display [*4] | Display output statuses | OUT | ←→ | IN | Display input statuses |
| Hold/reset output on communications error[*5] | Hold | HLD | ←→ | R | Reset |
| Communications mode | Half duplex on 2-wire system | H | ←→ | F | Full duplex on 4-wire system |
| Transmission speed (Only one of the bits can be selected) | 3 Mbps | 3 | ←→ | | |
| | 6 Mbps | 6 | ←→ | B.RATE | |
| | 12 Mbps | 12 | ←→ | | |

*4: Applicable to TAHWD32-3□□M only.
*5: Applicable to TAHYD16-3E□M and the outputs of TAHWD32-3□□M only.

### ● Terminating resistor switch

| Settings | Meaning | Label | | Label | Meaning |
|---|---|---|---|---|---|
| Terminating resistor on Rx side[*6] | Terminating resistor of receiving side of 4-wire system (full duplex) is turned on. | – | ←→ | Rx | Off |
| Terminating resistor on Tx side[*6] | Terminating resistor of transmission/ receiving side of 2-wire (half duplex) or terminating resistor of transmission side of 4-wire (full duplex) system is turned on. | – | ←→ | Tx | Off |

*6: The resistance of the terminating resistor is 100 Ω.

## Specifications

### ■ Common Specifications

| Item | Specifications |
|---|---|
| Operating ambient temperature | 0 to 55°C |
| Operating ambient humidity | 10 to 90% RH (non-condensing) |
| Operating ambient atmosphere | Must of free of corrosive gases, flammable gases and heavy dust |
| Storage ambient temperature | -20 to 70°C |
| Storage ambient humidity | 10 to 90% RH (non-condensing) |
| Cooling method | Natural air-cooling |
| Mounting[*1] | Direct mounting with M4-size setscrews or DIN-rail mounting |
| Structure | Designed for mounting inside a panel enclosure |
| Altitude of installation | 2000 m max. above sea level |
| Mounting direction | X, Y and Z directions. For details, see Section 7.2, "Orientation, Separation and Ambient Temperature Requirements for Cluster Mounting," of User's Manual. |
| Vibration resistance[*2] | Tested in compliance with JIS C60068-2-6 under the following conditions:<br>- Frequency ranges: 10 to 57 Hz with an amplitude of 0.075 mm<br> 57 to 150 Hz with an acceleration of 9.8 m/s2 (1 G)<br>- Direction and sweep cycles: 10 times each in the X, Y, and Z directions |
| Shock resistance[*2] | Tested in compliance with JIS C60068-2-27 under the following conditions:<br>- Direction and sweep cycles: 3 times each in the X, Y, and Z directions with an acceleration of 147 m/s$^2$ |
| External dimensions | See "External Dimensions." |
| Insulation resistance | 1 MΩ min. when tested between the power supply circuit and the communication terminals using a 500 VDC insulation resistance tester |
| Withstanding voltage | 500 V AC for one minute between the power supply circuit and communication terminals. |

*1: Compatible DIN rails are TH35-7.5AI and TH35-7.5Fe (JIS C 2812-compliant).
*2: When mounting on a DIN rail, secure the unit using metal stoppers to prevent it from moving.

## ■ I/O Units

| | Item | | TAHWD32-3PAM | TAHWD32-3NBM |
|---|---|---|---|---|
| **Power supply block, etc.** | Power supply voltage [1] (P24Vin) | | 24 VDC | 24 VDC |
| | Power supply voltage range | | 20.4 to 26.4 VDC | 20.4 to 26.4 VDC |
| | Current consumption | | P24Vin:          3.3 A (max.)<br>P24Vout:         3.2 A (max.)<br>Internal circuitry:    0.1 A (max.) | P24Vin:          3.3 A (max.)<br>P24Vout:         1.6 A (max.)<br>Internal circuitry:    0.1 A (max.) |
| | Short-circuit protector for I/O power supply [2] | | Short-circuit protection threshold current across P24Vout-N24Vout: 3.9 A to 5.5 A<br>4.4±0.2 A (at 25℃) | Short-circuit protection threshold current across P24Vout-N24Vout: 2.0 A to 2.7 A<br>2.2±0.2 A (at 25℃) |
| | Weight | | 145 g | 145 g |
| **Input block** | Input type | | DC voltage (positive common) | DC voltage (negative common) |
| | Number of points | | 16 | 16 |
| | Common line type | | 16 points/common | 16 points/common |
| | Isolation method | | Photocoupler isolation | Photocoupler isolation |
| | Rated input voltage | | 24 VDC | 24 VDC |
| | Operating voltage range | | 20.4 to 26.4 VDC | 20.4 to 26.4 VDC |
| | Rated input current | | 4.1 mA/point (24V DC) | 4.1 mA/point (24V DC) |
| | I/O power supply [3] (P24Vout) | Voltage | P24Vin ‐ 0.5V | P24Vin ‐ 0.5V |
| | | Current | 0.1 A/point, 1.6 A/common | 0.1 A per point, 1.6 A per common [4] |
| | Maximum ratio of inputs turned on simultaneously | | 75%   (0 to 55℃)<br>100% (0 to 40℃) | 75%   (0 to 55℃)<br>100% (0 to 40℃) |
| | Input impedance | | 5.9 kΩ | 5.9 kΩ |
| | Operating voltage /current | ON | 16.0 VDC min.<br>3.2 mA min. | 16.0 VDC min.<br>3.2 mA min. |
| | | OFF | 5.8 VDC max.<br>0.9 mA max. | 5.8 VDC max.<br>0.9 mA max. |
| | Response time | OFF→ON | 1.0 ms max. | 1.0 ms max. |
| | | ON→OFF | 1.0 ms max. | 1.0 ms max. |
| | Interrupt | | None | None |
| | Input connector | | Two 26-pin MIL-type connectors | Two 26-pin MIL-type connectors |
| | Input display [5] | | LED (Lit when input is turned on) | LED (Lit when input is turned on) |
| **Output block** | Output type | | Transistor contact (sink-type) | Transistor contact (source type) |
| | Protectors | Short-circuit protector | Limits short-circuit current when error is detected. | Limits short-circuit current when error is detected. |
| | | Overheat protector | Shuts off output when error is detected. | Shuts off output when error is detected. |
| | Surge protector [6] | | Active clamp | Active clamp |
| | Number of points | | 16 | 16 |
| | Common line type | | 16 points/common | 16 points/common |
| | Isolation method | | Photocoupler isolation | Photocoupler isolation |
| | Rated load voltage | | 24 VDC | 24 VDC |
| | I/O power supply [3] (P24Vout) | Voltage | P24Vin ‐ 0.5 V [6] | P24Vin ‐ 0.5V [6] |
| | | Current | 0.1A/point, 1.6A/common | ‐ [4] |
| | Maximum load current | | 0.1A/point, total 1.2 A (0 to 55℃)<br>0.1A/point, total 1.6 A (0 to 40℃) | 0.1A/point, total 1.2 A (0 to 55℃)<br>0.1A/point, total 1.6 A (0 to 40℃) |
| | Response time | OFF→ON | 1 ms max. | 1 ms max. |
| | | ON→OFF | 1 ms max. | 1 ms max. |
| | ON voltage | | 0.5 VDC max. | 0.5 VDC max. |
| | Off-time leak current | | 0.1 mA max. | 0.1 mA max. |
| | Output connector | | Two 26-pin MIL-type connectors | Two 26-pin MIL-type connectors |
| | Output status at YHLS communications failure or when program stops | | Configurable globally on per unit basis using a DIP switch<br>HLD:HOLD, R: RESET (Shutdown) | Configurable globally on per unit basis using a DIP switch<br>HLD:HOLD, R: RESET (Shutdown) |
| | Output display [5] | | LED (lit when output is turned on) | LED (lit when output is turned on) |
| **Communications block** | Communications mode | | 4-wire full-duplex, 2-wire half-duplex | |
| | Transmission speed | | 3 Mbps, 6 Mbps or 12 Mbps | |
| | Synchronization | | Bit synchronization | |
| | Error detection | | CRC-12 | |
| | Maximum total transmission distance | | 300 m (at 3 Mbps), 200 m (at 6 Mbps) or 100 m (at 12 Mbps) | |
| | Number of connected units | | 63 units max. per port  (32 units per connector) | |
| | Connection method | | Daisy-chain connection | |
| | Impedance | | 100 Ω | |
| | Terminating resistor | | Internal resistor can be enabled or disabled using a switch | |
| | Communication connector | | European-type terminal block | |
| | Recommended cables | | KM80 and KM81 | |
| | Number of slave addresses required | | 1 | |

*1: Use a dedicated power supply for the TAH series with an internal noise filter. A ferrite core should be fitted on the power cable.

*2: The current threshold value for activating the short-circuit protector varies with the ambient temperature. The threshold value is larger at higher temperatures and smaller at lower temperatures.

*3: The external power supply to the P24Vin pin is passed through a diode and a short-circuit detection circuit before its output at the I/O power supply (P24Vout) pin. This causes a voltage drop of about 0.5 V.

*4: For TAHWD32-3NBM, the I/O power supply for the input block and the I/O power supply for the output block add up to 1.6 A. If the I/O current supply exceeds the range of 2.0 to 2.7 A, the short-circuit protector will be activated.

*5: The contact operation of the output block of the circuit and the LED indicators operate independently and thus may be inconsistent in the event of an error.

*6: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the unit's output terminal voltage will not exceed the specified operating load voltage range.

## ∎ Input Units

| | Item | TAHXD16-3PEM | TAHXD16-3NEM |
|---|---|---|---|
| **Power supply block, etc.** | Power supply voltage *1 (P24Vin) | 24 VDC | 24 VDC |
| | Power supply voltage range | 20.4 to 26.4 VDC | 20.4 to 26.4 VDC |
| | Current consumption | P24Vin:  1.7 A (max.)<br>P24Vout:  1.6 A (max.)<br>Internal circuitry:  0.1 A (max.) | P24Vin:  1.7 A (max.)<br>P24Vout:  1.6 A (max.)<br>Internal circuitry:  0.1 A (max.) |
| | Short-circuit protector for I/O power supply *2 | Short-circuit protection threshold current across P24Vout-N24Vout: 2.0 A to 2.7 A<br>2.2±0.2 A (at 25°C) | Short-circuit protection threshold current across P24Vout-N24Vout: 2.0 A to 2.7 A<br>2.2±0.2 A (at 25°C) |
| | Weight | 130 g | 130 g |
| **Input block** | Input type | DC voltage (positive common) | DC voltage (negative common) |
| | Number of points | 16 | 16 |
| | Common line type | 16 points/common | 16 points/common |
| | Isolation method | Photocoupler isolation | Photocoupler isolation |
| | Rated input voltage | 24 VDC | 24 VDC |
| | Operating voltage range | 20.4 to 26.4 VDC | 20.4 to 26.4 VDC |
| | Rated input current | 4.1 mA/point (24V DC) | 4.1 mA/point (24V DC) |
| | I/O power supply *3 (P24Vout) — Voltage | P24Vin − 0.5V | P24Vin − 0.5V |
| | I/O power supply *3 (P24Vout) — Current | 0.1 A/point, 1.6 A/common | 0.1 A per point, 1.6 A per common |
| | Maximum ratio of inputs turned on simultaneously | 100% | 100% |
| | Input impedance | 5.9 kΩ | 5.9 kΩ |
| | Operating voltage /current — ON | 16.0 VDC min.<br>3.2 mA min. | 16.0 VDC min.<br>3.2 mA min. |
| | Operating voltage /current — OFF | 5.8 VDC max.<br>0.9 mA max. | 5.8 VDC max.<br>0.9 mA max. |
| | Response time — OFF→ON | 1.0 ms max. | 1.0 ms max. |
| | Response time — ON→OFF | 1.0 ms max. | 1.0 ms max. |
| | Interrupt | None | None |
| | Input connector | Two 26-pin MIL-type connectors | Two 26-pin MIL-type connectors |
| | Input display *4 | LED (Lit when input is turned on) | LED (Lit when input is turned on) |
| **Communications block** | Communications mode | 4-wire full-duplex, 2-wire half-duplex | |
| | Transmission speed | 3 Mbps, 6 Mbps or 12 Mbps | |
| | Synchronization | Bit synchronization | |
| | Error detection | CRC-12 | |
| | Maximum total transmission distance | 300 m (at 3 Mbps), 200 m (at 6 Mbps) or 100 m (at 12 Mbps) | |
| | Number of connected units | 63 units max. per port  (32 units per connector) | |
| | Connection method | Daisy-chain connection | |
| | Impedance | 100 Ω | |
| | Terminating resistor | Internal resistor can be enabled or disabled using a switch | |
| | Communication connector | European-type terminal block | |
| | Recommended cables | KM80 and KM81 | |
| | Number of slave addresses required | 1 | |

*1: Use a dedicated power supply for the TAH series with an internal noise filter. A ferrite core should be fitted on the power cable.

*2: The current threshold value for activating the short-circuit protector varies with the ambient temperature. The threshold value is larger at higher temperatures and smaller at lower temperatures.

*3: The external power supply to the P24Vin pin is passed through a diode and a short-circuit detection circuit before its output at the I/O power supply (P24Vout) pin. This causes a voltage drop of about 0.5 V.

*4 The contact operation of the output block of the circuit and the LED indicators operate independently and thus may be inconsistent in the event of an error.

## ■ Output Units

| Item | | | TAHYD16-3EAM | TAHYD16-3EBM |
|---|---|---|---|---|
| **Power supply block, etc.** | Power supply voltage *1 (P24Vin) | | **24 VDC** | **24 VDC** |
| | Power supply voltage range | | **20.4 to 26.4 VDC** | **20.4 to 26.4 VDC** |
| | Current consumption | | **P24Vin:** 1.7 A (max.)<br>**P24Vout:** 1.6 A (max.)<br>**Internal circuitry:** 0.1 A (max.) | **P24Vin:** 1.7 A (max.)<br>**P24Vout:** 1.6 A (max.)<br>**Internal circuitry:** 0.1 A (max.) |
| | Short-circuit protector for I/O power supply *2 | | **Short-circuit protection threshold current across P24Vout-N24Vout: 2.0 A to 2.7 A 2.2±0.2 A (at 25°C)** | **Short-circuit protection threshold current across P24Vout-N24Vout: 2.0 A to 2.7 A 2.2±0.2 A (at 25°C)** |
| | Weight | | **130 g** | **130 g** |
| **Output block** | Output type | | **Transistor contact (sink-type)** | **Transistor contact (source type)** |
| | Protectors | Short-circuit protector | **Limits short-circuit current when error is detected.** | **Limits short-circuit current when error is detected.** |
| | | Overheat protector | **Shuts off output when error is detected.** | **Shuts off output when error is detected.** |
| | Surge protector *5 | | **Active clamp** | **Active clamp** |
| | Number of points | | **16** | **16** |
| | Common line type | | **16 points/common** | **16 points/common** |
| | Isolation method | | **Photocoupler isolation** | **Photocoupler isolation** |
| | Rated load voltage | | **24 VDC** | **24 VDC** |
| | I/O power supply *3 (P24Vout) | Voltage | **P24Vin - 0.5 V** | **P24Vin - 0.5 V** |
| | | Current | **0.1 A/point, 1.6 A/common** | **0.1 A/point, 1.6 A/common *6** |
| | Maximum load current | | **0.1 A/point, total 1.6 A** | **0.1 A/point, total 1.6 A *6** |
| | Response time | OFF→ON | **1 ms max.** | **1 ms max.** |
| | | ON→OFF | **1 ms max.** | **1 ms max.** |
| | ON voltage | | **0.5 VDC max.** | **0.5 VDC max.** |
| | Off-time leak current | | **0.1 mA max.** | **0.1 mA max.** |
| | Output connector | | **Two 26-pin MIL-type connectors** | **Two 26-pin MIL-type connectors** |
| | Output status at YHLS communications failure or when program stops | | **Configurable globally on per unit basis using a DIP switch HLD:HOLD, R: RESET (Shutdown)** | **Configurable globally on per unit basis using a DIP switch HLD:HOLD, R: RESET (Shutdown)** |
| | Output display *4 | | **LED (lit when output is turned on)** | **LED (lit when output is turned on)** |
| **Communications block** | Communications mode | | **4-wire full-duplex, 2-wire half-duplex** | |
| | Transmission speed | | **3 Mbps, 6 Mbps or 12 Mbps** | |
| | Synchronization | | **Bit synchronization** | |
| | Error detection | | **CRC-12** | |
| | Maximum total transmission distance | | **300 m (at 3 Mbps), 200 m (at 6 Mbps) or 100 m (at 12 Mbps)** | |
| | Number of connected units | | **63 units max. per port (32 units per connector)** | |
| | Connection method | | **Daisy-chain connection** | |
| | Impedance | | **100 Ω** | |
| | Terminating resistor | | **Internal resistor can be enabled or disabled using a switch** | |
| | Communication connector | | **European-type connector** | |
| | Recommended cables | | **KM80 and KM81** | |
| | Number of slave addresses required | | **1** | |

*1: Use a dedicated power supply for the TAH series with an internal noise filter. A ferrite core should be fitted on the power cable.

*2: The current threshold value for activating the short-circuit protector varies with the ambient temperature. The threshold value is larger at higher temperatures and smaller at lower temperatures.

*3: The external power supply to the P24Vin pin is passed through a diode and a short-circuit detection circuit before its output at the I/O power supply (P24Vout) pin. This causes a voltage drop of about 0.5 V.

*4: The contact operation of the output block of the circuit and the LED indicators operate independently and thus may be inconsistent in the event of an error.

*5: If an inductive load, such as a relay, is to be connected, a surge protector is also required on the load side. Connect a surge protector or a diode across the load nearby so that the unit's output terminal voltage will not exceed the specified operating load voltage range.

*6: The maximum load current is 1.6 A including the I/O current supply.

## CAUTION

● **Operation of the protectors**

The I/O power supply (P24Vout, N24Vout) terminals are output terminals for supplying current to connected I/O instruments. Never connect these terminals to an external power supply. Doing so may damage the internal circuitry.

The short-circuit protector for the I/O power supply (P24Vout) and the output protectors operate independently (the former may not be activated even if the latter is activated).

● **Operation of the short-circuit protector for the I/O power supply (P24Vout)**

- If a short-circuit occurs, or if the current flowing through P24Vout exceeds the short-circuit current threshold, the short-circuit protector is activated to cut off current flow to the P24Vout terminal.
- When the short-circuit protector is activated, the OCP (Over Current Protection) LED is lit and the slave unit is withdrawn from communications. (If this occurs during communications, the LNK LED goes off and the ALM LED is lit).
- When a slave unit is withdrawn from communications, its contact outputs are either shutdown (turned off) or held depending on whether its DIP switch is set to HOLD or RESET. You should implement measures outside the PLC to ensure safe system operation even under such situations.
- Once the short-circuit condition is removed, current supply to the P24Vout is resumed, and at the same time, the OCP goes off and communications is restored to normal. (LNK LED is lit, while ALM LED goes off)
- You can check internal registers (Alive Slave List) of the master module to determine which slaves are participating in or withdrawn from YHLS communication.

● **Operation of the output protectors**

- If a short-circuit occurs, the ON voltage increases and the short-circuit current is limited within the range 1-3 A.
- Once the short-circuit condition disappears, output behavior is restored to normal.
- If the short-circuit condition continues, the temperature of the output element increases due to the short-circuit current. If the temperature reaches approx. 160°C, the overheat protector will be activated and will shut down the output.
- If the temperature drops by approx. 10°C after the overheat protector had been activated, the output is restored.
- The overheat protector is not activated as long as there is no short-circuit condition and the unit is operated normally within its specifications.
- For sink-type outputs, the short-circuit and overheat protectors protect outputs individually. For source-type outputs, however, the short-circuit protector protects outputs individually but the overheat protector protects outputs in pairs (OUT1 and OUT2; OUT3 and OUT4; OUT5 and OUT6; OUT7 and OUT8; OUT9 and OUT10; OUT11 and OUT12; OUT13 and OUT14; OUT15 and OUT16). If any output of a pair is overheated, both outputs are shut down. Under some short-circuit conditions, the overheat protector may shut down not only the associated output but also other outputs.
- Both the short-circuit protector and overheat protector are designed to protect the output elements of the module against short-term short-circuit conditions. Never leave the module in prolonged short-circuit condition. Otherwise, the module enclosure may deteriorate or the PCB may be discolored.

● **24 V DC power supply**

- Use a dedicated 24V DC power supply for the TAH series. Avoid sharing power with other equipment.
- The power supply should incorporate an internal noise filter.
- A ferrite core should be fitted on the power cable.

## Circuit Diagrams

■ **Power supply circuit (common to all slave units)**

YHLS slave unit

```
DC24V    +    1/P24Vin                    ▶|
 ⎓            2/P24Vin                         ┬                Isolation    5V   Internal    Error
         -    3/N24Vin                         ⊥                DC/DC        SG   circuitry   display
              4/N24Vin
                                                                                              Com-
                              ▼                                                               munica-
                                                                                              tion
                              ⌇   Over-                                                       I/F
                                  current        Photo-
                              FET detection      coupler      Error notification
                                  circuit
                                                                                     P24Vout
                                                                                     N24Vout
```
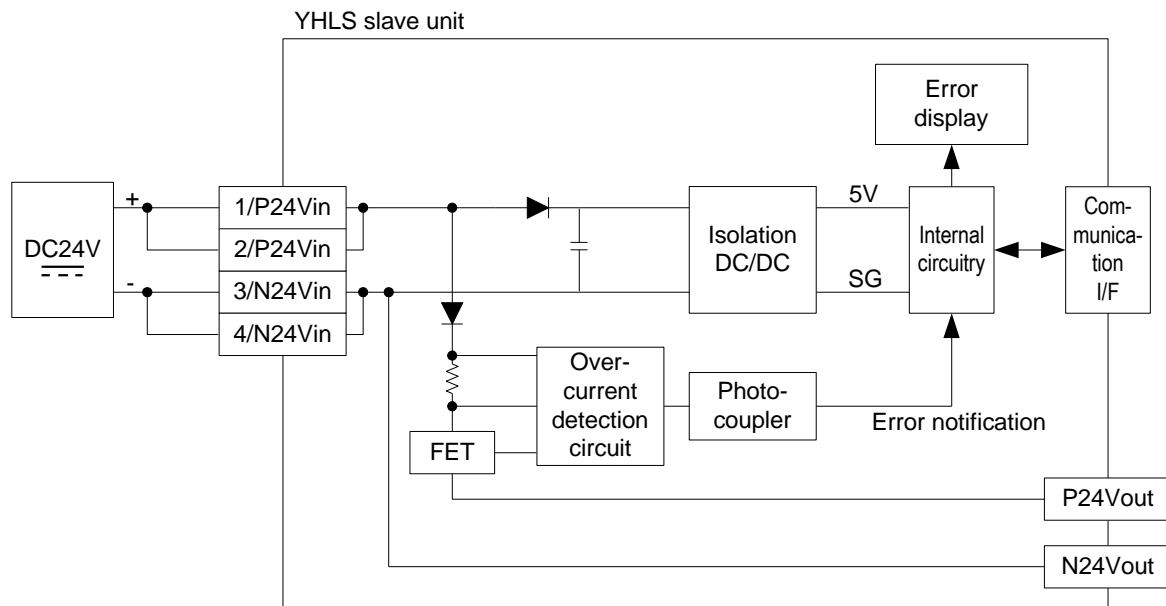
## ■ Input circuits

### (1) Positive input common

#### TAHWD32-3PAM and TAHXD16-3PEM
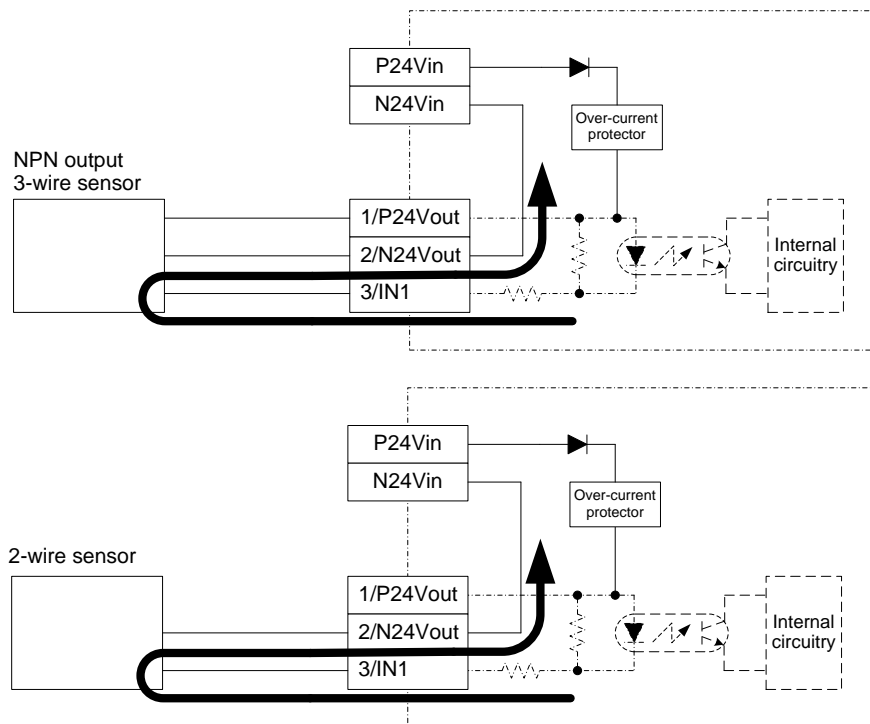


### (2) Negative input common

#### TAHWD32-3NBM and TAHXD16-3NEM
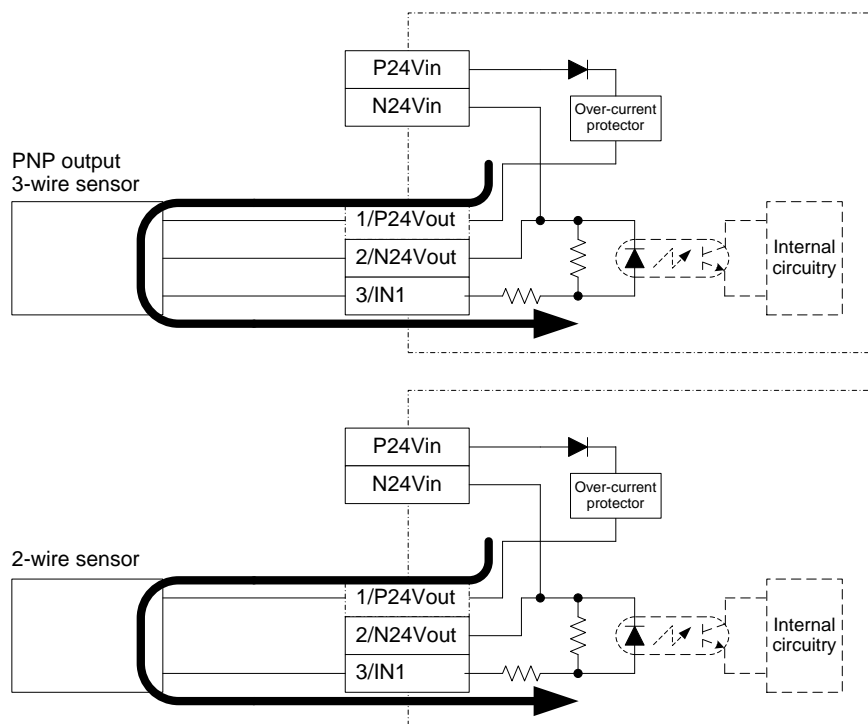
## ■ Output circuits

### (1) Sink-type output
**TAHWD32-3PAM and TAHYD16-3EAM**

Indicator
lamps

| | |
|---|---|
| P24Vin | |
| N24Vin | |

Over-current
protector — 1/P24Vout — +

Step-down
circuit

Internal
circuitry

MosFET (Nch)
(short-circuit
protector) — 3/OUT1 — Individual lines

2/N24Vout
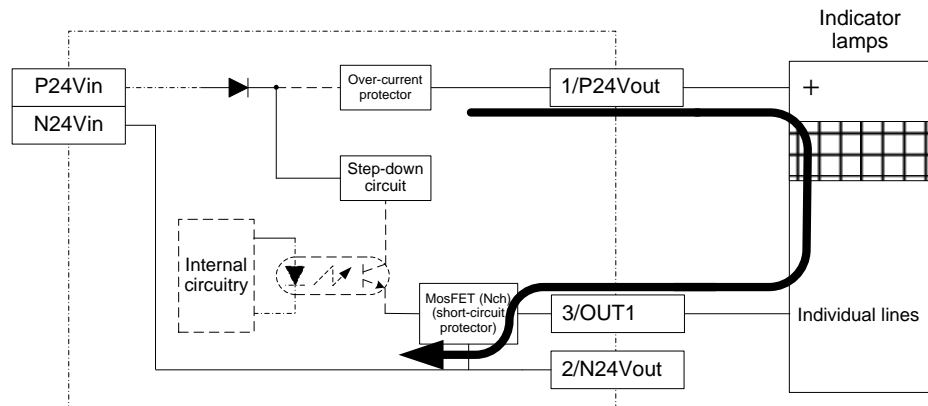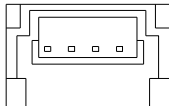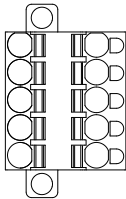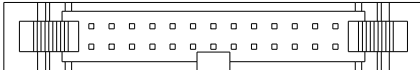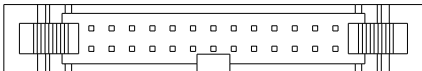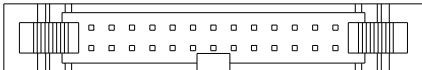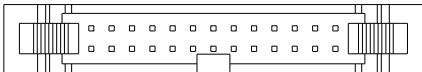
### (2) Source-type output
**TAHWD32-3NBM and TAHYD16-3EBM**

Indicator
lamps

| | |
|---|---|
| P24Vin | |
| N24Vin | |

Over-current
protector — 1/P24Vout

Step-down
circuit

Internal
circuitry

MosFET (Pch)
(short-circuit
protector) — 3/OUT1 — Individual lines

2/N24Vout — -
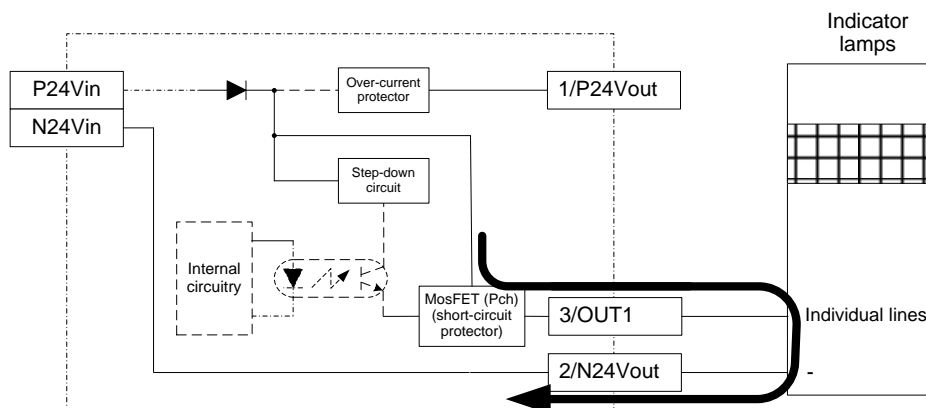
## Pin Assignment

| Component | Description | YHLS Slave Units |
|---|---|---|
| 24 V DC power supply connector (PWR 24V DC) | Pin 1    Pin 4<br><br>| Pin# | Symbol |<br>\|---\|---\|<br>\| 4 \| N24Vin [*1] \|<br>\| 3 \| N24Vin [*1] \|<br>\| 2 \| P24Vin [*1] \|<br>\| 1 \| P24Vin [*1] \|<br><br>See the table "Power Supply Connectors on Cable" below for recommended connectors. | TAHWD32-3PAM<br>TAHWD32-3NBM<br>TAHXD16-3PEM<br>TAHXD16-3NEM<br>TAHYD16-3EAM<br>TAHYD16-3EBM |
| YHLS communication connector (COM) | Pin 5 ... Pin 1<br><br>| Pin# | 4-wire, full-duplex | 2-wire, half-duplex |<br>\|---\|---\|---\|<br>\| 5 \| RxD− \| NC \|<br>\| 4 \| RxD+ \| NC \|<br>\| 3 \| TxD− \| TRD− \|<br>\| 2 \| TxD+ \| TRD+ \|<br>\| 1 \| SHIELD \| SHIELD \|<br><br>See the table "Communication Connectors on Cable" below for recommended connectors. | TAHWD32-3PAM<br>TAHWD32-3NBM<br>TAHXD16-3PEM<br>TAHXD16-3NEM<br>TAHYD16-3EAM<br>TAHYD16-3EBM |
| Output interface connector for 8-output connector (OUT 1 to 8) | Pin 2 ... Pin 26 / Pin 1 ... Pin 25<br><br>See table below.<br><br>See the table "I/O Connectors (MIL) on Cable" below for recommended connectors. | TAHWD32-3PAM<br>TAHWD32-3NBM<br>TAHYD16-3EAM<br>TAHYD16-3EBM |

Output interface connector pin table:

| Pin# | Symbol | Pin# | Symbol |
|---|---|---|---|
| 26 | N.C. [*4] | 25 | N.C. [*4] |
| 24 | OUT8 | 23 | N24Vout [*3] |
| 22 | P24Vout [*2] | 21 | OUT7 |
| 20 | N24Vout [*3] | 19 | P24Vout [*2] |
| 18 | OUT6 | 17 | N24Vout [*3] |
| 16 | P24Vout [*2] | 15 | OUT5 |
| 14 | N24Vout [*3] | 13 | P24Vout [*2] |
| 12 | OUT4 | 11 | N24Vout [*3] |
| 10 | P24Vout [*2] | 9 | OUT3 |
| 8 | N24Vout [*3] | 7 | P24Vout [*2] |
| 6 | OUT2 | 5 | N24Vout [*3] |
| 4 | P24Vout [*2] | 3 | OUT1 |
| 2 | N24Vout [*3] | 1 | P24Vout [*2] |

| Component | Description | YHLS Slave Units |
|---|---|---|
| Output interface connector for 8-output connector (OUT 9 to 16) | Pin 2      Pin 26<br><br>Pin 1      Pin 25<br><br>See table below<br><br>See the table "I/O Connectors (MIL) on Cable" below for recommended connectors. | TAHWD32-3PAM<br>TAHWD32-3NBM<br>TAHYD16-3EAM<br>TAHYD16-3EBM |
| Input interface connector for 8-input connector (IN 1 to 8) | Pin 2      Pin 26<br><br>Pin 1      Pin 25<br><br>See table below<br><br>See the table "I/O Connectors (MIL) on Cable" below for recommended connectors. | TAHWD32-3PAM<br>TAHWD32-3NBM<br>TAHXD16-3PEM<br>TAHXD16-3NEM |

Output interface connector pin assignment (OUT 9 to 16):

| Pin# | Symbol | Pin# | Symbol |
|---|---|---|---|
| 26 | N.C. [4] | 25 | N.C. [4] |
| 24 | OUT16 | 23 | N24Vout [3] |
| 22 | P24Vout [2] | 21 | OUT15 |
| 20 | N24Vout [3] | 19 | P24Vout [2] |
| 18 | OUT14 | 17 | N24Vout [3] |
| 16 | P24Vout [2] | 15 | OUT13 |
| 14 | N24Vout [3] | 13 | P24Vout [2] |
| 12 | OUT12 | 11 | N24Vout [3] |
| 10 | P24Vout [2] | 9 | OUT11 |
| 8 | N24Vout [3] | 7 | P24Vout [2] |
| 6 | OUT10 | 5 | N24Vout [3] |
| 4 | P24Vout [2] | 3 | OUT9 |
| 2 | N24Vout [3] | 1 | P24Vout [2] |

Input interface connector pin assignment (IN 1 to 8):

| Pin# | Symbol | Pin# | Symbol |
|---|---|---|---|
| 26 | N.C. [4] | 25 | N.C. [4] |
| 24 | IN8 | 23 | N24Vout [3] |
| 22 | P24Vout [2] | 21 | IN7 |
| 20 | N24Vout [3] | 19 | P24Vout [2] |
| 18 | IN6 | 17 | N24Vout [3] |
| 16 | P24Vout [2] | 15 | IN5 |
| 14 | N24Vout [3] | 13 | P24Vout [2] |
| 12 | IN4 | 11 | N24Vout [3] |
| 10 | P24Vout [2] | 9 | IN3 |
| 8 | N24Vout [3] | 7 | P24Vout [2] |
| 6 | IN2 | 5 | N24Vout [3] |
| 4 | P24Vout [2] | 3 | IN1 |
| 2 | N24Vout [3] | 1 | P24Vout [2] |

| Component | Description | YHLS Slave Units |
|---|---|---|
| Input interface connector for 8-input connector (IN 9 to 16) | Pin 2　　　　　　　　Pin 26<br><br>Pin 1　　　　　　　　Pin 25<br><br><table><tr><td>Pin#</td><td>Symbol</td><td>Pin#</td><td>Symbol</td></tr><tr><td>26</td><td>N.C. [4]</td><td>25</td><td>N.C. [4]</td></tr><tr><td>24</td><td>IN16</td><td>23</td><td>N24Vout [3]</td></tr><tr><td>22</td><td>P24Vout [2]</td><td>21</td><td>IN15</td></tr><tr><td>20</td><td>N24Vout [3]</td><td>19</td><td>P24Vout [2]</td></tr><tr><td>18</td><td>IN14</td><td>17</td><td>N24Vout [3]</td></tr><tr><td>16</td><td>P24Vout [2]</td><td>15</td><td>IN13</td></tr><tr><td>14</td><td>N24Vout [3]</td><td>13</td><td>P24Vout [2]</td></tr><tr><td>12</td><td>IN12</td><td>11</td><td>N24Vout [3]</td></tr><tr><td>10</td><td>P24Vout [2]</td><td>9</td><td>IN11</td></tr><tr><td>8</td><td>N24Vout [3]</td><td>7</td><td>P24Vout [2]</td></tr><tr><td>6</td><td>IN10</td><td>5</td><td>N24Vout [3]</td></tr><tr><td>4</td><td>P24Vout [2]</td><td>3</td><td>IN9</td></tr><tr><td>2</td><td>N24Vout [3]</td><td>1</td><td>P24Vout [2]</td></tr></table><br>See the table "I/O Connectors (MIL) on Cable" below for recommended connectors. | TAHWD32-3PAM<br>TAHWD32-3NBM<br>TAHXD16-3PEM<br>TAHXD16-3NEM |

[1]: Connect pin P24Vin to the positive and pin N24Vin to the negative of a 24 V DC power supply.
 Pins 1 and 2, as well as pins 3 and 4, of the power supply connector are shorted inside the slave unit.

[2]: Pins 1, 4, 7, 10, 13, 16, 19 and 22 (P24Vout) is the positive of the I/O power supply.

[3]: Pins 2, 5, 8, 11, 14, 17, 20 and 23 (N24Vout) is the negative of the I/O power supply.

[4]: Leave pins 25 and 26 (N.C.) unconnected.

## Connectors for External Connection

| Connector Type | Connector on Slave Unit | Connector on Cable |
|---|---|---|
| Power supply connector | Sumitomo 3M 38204-62S3-000PL | See table "Power Supply Connectors on Cable" for details. |
| Communication connector | Phoenix Contact MSTBV2,5/5-GF-5,08 AU | See table "Communication Connectors on Cable" for details. |
| I/O connector | Hirose Electric HIF3CA-26PA-2.54DSA(71) | See table "I/O Connectors (MIL) on Cable" for details. |

● **Power supply connectors on cable**

| Cable Type | AWG | Model |
|---|---|---|
| Flat cable | AWG18 | 38104-0018-□00FL (from Sumitomo 3M) |
| | AWG20 | 38104-0020-□00FL (from Sumitomo 3M) |
| Round cable | AWG18 | 38104-□018-□00FL (from Sumitomo 3M) |
| | AWG20 | 38104-□020-□00FL (from Sumitomo 3M) |

● **Communication connectors on cable**

| Connector Type | Lock | Model |
|---|---|---|
| Spring type | With flange | TFKC 2,5/5STF-5,08 AU (from Phoenix Contact) (comes with the slave unit) |
| Screw type | With flange | TMSTBP 2,5/5-STF-5,08 (from Phoenix Contact ) |

● **I/O connectors (MIL) on cable**

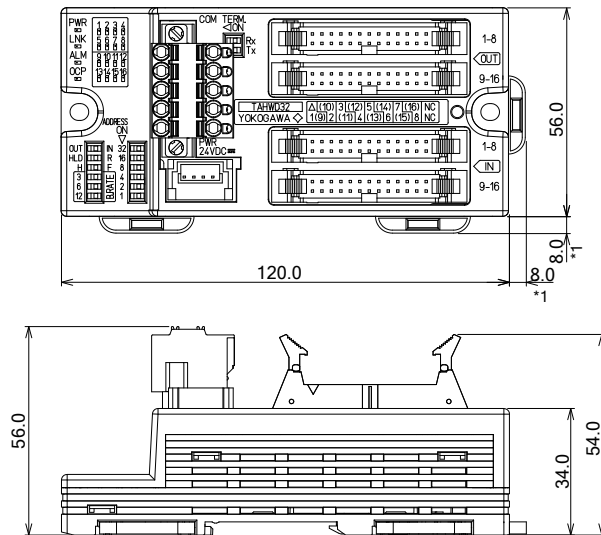| Connector Type | | Model |
|---|---|---|
| Crimp type | Socket | HIF3BA-26D-2.54C (from Hirose Electric) |
| | Pin | HIF3-2428SCA (for AWG#24-28, UL1007 strands) (from Hirose Electric) |
| | | HIF3-2226SCA (for AWG#22-26, UL1007 strands) (from Hirose Electric) |
| | | HIF3-2022SC (for AWG#20-22, UL1007 strands) (from Hirose Electric) |
| Insulation displacement type | Socket | HIF3BA-26D-2.54R (from Hirose Electric) |

## Model and Suffix Codes

| Model | Suffix Code | Style Code | Option Code | Description |
|---|---|---|---|---|
| TAHWD32 | -3PAM | … | … | 16 DC inputs (positive common), 24 V DC, MIL<br>16 TR outputs (sink-type, with short-circuit protection),<br>24 V DC  0.1 A, MIL |
| TAHWD32 | -3NBM | … | … | 16 DC inputs (negative common), 24 V DC, MIL<br>16 TR outputs (source-type, with short-circuit protection),<br>24 V DC  0.1 A, MIL |
| TAHXD16 | -3PEM | … | … | 16 DC inputs (positive common), 24 V DC, MIL |
| TAHXD16 | -3NEM | … | … | 16 DC inputs (negative common), 24 V DC, MIL |
| TAHYD16 | -3EAM | … | … | 16 TR outputs (sink-type, with short-circuit protection),<br>24 V DC  0.1 A, MIL |
| TAHYD16 | -3EBM | … | … | 16 TR outputs (source-type, with short-circuit protection),<br>24 V DC  0.1 A, MIL |

Note: All models are provided with spring-type communication connectors.

GS 34M06H46-03E    Jul.26,2019-00

# External Dimensions

**TAHWD32-3□□M**

Unit: mm



*1: Dimensions for DIN rail mounting and unmounting

**TAHXD16-3□□M**

Unit: mm



*1: Dimensions for DIN rail mounting and unmounting

**TAHYD16-3□□M**

Unit: mm



*1: Dimensions for DIN rail mounting and unmounting
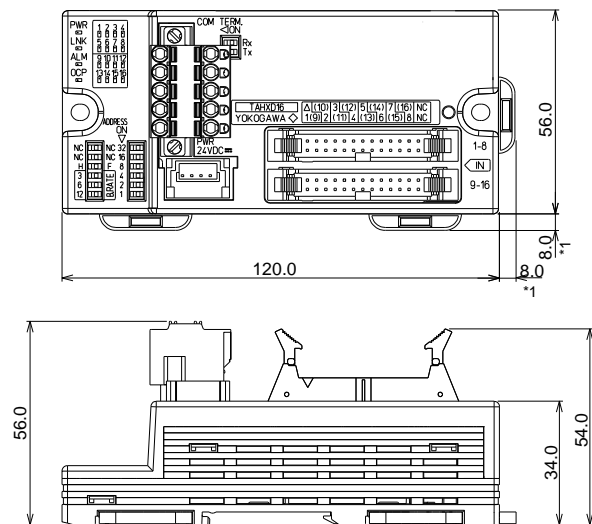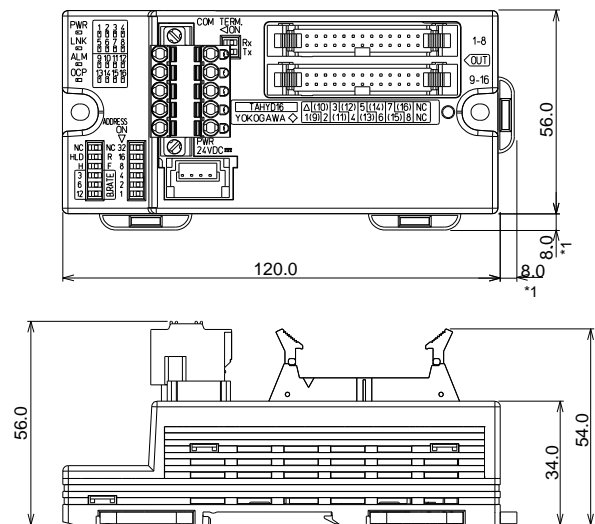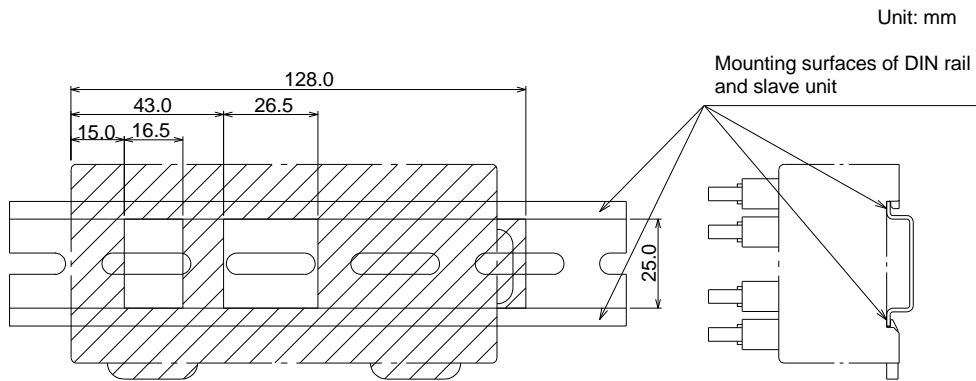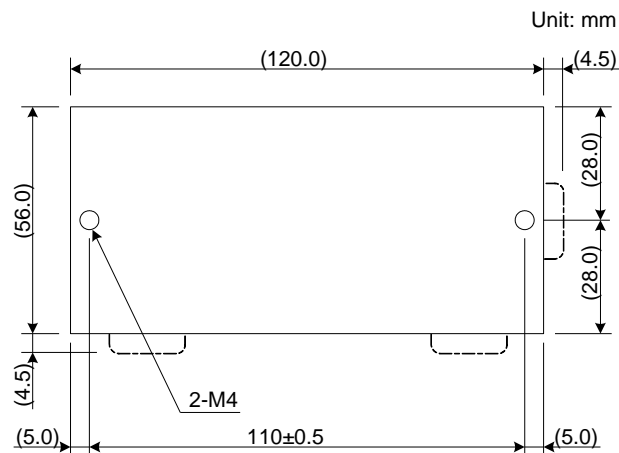
## Position of Mounting Screws for DIN Rail

If the YHLS slave unit is to be attached to a DIN rail horizontally, position the mounting screws of the DIN rail outside the hatched area as shown below.

This restriction does not apply if the YHLS slave unit is mounted vertically.

Unit: mm

## Screw Mounting Dimensions

Unit: mm

# General Specifications

## YHLS Communication Cables
## (KM80 and KM81)

FA-M3

## General

These communication cables are used for connecting a YHLS master module and a YHLS slave unit, as well as two YHLS slave units.
They are shielded cables consisting of two sets of a twisted pair of two wires. There are two models for different applications: KM80 (fixed) and KM81 (flexible).
The KM81 flexible cable is used for applications where YHLS slave units move about. It can withstand more than 4 million times of flexing on a cable bearer and more than 10 million times of 90-degree bending in both directions (according to laboratory test under the test conditions given on the next page).
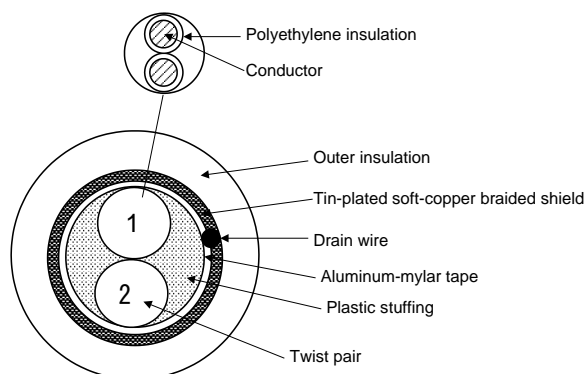
## Model and Suffix Codes

| Model | Suffix Code | Style Code | Option Code | Description |
|---|---|---|---|---|
| KM80 (fixed cable) | -010 | … | … | Cable length: 10 m |
| | -050 | … | … | Cable length: 50 m |
| | -100 | … | … | Cable length: 100 m |
| | -200 | … | … | Cable length: 200 m |
| | -300 | … | … | Cable length: 300 m |
| KM81 (flexible cable) | -010 | … | … | Cable length: 10 m |
| | -050 | … | … | Cable length: 50 m |
| | -100 | … | … | Cable length: 100 m |
| | -200 | … | … | Cable length: 200 m |

## Cable Specifications

| | YHLS Fixed Cable | YHLS Flexible Cable |
|---|---|---|
| Model | KM80 | KM81 |
| Conductors | 2 pairs of 23AWG wires (tin-plated soft-copper braids) | 2 pairs of 21AWG wires (soft-copper braids) |
| Insulation | Polyethylene | |
| Shields | Aluminum-mylar tape Tin-plated soft-copper braided shield | |
| Drain wire size | 23AWG | 22AWG |
| Outer diameter | Approx. 8.0 mm | Approx. 11.0 mm |
| Conductor resistance @ 20°C | 65.7 Ω/km max. | 37.8 Ω/km max. |
| Dielectric strength (through air) | Withstanding 2000 V AC for one minute | |
| Insulation resistance | 2500 MΩ km min. | |
| Characteristic impedance @ 1 MHz | $100 \pm 15$ Ω | |
| Flame retardancy | VW-1 (tested according to UL Subject 758) | |
| Applicable standards | UL (E107262), AWM 2464 | |

## Cable Cross-Section Drawing

KM80



- Polyethylene insulation
- Conductor
- Outer insulation
- Tin-plated soft-copper braided shield
- Drain wire
- Aluminum-mylar tape
- Plastic stuffing
- Twist pair

KM81



- Polyethylene insulation
- Conductor
- Outer insulation
- Tin-plated soft-copper braided shield
- Drain wire
- Aluminum-mylar tape
- Insulation paper
- Cotton stuffing
- Twist pair
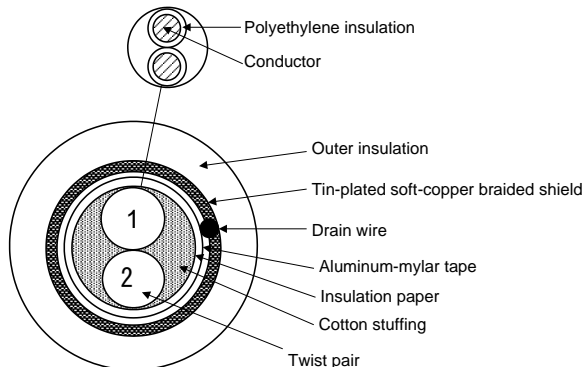
## External Connections

| Connector Pin No. | Wire Color | | Master Module | | Slave Unit | |
|---|---|---|---|---|---|---|
| | Full duplex | Half duplex | Full duplex | Half duplex | Full duplex | Half duplex |
| 5 | Green | - | TxD - | NC | RxD - | NC |
| 4 | Yellow | - | TxD + | NC | RxD + | NC |
| 3 | Blue | Blue | RxD - | TRD - | TxD - | TRD - |
| 2 | White | White | RxD + | TRD + | TxD + | TRD + |
| 1 | Drain | Drain | SHIELD | SHIELD | SHIELD | SHIELD |

It is recommended to terminate the cable wires with pin terminals for insertion into a connector. Pin terminals do not come with the cables.

**- Pin terminals**

Manufacturer: Phoenix Contact

Model: AI 0,34 - 8 TQ (for fixed cable)

AI 0,5 - 10 WH (for flexible cable)

## KM81 Cable Flexibility Performance

| Test | Test Conditions | Performance |
|---|---|---|
| U-bend test simulating the movement of a cable bearer | - Cable bearer bending radius (R) is 50 mm.<br>- Cable bearer stroke is 800 mm.<br>- The cable bearer is moved 28 cycles per minute where one back-and-forth movement is counted as one movement cycle. | Withstanding more than 4 million times of flexing |
| 90-degree bending in both directions | - Mandrel radius (R) is 100 mm.<br>- A load of 1 kg is attached to the lower end of the cable.<br>- The cable is bent 60 times per minute where one time of bending consists of bending and straightening the cable in one direction and then in the opposite direction. | Withstanding more than 10 million times of bending |

Note: The above test results are obtained under the specified test conditions, and should not be interpreted as guaranteed values for actual usage in real applications.