OMRON

Machine Automation Controller
NX-series

# Load Cell Input Unit Startup Guide for Weight Measurement

NX-RS□□□□

Startup
Guide

sysmac
always in control

# Introduction

The *NX-series Load Cell Input Unit Startup Guide for Weight Measurement* (hereinafter, may be referred to as "this Guide") describes the startup procedures for weight measurement in combination with the NJ-series CPU Unit and the basic operating instructions for the Sysmac Studio. A simple scaling system is used for the discussion. You can perform the procedures that are presented in this Guide to quickly gain a basic understanding of how to use the Load Cell Input Unit.

This Guide does not contain safety information and other details that are required for actual use. Thoroughly read and understand the manuals for all of the devices that are used in this Guide to ensure that the system is used safely. Review the entire contents of these materials, including all safety precautions, precautions for safe use, and precautions for correct use.

## Intended Audience

This Guide is intended for the following personnel.
• Personnel in charge of introducing FA systems
• Personnel in charge of designing FA systems

The personnel must also have the following knowledge.
• Knowledge of electrical systems (an electrical engineer or the equivalent)
• Knowledge of NJ-series CPU Units
• Knowledge of operation procedure of Sysmac Studio
• Knowledge of NA-series Programmable Terminal
• Knowledge of load cells

## Applicable Products

This Guide covers the following products.
• Load Cell Input Units of NX-series Machine Automation Controllers
• CPU Units of NJ-series Machine Automation Controllers
• Sysmac Studio Automation Software
• NA-series Programmable Terminals

## Special Information

The icons that are used in this Guide are described below.

**Precautions for Correct Use**

Precautions on what to do and what not to do to ensure proper operation and performance.

**Additional Information**

Additional information to read as required.
This information is provided to increase understanding or make operation easier.

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- When building a system, check the specifications for all devices and equipment that will make up the system and make sure that the OMRON products are used well within their rated specifications and performances. Safety measures, such as safety circuits, must be implemented in order to minimize the risks in the event of a malfunction.
- Thoroughly read and understand the manuals for all devices and equipment that will make up the system to ensure that the system is used safely. Review the entire contents of these manuals, including all safety precautions, precautions for safe use, and precautions for correct use.
- Confirm all regulations, standards, and restrictions that the system must adhere to.

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# Related Manuals

The following manuals are related to this Guide. Use these manuals for reference.
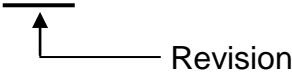
| Manual name | Cat. No. | Model numbers | Application | Description |
|---|---|---|---|---|
| NX-series Load Cell Input Unit Startup Guide for Weight Measurement (this guide) | P104 | NX-RS1201 | Learning the startup procedures for a weight measuring system using the NX-series Load Cell Input Unit | The startup procedures for a weight measuring system using the NX-series Load Cell Input Unit are described. |
| NX-series Load Cell Input Unit User's Manual | W565 | NX-RS□□□□ | Learning how to use an NX-series Load Cell Input Unit | The hardware, setup methods, and functions of the NX-series Load Cell Input Unit are described. |
| NJ/NX-series Sysmac Library User's Manual for Weighing Control Library | W569 | SYSMAC-XR010 | Learning the function block specifications in the Weighing Control Library | Information required to use the Weighing Control Library is described. |
| Sysmac Studio Version 1 Operation Manual | W504 | SYSMAC-SE2□□□ | Learning about the operating procedures and functions of the Sysmac Studio. | The operating procedures of the Sysmac Studio are described. |
| NJ-series CPU Unit Hardware User's Manual | W500 | NJ501-□□□□ NJ301-□□□□ | Learning the basic specifications of the NJ-series CPU Units, including introductory information, designing, installation, and maintenance. Mainly hardware information is provided. | An introduction to the entire NJ-series system is provided along with the following information on a Controller built with an NJ501 CPU Unit. ・Features and system configuration ・Introduction ・Part names and functions ・General specifications ・Installation and wiring ・Maintenance and inspection Use this manual together with the *NJ-series CPU Unit Software User's Manual* (Cat. No. W501). |
| NJ-series CPU Unit Software User's Manual | W501 | NJ501-□□□□ NJ301-□□□□ | Learning how to program and set up an NJ-series CPU Unit. Mainly software information is provided. | The following information is provided on a Controller built with an NJ-series CPU Unit. ・CPU Unit operation ・CPU Unit features ・Initial settings ・Programming based on IEC 61131-3 language specifications Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No.W500). |

| Manual name | Cat. No. | Model numbers | Application | Description |
|---|---|---|---|---|
| NJ-series Troubleshooting Manual | W503 | NJ501-□□□□ NJ301-□□□□ | Learning about the errors that may be detected in an NJ-series Controller. | Concepts on managing errors that may be detected in an NJ-series Controller and information on individual errors are described. Use this manual together with the *NJ-series CPU Unit Hardware User's Manual* (Cat. No.W500) and *NJ-series CPU Unit Software User's Manual* (Cat. No. W501). |
| NX-series Data Reference Manual | W525 | NX-□□□□□□ | Referencing lists of the data that is required to configure systems with NX-series Units | Lists of the power consumptions, weights, and other NX Unit data that is required to configure systems with NX-series Units are provided. |
| NX-series EtherCAT Coupler Unit User's Manual | W519 | NX-ECC201 NX-ECC202 NX-ECC203 | Leaning how to use an NX-series EtherCAT Coupler Unit and EtherCAT Slave Terminals | The following items are described: the overall system and configuration methods of an EtherCAT Slave Terminal (which consists of an NX-series EtherCAT Coupler Unit and NX Units), and information on hardware, setup, and functions to set up, control, and monitor NX Units through EtherCAT. |
| NA-series Programmable Terminal Hardware User's Manual | V117 | NA5-□W□□□□ NA5-□□W□□□□ | Learning the specifications and settings required to install an NA-series PT and connect peripheral devices. | Information is provided on NA-series PT specifications, part names, installation procedures, and procedures to connect an NA Unit to peripheral devices. Information is also provided on maintenance after operation and troubleshooting. |
| NA-series Programmable Terminal Software User's Manual | V118 | NA5-□W□□□□ NA5-□□W□□□□ | Learning about NA-series PT pages and object functions. | NA-series PT pages and object functions are described. |
| NA-series Programmable Terminal Device Connection User's Manual | V119 | NA5-□W□□□□ NA5-□□W□□□□ | Learning the specifications required to connect devices to an NA-series PT. | Information is provided on connection procedures and setting procedures to connect an NA-series PT to a Controller or other device. |
| NA-series Programmable Terminal Startup Guide | V120 | NA5-□W□□□□ NA5-□□W□□□□ | Learning in concrete terms information required to install and start the operation of an NA-series PT. | The part names and installation procedures are described followed by page creation and transfer procedures with the Sysmac Studio. Also operation, maintenance, and inspection procedures after the project is transferred are described. Sample screen captures are provided as examples. |

# Revision History

A manual revision code appears as a suffix to the catalog number on the front and back covers of the manual.

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┌─────────────┬──────────────────────┐
│  Cat. No.   │   P104-E1-01         │
└─────────────┴──────────────────────┘
                              ↑
                              └─── Revision
```

| Revision code | Date | Revised content |
|---|---|---|
| 01 | April 2016 | Original production |

# CONTENTS

# 1. System to Construct and Configuration Devices

## 1.1. System Configuration and Configuration Devices

This section describes the system configuration and configuration devices used in this Guide. The system configuration is shown below. This system is a scaling system where a measured material is placed onto the scale to measure its weight.

The load cell output, which is obtained from the data inputted to the Load Cell Input Unit, is converted into the weight value to measure the weight of the measured material. The weight value converted by the Load Cell Input Unit is sent to a CPU Unit and displayed on the Programmable Terminal.
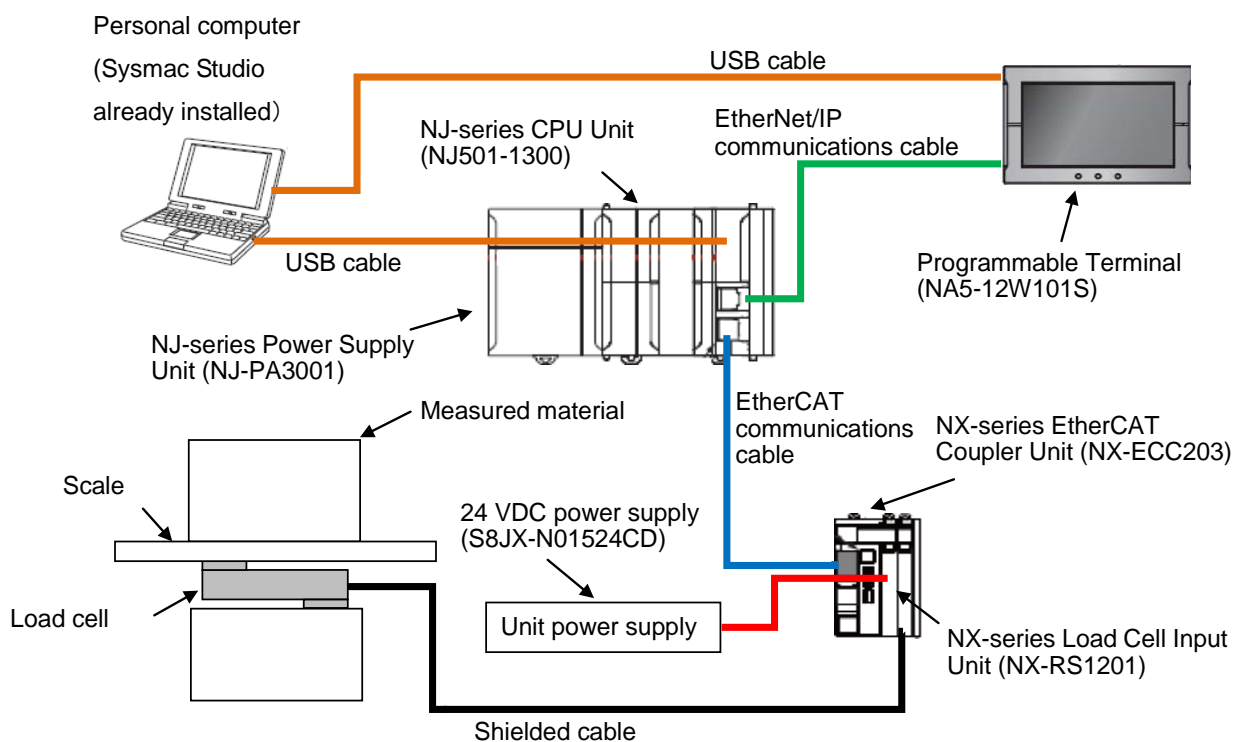


📖 **Additional Information**

Refer to the *NJ/NX-series Sysmac Library User's Manual for Weighing Control Library* (Cat. No. W569) for examples of use in other weighing systems.

This Guide's examples assume the specifications of the used load cell as follows.

| Connection line | Rated capacity | Rated output | Zero balance |
|---|---|---|---|
| 6-wire type or 4-wire type | 20 kg | 2 mV/V | 1 µV/V |

This Guide's examples assume the weights of the scale and the measured material as follows.

| Item | Weight |
|---|---|
| Scale | 5 kg |
| Measured material | 10 kg |

📓 **Additional Information**

> Select the load cell's rated capacity, scale, and measured material so as to satisfy the
> following relationship:
> Rated capacity of the load cell ≥ Weight of the scale + Maximum weight of the measured
> material

The table below shows the models of the devices used for explanation in this Guide. When
selecting devices for actual use, refer to their respective manuals.

| Device name | Model | Manual name |
|---|---|---|
| NX-series Load Cell Input Unit | NX-RS1201 (version 1.0) | *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565) |
| NJ-series CPU Unit | NJ501-1300 (version 1.05 or later) | *NJ-series CPU Unit Hardware User's Manual* (Cat. No. W500). |
| NJ-series Power Supply Unit | NJ-PA3001 | |
| EtherCAT communications cables EtherNet/IP communications cables | XS5W-T421-CMD-K | |
| NX-series EtherCAT Coupler Unit | NX-ECC203 (version 1.0 or later) | *NX-series EtherCAT Coupler Unit User's Manual* (Cat. No. W519) |
| Ferrule | H0.25/12 (used for other than ground terminals) AI2,5-10 (used for ground terminals) | |
| Programmable Terminal | NA5-12W101S (Ver.1.01) | *NA-series Programmable Terminal Hardware User's Manual* (Cat. No. V117) |
| Switching power supply (24 VDC power supply) | S8JX-N01524CD | [Instruction Manual] *S8JX Switching Power Supply* (1141546-0) |
| Load cell | Commercially available load cell[*1] | — |
| USB cable | Commercially available USB cable[*2] | — |
| Shielded cable | Commercially available shielded cable[*3] | — |
| Scale | — | — |
| Standard weight | — | — |

*1. For the load cells that can be connected to the NX-RS1201 Load Cell Input Unit, refer to
*1.2 Applicable Load Cells.*

*2. Use a USB2.0 (or 1.1) cable (A to B connector) with a maximum length of 5.0 meters.

*3. For use of a 4-wire load cell, use a 4-conductor type; for use of a 6-wire load cell, use a 6-conductor type. In addition, the wire resistance should be less than 5 Ω.

The table below shows the software, used for explanation in this Guide, to install on the personal computer (OS: Windows 7 64-bit edition).

| Manufacturer | Name | Version |
|---|---|---|
| OMRON Corporation | Sysmac Studio | Version 1.16 or later |

## 1.2. Applicable Load Cells

The table below shows the specifications of the NX-RS1201 Load Cell Input Unit used for explanation in this Guide. Select the applicable load cell within the range of specifications as shown in the table.

| Load cell excitation voltage | Input range | Connection to load cell | Number of load cell input |
|---|---|---|---|
| 5 VDC ±10% Output current: 60mA or less | -5.0 to +5.0 mV/V | 6-wire type or 4-wire type | 1 |

For use of a load cell for which a load cell excitation voltage of more than 5 VDC is recommended, ask the load cell's manufacturer if the use of 5 VDC is acceptable.[1] You cannot use a load cell whose load cell excitation voltage is less than 5 VDC in its specifications.
For use of multiple load cells in parallel connection, the total current supplied to the load cell should be 60 mA or less.

*1. For example, if the load cell excitation voltage is specified as 5 to 10 VDC in the specifications, its use is possible. If specified as 10 VDC, ask the load cell's manufacturer if the use of 5 VDC is acceptable.

# 2. Before You Begin

## 2.1. Wiring the Devices and Installing the Software

Wire the devices and install the Sysmac Studio to the personal computer as described in *1.1. System Configuration and Configuration Devices*.

📝 **Additional Information**

- Refer to *3.2 Installing Wiring for the Load Cell Input Unit* for how to wire Load Cell Input Unit and a load cell.
- For wiring and usage of the NJ-series CPU Unit, NX-series EtherCAT Coupler Unit, and Programmable Terminal, refer to their respective manuals. For manual information, see *Related Manuals*.
- Refer to the *Sysmac Studio Version 1 Operation Manual* (Cat. No. W504) for how to install the Sysmac Studio.
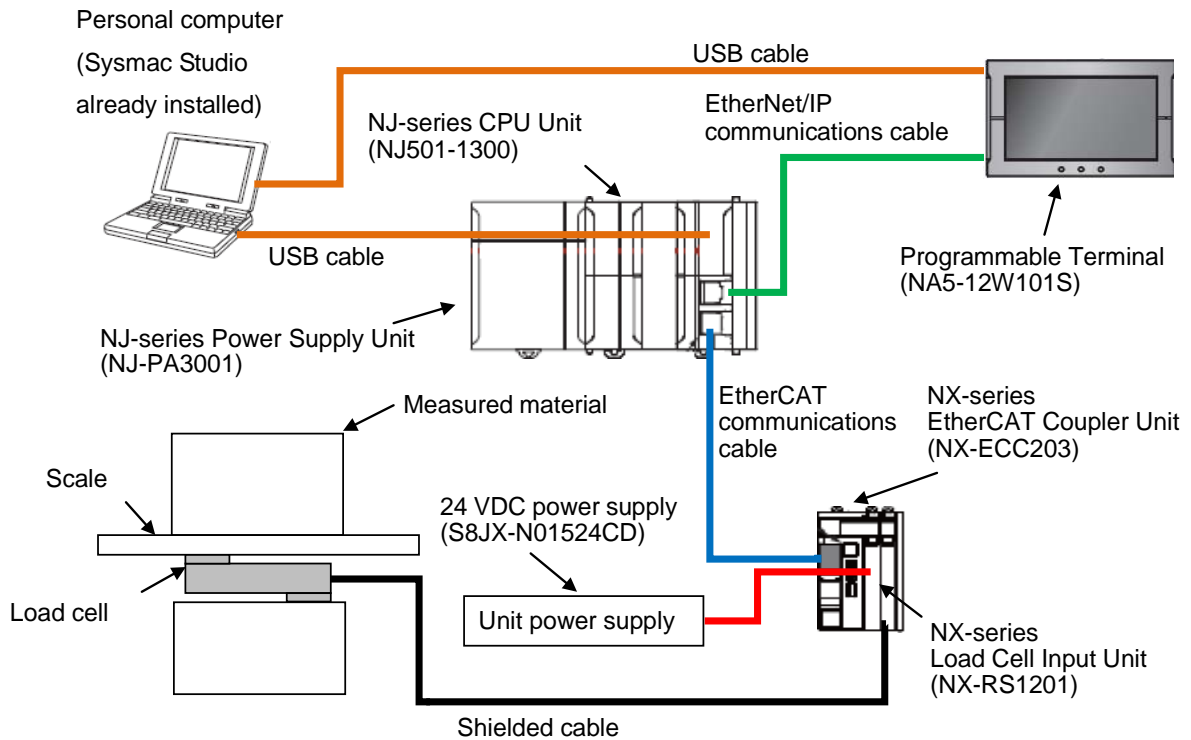
# 3.  Starting Up the Weight Measuring System

## 3.1.  Steps to Start Up the Weight Measuring System

The steps to start up the weight measuring system using a scale are as follows:

| 3.2 | **Installing Wiring for the Load Cell Input Unit** | Install wiring between the Load Cell Input Unit and a load cell. The wiring configuration is different between a 4-wire load cell and a 6-wire load cell. |
|---|---|---|

▼

| 3.3 | **Performing a Calibration** | Be sure to perform calibration before measurement in order to measure the weight and force using the Load Cell Input Unit. There are two calibration methods for the Load Cell Input Unit:<br>・Actual load calibration<br>・Equivalent input calibration |
|---|---|---|

▼

| 3.4 | **Checking Measurement Values** | Place a measured material onto the scale of the scale weighing system and check its measurement value (weight value). |
|---|---|---|

This Guide covers the Load Cell Input Unit's startup procedures only. For wiring and usage of the NJ-series CPU Unit, NX-series EtherCAT Coupler Unit, and Programmable Terminal, refer to their respective manuals. For manual information, see *Related Manuals*.

## 3.2. Installing Wiring for the Load Cell Input Unit

This section shows the examples of wiring to a load cell.

You can connect the Load Cell Input Unit to a load cell with a 6-wire or 4-wire connection. We recommend that you use a 6-wire connection for connecting the load cell with the Load Cell Input Unit to achieve high-precision measurements.

### Precautions for Correct Use

- Use a shielded cable to connect to the load cell. Connect the shield wire to the SHLD terminal on the Load Cell Input Unit.
- Ground the functional ground terminal on the Load Cell Input Unit to 100 Ω or less.
- We recommend that you use a 6-wire connection for connecting the load cell with the Load Cell Input Unit to achieve high-precision measurements. When you use a 4-wire connection, the measurement resolution of wiring resistance decreases due to temperature changes.
- Keep the wiring resistance from the load cell to the Load Cell Input Unit to 5 Ω or less while in use.
- Wire the cable that connects the load cell and the Load Cell Input Unit separately from AC power supply lines or power lines in order to avoid the effects of the noise. Do not place such lines in the same duct.
- Insert a noise filter into the power supply input section if noise may overlap from power supply lines when using the same power supply to power an electrical welder or an electric discharge machine, or there is a high-frequency source nearby.

### Additional Information

- The Load Cell Input Unit uses screwless clamping terminal blocks. The use of ferrules makes wiring an easy matter of inserting them. The screwless design greatly reduces wiring work.



Ferrule
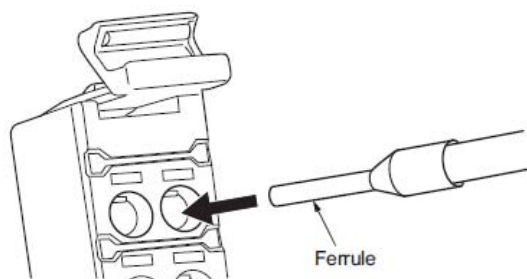
- The sensor disconnection test is available for the Load Cell Input Unit. Using the sensor disconnection test after the completion of wiring allows you to check whether there is a cable disconnection and a non-connected wiring. Refer to the *NX-series Load Cell Input User's Manual* (Cat. No. W565) for details on the sensor disconnection test.

### 3.2.1. Wiring Example with 6-wire Connection

For the connection between a 6-wire load cell and the Load Cell Input Unit, lay the wiring as in the figure below.
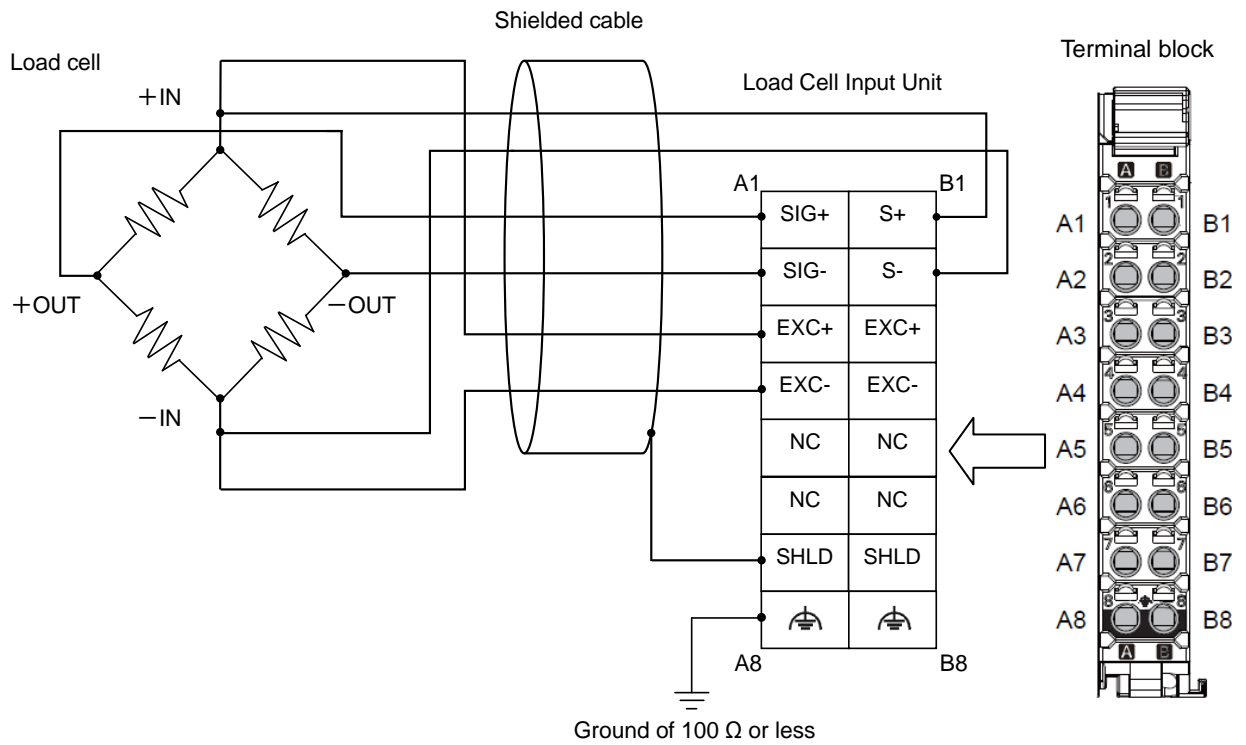


### 3.2.2. Wiring Example with 4-wire Connection

For the connection between a 4-wire load cell and the Load Cell Input Unit, lay the wiring as in the figure below.

The application of 4-wire connection leads to a decrease in measurement precision due to temperature variations of the wiring resistance compared to the 6-wire connection.
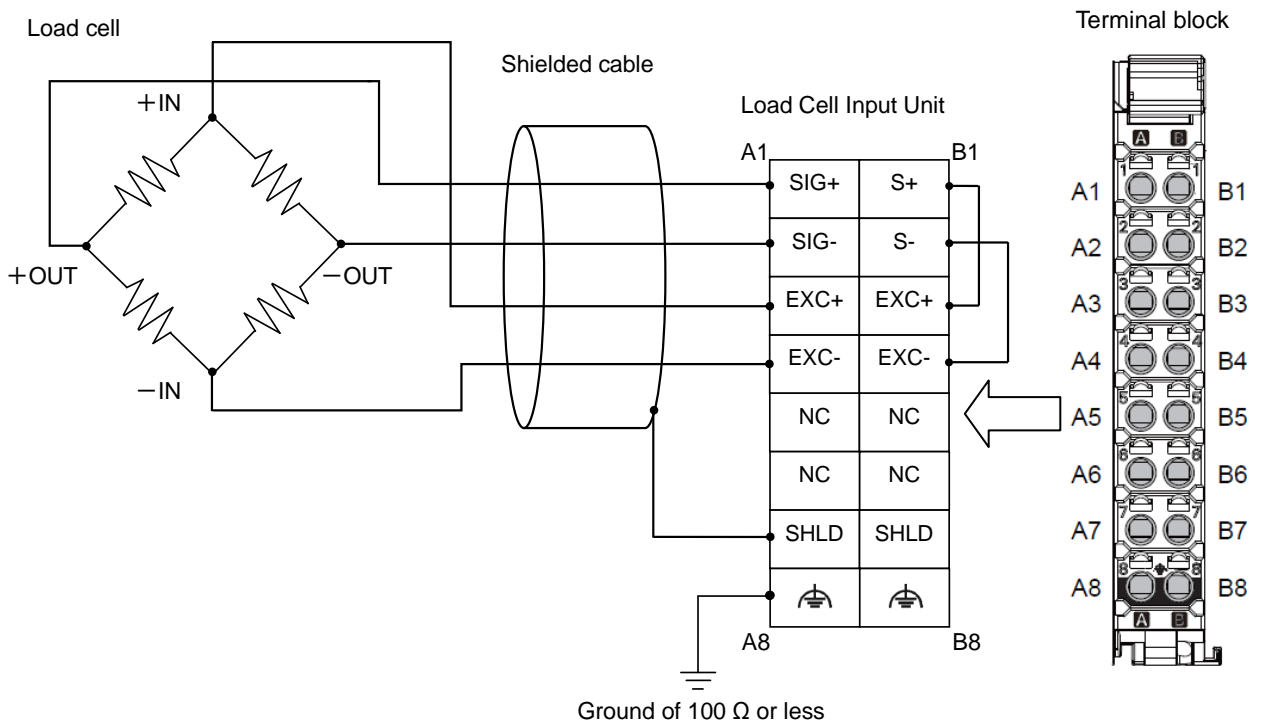
<table>
<tr><td>⊞</td><td><strong>Precautions for Correct Use</strong></td></tr>
</table>

When you use the Load Cell Input Unit with a 4-wire connection, always connect S+ terminal with EXC+ terminal, and S- terminal with EXC- terminal on the terminal block. If they are not connected, the Load Cell Input Unit does not operate normally.

### 3.2.3.    Wiring Example of Parallel Connection

The system configuration example in this Guide is based on the assumption that one load cell is in use, but multiple load cells can be connected in parallel by using a summing box as in the diagram below. Refer to *4-4 Wiring the Connected External Devices* described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565).
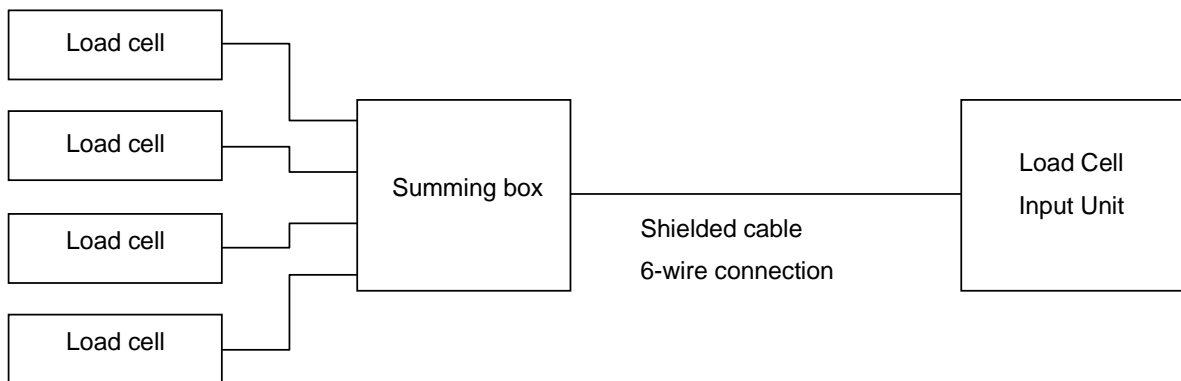
## 3.3. Performing a Calibration

The measurement of weight and force using the Load Cell Input Unit always requires calibration to be performed before measurement. There are two calibration methods for the Load Cell Input Unit:

・Actual load calibration
・Equivalent input calibration

This section describes the overview of each calibration and its procedure.

### 3.3.1. Overview of Calibration

The Load Cell Input Unit can properly convert the input into weight values and load values according to the load on the load cell when a calibration is performed. For example, when a load of 10 kg is applied to the load cell, perform a calibration in order for the Load Cell Input Unit to convert the measurement value to 10 kg. The overview of each calibration method is described below.

・ Overview of Actual Load Calibration

This is a calibration method that applies an actual load to the load cell that is connected to the Load Cell Input Unit, and registers the actual load value on the Load Cell Input Unit as calibration data. Because the margin of error is small during calibration, highly accurate measurement is achieved. For high precision measurement, the actual load calibration is recommended.

・ Overview of Equivalent Input Calibration

This is a calibration method that sets the rated capacity, the rated output and the zero balance that are listed on the data sheet for the load cell by entering numeric values, and registers the values on the Load Cell Input Unit as calibration data.

Compared to an actual load calibration, the measurement resolution is lower because the margin of error is greater with this calibration. An equivalent input calibration is performed in the following cases:

• When measuring a force[1]
• When measuring a material of a weight for which preparation of a standard weight is not possible
• When spatial limitation makes it difficult to apply an actual load, such as when the load cell and the filing machine are integrated.

*1. The force applied to the load cell is measured. The unit is N or kN.

・ How to Perform Calibration

Two calibration methods can be used for the Load Cell Input Unit:

・By using the Sysmac Studio
・By using the I/O data

This Guide describes the method using the Sysmac Studio. For the method using the I/O data, refer to *6-2 Specifications of I/O Data* and *7-4 Calibration with the User Program* described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565).

### 3.3.2. Performing an Actual Load Calibration

The following operations are performed for actual load calibration:

- Basic parameter settings
- Performing a zero calibration
- Performing a span calibration
- Correcting the gravity acceleration as needed

This section describes how to perform these operations with the Sysmac Studio.

📝 **Precautions for Correct Use**

Before you perform an actual load calibration after the completion of wiring to the load cell, turn ON the power and warm up the system for at least 30 minutes. If the system is not warmed up, the error by a zero drift or a gain drift after the calibration becomes greater than that of when the system is warmed up and the error of measurement values becomes larger.

● Basic Parameter Settings

Set the standard weight as the basic parameter for actual load calibration.

The standard weight can be set from the Unit operation settings. The procedure to set the standard weight with the Sysmac Studio is shown below. Note that in this example, a 5 kg standard weight is used for calibration.

| 1 | With the Sysmac Studio and the CPU Unit being online, double-click your Load Cell Input Unit in the Multiview Explorer to open the Edit Unit Operation Settings Tab Page. The following tab page is displayed. |
|---|---|



| 2 | Since a 5 kg standard weight is used for calibration in this example, set the Ch1 Standard Weight to 5. Leave the other setting values of the Unit operation settings at their defaults. |
|---|---|

| 3 | Click the **Transfer to Unit** Button. |
|---|---|
|   | The settings are transferred from the Sysmac Studio to the NX Unit. |

● Performing a Zero Calibration

This section describes how to perform zero calibration.

Before zero calibration, make a state where only a scale is placed on the load cell.

Performing zero calibration with only a scale placed on the load cell yields a gross weight value of 0 for this state.
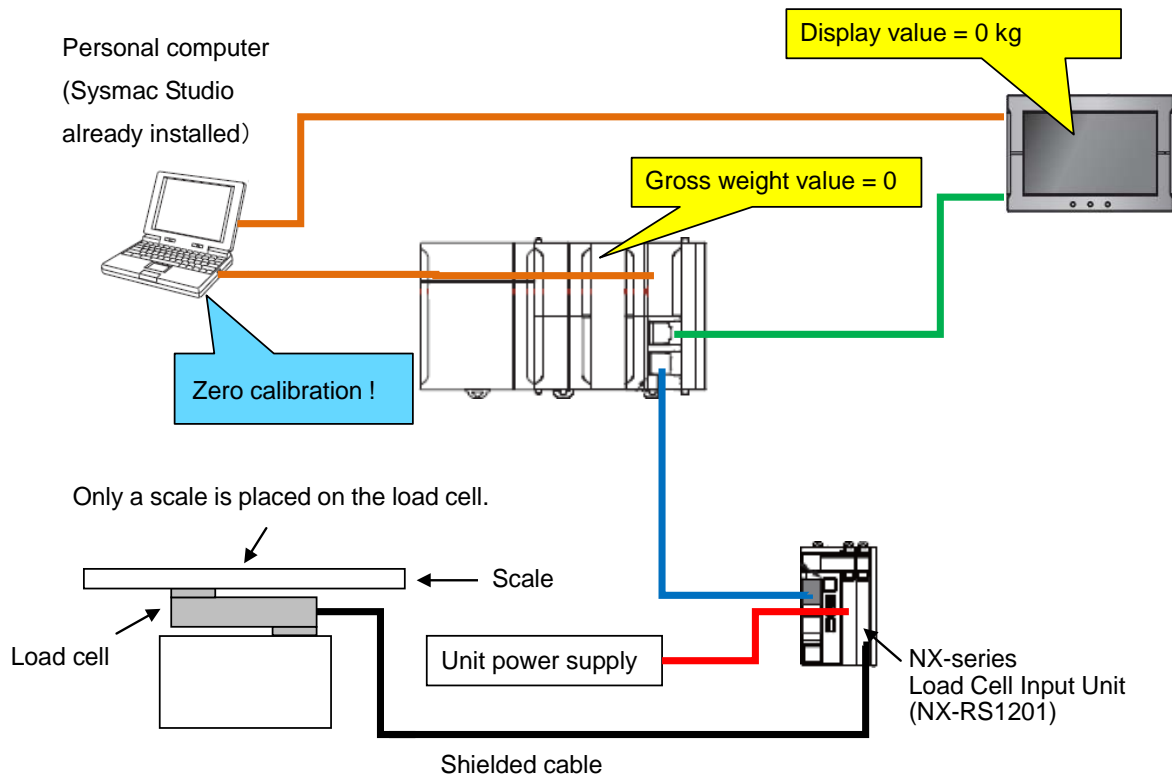


The steps to perform zero calibration with the Sysmac Studio are as follows.

| 1 | With the Sysmac Studio and the CPU Unit being online, double-click the Communications Coupler Unit to which your Load Cell Input Unit is connected in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page. The following tab page is displayed. |
|---|---|
|   |  |

| 2 | Right-click your Load Cell Input Unit on the Edit Slave Terminal Configuration Tab Page and select **Calibration and Data Trace**.<br>The following tab page is displayed.<br> |
|---|---|
| 3 | Check Stable status in Actual Load Calibration is ON if the stability of the gross weight value is being checked using the stable detection. A check of Stable status is not required if the stability of the gross weight value is not being checked.<br><br>If Stable status is not ON in confirming the stability of the gross weight value, eliminate the factors that cause Stable status not to turn ON. The following factors are possible:<br>● The set value for Ch1 Stable Status Range is invalid.<br>For example, a case with a set value of 0, or with a different setting from the unit of the gross weight value to measure.<br>● The set value for Ch1 Stable Status Period is invalid.<br>For example, a case with Ch1 Stable Status Period set to 0.<br>● Enough time has not elapsed from a time when the load applied to the load cell is changed.<br>● Being affected by noise. |
| 4 | Click the **Execute Zero Calibration** Button in Actual Load Calibration.<br>An execution confirmation dialog box is displayed.<br> |
| 5 | Click the **Yes** Button.<br>A zero calibration is performed. |

*1. By default, the stable detection capability is disabled. Refer to *8-7 Stable Detection* described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565) for details on the stable detection feature.

● Performing a Span Calibration

This section describes how to perform span calibration.
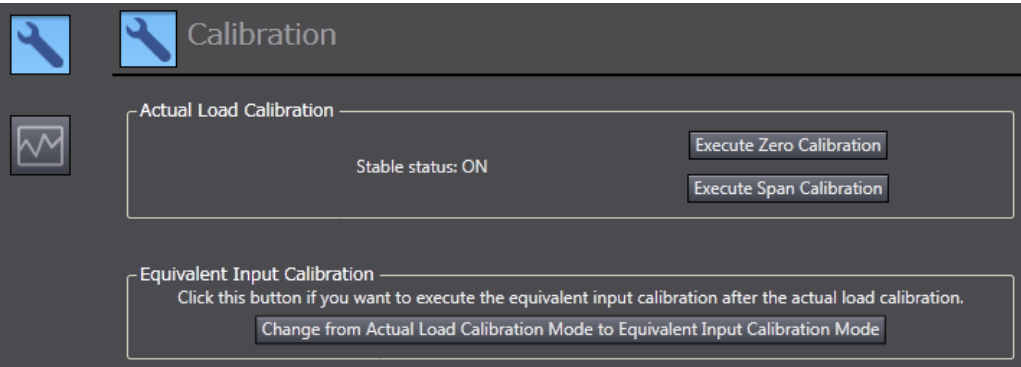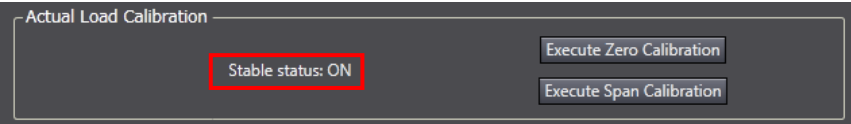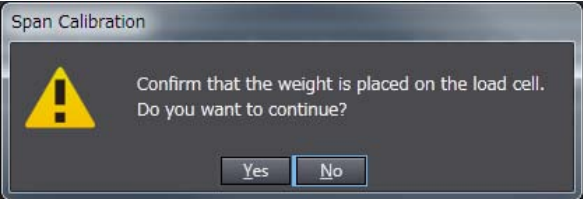
Before span calibration, make a state where a standard load such as a standard weight is placed on the scale. Performing span calibration with a 5 kg standard weight placed on the scale, as shown below, yields a gross weight value of 5, which is the value set as Ch1 Standard Weight.
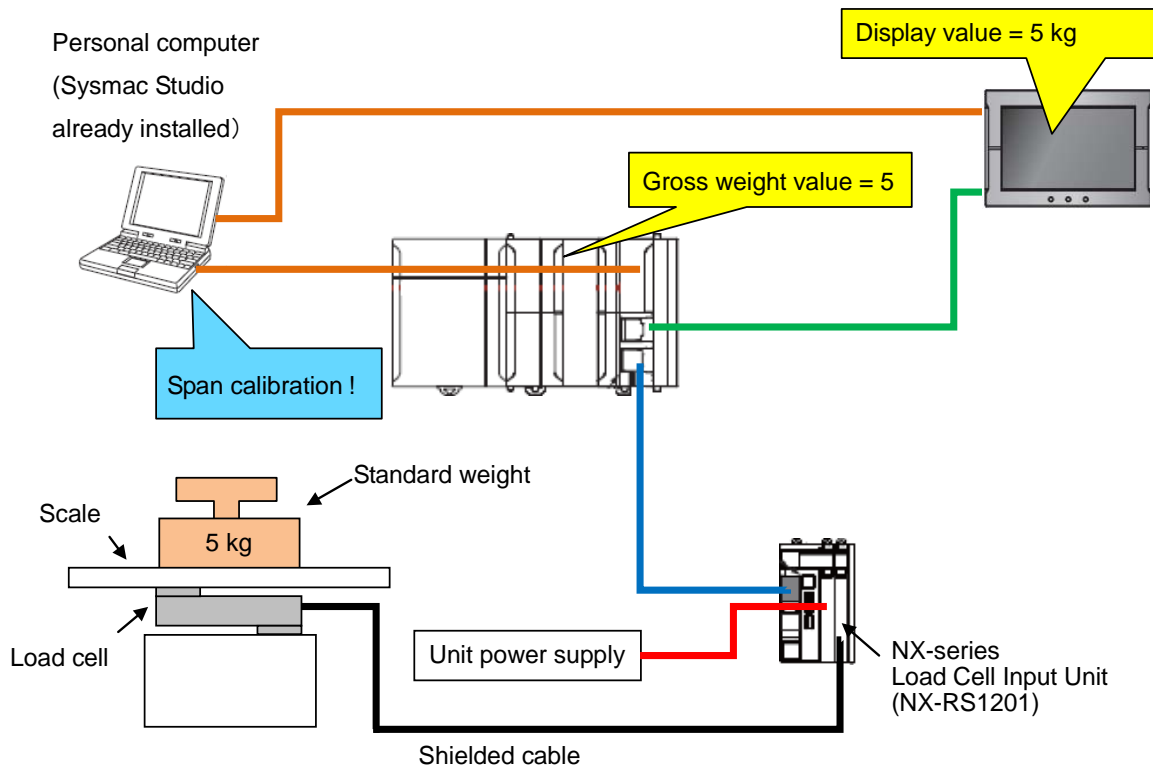


The steps to perform span calibration with the Sysmac Studio are as follows. Note that you can skip steps 1 and 2 when performing span calibration following zero calibration.

| 1 | With the Sysmac Studio and the CPU Unit being online, double-click the Communications Coupler Unit to which your Load Cell Input Unit is connected in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page. The following tab page is displayed.  |
|---|---|

| | |
|---|---|
| 2 | Right-click your Load Cell Input Unit on the Edit Slave Terminal Configuration Tab Page and select **Calibration and Data Trace**.<br>The following tab page is displayed.<br> |
| 3 | Check Stable status in Actual Load Calibration is ON if the stability of the gross weight value is being checked using the stable detection. A check of Stable status is not required if the stability of the gross weight value is not being checked.<br><br>If Stable Status is not ON in confirming the stability of the gross weight value, eliminate the factors that cause Stable Status not to turn ON. The following factors are possible:<br>● The set value for Ch1 Stable Status Range is invalid.<br>    For example, a case with a set value of 0, or with a different setting from the unit of the gross weight value to measure.<br>● The set value for Ch1 Stable Status Period is invalid.<br>    For example, a case with Ch1 Stable Status Period set to 0.<br>● Enough time has not elapsed from a time when the load applied to the load cell is changed.<br>● Being affected by noise. |
| 4 | Click the **Execute Span Calibration** Button in Actual Load Calibration.<br>An execution confirmation dialog box is displayed.<br> |
| 5 | Click the **Yes** Button.<br>A span calibration is performed. |

*1. By default, the stable detection capability is disabled. Refer to *8-7 Stable Detection* described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565) for details on the stable detection feature.

● Correcting the Gravity Acceleration

If the place where actual load calibration is performed for a device is different from the place where the device is installed, a difference in gravity acceleration between these places causes an error in the gross weight value, resulting from conversion by the Load Cell Input Unit, between the calibration place and the installation place. The gravity acceleration correction allows this error to be corrected.

The gravity acceleration correction is based on the following equation to correct the gross weight value:

$$\text{Gross weight value after correction} = \text{Gross weight value before correction} \times \frac{\text{Gravity acceleration of calibration site}}{\text{Gravity acceleration of installation site}}$$

Note, however, that the following cases do not require the gravity acceleration correction:
• The site where the actual load calibration is executed and the installation site are the same.
• For the force measurement system.[1]
• A Load Cell Input Unit is calibrated with the equivalent input calibration.

*1. This system measures a force applied to a load cell. The unit is N or kN.

📝 **Additional Information**

For the gravity accelerations in Japan, refer to the following GSI website.
http://www.gsi.go.jp/kizyunten.html
For the gravity accelerations outside of Japan, refer to the following
Physikalisch-Technische Bundesanstalt website.
http://www.ptb.de/cartoweb3/SISproject.php

The steps to set the gravity acceleration correction with the Sysmac Studio are as follows.

| 1 | With the Sysmac Studio and the CPU Unit being online, double-click your Load Cell Input Unit in the Multiview Explorer to open the Edit Unit Operation Settings Tab Page. The following tab page is displayed. |
|---|---|

| 2 | Set the Ch1 Gravity Acceleration of Calibration Site and Ch1 Gravity Acceleration of Installation Site. |
|---|---|
| 3 | Click the **Transfer to Unit** Button.<br>The settings are transferred from the Sysmac Studio to the NX Unit. |

### 3.3.3.　　Performing Equivalent Input Calibration

The following operations are performed for equivalent input calibration:

・Basic parameter settings

・Switching the calibration mode as needed

This section described how to perform these operations with the Sysmac Studio.

● Basic Parameter Settings

For equivalent input calibration, set the following three values as the basic parameters:

・Ch1 Load Cell Rated Capacity

・Ch1 Load Cell Rated Output

・Ch1 Load Cell Zero Balance

These three basic parameters can be set from the Unit operation settings. The description from here is based on the use of a load cell with the specifications shown in the table below.

| Rated capacity | Rated output | Zero balance |
|---|---|---|
| 20 kg | 2 mV/V | 1 µV/V |

The steps to set the basic parameters with the Sysmac Studio are as follows.

| 1 | With the Sysmac Studio and the CPU Unit being online, double-click your Load Cell Input Unit in the Multiview Explorer to open the Edit Unit Operation Settings Tab Page.<br>The following tab page is displayed.<br> |
|---|---|

| 2 | Set the Ch1 Load Cell Rated Capacity, Ch1 Load Cell Rated Output, and Ch1 Load Cell Zero Balance. The following values are set in this example. |
|---|---|

| Item | Setting value | Unit |
|---|---|---|
| Ch1 Load Cell Rated Capacity | 20.0 | — |
| Ch1 Load Cell Rated Output | 2.0 | mV/V |
| Ch1 Load Cell Zero Balance | 1.0 | µV/V |

| 2 (cont.) | Set these values with reference to the data sheet of the used load cell. If the information on the load cell zero balance is not specified in the data sheet, set the Ch1 Load Cell Zero Balance to 0. |
|---|---|
| 3 | Click the **Transfer to Unit** Button. The settings are transferred from the Sysmac Studio to the NX Unit. |

● Switching the Calibration Mode

Performing equivalent input calibration following actual load calibration requires the calibration mode to be switched. Performing equivalent input calibration with the factory default settings or one more time does not require the calibration mode to be switched. The steps to switch the calibration mode with the Sysmac Studio are as follow.

| 1 | With the Sysmac Studio and the CPU Unit being online, double-click the Communications Coupler Unit to which your Load Cell Input Unit is connected in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page.<br>The following tab page is displayed.<br> |
|---|---|
| 2 | Right-click your Load Cell Input Unit on the Edit Slave Terminal Configuration Tab Page and select *Calibration and Data Trace*.<br>The following tab page is displayed.<br> |
| 3 | Click the **Change from Actual Load Calibration Mode to Equivalent Input Calibration Mode** Button in Equivalent Input Calibration.<br>An execution confirmation dialog box is displayed.<br> |
| 4 | Click the **Yes** Button.<br>The actual load calibration mode is changed to the equivalent input calibration mode. |

## 3.4. Checking Measurement Values

This section describes how to check measurement values.

In this Guide's examples for weight measurement, measurement values are checked from the following I/O data:

・Ch1 Gross Weight Value/Force Measurement Value DINT
・Ch1 Gross Weight Value/Force Measurement Value REAL

Checking measurement values requires these two I/O data to be allocated in the I/O allocation settings. The measurement values are different between the calibration methods, actual load calibration and equivalent input calibration. Below are the I/O data allocation procedure and the measurement value check methods for both cases where the calibration method is actual load calibration and equivalent input calibration.

### 3.4.1. I/O Data Allocation

To check measurement values, allocate the following I/O data in the I/O allocation settings:

・Ch1 Gross Weight Value/Force Measurement Value DINT
・Ch1 Gross Weight Value/Force Measurement Value REAL

**Additional Information**

- A measurement value of DINT data type is recommended for use in the following cases:
  - ・ To perform operation between integer measurement values
  - ・ To display an integer measurement value obtained from the Load Cell Input Unit on the HMI just as it is without operation.

  Take the following information into consideration when performing the operation including the fractional part of a measurement value of DINT data type:

  The Load Cell Input Unit allows the decimal point position of a measurement value of DINT data type to be set in the decimal point position setting. If measurement values of DINT data type, which are obtained from multiple Load Cell Input Units, have different settings for the decimal point position, the decimal point positions of the respective measurement values need to be matched for operation.
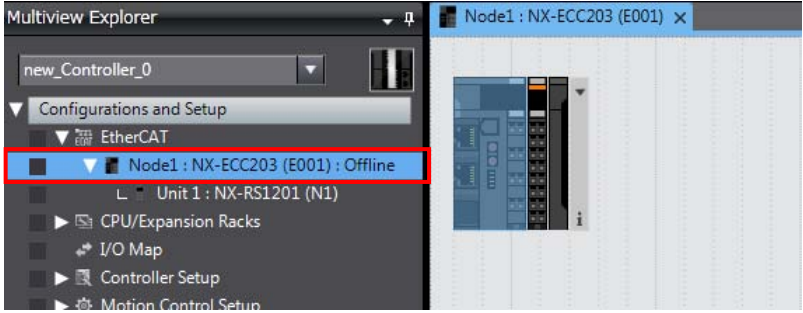
- A measurement value of REAL data type is recommended for use in the following cases:
  - ・ To perform operation between measurement values with a fractional part.
  - ・ To use Weighing Control Library[1] of the Sysmac Library.

  Note that attention needs to be paid to the significant digits when performing the operation between measurement values of REAL data type. A difference in significant digits between the measurement values in operation results in the cancellation of significant digits.
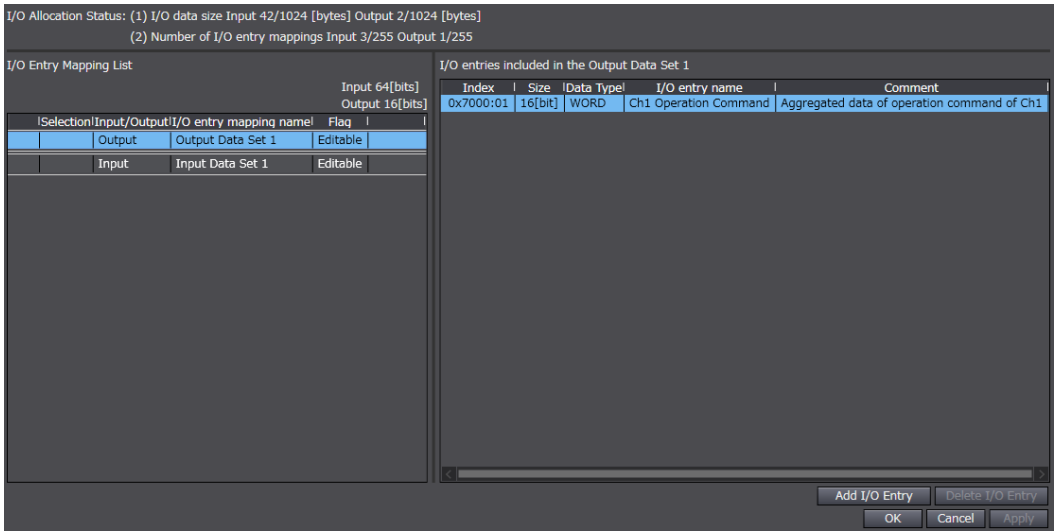
  *1. Refer to the *NJ/NX-series Sysmac Library User's Manual for Weighing Control Library* (Cat. No. W569) for details on Weighing Control Library of Sysmac Library.

Below is the I/O data allocation procedure with the Sysmac Studio. The initial value of Ch1 Gross Weight Value/Force Measurement Value DINT is already allocated to the I/O data, so now let us take Ch1 Gross Weight Value/Force Measurement Value REAL for example.
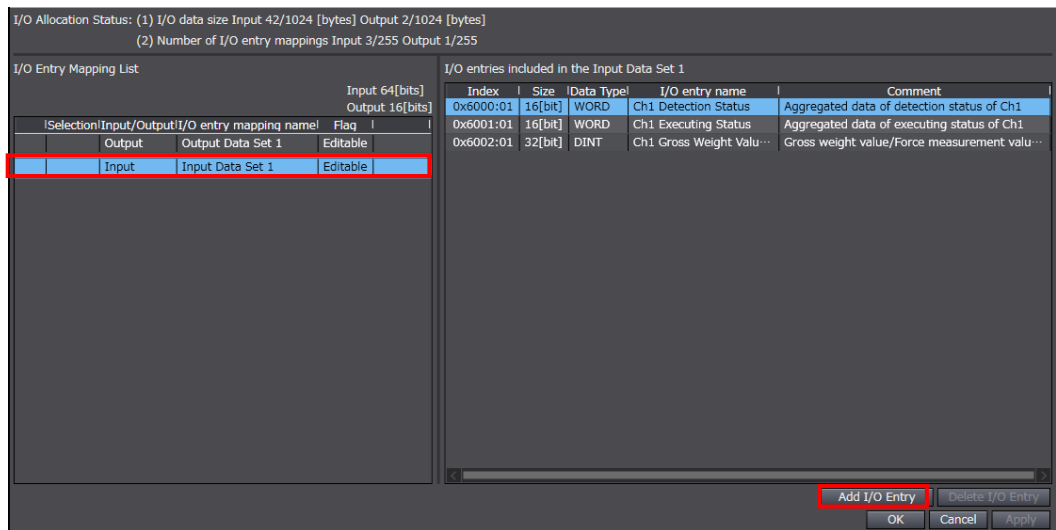
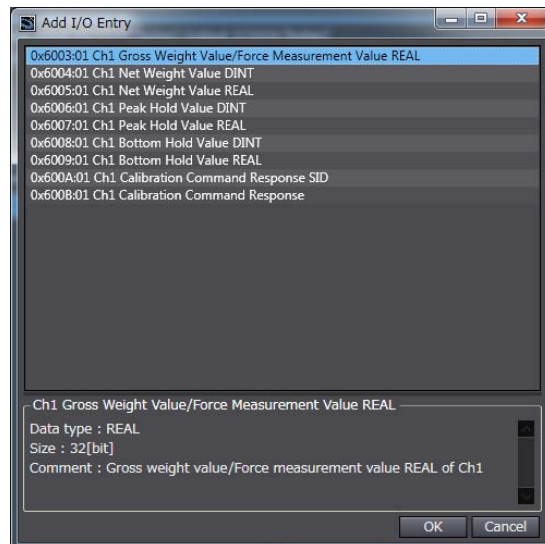| 1 | With the Sysmac Studio and the CPU Unit being offline, double-click the Communications Coupler Unit to which your Load Cell Input Unit is connected in the Multiview Explorer to open the Edit Slave Terminal Configuration Tab Page.<br>The following tab page is displayed.<br> |
|---|---|
| 2 | In the Edit Slave Terminal Configuration Tab Page, click your Load Cell Input Unit.<br>The following tab page is displayed.<br> |
| 3 | Click the **Edit I/O Allocation Settings** Button.<br>The following tab page is displayed.<br> |

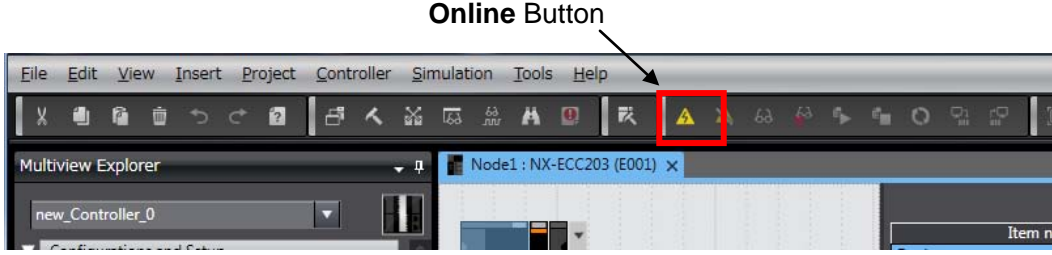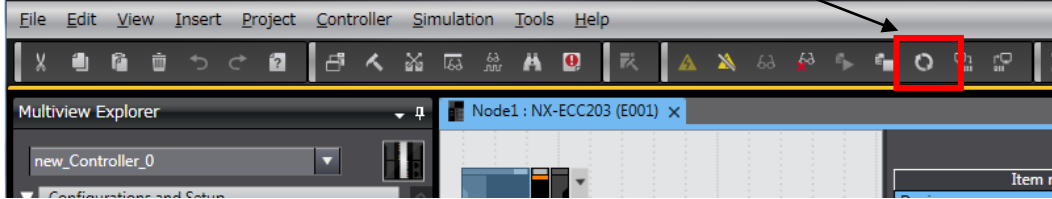| 4 | In I/O Entry Mapping List, select *Input* and then click the **Add I/O Entry** Button. |
|---|---|
| |  The following tab page is displayed.  |
| 5 | Select *0x6003:01 Ch1 Gross Weight Value/Force Measurement Value REAL* and then click the **OK** Button<br>Ch1 Gross Weight Value/Force Measurement Value REAL is added to I/O entries included in the Input Data Set 1.<br> |
| 6 | Click the **OK** Button. |

| 7 | Click the **Online** Button to bring the Sysmac Studio and the CPU Unit online. |
|---|---|
| | **Online** Button<br><br>File  Edit  View  Insert  Project  Controller  Simulation  Tools  Help<br><br>Multiview Explorer<br>new_Controller_0<br>Node1 : NX-ECC203 (E001) |
| 8 | Click the **Synchronize** Button to transfer the configuration from the personal computer to the CPU Unit. |
| | **Synchronize** Button<br><br>File  Edit  View  Insert  Project  Controller  Simulation  Tools  Help<br><br>Multiview Explorer<br>new_Controller_0<br>Node1 : NX-ECC203 (E001) |

### 3.4.2.　　Checking Measurement Values

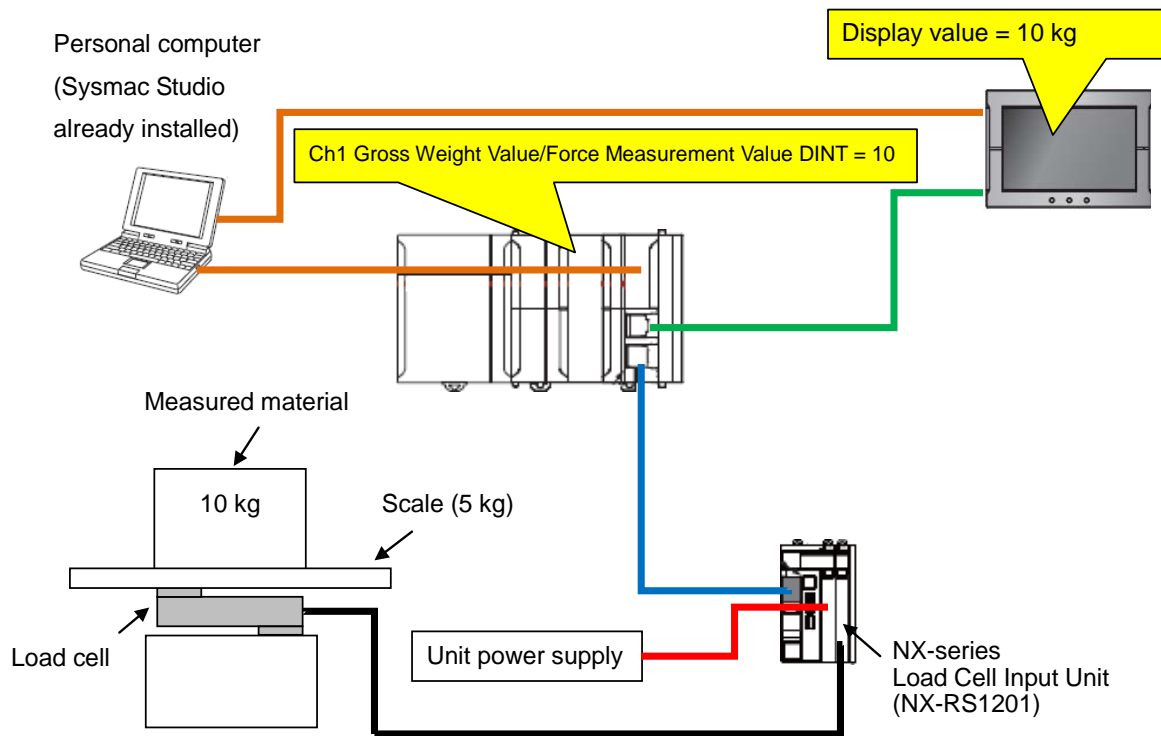This section describes how to check measurement values.

The measurement values are different between the calibration methods, actual load calibration or equivalent input calibration. For each calibration, the check method is shown below.

● **When the Calibration Method is Actual Load Calibration**

When the performed calibration method is actual load calibration, placing a measured material on the scale after the calibration, as in the figure below, allows the weight value of the measured material to be checked from the I/O data, Ch1 Gross Weight Value/Force Measurement Value DINT and Ch1 Gross Weight Value/Force Measurement Value REAL.

If a 10 kg measured material is placed on the scale, the measurement values are as follows.

| Data name | Measurement value | Remarks |
|---|---|---|
| Ch1 Gross Weight Value/Force Measurement Value DINT | 10 | Measurement value with a value of 0 (initial value) set in the decimal point position setting.[1] |
| Ch1 Gross Weight Value/Force Measurement Value REAL | 10.0 | — |

*1. Refer to *8-13 Decimal Point Position Setting* described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565) for details on the decimal point position setting.

Personal computer (Sysmac Studio already installed)

Display value = 10 kg

Ch1 Gross Weight Value/Force Measurement Value DINT = 10

Measured material

10 kg

Scale (5 kg)

Load cell

Unit power supply

NX-series
Load Cell Input Unit
(NX-RS1201)

From the Sysmac Studio's I/O map, you can check the values of Ch1 Gross Weight Value/Force Measurement Value DINT and Ch1 Gross Weight Value/Force Measurement Value REAL. The following is how to check measurement values from the Sysmac Studio's I/O map.

| 1 | With the Sysmac Studio and the CPU Unit being online, from Multiview Explorer, double-click **I/O Map** to open the I/O map. The following tab page is displayed.  |
|---|---|
| 2 | On the I/O map that opens, check the values of Ch1 Gross Weight Value/Force Measurement Value DINT and Ch1 Gross Weight Value/Force Measurement Value REAL.  |

● **When the Calibration Method is Equivalent Input Calibration**

When the performed calibration method is equivalent input calibration, placing a measured material on the scale after the calibration, as in the figure below, allows the total weight value of the scale and the measured material to be checked from the I/O data, Ch1 Gross Weight Value/Force Measurement Value DINT and Ch1 Gross Weight Value/Force Measurement Value REAL.

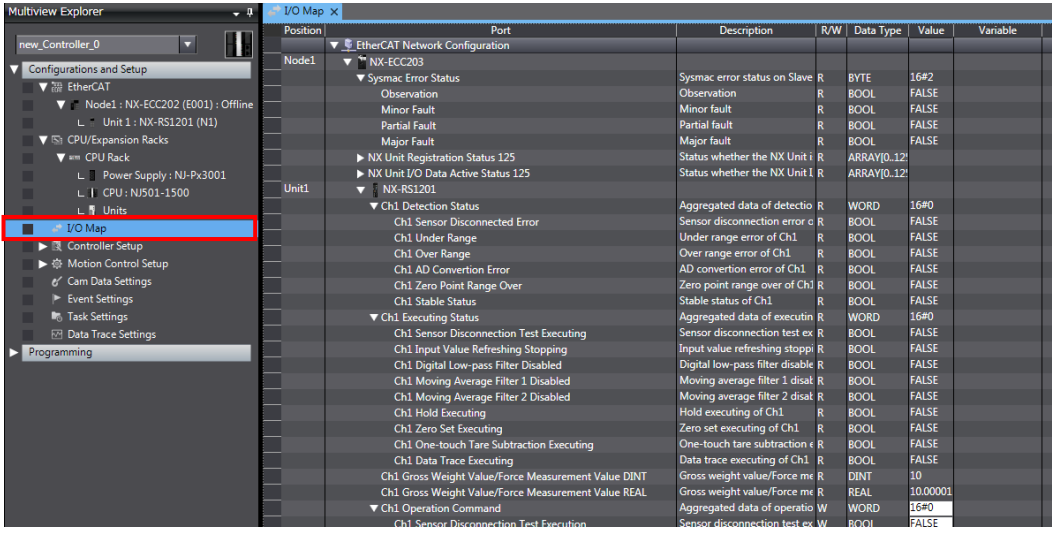If a 10 kg measured material is placed on a 5 kg scale, the measurement values are as follows.

| Data name | Measurement value | Remarks |
|---|---|---|
| Ch1 Gross Weight Value/Force Measurement Value DINT | 15 | Measurement value with a value of 0 (initial value) set in the decimal point position setting.[1] |
| Ch1 Gross Weight Value/Force Measurement Value REAL | 15.0 | — |

*1. Refer to *8-13 Decimal Point Position Setting* described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565) for details on the decimal point position setting.

Personal computer
(Sysmac Studio
already installed)

Display value = 15 kg

Ch1 Gross Weight Value/Force Measurement Value DINT = 15

Measured material

10 kg

Scale (5 kg)

Load cell

Unit power supply

NX-series
Load Cell Input Unit
(NX-RS1201)
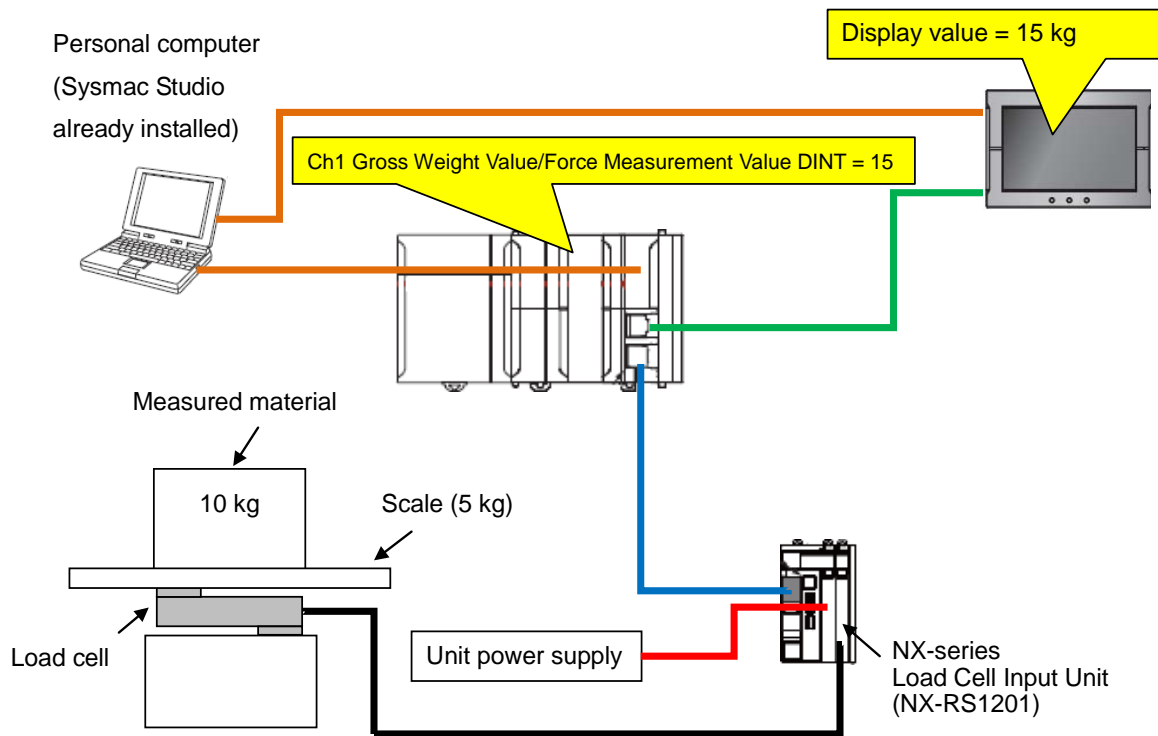
📝 **Additional Information**

When performing a calibration by the equivalent input calibration method, if you want to measure
the weight value of the measured material excluding the weight of the scale, execute zero set with
only the scale placed on a load cell, as in the figure below. If you execute zero set with this state,
the gross weight value with only the scale placed on a load cell is corrected to 0.



Personal computer
(Sysmac Studio
already installed)

Display value = 0 kg

Ch1 Gross Weight Value/Force Measurement Value DINT = 0

Only a scale is placed on the load cell.

Scale (5 kg)

Zero set !

Load cell

Unit power supply

NX-series
Load Cell Input Unit
(NX-RS1201)
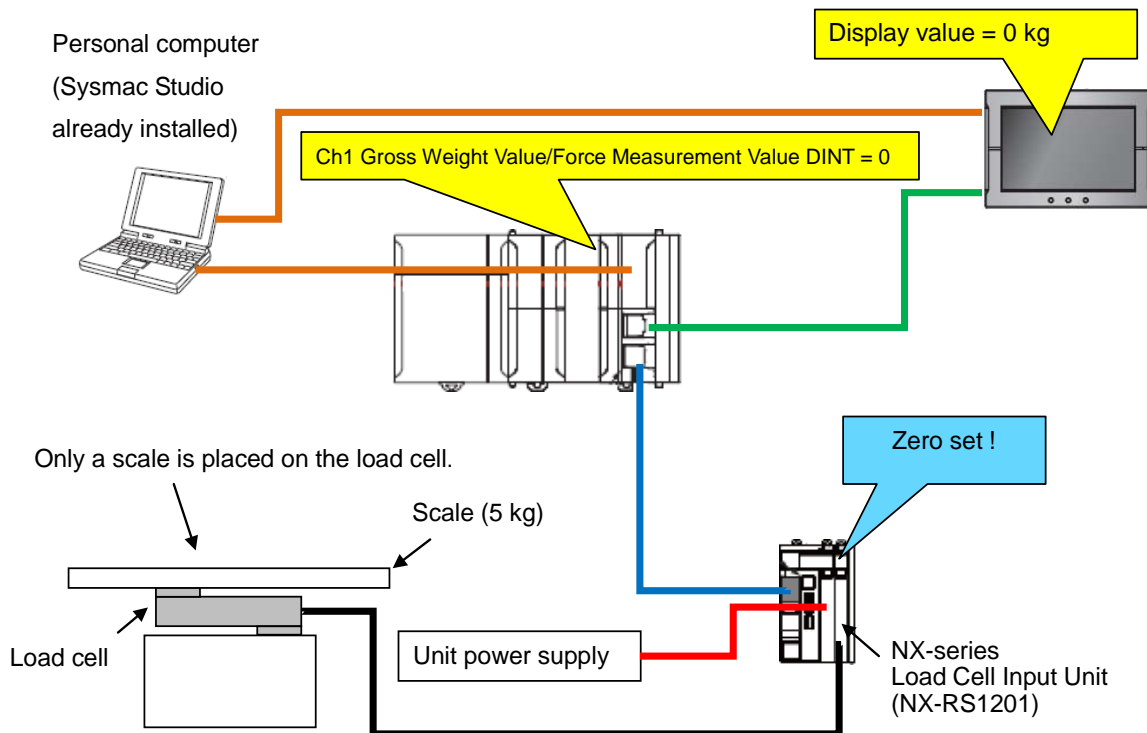
Following the above condition where zero set is performed, placing a measured material on the scale allows the weight value of the measured material to be checked from the I/O data, Ch1 Gross Weight Value/Force Measurement Value DINT and Ch1 Gross Weight Value/Force Measurement Value REAL.
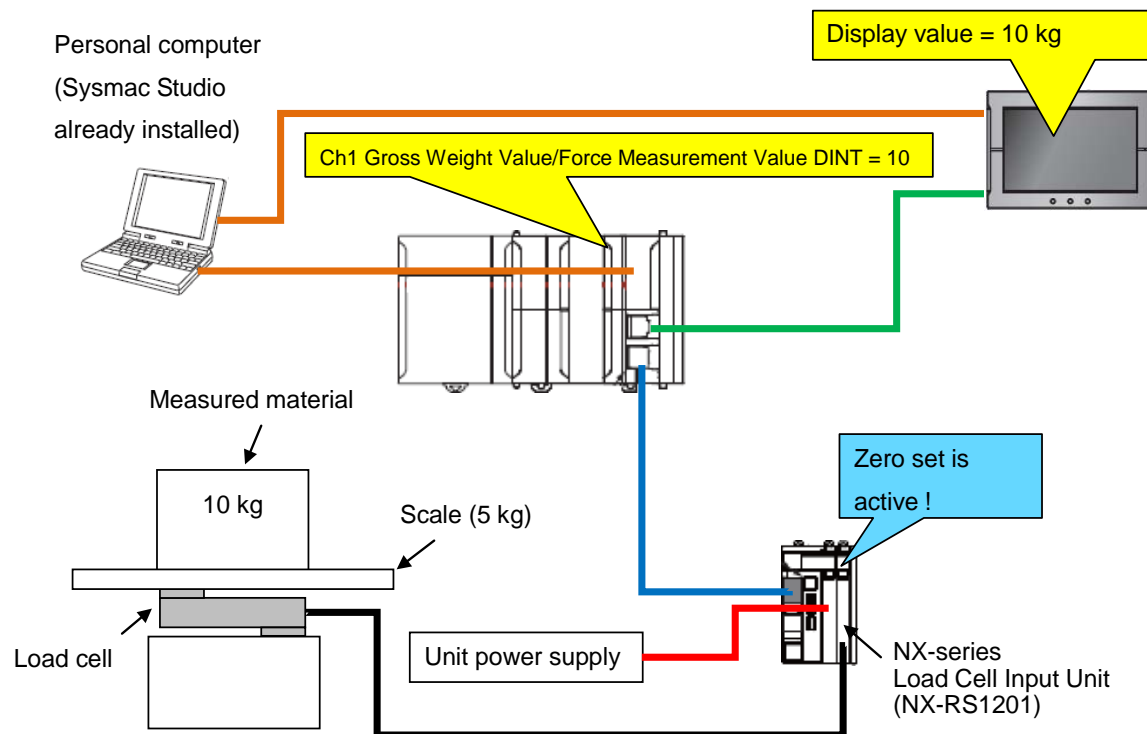


Refer to *8-3 Zero Set/Zero Reset* described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565) for details on the zero set feature.

From the Sysmac Studio's I/O map, you can check the values of Ch1 Gross Weight Value/Force Measurement Value DINT and Ch1 Gross Weight Value/Force Measurement Value REAL. Refer to the previously mentioned procedure in *3.4.2. Checking Measurement Values* ●*When the Calibration Method is Actual Load Calibration* for how to check measurement values from the Sysmac Studio's I/O map.

# 4. Appendices

## 4.1. Features for Stable Measurement

The following features are available for the Load Cell Input Unit to perform stable measurement.
Make use of them as needed.

- Digital filtering

  The digital filtering suppresses the fluctuation of measurement values due to the effect of electrical noise and mechanical noise, enabling stable measurement. The digital filtering can be used in any combination with the following three filters:

  ・Digital low-path filter

  ・Moving average filter 1

  ・Moving average filter 2

  Refer to *8-2 Digital Filtering* described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565) for details on the digital filtering feature.

- Data tracing

  The data tracing feature is available to sample and record the measurement values before and after digital filtering processing.

  Referring to the recorded results makes it easy to identify the noise frequency band and check the effect of noise removal, allowing optimal digital filter design.

  Refer to *8-12 Data Tracing* and A-2 Digital Filter Design That Utilizes Data Tracing described in the *NX-series Load Cell Input Unit User's Manual* (Cat. No. W565) for details on the data tracing feature.

## 4.2. Data Backup When Replacing the Load Cell Input Unit

The data below of the Load Cell Input Unit is stored in the Communications Coupler Unit. Therefore, resetting is not required upon replacement of the Load Cell Input Unit if you will not change the settings after the replacement of the Unit.

・I/O allocation settings

・Unit operation settings

The basic parameters to set for equivalent input calibration are included in the Unit operation settings. Therefore, recalibration is not required after replacement of the Unit if you have been used it with equivalent input calibration.

If you have been used the Unit with actual load calibration, zero calibration and span calibration are required after replacement of the Unit. Note that the setting for Ch1 Standard Weight is included in the Unit operation settings, so Ch1 Standard Weight does not need to be set again if you will not change the weight used for span calibration.

## 4.3. Weighing Control Library of Sysmac Library

For the configuration of other weight measurement systems using the Load Cell Input Unit, for example, a quantitative discharging control system, Weighing Control Library of Sysmac Library[1], which is designed for the Load Cell Input Unit, is available for creating a user program. Refer to the *NJ/NX-series Sysmac Library User's Manual for Weighing Control Library* (Cat. No. W569) for details on Weighing Control Library of Sysmac Library.

*1. The Sysmac Library is a suite of software functional components that can be used for programs of the NJ/NX-series Machine Automation Controller. Programming samples and HMI window samples are also available.

Download it from our website to install it to the Sysmac Studio for use.

http://www.fa.omron.co.jp/sysmac_library

**MEMO**

**MEMO**

**MEMO**

Note: Do not use this document to operate the Unit.

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