

Dynamic Test DT10

Hardware Manual



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About this manual

- This manual explains the hardware specification and how to operate the DT10.
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- The content and specification of this product are subject to change without prior notice.
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Product precautions

- To use this product safely, please read this manual before using.


Caution on installation

 <p>Caution</p>	Install DynamicTracer in a horizontal and stable place.
	Install DynamicTracer in a well-ventilated place.
	Where the risk of static electricity is high, use the antistatic mat to protect DynamicTracer.
	Install DynamicTracer in a wide and flat space. The bottom rubber must be in contact with the ground.
	Never install DynamicTracer near any volatile substances or fire.
	Never install / store in the following places: <ul style="list-style-type: none"> • An unstable place • A place within children's reach • A place exposed to any other mechanical vibration.
	Never install in any of the following places to protect DynamicTracer against fire, electric shock, malfunction, and other troubles: <ul style="list-style-type: none"> • A humid/dusty place • A wet place • A place exposed to direct sunlight • A place subject to considerable fluctuations in temperature and humidity • A place near HVAC equipment.

Cautions regarding power

 Caution	Never connect/disconnect the power plug while hands are wet to prevent the risk of electric shock.
	Never use an unlabeled power plug (other than 100 - 240V AC) and never use octopus tentacle power wire.
	Never use a broken AC wire to prevent electric shock and fire.
	Obey the following rules when using an AC wire: <ul style="list-style-type: none"> • Never modify the AC wire. • Never expose the AC wire to strain. • Never bend, twist and pull hard. • Never place near heat equipment.
	Handle AC plugs carefully to prevent fire: <ul style="list-style-type: none"> • Never plug in a dusty AC plug. • Plug in the AC plug firmly.
	Unplug AC plug while holding it firmly.
	Never unplug by pulling the AC wire to prevent the risk of fire and electric shock.
	Clean the AC plug regularly.
	If not using DynamicTracer for an extended period, unplug the AC plug for safety.

Cautions when using

 Caution	Never use if you notice any strange condition (smoke, strange smell, strange sound, etc...).
	Stop using DynamicTracer if is contaminated with water or any foreign body.
	Do not decompose/custom DynamicTracer.
	Never place any heavy object on DynamicTracer.
	Connect DynamicTracer to a PC by a cable connector ensuring the cable is in the correct direction.
	When moving DynamicTracer, switch the power off, unplug the AC cable for safety and ensure all cables/connectors are disconnected.
	The temperature range is as follows. Operating: 0 ° C to 40 ° C Storage: -20 ° C to 65 ° C Under the temperature environment outside the above temperature range, by attaching a cover to the main body, Please keep warm at the temperature in the specification range.

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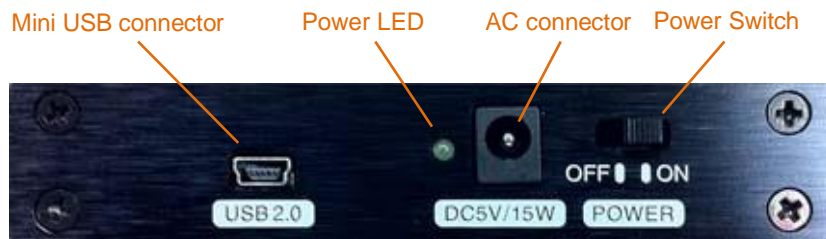
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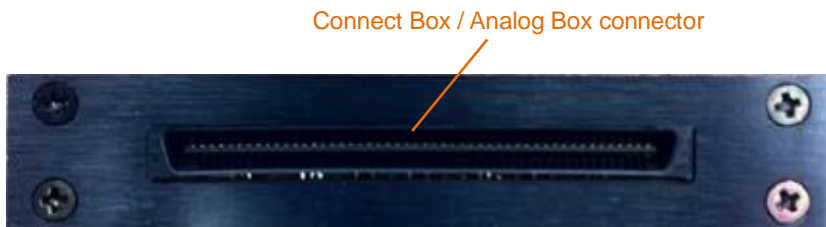
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1. Hardware spec. of DynamicTracer

1.1. Appearance (front)



1.2. Appearance (rear)



1.3. Connection image

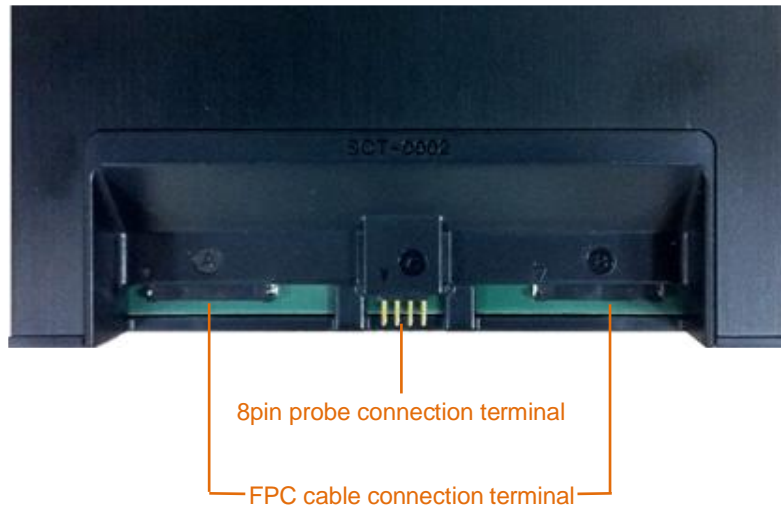
Use the attached USB cable to connect DynamicTracer to the PC being used.

The PC's USB port must support USB2.0.



2. Hardware spec. of Connect Box A

2.1. Appearance (top)



2.2. Supported connection methods

Connect Box A supports the following connection methods:

Async Bus	: Async bus connection.
GPIO	: GPIO (4bit / 2bit) bus output method connection.
SPI	: SPI output bus method connection.
SD I/F	: Connection that supports the SD interface.

2.3. Electric spec.

Recommended operating condition (Connect Box A)

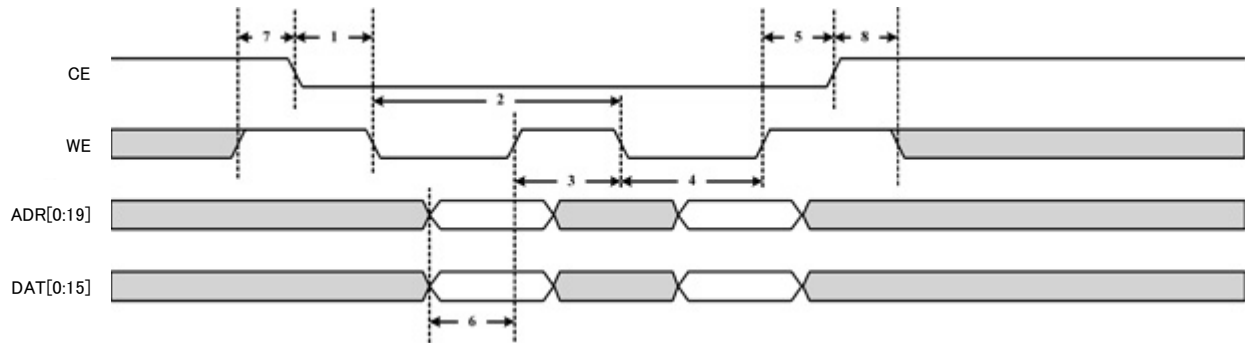
Name	Description	MIN	TYP	MAX	UNIT
VIH	High-level input voltage	2.37		5.5	V
VIL	Low-level input voltage			0.99	V
VI	Input voltage *5V_tolerant	0		5.5	V
RIN	Input resistance		100		KΩ

- VIH/VIL/VI/RIN is the spec. of the probe and FPC cable.

2.4. Async bus connection

2.4.1. Timing chart

Async bus Write timing



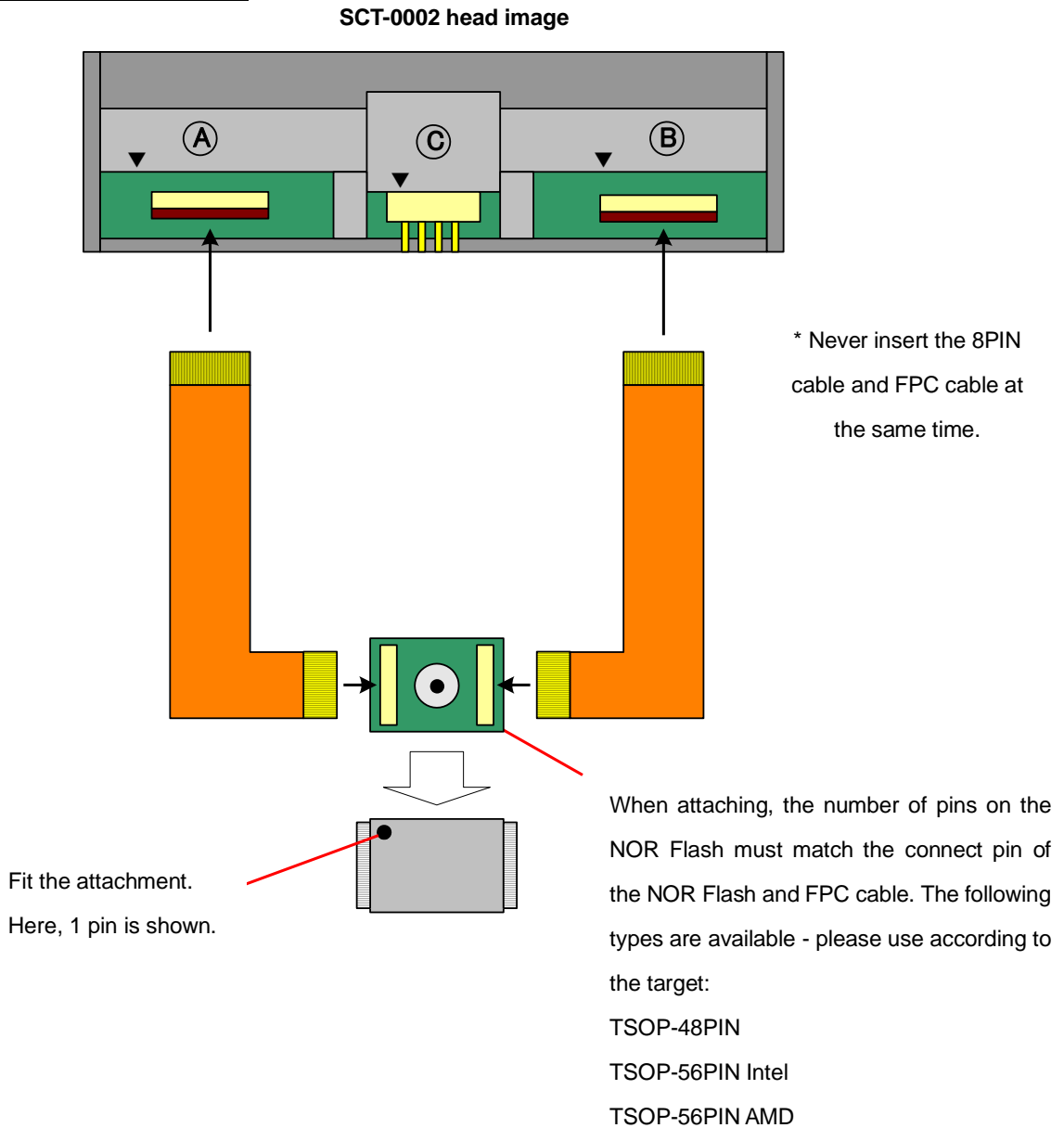
No.	Description	MIN.	MAX.	UNIT
1	CE setup time	0		ns
2	WE period	54		ns
3	WE high-level period	27		ns
4	Data/Address setup time	27		ns
5	CE hold time	0		ns
6	Data/Address latch timing	10		ns
7	Waiting time from other CE access to CE active	0		ns
8	Waiting time from CE high-edge to CE access	0		ns

2.4.2. FPC cable connection spec.

When using an Async bus connection, connect the FPC cable to Connect Box A.

When connecting an FPC cable to the target, an attachment is needed. The attachment mounting manual specifies how to attach the attachment.

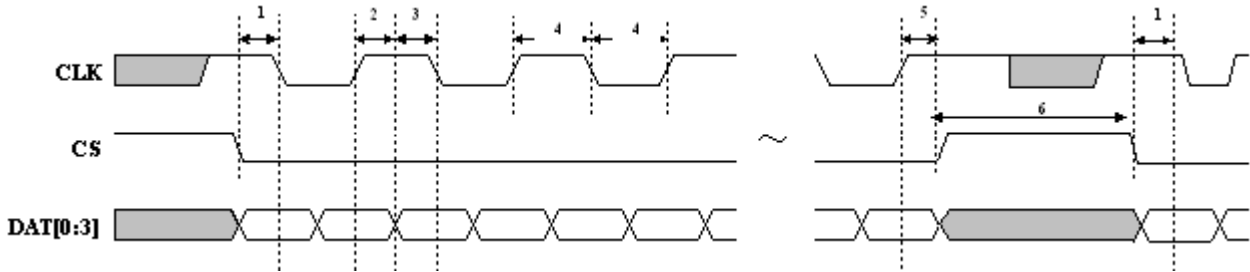
FPC cable connection image



2.5. GPIO connection 4bit / 2bit

2.5.1. Timing chart

GPIO bus timing




* In the case of "GPIO 2bit", DAT[0:1]

No.	Description	MIN.	MAX.	UNIT
1	CS (Low) - CLK timing	20		ns
2	Data hold timing	20		ns
3	Data setup timing	20		ns
4	CLK switch period	40		ns
5	CLK - CS (High) timing	20		ns
6	CS (High) period	20		ns

- Data is transferred as 4bit parallel and output as MSB First in order of the following items:
- Latch timing is the edge of CLK rising and falling.
 1. Argument of `_TP_BusOut () dat` (16bit)
 2. Argument of `_TP_BusOut () addr` (0 - 24bit)

* In the case of 4bit, the number of "addr" bit varies (0/4/8/12/16/20/24) and high-order bits less than 24bit are treated as "0".

* In the case of 2bit, the number of "addr" bit varies (0/2/4/6/8/10/12/14/16/18/20/22/24) and high-order bits less than 24bit are treated as "0".

 Caution	<p>CS must be set "high", except when outputting the Test Point.</p> <p>Never set it to "low" when the Test Point output stops.</p>
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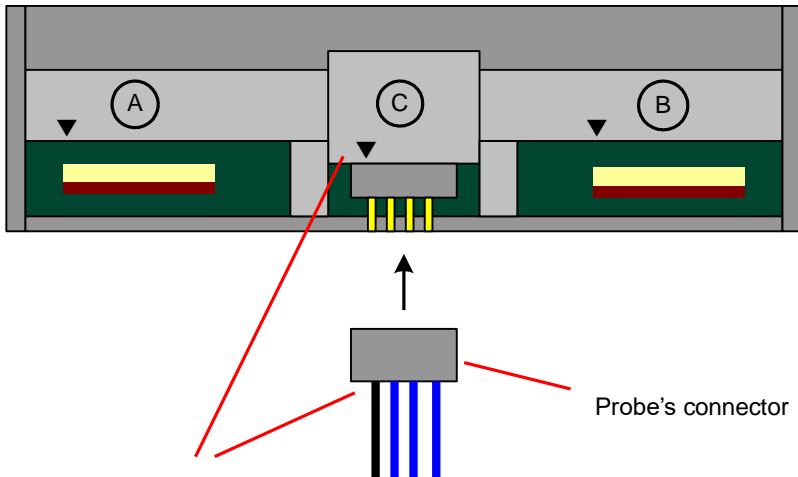
2.5.2. GPIO connection spec.

An 8pin probe is needed for GPIO connections. Refer to the following table and connect the 8pin probe to the target.

Pins used for GPIO connections

No.	Name	Description (4bit)	Description (2bit)
1	GND	Connect to the target GND	Connect to the target GND
2	CLK	Connect to the CLK output pin	Connect to the CLK output pin
3	CS	Connect to the CS output pin	Connect to the CS output pin
4	DOUT	For write data output	For write data output
5	DAT0	Connect to the DAT0 output pin	Connect to the DAT0 output pin
6	DAT1	Connect to the DAT1 output pin	Connect to the DAT1 output pin
7	DAT2	Connect to the DAT2 output pin	Unused
8	DAT3	Connect to the DAT3 output pin	Unused

How to insert the probe



* Never insert the 8PIN cable and FPC cable at the same time.

The probe's 1PIN (black cable) and the ▼ mark of the C-connector are matched and inserted.

Front view of the pin header

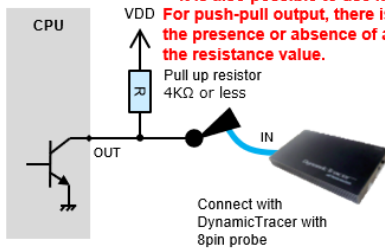


2.5.3. Recommended port peripheral circuit.

CS

Make it a pull-up circuit so that it normally becomes a Hi voltage.

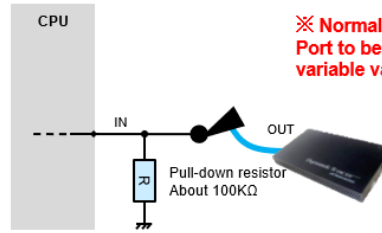
※ It is also possible to use it with push-pull output. For push-pull output, there is no specification for the presence or absence of an external resistor or the resistance value.



DOUT

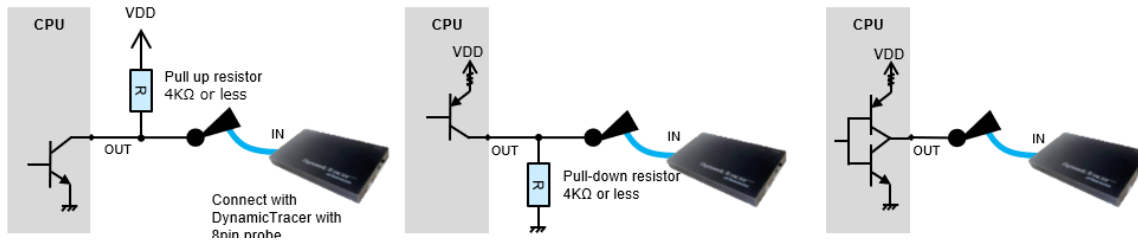
The output on the DynamicTracer (ConnectBox) side is push-pull. Connect a pull-down resistor of about 100KΩ to the CPU input port.

※ Normally, it can be left unconnected. Port to be connected only when using the variable value rewriting function.



CLK / D0~D3

Either pull-up, pull-down, or push-pull output circuits are acceptable.



When designing a trace port in the board design of the target board, please contact the user support.

user@hldc.co.jp

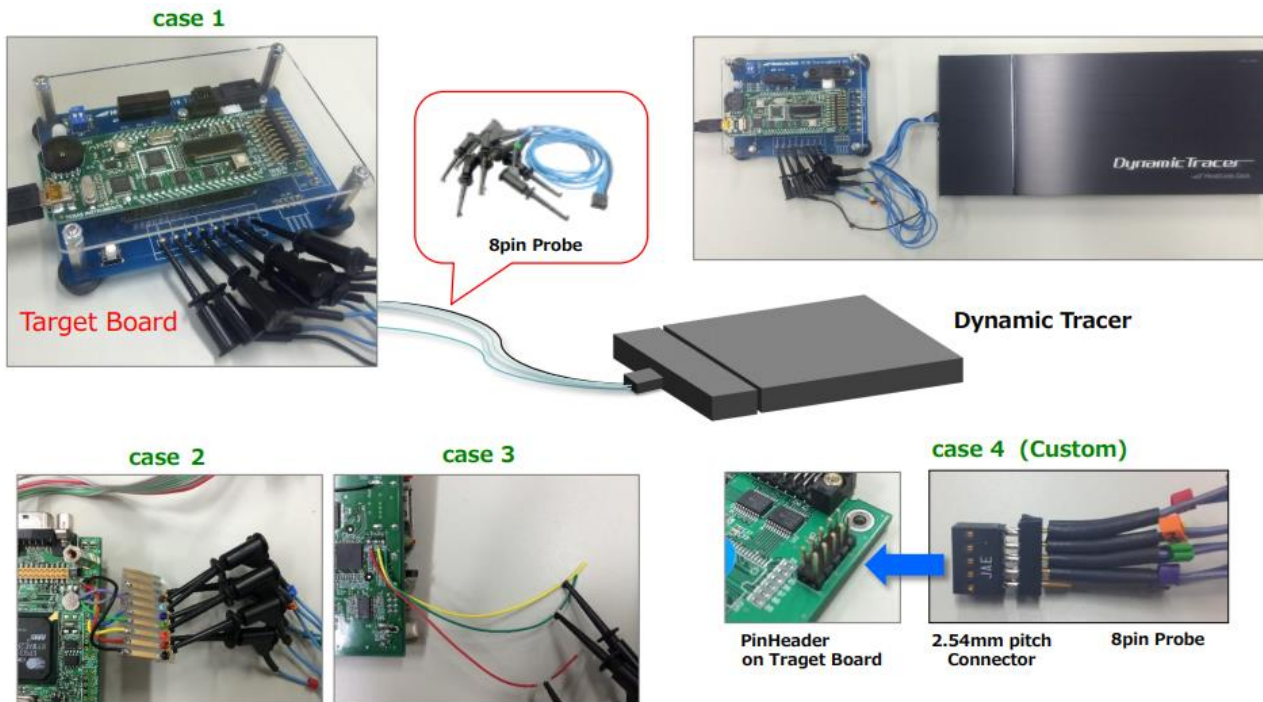
2.5.4. Connection image.

For each connection of GPIO4bit, GPIO2bit, SPI, I2C, use 8pin probe.

When connecting to the Target Board side, connect a clip of the 8pin probe to the check terminal or Pin header on the GPIO port line of the CPU.

Moreover, it is possible to customize the cable connector part, not the clip.

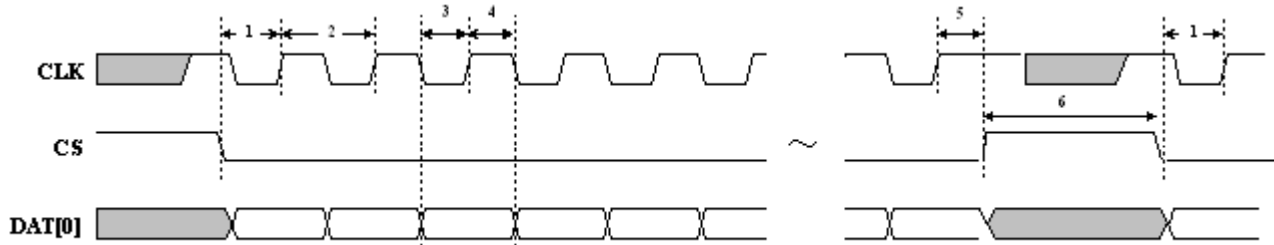
If there is an available port, it can be connected even with a ready-made board.



2.6. SPI connection

2.6.1. Timing chart

SPI bus timing



No.	Description	MIN.	MAX.	UNIT
1	CS (Low) - CLK timing	20		ns
2	CLK period	40		ns
3	CLK low period (setup time)	20		ns
4	CLK high period (hold time)	20		ns
5	CLK - CS (high) timing	20		ns
6	CS (high) period	20		ns

- Data is transferred as 1bit parallel and output as MSB First in order of the following items:
- Latch timing is the rising edge of CLK.
 1. Argument of `_TP_BusOut () dat` (16bit)
 2. Argument of `_TP_BusOut () addr` (0 - 24bit)

* The number of "addr" bit varies (0/4/8/12/16/20/24) and high-order bits less than 24bit are treated as "0".



Caution

**CS must be set "high", except when outputting the Test Point.
Never set it to "low" when the Test Point output stops.**

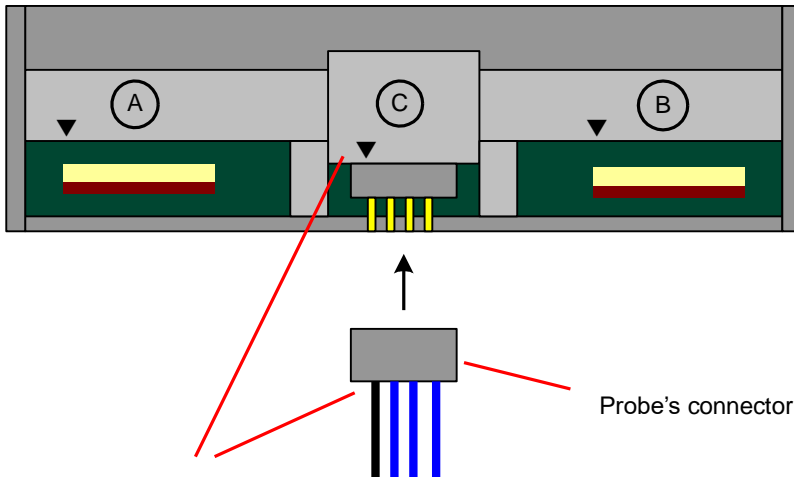
2.6.2. SPI connection spec.

An 8pin probe is needed for the SPI connection. Refer to the next table and connect the 8pin probe to the target.

Pins used for SPI connection

No.	Name	Description
1	GND	Connect to the target GND
2	CLK	Connect to the CLK output pin
3	CS	Connect to the CS output pin
4	DOUT	For write data output
5	DAT0	Connect to the DAT0 output pin
6	DAT1	Unused
7	DAT2	Unused
8	DAT3	Unused

How to insert the probe



* Never insert the 8PIN cable and FPC cable at the same time.

The probe's 1PIN (black cable) and the ▼ mark of the C-connector are matched and inserted.

Front view of the pin header



2.6.3. Recommended port peripheral circuit.

Refer to [2.5.3. Recommended port peripheral circuit].

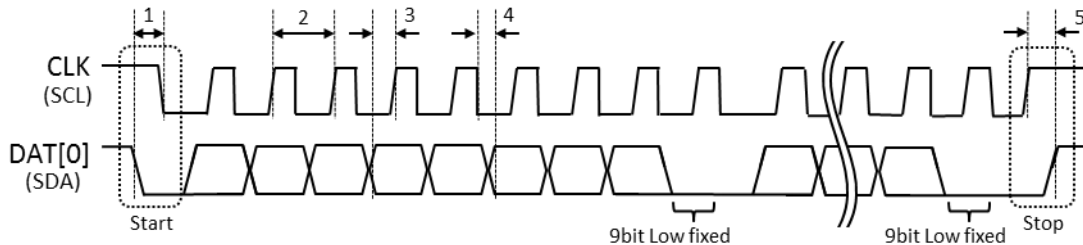
2.6.4. Connection image.

Refer to [2.5.4. Connection image].

2.7. I2C connection

2.7.1. Timing chart

I2C bus timing



No.	Description	MIN.	MAX.	UNIT
1	Start condition (SDA flank down to SCL flank up)	20		ns
2	CLK switch period	40		ns
3	Data(SDA) setup timing	20		ns
4	Data(SDA) hold timing	20		ns
5	Stop Condition (SCL flank down to SDA flank up)	20		ns

- Data is transferred as 1bit parallel and output as MSB First in order of the following items:
- For 9th bit, output Low.
- Latch timing is the rising edge of CLK.
 1. Argument of `_TP_BusOut () dat (2byte)`
 2. Argument of `_TP_BusOut () addr (1 - 3 byte)`

* The number of "addr" bit varies and high-order bits less than 3 bytes are treated as "0".



Caution

Please ensure to output Low for 9th bit of data.

ConnectBoxC does NOT output ACK signal though using I2C bus format.

Therefore, please use the port that push-pull output setting is available, not open-drain-output by pull-up resistance.

Please prepare the I2C bus (general port) for the output of trace data of DT10.

Do NOT connect other devices in the I2C bus connecting DynamicTracer (ConnectBoxC) because slave address is not output.

Similarly, I2C bus using for communication to other devices can NOT use for the output the trace data of DT10.

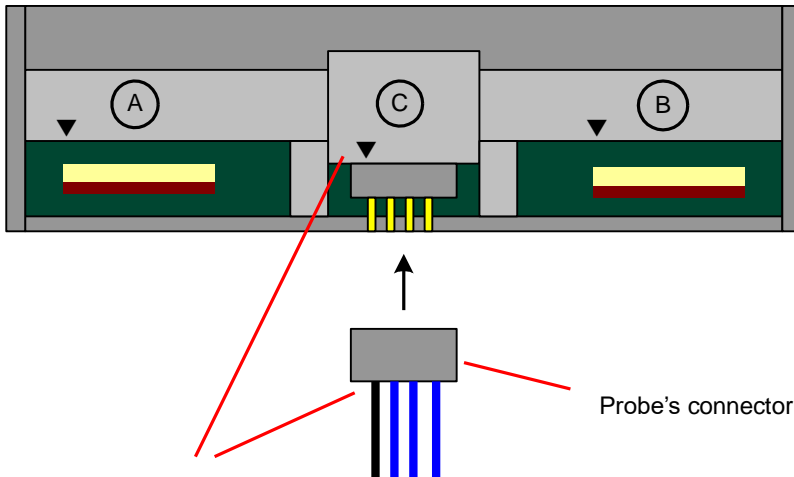
2.7.2. I2C connection spec.

An 8pin probe is needed for the I2C connection. Refer to the following table and connect the 8pin probe to the target.

Pins used for the I2C connection

No.	Name	Description
1	GND	Connect to the target GND
2	CLK	Connect to the SCL output pin
3	CS	Unused
4	DOUT	Unused
5	DAT0	Connect to the SDA output pin
6	DAT1	Unused
7	DAT2	Unused
8	DAT3	Unused

How to insert the probe



* Never insert the 8PIN cable and FPC cable at the same time.

The probe's 1PIN (black cable) and the ▼ mark of the C-connector are matched and inserted.

Front view of the pin header



2.7.3. Recommended port peripheral circuit.

Refer to [2.5.3. Recommended port peripheral circuit].

2.7.4. Connection image.

Refer to [2.5.4. Connection image].

3. Hardware spec. of Connect Box B

3.1. Appearance (front)



3.2. Supported connection methods

Connect Box B supports the following connection methods:

Ethernet	: Ethernet connection
UART	: UART connection

3.3. Communication spec.

Ethernet

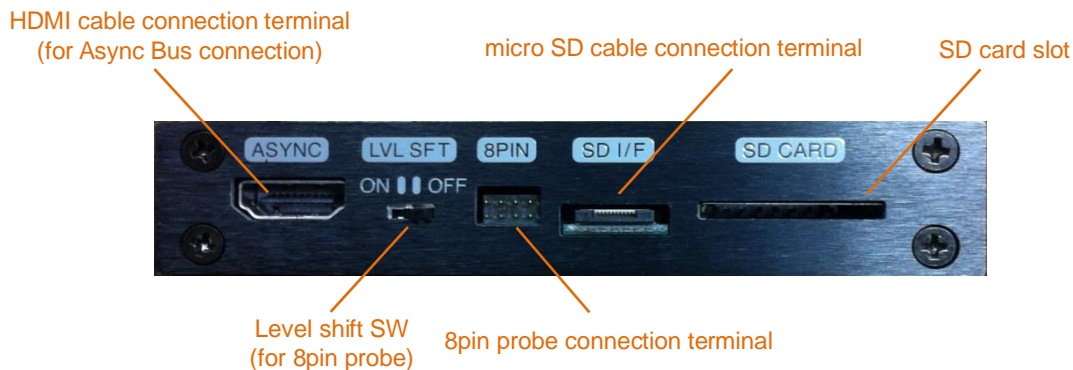
- 10BaseT/100BaseTX
- Supports auto-negotiation (Full-duplex/half duplex)
- Supports auto MDI/MDIX (Crossover)
- IP packet division is NOT supported

UART

- RS-232C-compliant
- Supported baud rate 2400 - 921600 bps

4. Hardware spec. of Connect Box C

4.1. Appearance (front)



4.2. Supported connection methods

Connect Box C supports the following connection methods:

Async bus	: Async bus connection.
GPIO	: GPIO (4bit / 2bit) bus output method connection.
SPI	: SPI output bus method connection.
I2C	: I2C bus connection.
SD I/F	: Connection that supports the SD interface.

For the connection "GPIO", "SPI" and "I2C", "GPIO-NoiseIsolator" can be used.

For more details of it, please refer to "GPIO-NoiseIsolator manual".

4.3. Electric spec.

Recommended operating condition

<Connect Box C 8pin probe>

Name	Description	MIN.	TYP.	MAX.	UNIT
VIH	High-level input voltage (Level Shifter OFF)	2.37		5.5	V
	High-level input voltage (Level Shifter ON)	1.17			
VIL	Low-level input voltage (Level Shifter OFF)			0.99	V
	Low-level input voltage (Level Shifter ON)			0.63	
VI	Input voltage *5V_tolerant	0		5.5	V
RIN	Input resistance		100		KΩ

When using the signal output port of the target CPU for N-ch output with a pull-up resistor or P-ch output with a pull-down resistor, use a resistance value of 4KΩ or less.

If the target output signal is 1.8V, set the ConnectBoxC [LVL SFT] switch to [ON].

<Connect Box C SD I/F>

Name	Description	MIN.	TYP	MAX.	UNIT
VIH	High-level input voltage	2.37		5.5	V
VIL	Low-level input voltage			0.99	V
VI	Input voltage *5V_tolerant	0		5.5	V
RIN	Input resistance		100		KΩ

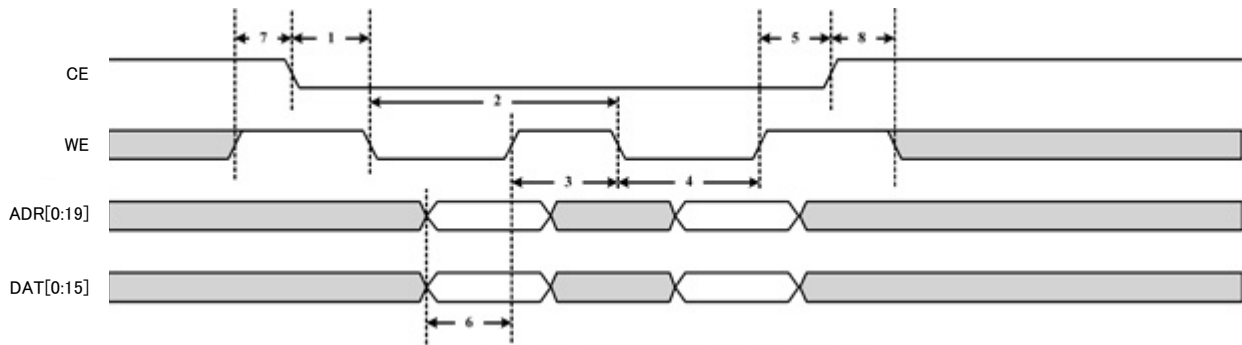
**Caution**

Never connect anything except the relay box to the HDMI connector of Connect Box C.

4.4. Async bus connection

4.4.1. Timing chart

Async bus Write timing



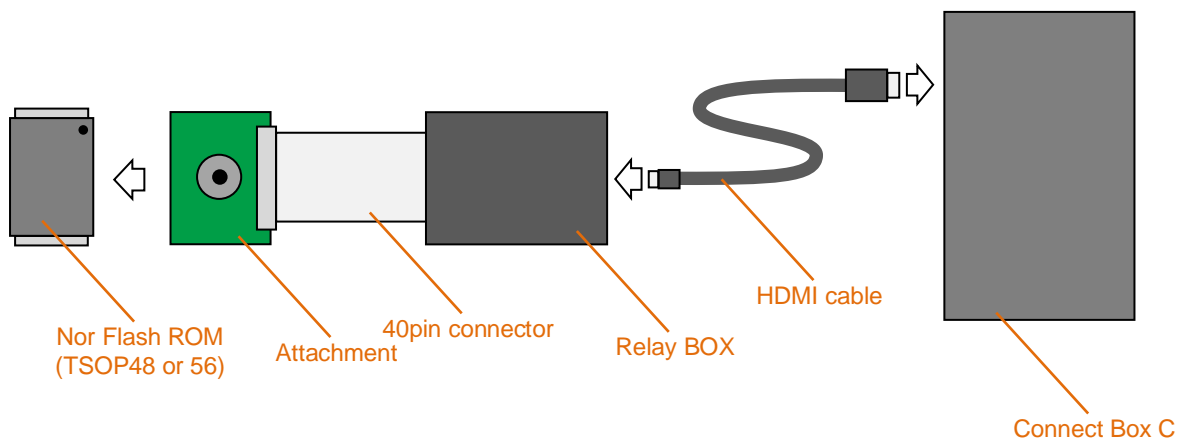
No.	Description	MIN.	MAX.	UNIT
1	CE setup time	0		ns
2	WE period	84		ns
3	WE high-level period	42		ns
4	Data/Address setup time	42		ns
5	CE hold time	0		ns
6	Data/Address latch timing	15		ns
7	Waiting time from other CE access to CE active	0		ns
8	Waiting time from CE high-edge to CE access	0		ns

4.4.2. Async bus connection spec.

A dedicated relay box is needed for an async bus connection using Connect Box C.

Connect the relay box and attachment via a 40pin cable, and connect the relay box and Connect Box C via an HDMI cable. The attachment mounting manual shows how to connect the target and attachment.

Relay box connection image



4.5. GPIO connection 4bit / 2bit

4.5.1. Timing chart

Same as Connect Box A's timing chart.

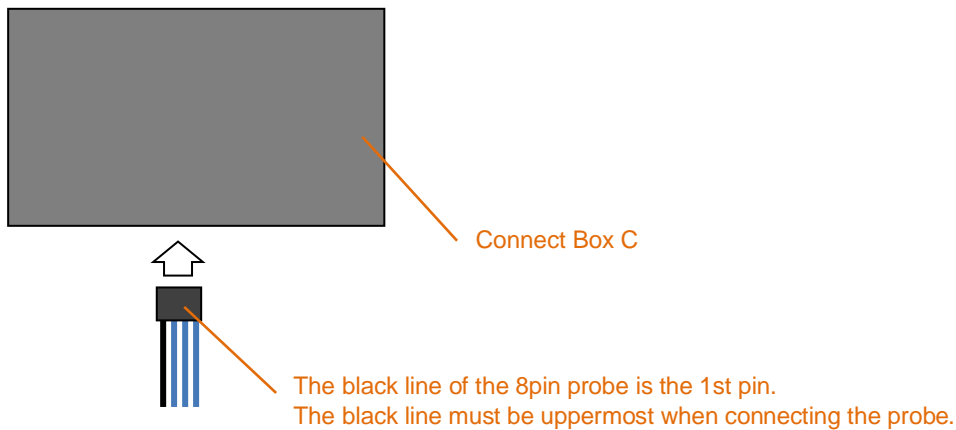
4.5.2. GPIO connection spec.

An 8pin probe is needed for the GPIO connection. Please refer to the following table and connect an 8pin probe to the target.

Pins used for the GPIO connection

No.	Name	Description (4bit)	Description (2bit)
1	GND	Connect to the target GND	Connect to the target GND
2	CLK	Connect to the CLK output pin	Connect to the CLK output pin
3	CS	Connect to the CS output pin	Connect to the CS output pin
4	DOUT	For write data output	For write data output
5	DAT0	Connect to the DAT0 output pin	Connect to the DAT0 output pin
6	DAT1	Connect to the DAT1 output pin	Connect to the DAT1 output pin
7	DAT2	Connect to the DAT2 output pin	Unused
8	DAT3	Connect to the DAT3 output pin	Unused

How to insert the probe.



Front view of the pin header



4.5.3. Level Shifter switch spec.

When connecting to a target with output of 1.5V, the Level Shifter switch must be switched ON.

Threshold level of signal detection switches Hi: 2.37V to Hi: 1.17V.

In CLK, CS and Dat0 - Dat3 terminal, Level Shift is enabled.

4.5.4. Recommended port peripheral circuit.

Refer to [2.5.3. Recommended port peripheral circuit].

4.5.5. Connection image.

Refer to [2.5.4. Connection image].

4.6. SPI connection

4.6.1. Timing chart

It is the same as the SPI connection of Connect Box A.

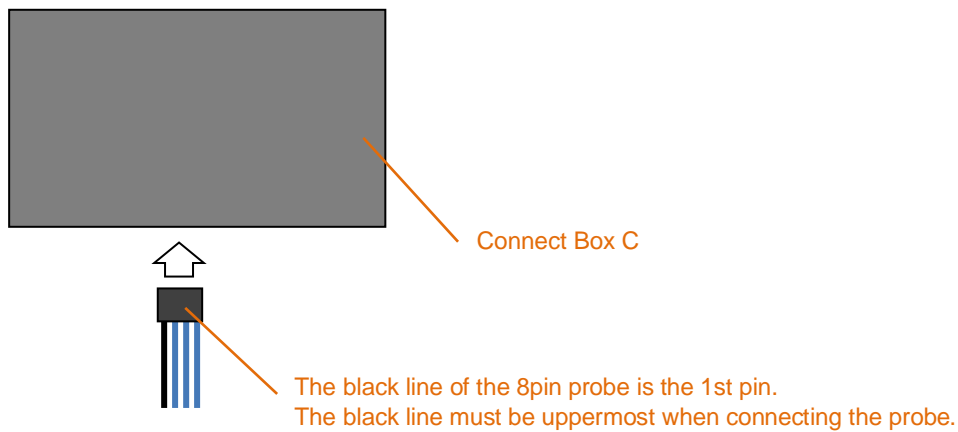
4.6.2. SPI connection spec.

An 8pin probe is needed for the SPI connection. Refer to the following table and connect the 8pin probe to the target.

Pins used for SPI connection

No.	Name	Description
1	GND	Connect to the target GND
2	CLK	Connect to the CLK output pin
3	CS	Connect to the CS output pin
4	DOUT	For write data output
5	DAT0	Connect to the DAT0 output pin
6	DAT1	Unused
7	DAT2	Unused
8	DAT3	Unused

How to insert the probe



Front view of the pin header



4.6.3. Level Shifter switch spec.

When connecting to a target with output of 1.5V, the Level Shifter switch must be switched ON.

Threshold level of signal detection switches Hi: 2.37V to Hi: 1.17V.

In CLK, CS and Dat0 - Dat3 terminal, Level Shift is enabled.

4.6.4. Recommended port peripheral circuit.

Refer to [2.5.3. Recommended port peripheral circuit].

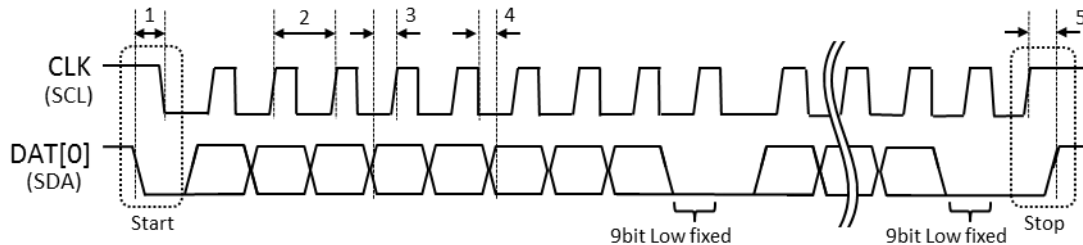
4.6.5. Connection image.

Refer to [2.5.4. Connection image].

4.7. I2C connection

4.7.1. Timing chart

I2C bus timing



No.	Description	MIN.	MAX.	UNIT
1	Start condition (SDA flank down to SCL flank up)	20		ns
2	CLK switch period	40		ns
3	Data(SDA) setup timing	20		ns
4	Data(SDA) hold timing	20		ns
5	Stop Condition (SCL flank down to SDA flank up)	20		ns

- Data is transferred as 1bit parallel and output as MSB First in order of the following items:
 - For 9th bit, output Low.
 - Latch timing is the rising edge of CLK.
3. Argument of `_TP_BusOut () dat` (2byte)
 4. Argument of `_TP_BusOut () addr` (1 - 3 byte)
- * The number of "addr" bit varies and high-order bits less than 3 bytes are treated as "0".



Caution

Please ensure to output Low for 9th bit of data.

ConnectBoxC does NOT output ACK signal though using I2C bus format.

Therefore, please use the port that push-pull output setting is available, not open-drain-output by pull-up resistance.

Please prepare the I2C bus (general port) for the output of trace data of DT10.

Do NOT connect other devices in the I2C bus connecting DynamicTracer (ConnectBoxC) because slave address is not output.

Similarly, I2C bus using for communication to other devices can NOT use for the output the trace data of DT10.

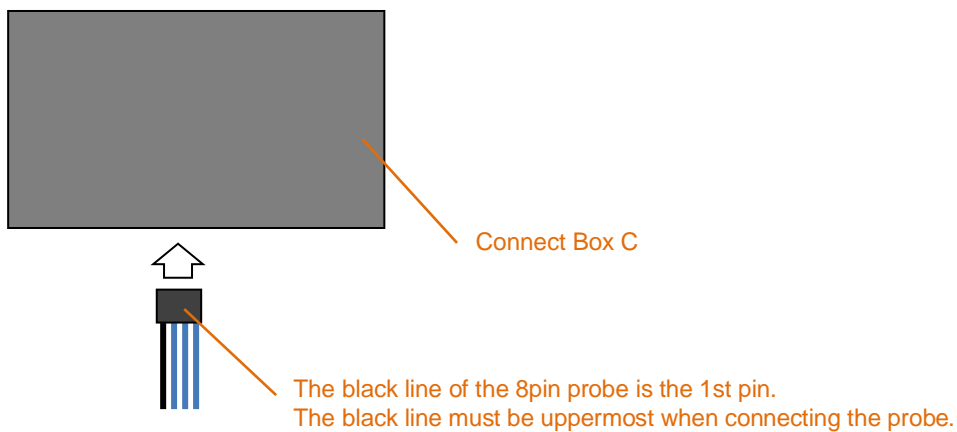
4.7.2. I2C connection spec.

An 8pin probe is needed for the I2C connection. Refer to the following table and connect the 8pin probe to the target.

Pins used for the I2C connection

No.	Name	Description
1	GND	Connect to the target GND
2	CLK	Connect to the SCL output pin
3	CS	Unused
4	DOUT	Unused
5	DAT0	Connect to the SDA output pin
6	DAT1	Unused
7	DAT2	Unused
8	DAT3	Unused

How to insert the probe.



Front view of the pin header



4.7.3. Level Shifter switch spec.

When connecting to a target with output of 1.8V, the Level Shifter switch must be switched ON.

Threshold level of signal detection switches Hi: 2.37V to Hi: 1.17V.

In CLK, CS and Dat0 - Dat3 terminal, Level Shift is enabled.

4.7.4. Recommended port peripheral circuit.

Refer to [2.5.3. Recommended port peripheral circuit].

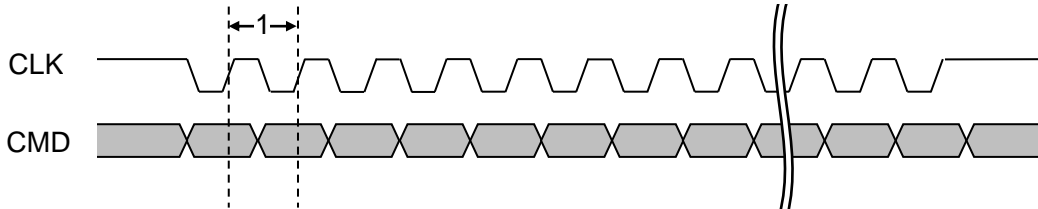
4.7.5. Connection image.

Refer to [2.5.4. Connection image].

4.8. SD I/F connection

4.8.1. Timing chart

SD I/F bus timing

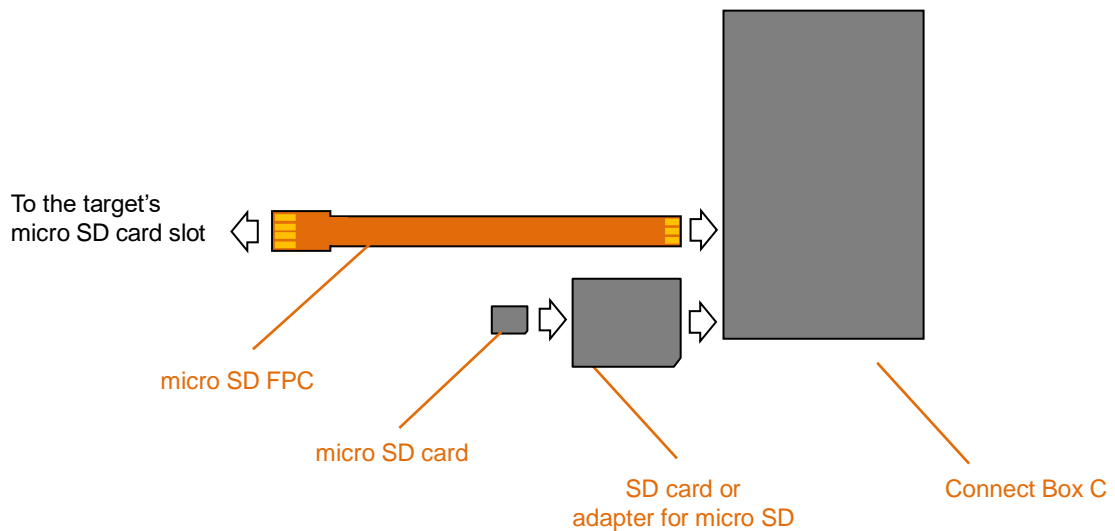


No.	Description	MIN.	MAX.	UNIT
1	CLK period	20		ns

4.8.2. Connection spec. of SD I/F

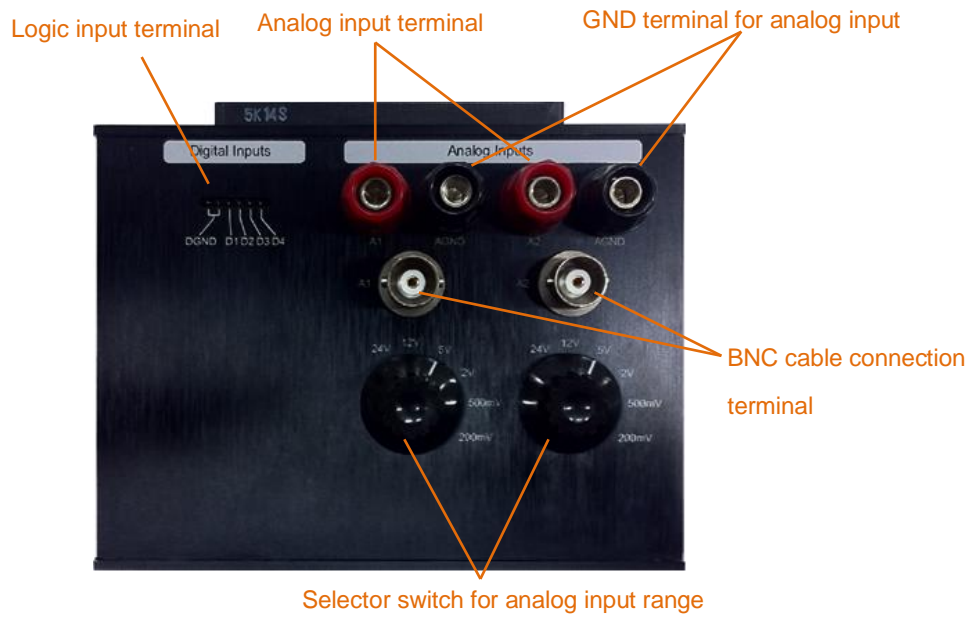
A dedicated micro SD FPC cable is needed for SD I/F connections using Connect Box C.
 Insert the micro SD FPC cable to the target SD card slot, whereupon the Connect Box can connect to the target.
 The SD card that was inserted into the target can access using an adapter for insertion into Connect Box C.

micro SD FPC cable connection image



5. Hardware spec. of Analog Box

5.1. Appearance (top)



5.2. How to connect

Connect between DynamicTracer and Connect Box.



5.3. Logic signal input spec.

The attached probe is needed for the logic input.

To input the logic signal, connect the GND of the target to the GND of the logic input.

A 4ch logic signal can be input at once.

Pins used for logic input.

No.	Name	Description
1	DGND	Connect to the target GND
2	DGND	Connect to the target GND
3	D1	Input for the D1 signal
4	D2	Input for the D2 signal
5	D3	Input for the D3 signal
6	D4	Input for the D4 signal

Spec. of logic input

Name	MIN.	TYP.	MAX.	UNIT
Input voltage (can be specified from 0 to 5V by application)			5	V
Sampling frequency		100		MHz
Maximum input voltage			5.5	V

5.4. Analog signal input spec.

When you input the analog signal, input the signal to the analog input terminal or BNC connector.

The GND of the analog input must connect to the GND for an analog signal.

The 2ch analog input can be input at once.

The range can be selected according to the analog signal using a range selector switch.

Pins used for analog input

Terminal Name	Description
AGND	GND for the analog signal input
A1	Input for the A1 signal
A1 (BNC connector)	Input for the A1 signal
A2	Input for the A2 signal
A2 (BNC connector)	Input for the A2 signal

Spec. of analog input

Name	MIN.	TYP.	MAX.	UNIT
Resolution of the analog signal		8		bit
Sampling frequency		1		MHz
Maximum input voltage			24	V

6. Hardware spec. of CAN connection

CAN bus interface as the followings is used for CAN connection. DynamicTracer is NOT used.

6.1. VN1600 series (Vector Japan Co., Ltd.)

6.1.1. Appearance



Product name : VN1600 series

Manufacturer : Vector Japan Co., Ltd.

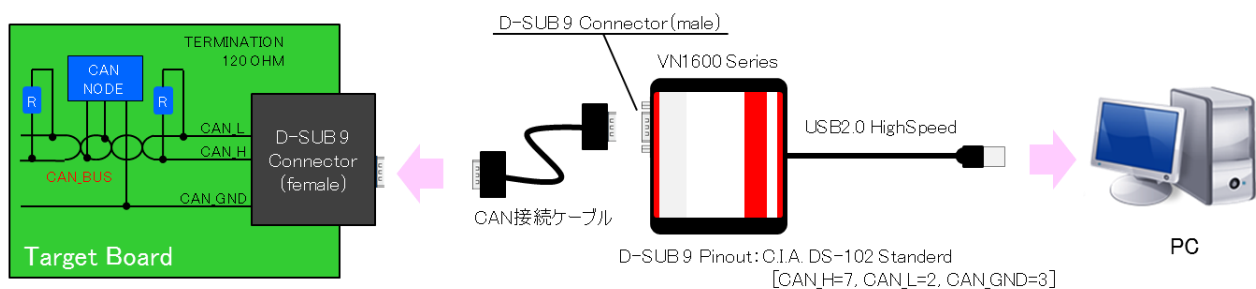
Manufacturer's site : https://vector.com/vj_vn1600_jp.html

6.1.2. Communication spec.

- Supports CAN2.0A standard format (11Bit_ID) and CAN2.0B extended format (29Bit_ID).
 - *CANFD communication will be supported in the future version.
- Supported baud rates: 10 / 20 / 50 / 100 / 250 / 500 / 800K / 1M bps (Select one of them on PC application)

6.1.3. How to connect

- Connect CAN I/F(VN1600 series) and PC installed DT10 via the USB cable.
- Please prepare connection cable between CAN I/F(VN1600 series) and the target board suitable for the connector of the target board



Caution

Please download and install the driver for VN1600 series from the manufacturer's site (https://vector.com/vj_vn1600_jp.html).

Please use DT10 after ensuring the PC detection of CAN interface.

6.2. CANUSB cable (LAWICEL AB)

6.2.1. Appearance



Product name : CANUSB

Manufacturer : LAWICEL AB

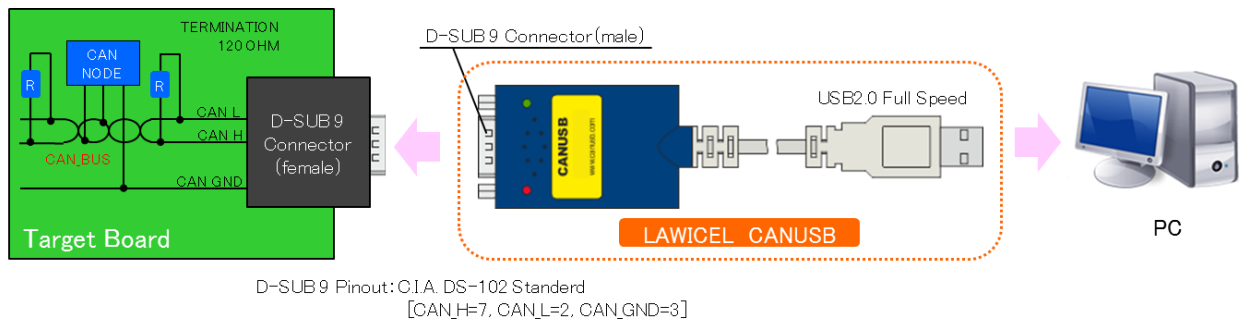
Manufacturer's site : <http://www.canusb.com/>

6.2.2. Communication spec.

- Supports the CAN2.0A standard format (11Bit_ID) and CAN2.0Bextended format (29Bit_ID).
- Supported baud rates: 10 / 20 / 50 / 100 / 250 / 500 / 800K / 1M bps (Select one of them on PC application)

6.2.3. How to connect

- Connect CANUSB and PC via USB2.0
- Connect CANUSB and target board by D-SUB 9pin Connector.



Caution

Download the **CANUSB Direct Driver (D2XX)** from LAEICEL's website at <http://www.canusb.com/> and install it.

Ensure your PC recognizes CANUSB before starting to use DT10.

7. Change History

Date	Version	Changed Summary ([] refer to item number and section)
January 25, 2016	Ver.2.00	Renewal of the Installation guide. <ul style="list-style-type: none"> ▪ Add the I2C connection and CAN connection interface
April 27, 2018	Ver.2.01	The port name mistake was corrected. <ul style="list-style-type: none"> ▪ 2.4. Async bus connection 2.4.1 Timing chart. ▪ 4.4. Async bus connection 4.4.1 Timing chart.
July 20, 2018	Ver.2.02	<ul style="list-style-type: none"> ▪ Recommended port peripheral circuit and connection image were added.
March 08,2019	Ver.2.03	The temperature range was added to "Cautions when using".
November 11,2022	Ver.2.04	<ul style="list-style-type: none"> • 4.3 Added description to electrical specifications. • 2.5.3 Errors in the recommended port peripheral circuit diagram have been corrected.



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