Serial Multilink Guide

1 About Multilink

Multilink communication connects multiple Displays for direct access to a single External Device. This is done using a token ring network, where only one of multiple connected Displays has exclusive communication with the External Device at a time. The maximum cable extension length is 1000m, or the maximum length specified for the External Device, whichever is shorter.
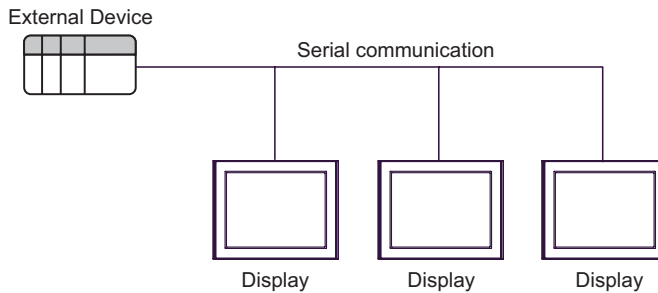
- Connect multiple Displays to a single External Device.
  Multiple Displays can be connected to a single link interface dedicated to each manufacturer's External Device. (You can connect a maximum of 16 Displays. However, for optimum performance, we recommend using a maximum of four Displays.)
- Direct access communication
  No special program is required for multilink communication.
- Connect without using specialized hardware
  No specialized hardware is required.
- Large and small size Displays can be connected.
  Enables multilink communication with connections of large, medium, and small-size Displays (GP4000, GP3000, ST3000, LT3000, GP77R, GP2000, GLC2000, and ST400 Series).
  Multilink communication is available using WinGP.

NOTE
- For all connected Displays, set the same address of the same External Device under the multilink settings "Communication" option.
- As the number of connected Displays is increased, the display and operation speeds for each Display will decrease. Please keep this in mind when designing your system.
- To ensure performance for practical use, set consecutive addresses for Parts and any other features. If the those address settings are not consecutive, processing speed may decrease.
- System response speed depends on the External Device's scan time (cycle time).
- If the power supply for the External Device is turned OFF during communication, a communication error may come up on the Display.
- Use a conductive material to connect the FG terminal via a connector hood when Displays are connected to an External Device.
- To set up the GP77R, GP2000, GLC2000, and ST400 Series, the GP-Pro PBIII C-Package is required.

IMPORTANT
- Do not use the multilink system for an application that requires simultaneous operations.
  If you enter touch input simultaneously from multiple Displays, response speed may decrease because the External Device must respond to the first Display before it can respond to the following Displays.

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2   Monopolize PLC

"Monopolize PLC" means that one of the connected Displays has exclusive control of the External Device.
For example, when you enter data with a keyboard on the screen, use this function to show input/output data using a single Display.

• How to enable the "Monopolize PLC" setting

To enable the "Monopolize PLC" setting, the following two methods are available:

(1) Turn ON bit 7 of system data area LS0014 (Control) from an External Device or Display.

(2) Set "Monopolize Touch Panel" to "Enable".

• How to disable the "Monopolize PLC" setting

Turn OFF the LS0014 (Control) bit 7 of the Display currently using the External Device.

When the "Monopolize PLC" setting is enabled via the above method (1), you can specify how long the External Device will be exclusively used. After the set time elapses, the Monopolize setting will be automatically stopped.

While a single Display monopolizes the External Device, bit 7 of system data area LS0006 (Status) on the other Displays is set to ON, and those Displays are on standby.

If you enter requests from a Display that is on standby, the processing will be executed after the monopolize status is ended and communication with the Display on standby is restored. This may therefore result in malfunction, depending on the accumulated processing requests.

The system data area bit status of a Display on standby cannot be monitored from an External Device. It is recommended that the Displays should indicate Monopolized status or Standby status on their screens.

(Example: When bit 7 of the system data area LS0006 (Status) is defined as the start bit on a Display, a "Standby" message is indicated on the screen.
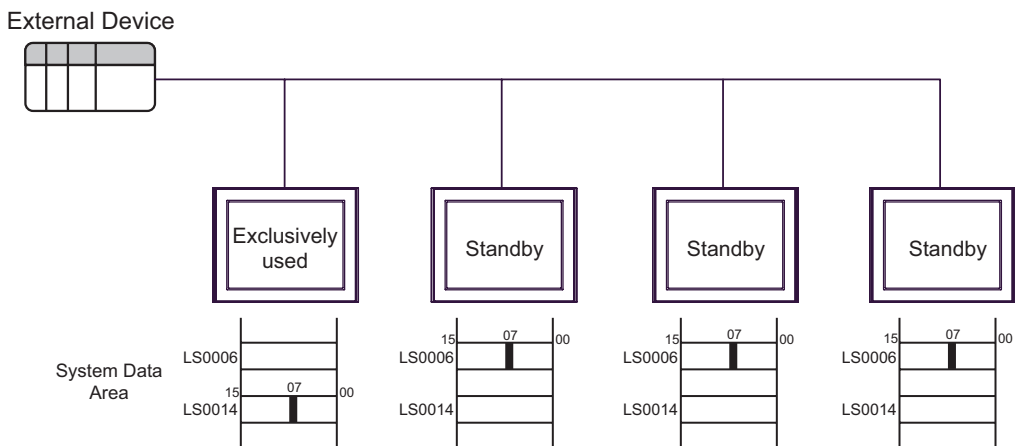
External Device

NOTE	• If multiple Displays have the LS0014 (Control) bit turned ON, the External Device is monopolized by the Display whose bit is turned ON first.
	• While a single Display monopolizes the External Device, the other Display screens are turned OFF.
	• The pass-through function can be used during multilink communication. Since a Display that uses the pass-through function monopolizes the External Device constantly, the other Display screens are turned OFF.

3   System Data Area Settings

Multilink communication uses a large volume of data for the overall system, because the number of system data areas to be assigned corresponds to that of connected Displays. This may result in slower processing speeds for the Displays.

When you set up the system data area, it is recommended that you select only the required items.

To show the GP-Pro EX system data area setting screen, from [System Settings] in the workspace, select [Display Unit], [System Area] tab.

NOTE

• Configure the system data area for each Display to be connected. Do not duplicate assigned External Device addresses on other Displays.

• To increase the processing speed of each Display, you can leave some system data area items cleared as shown above. With those settings disabled, you cannot change a screen from the External Device that controls the Display, and the Monopolize PLC function is disabled.

4 Multilink Settings

Multilink settings are intended to verify the system configuration of connected Displays and to check if communication is operating normally. Set a communication information storage address and station number.

4.1 Communication information storage address

Multilink communication is executed based on the Communication settings. The Communication settings uses two word areas: Enabled Stations and Active Stations. These areas have specific roles. Data are assigned to the data register and data memory of the External Device.

Data register of External Device

+0	Enabled Stations
+1	Active Stations

External Device→Display
Display→External Device
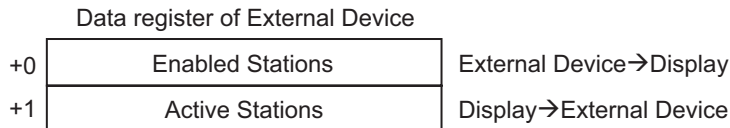
IMPORTANT
- A communication information storage address can be set only on an External Device that has been configured in the system area.
- When you set a communication information storage address, specify the same address for all Displays connected to a External Device. If the External Device has two connection ports and several Displays are connected to each port, specify the same address for all connected Displays.

■ **Enabled Stations**

Use the Enabled Stations to register an External Device and the number of connected Displays in the External Device in advance. When a Display is connected to an External Device, a bit corresponding to the station number of the Display is turned ON.

NOTE
- To stop a specific Display's communication and switch to OFFLINE mode while connected to an External Device, turn OFF the bit corresponding to the station number of the Display.

Bit 15 ... Bit 0

Unit 15	Unit 14	Unit 13	Unit 12	Unit 11	Unit 10	Unit 9	Unit 8	Unit 7	Unit 6	Unit 5	Unit 4	Unit 3	Unit 2	Unit 1	Unit 0

(Example)
To connect four Displays (No. 0, No. 2, No. 3 and No. 5 units), write "002D(H)".

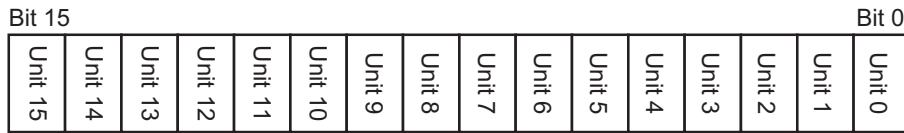| Enabled Stations | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 002D(H) |

IMPORTANT
- Before operation, be sure to set the Enabled Stations status bits.
- Displays that are not connected should have their status bits set to OFF.
- Do not turn OFF an Enabled Stations bit for a long period of time while the corresponding Display is being connected.
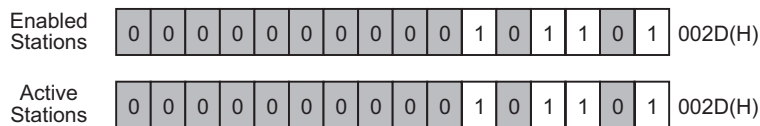

■ Active Stations

Active Stations indicate the communication status of each connected Display. When the bit corresponding to the Enabled Stations bit is set to ON, communication has been established. A bit corresponding to the Station Number of the Display in communication is turned ON.

Bit 15															Bit 0
Unit 15	Unit 14	Unit 13	Unit 12	Unit 11	Unit 10	Unit 9	Unit 8	Unit 7	Unit 6	Unit 5	Unit 4	Unit 3	Unit 2	Unit 1	Unit 0

If a Display normally communicates with an External Device, the same value in the Enabled Stations is written in the Active Stations.

(Example)

The same value 002D(H) as that for the settings of four Displays (No. 0, No. 2, No. 3 and No. 5 units) is written in the Active Stations.

Enabled Stations	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	002D(H)
Active Stations	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	002D(H)

NOTE
• If the Enabled Stations values do not match the Active Stations, there will be a communication error. Check the settings.

IMPORTANT
• To change the connection, turn OFF all bits once.

4.2　Station Number

Set the station number of a Display. The setting range is from 0 to 15. You can set a random number so that it is not duplicated with a station number of the other Displays. If the assigned number is duplicated, it results in a communication error.

NOTE
• The Station Number is a number assigned to a Display itself. It is not related to a unit number of the External Device.

5 Customize Function

Use the Customize Function to make multilink communication more efficient.

To improve communication efficiency, specify whether a Display will be a monitor or operation panel. Setting this function can increase the communication response speed, depending on the information displayed on the screen.

To display the [Customize - Multilink] dialog, in GP-Pro EX [System Settings] - [Display Unit], select the [System Area] tab, and click [Customize].
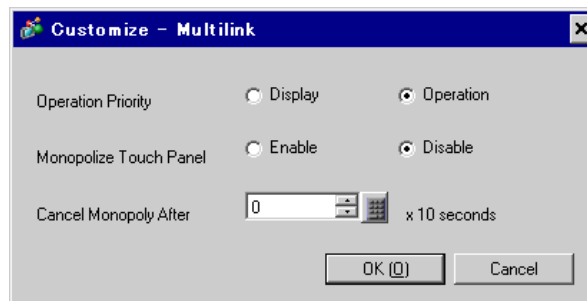
■ Operation Priority

You can specify which is to be given higher priority: Display or Operation functions, according to the Display application.

• Display Priority

If a Display is mainly used as a monitor screen, select this option. This setting improves the display speed of the whole Display, but reduces the operation response of the touch panel.

• Operation Priority

If a Display is mainly used as an operation panel, select this option. This setting improves the numerical input speed on the touch panel, as well as the switch response speed.

Differences in the "all read during writing" and "transmission right shift timing" process speeds depending on the priority setting are as follows.

Process	Display Priority	Operation Priority
All read during writing	Disabled	Enabled
Transmission right shift timing	All read	1 frame

NOTE	• Specify the same priority mode for all connected Displays. If a different mode is selected for a Display, the display speed or operation response cannot be improved.

■ Monopolize Touch Panel

You can specify whether to enable or disable the Monopolize Touch Panel function. To use an External Device exclusively with a touch panel that has been set for momentary operation, set "Monopolize Touch Panel" to "Enable".

If "Monopolize Touch Panel" is enabled for a touch panel that has been set for momentary operation, the External Device is exclusively used by the touch panel while it is being touched. This function enables inching operations with momentary switches. When you finish using the touch panel, the Monopolize PLC setting is switched off.

> **NOTE**
> • When several switches are simultaneously pressed, the Monopolize PLC setting will be switched off when any switch is turned OFF. For example, when a momentary switch and a momentary function switch are simultaneously pressed on a screen, the Monopolize PLC setting will be switched off at the moment when either switch is released.
> • While global interlock is being activated, the Monopolize Touch Panel function is disabled.

■ Cancel Monopoly After

If the Monopolize PLC function is enabled by turning ON the system data area LS0014 (Control) bit 7, you can specify the time period of exclusive use. With this setting, the system will automatically cancel the Monopolize PLC setting after the specified time elapses, even if bit 7 is still ON. After the Monopolize PLC setting is canceled, the system will return to the multilink communication mode.

> **NOTE**
> • When a touch operation (screen touch or function switch input) is executed while the Monopolize PLC function is enabled, the Cancel Monopoly After time will be reset.
> • If the Cancel Monopoly After time is set to "0" (zero), the Monopolize PLC setting will not be automatically canceled.
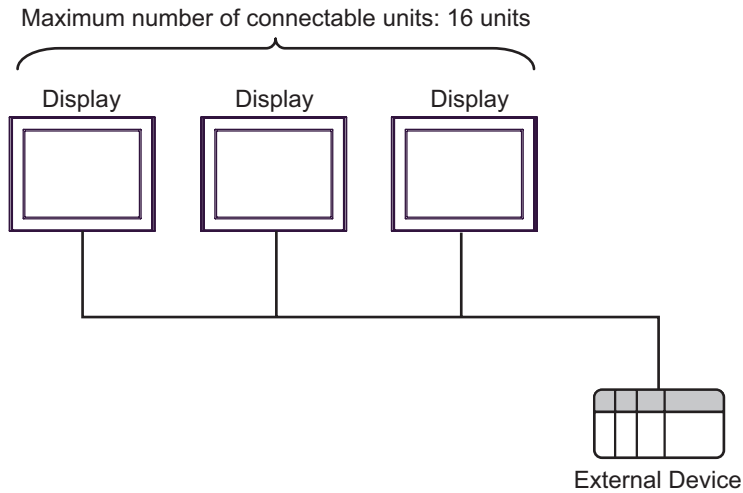
6   System Configuration

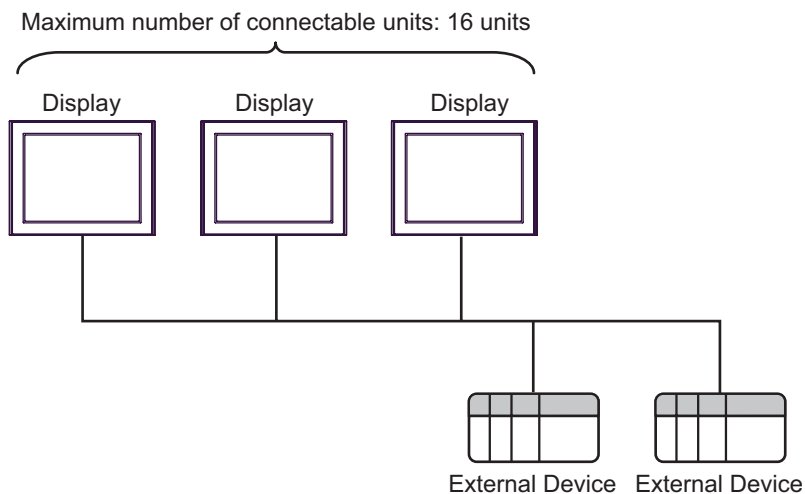To use serial multilink, the system configuration is as follows.

■ Serial

- n:1 Connection

Maximum number of connectable units: 16 units

Display   Display   Display

External Device

| NOTE | • You can connect a maximum of 16 Displays. However, for optimum performance, we recommend using a maximum of four Displays. |

- n:m Connection

Maximum number of connectable units: 16 units

Display   Display   Display

External Device   External Device

| NOTE | • You can connect a maximum of 16 Displays. However, for optimum performance, we recommend using a maximum of four Displays.
• The maximum number of connectable External Devices varies depending on the driver being used. |

7   Communication Settings

The following is an example of the system settings for connecting two Displays for multilink communication.

External Device (PLC1)
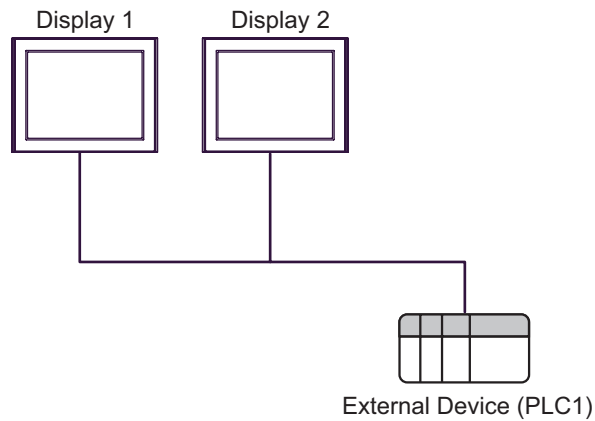
■ Setup Description

Setup Items	Display 1	Display 2
Station Number[*1]	0	1
Communication (storage address [*2])	[PLC1] D00100	[PLC1] D00100

*1   Set a Station Number (0 to 15) for the Display that is not used by other Displays.

*2   For all the connected Displays, set the same External Device name and address so that they are different from the settings in the system data area.

NOTE   • The storage address format varies depending on the External Device being used.

■ Setting Procedures

1 From [System Settings] in the workspace, select [System Area] from [Display Unit].

2 Select the [Enable Multilink] check box.
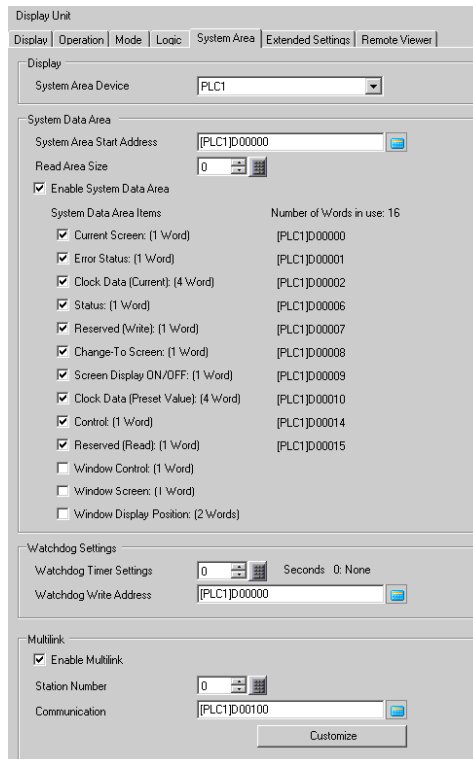
NOTE • Multilink setting items are displayed only when a multilink-compatible driver is selected.

3 Set [Station Number] and [Communication] as follows.

Setup Items	Display 1
Station Number	0
Communication (storage address)	[PLC1] D00100

4 Configure Customize settings, as required.

Click on [Customize], and set [Operation Priority], [Monopolize Touch Panel] and [Cancel Monopolize After] in the dialog box.

☞ "5 Customize Function" (page 7)
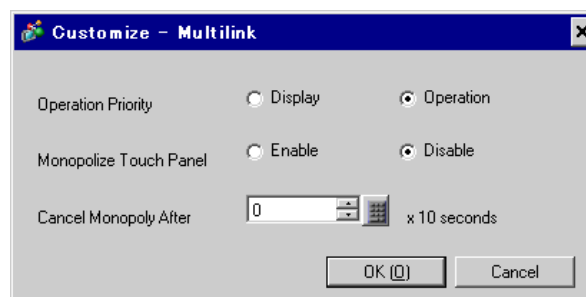
5 Set the communication parameters for a Display. For details, refer to the manual for the driver being used.

6 Transfer the settings to Display 1.

7 Transfer the following settings to Display 2 by following the procedures of step 1 to step 6.

Setup Items	Display 2
Station Number	1
Communication (storage address)	[PLC1] D00100

NOTE

• [Multilink] and [Customize] settings are enabled even in the OFFLINE mode.
  In the OFFLINE mode, touch [Display Unit] - [System Area], and then touch [Multilink
  Setting] in the displayed window.

8   Cable Diagrams

The multilink communication connection diagram varies depending on the driver being used.

Refer to the multilink connection diagram given in the manual for the driver being used.

9   Internal Devices

The following internal devices are used for multilink communication.

LS Address	Memory Link Address	Description	Bit	Details	System Variable
LS0006	0001	Status	7	Monopolize PLC via another station (Standby). When the External Device is monopolized by another Display during multilink connection, this bit turns ON.	#H_Status_PLCmonopoly
LS0014	0011	Control	7	Monopolize PLC via the current station. If this bit is turned ON during multilink connection, the External Device is monopolized by the station.	#H_Control_PLCmonopoly
LS2040	2040	Maximum value of token passing speed	-	Used during multilink connection only. The maximum cycle time for passing a token packet (right to issue a command to an External Device) among connected Displays (a random number of connected devices: N). The unit value is 10 ms. Every time the maximum value is changed, the set value will be updated. The initial setting is "0". The tolerance is ±10 ms.	#H_MAXTokenSpeed
LS2041	2041	Current value of token passing speed	-	Used during multilink connection only. The current cycle time for passing a token packet (right to issue a command to an External Device) among connected Displays (a random number of connected devices: N). The unit value is 10 ms. Every time the maximum value is changed, the set value will be updated. The initial setting is "0". The tolerance is ±10 ms.	#H_CurrentTokenSpeed

10   Error Messages

Error messages are displayed on the Display screen as follows: "No. : Device Name: Error Message(Error Occurrence Area)". Each description is shown below.

Item	Description
No.	Error number
Device Name	Name of the External Device where an error has occurred. Device/PLC name is the title of the External Device set with GP Pro-EX.(Initial value [PLC1])
Error Messages	Displays messages related to an error that has occurred.
Error Occurrence Area	Displays the IP address or device address of the External Device where an error has occurred, or error codes received from the External Device. **NOTE** • IP addresses are displayed as "IP address (Decimal): MAC address (Hex)". • Device addresses are displayed as "Address: Device address". • Received error codes are displayed as "Decimal [Hex]".

Examples of Error Messages

"RHAA035: PLC1: Error has been responded for device write command (Error Code: 2[02H])"

NOTE

• Refer to "When an error is displayed (Error Code List)" in "Maintenance/Troubleshooting Manual" for details on the error messages common to the driver.

11   Restrictions

The following restrictions exist for multilink communication:

- You can connect a maximum of 16 Displays. However, for optimum performance, we recommend using a maximum of four Displays.
- For multilink communication information, you can specify the address of the Device that has been set in the system area only.