# AD4212L-R50
# AD4212L-R100

## Weigh Module

# INSTRUCTION MANUAL

A&D Company, Ltd.

1WMPD4003874A

# The manual and Marks

All safety messages are identified by the following, “WARNING” or “CAUTION”, of ANSI Z535.4 (American National Standard Institute: Product Safety Signs and Labels). The meanings are as follows:

| | |
|---|---|
| ⚠**WARNING** | A potentially hazardous situation which, if not avoided, could result in death or serious injury. |
| ⚠**CAUTION** | A potentially hazardous situation which, if not avoided, may result in minor or moderate injury. |

⚠ This is a hazard alert mark.

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# Illustrations

# 1. Introduction

This manual describes how the AD-4212L series Weigh Module works and how to get the most out of it in terms of performance.
Read this manual thoroughly before using the balance and keep it at hand for future reference.

## 1.1. Features

A Weighing Unit, suitable for building into a production line system. The weighing unit is compact, with a width of 30 mm.

| Model | AD4212L-R50 | AD4212L-R100 |
|---|---|---|
| Maximum capacity | 51 g | 110 g |
| Minimum division | 1 mg | 1 mg |
| Stabilization time | 0 g to 5 g Approx. 0.3 s | 0 g to 5 g Approx. 0.3 s |
| (With optimal filter set, under good ambient conditions) | 5 g to 51 g Approx. 1.0 s | 5 g to 110 g Approx. 1.3 s |
| Weighing pan diameter | 20.5 mm | |
| Weighing unit size/mass | 30 × 165 × 56 mm (W×D×H)/Approx. 400 g | |
| Display unit size/mass | 35.3 × 101.3 × 110 mm (W×D×H)/Approx. 200 g | |
| Cable dia./length/mass | 4.5 mm/10 m/Approx. 350 g | |
| Power source | 24 VDC +10%, -15% | |
| Operating conditions | -10 °C to +40 °C, 85%RH or less (no condensation) | |

▫ Optimal digital filter setting example (FnC05 setting)

| AD4212L-R50 | | AD4212L-R100 | |
|---|---|---|---|
| Weighing range | Example (setting value) | Weighing range | Example (setting value) |
| 0 g to 20 g | 4.0 Hz (11) | 0 g to 50 g | 4.0 Hz (11) |
| 20 g to 51 g | 1.0 Hz (15) | 50 g to 110 g | 1.0 Hz (15) |

The AD4212L series are a weigh module that amplifies signals from a load cell, converts them to digital data and outputs after converting them to a weighing values.
The AD4212L series have the following functions.

❑ RS-485
There are two kinds of communication modes ( rS 02 ).
- Modbus RTU ( rS 02 : 5 )
- Interval output ( rS 02 : 6, 7, 8 )

This weigh module is used as a slave device of the Modbus RTU.
The output data format is the weighing display value with a sign.

❑ Remote I/O
The remote I/O is an I/O device with communication functions.
The control input status can be read from Modbus RTU coils.
Control output can be toggled on or off with Modbus RTU coils.

- Digital filter

  The digital filter is used to prevent electrical signal movement from the weighing unit.
  This module has two channels so that each cutoff frequency can be set separately.

  Digital filter 1 ( FnC05 )
  Digital filter 2 ( FnC06 )

- Calibration using gravity acceleration correction
  This function compensates for weighing error due to the difference of gravity acceleration between the location of calibration and the location of measurement.

- Digital linearization
  The digital linearization function can rectify and reduce deviation using weighing points at zero and maximum capacity. Up to four weighing points excluding the zero point can be specified. A high-order correction curve is used between each point.

- Flow rate calculation function
  Digital filter 2 is a low cutoff frequency filter that can calculate stable flow rates when an extreme change in mass has occurred. You can set the damping time, which moderates flow rate changes, and average the moving time of the flow rate.
  Flow rate is calculated a thousand times per second at the same speed as A/D conversion.
  A hold function to hold flow rate values and the flow rate values with a slight error (unstable flow rate) can be monitored and controlled from the control I/O.

- Batch weighing
  Batch weighing is a procedure to automatically weigh up to the final value.
  The weighing sequence which controls the valves (gates) and determines the weight is executed when the weighing start signal is sent to the input terminal.

# 2. Product Structure, Installation and Precautions

The weigh module is a precision instrument. Unpack the weigh module carefully. Keep the packing material to be used for transporting the weigh module in the future.

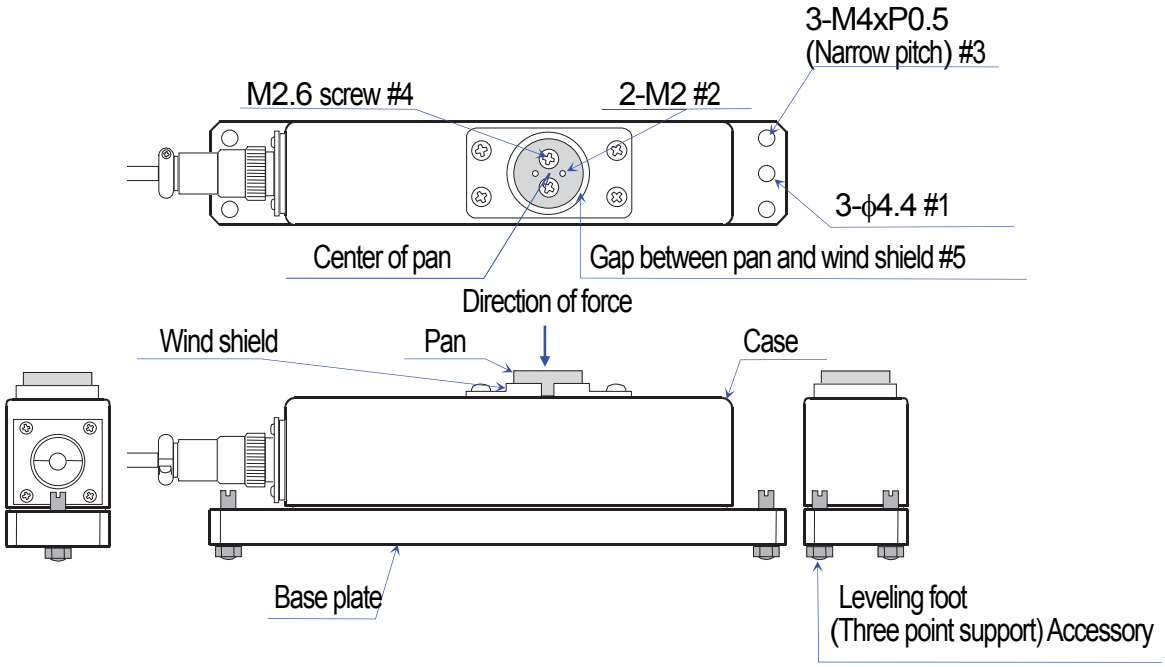



**Illustration 1 Weighing unit**

#1 Use the three ϕ4.4 holes to attach the weighing unit with a tightening torque of approx. 1 Nm.
#2 Use the two M2 holes to attach a jig to the pan with a depth of 5 mm and a tightening torque of 0.4 Nm or less.
#3 When using the leveling foot, insert the three leveling feet into the three M4xP0.5 holes (narrow pitch).
#4 Remove the two M2.6 screws when removing the pan. The tightening torque for installing is 0.4 Nm or less.
#5 When dirt and dust accumulate in the gap between the pan and the wind shield, remove the pan and then remove dirt and dust.

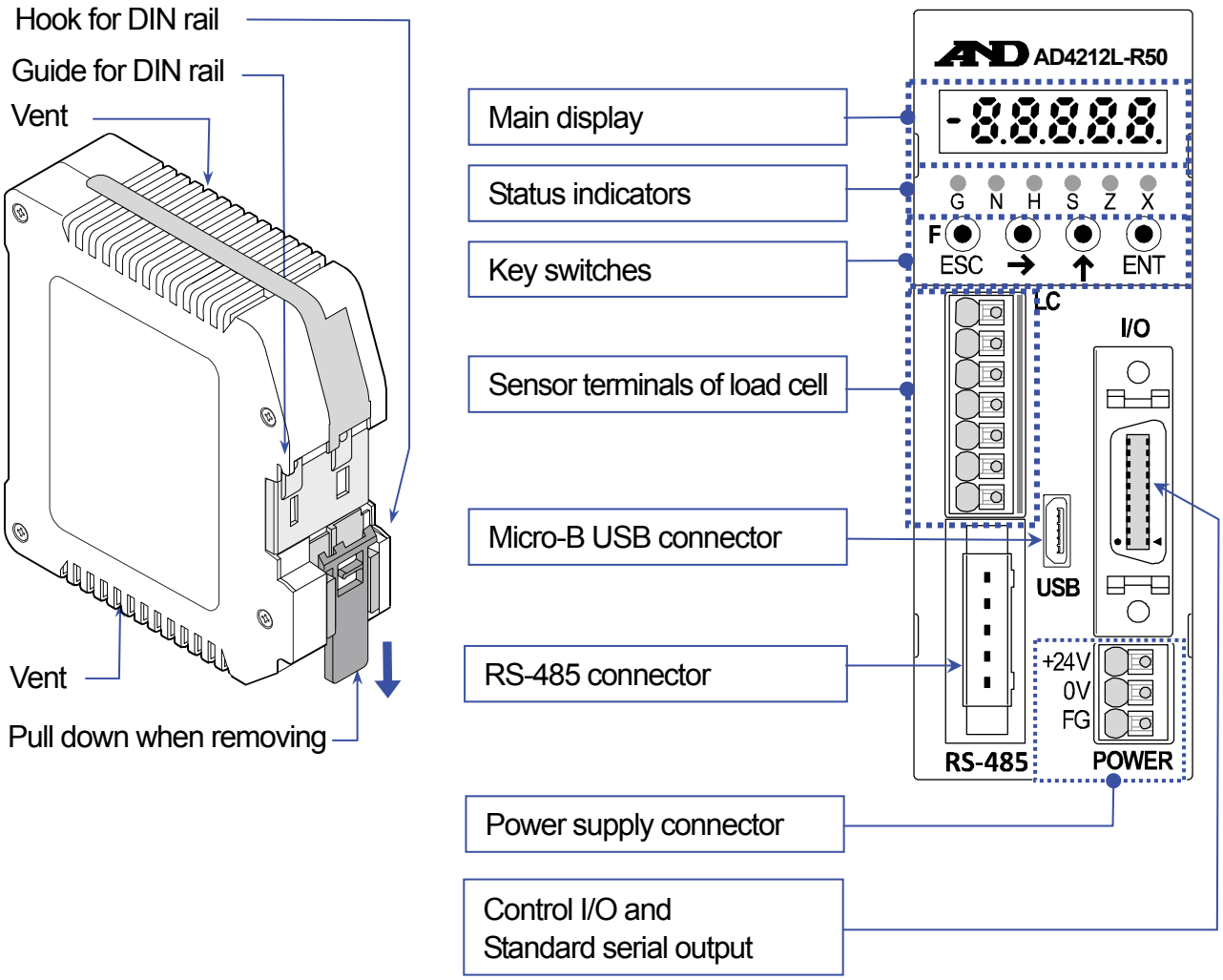



**Illustration 2 Display unit**

| | |
|---|---|
| Accessories | RS−485 connector (2 pieces)<br>35505−6200−A00 GF manufactured by 3M<br>Branch connector (1 piece)<br>35715−L010−A00 AK manufactured by 3M<br>Leveling foot (3 pieces) |

## 2.1. Assembling and Adjusting

Refer to the precautions described in “2.2”, “2.3”, “2.4” and “2.5” for installing the weigh module.

❑ Adjusting the leveling feet

When using the leveling feet, level the weighing unit by rotating the three leveling feet on the bottom of it as shown in the figure.

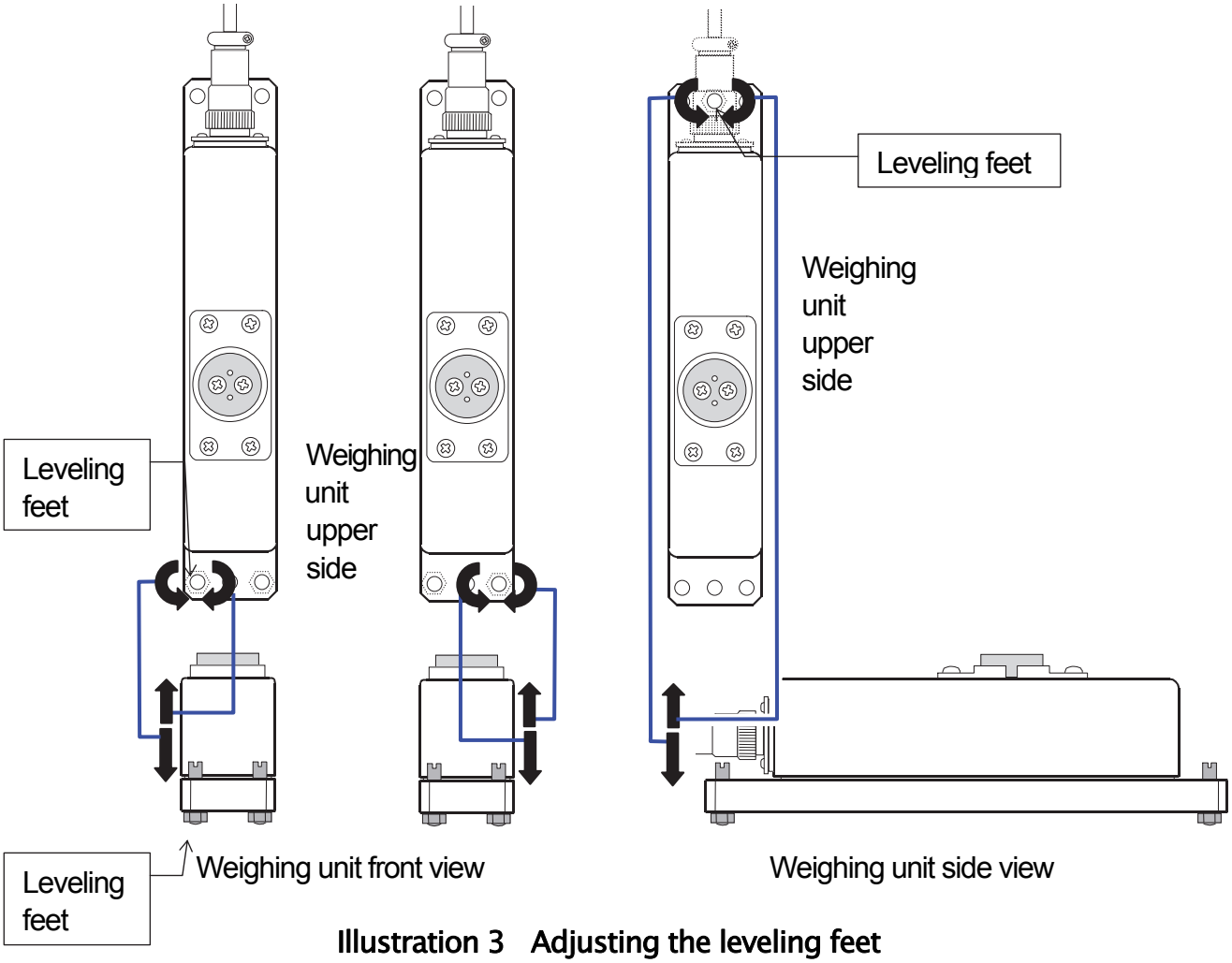



**Illustration 3 Adjusting the leveling feet**

▫ **Connection**

Display unit

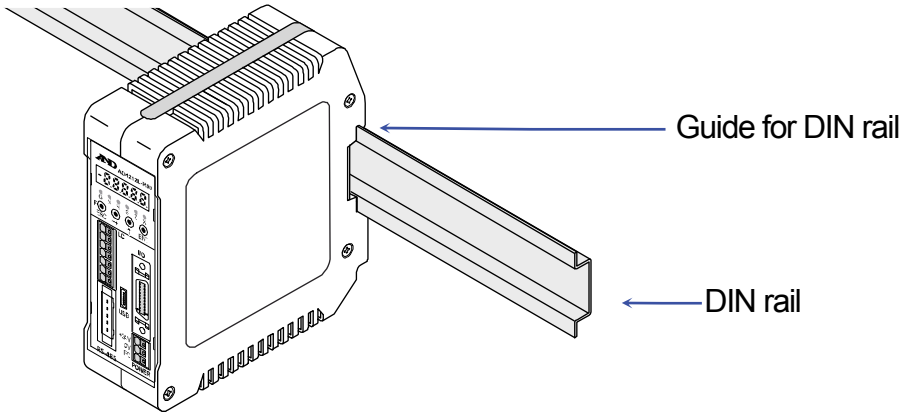



**Illustration 4 Mounting the module**

When connecting or removing the cable, push the connector button with a screwdriver, etc.

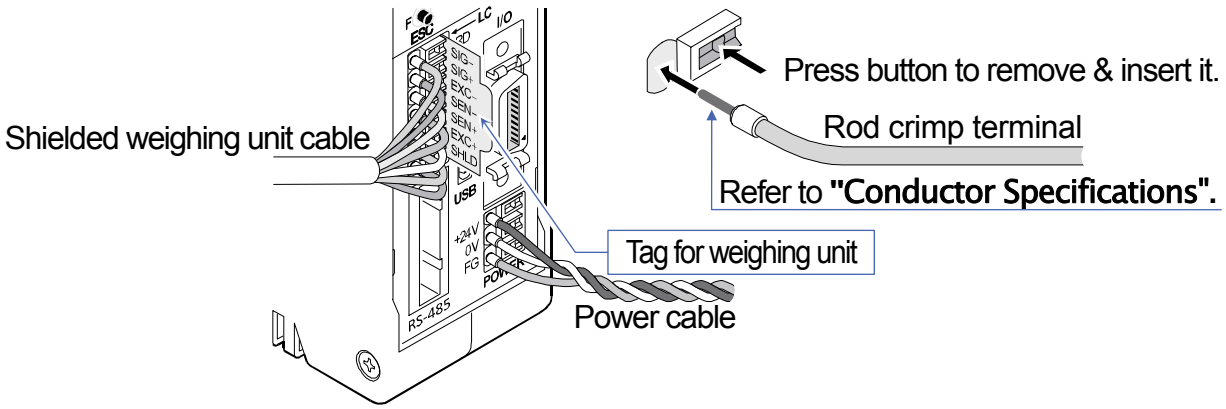



Illustration 5 Wiring the connector

### Power Supply Connector

+24 V ..... +24 VDC terminal
0 V ..... 0 VDC terminal
FG (SHLD/SLD) Ground terminal
(All connector shields are connected internally with FG.)

POWER

| | |
|---|---|
| 3 | +24V |
| 2 | 0V |
| 1 | FG |

### Sensor Terminals of Weighing Unit

| | |
|---|---|
| 7 | SIG− |
| 6 | SIG+ |
| 5 | EXC− |
| 4 | SEN− |
| 3 | SEN+ |
| 2 | EXC+ |
| 1 | SHLD |

| SIG− | SIG+ | EXC− | SEN− | SEN+ | EXC+ | SHLD |
|---|---|---|---|---|---|---|
| Blue | Green | White | Purple | Orange | Red | Yellow |

### Conductor Specifications

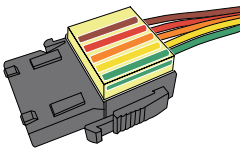
| | | |
|---|---|---|
| Clamp range (typ.) | | 0.13 $mm^2$ to 1.5 $mm^2$ |
| AWG | | AWG24 — AWG16 |
| Solder plated wire | | 0.2 $mm^2$ to 1.5 $mm^2$ |
| Twisted wire | | 0.2 $mm^2$ to 1.5 $mm^2$ |
| Rod crimp terminal | DIN 46228 Part1 | 0.25 $mm^2$ to 1.5 $mm^2$ |
| Rod crimp terminal with color | DIN 46228 Part4 | 0.25 $mm^2$ to 0.75 $mm^2$ |
| Lead length | | 8 mm |

### Specifications of conforming cable

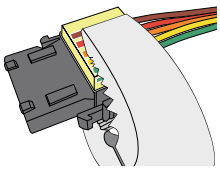
| | |
|---|---|
| Wire outside diameter | $\phi$1.6 ~ 2.0 mm |
| Wire size | AWG#20 ( 0.5 $mm^2$ ) |

### Procedure for connecting the cable.

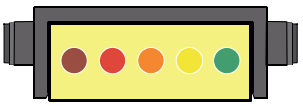
Step 1 Do not strip the cable jacket.
Insert the cable all the way into the yellow cover.



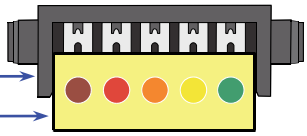
Step 2 Crimp the cover on the body using pliers from the side of the connector as shown in the illustration to the right.



Step 3 Be sure the cover and the body are parallel to each other and there is no space between the body and the cover.



After crimping




Before crimping

Using the branch connector

- When connecting a master device such as a PC or PLC to the RS-485 connector with the AD4212L (using a single AD4212L)

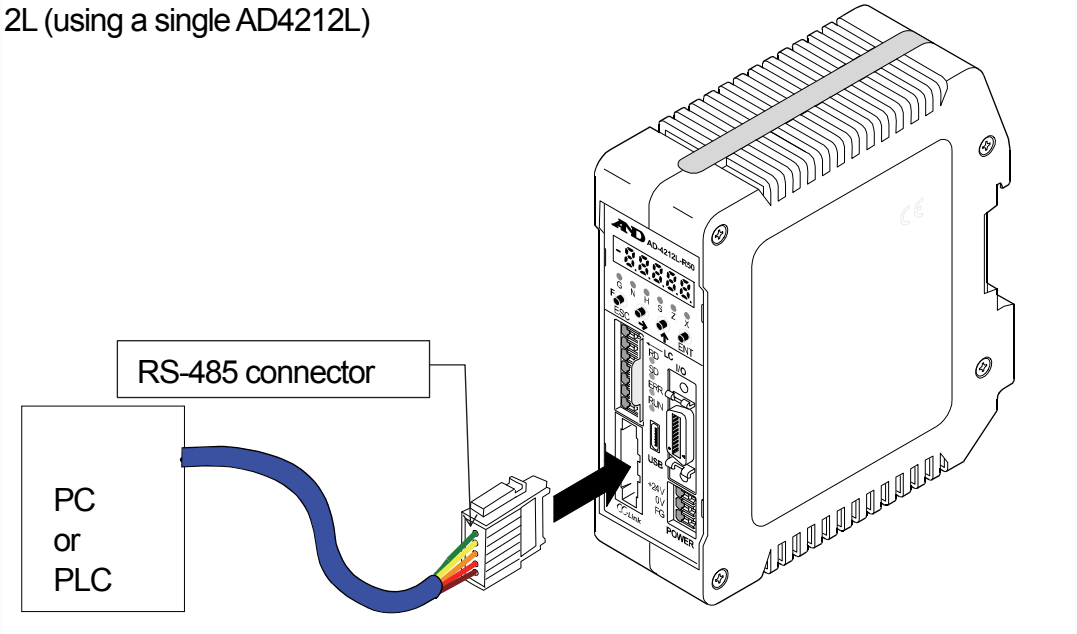



**Illustration 6 When using a branch connector (using a single AD4212L)**

❑ When connecting a master device such as a PC or PLC to the RS-485 connector with the multiple AD4212L units

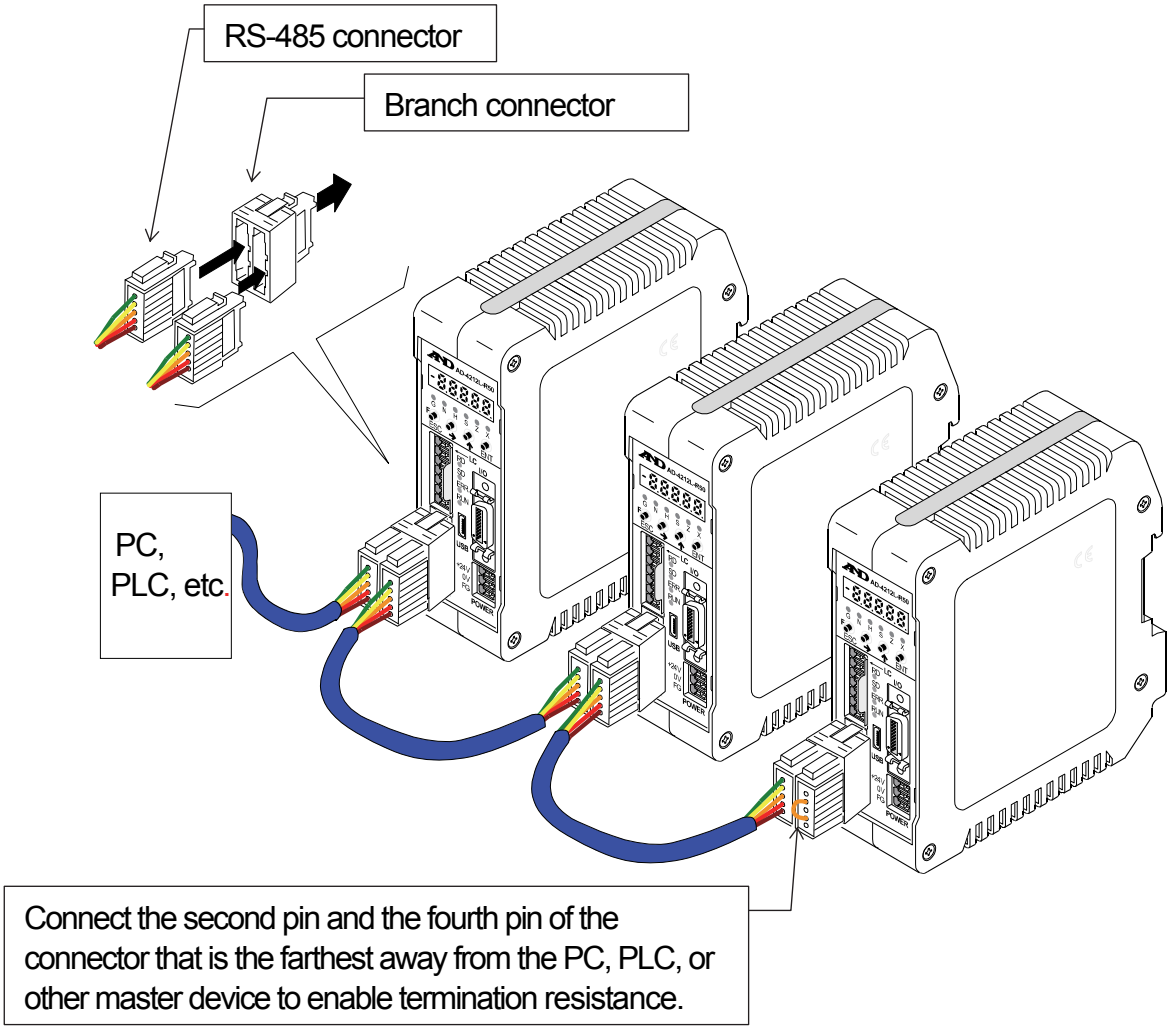



**Illustration 7 When using branch connectors (using multiple AD4212L)**

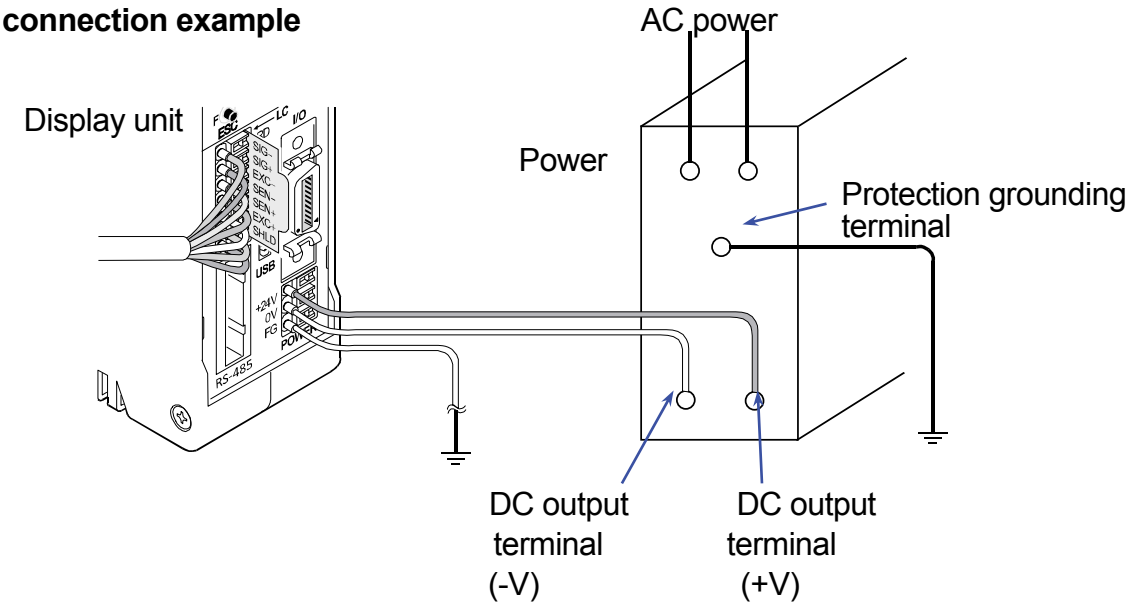
**Power Supply**

| ⚠CAUTION |
| --- |
| Ground the module to prevent electrical shock or display unit malfunction.<br>If the module is not grounded, it may cause an electrical shock, or malfunction due to static electricity. |

❑ Before connecting the module to the power source, read the instruction manual thoroughly.
❑ Do not connect the module to the power source before the installation is complete.
⚠❑ To avoid electrical shock, do not handle the power cable with wet hands.
⚠❑ Ground the module. Do not share the ground line with other electrical power equipment.
❑ The power requirement is 24 DCV, +10% to −15%.
Use a stable power source free from instantaneous power failure or noise.
❑ To avoid malfunction, do not share the power line with other devices.
❑ The output voltage of a load cell is a very sensitive signal. Keep all electrical noise sources away from the weighing unit and weighing unit cable.
❑ Use shielded cables for input and output. Connect the cable shield to the F.G. terminal or the module housing.
❑ F.G. ( frame ground ) is internally connected to all connector shields ( SHLD/SLD ).

As long as the power cord is connected to the weigh module, the weigh module is always in standby mode. This is a normal state and does not harm the weigh module. For accurate weighing, connect the power cord to the weigh module and warm up the weigh module for the appropriate duration before use.

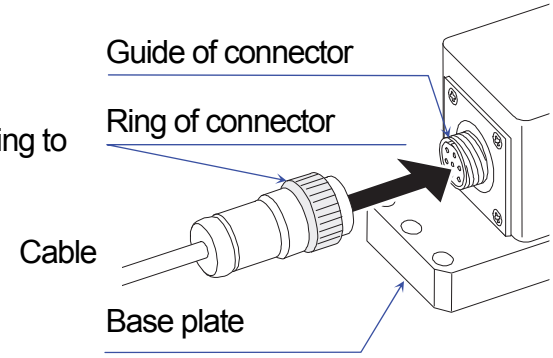
**∗ Power connection example**




Power reference specifications
Output voltage: 24 V
Output power: Output 6 W or more (per one AD4212L unit)

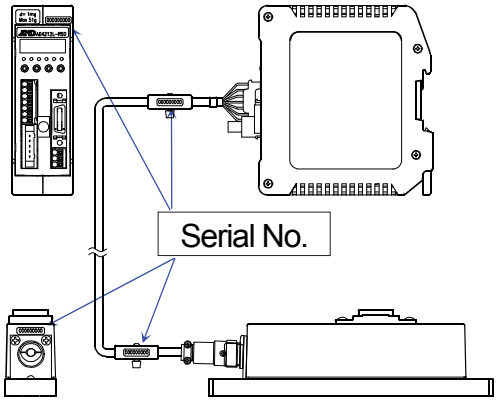
**Weighing unit**

The cable connector is detachable.
Match the guides on the connectors and turn the ring to secure the cable connector.




▫ **Note**

**When connecting the cable, confirm that the display unit, the weighing unit and the cable have the same serial number. Otherwise, the display unit may not display the correct weighing value.**



## 2.2. Precaution Before Use

- The weight module is a precision instrument. Handle it carefully.
- Install the weighing unit in an environment where the temperature is not excessive.
- Install the weight module where it is not exposed to direct sunlight.

- **Grounding the Module**
  Ground the module to the DIN rail. Separate this earth ground line from others, such as ground lines for the motor, inverter or power source. Unless the indicator is grounded, it may result in electric shock, operation error or fire.

- **Proper Power Source and Power Cable**
  Confirm the AC voltage, frequency and power tolerance of the power cable. If the voltage range of the cable is lower than the power line voltage, it may cause leakage or catch fire.

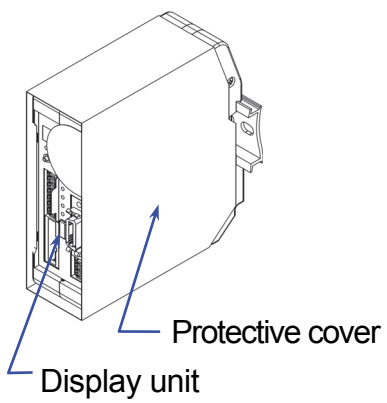
- **Fuse**
  A fuse is installed to help prevent the module from catching fire. The module is equipped with many safety circuits, so if the internal circuits are functioning properly, the fuse is not damaged. If the fuse is damaged, it may have been caused by strong electric discharge. If the fuse blows out, please contact us or our dealer. The fuse in this unit cannot be replaced.

- **Splashing Water**
  The module is not water resistant.

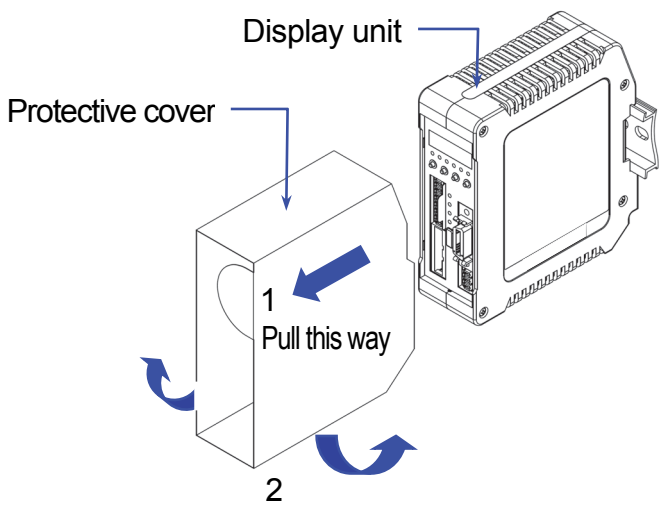
- **Flammable Gas**
  Do not install the module where flammable gas is present.

- **Heat Radiation of the Module**
  To prevent the module from overheating, leave sufficient space around the vent holes on the upper and bottom side of the display unit. Use a cooling fan to keep the operating temperature of the module within specifications.
  Display unit is covered with a protective transparent-resin cover. After the installation is complete, take off the protective cover prior to turning on the display unit. Heat damage may be caused if you do not remove the protective cover.
  **The protective cover is for preventing wire chips when you will install and wire so please do not take off the cover until complete the installing and wiring.**

Display unit with a protective cover




How to remove the protective cover




Take off the two tabs on the back of the protective cover.

- ❑ Install the weighing unit where it is not affected by air conditioners.
- ❑ Connect the power cord to the weigh module before use and warm up the weigh module for at least 30 minutes (while the display unit is connected to the power supply).
- ❑ Calibrate the balance before use or after having moved it to another location. In addition, calibrate it periodically to maintain the accuracy.

## 2.3. Precaution on Building Into a System

The AD-4212L is a precision device. When it is built into a system, errors such as unstable weight values may occur due to static electricity, vibration, sample temperature and magnetism of the materials weighed or used for the devices near the weigh module.
When using the weigh module as part of a system, take the following precautions:

● **Precautions when not performing the weighing at the center of the weighing pan**

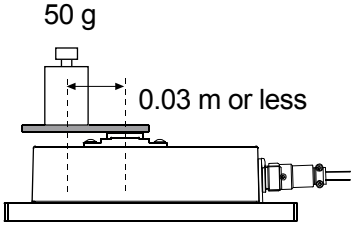
If not performing the weighing at the center of the weighing pan, design the weighing system so that the total moment of the support device and the object to be weighed will be the value specified in the table below.

**Allowable eccentric load for each model**

| Model | Allowable eccentric load |
|---|---|
| AD4212L-R50 | 0. 015 Nm or less |
| AD4212L- R100 | 0. 030 Nm or less |

**AD4212L-R50**

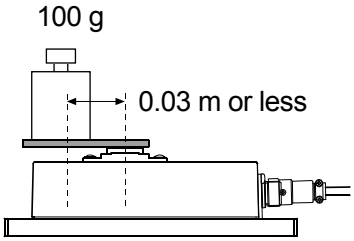
Example of a system where the total moment of the device and the object is 0.015 Nm or less:




50 g X 0.03 m

**AD4212 L- R100**

Example of a system where the total moment of the device and the object is 0.030 Nm or less:



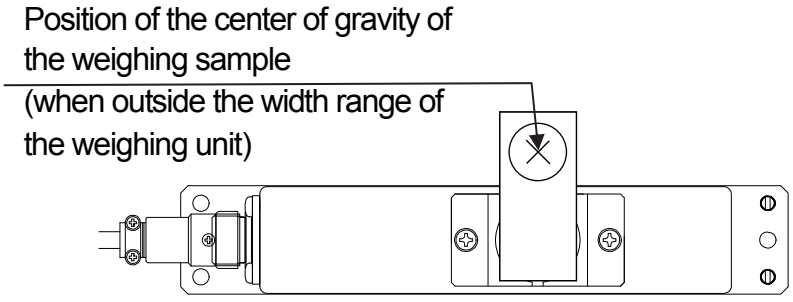

100 g X 0.03 m

**Note: The values above are for reference and may be different from actual specifications.**

**Although the overload protection mechanism is built in, please avoid giving impact shock to the weighing pan while weighing.**

**Precaution on using the leveling foot**

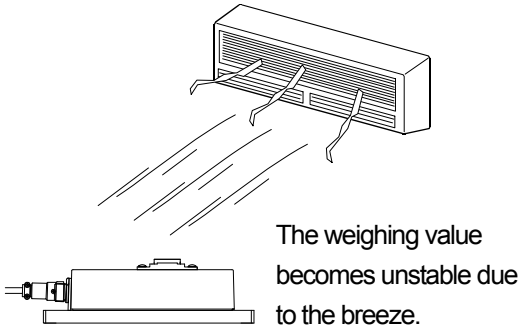
If the center of gravity of the weighing sample is outside the width range of the weighing unit, the weighing unit may tilt to one side even if the load is within the allowable moment, preventing proper weighing. In such a case, secure the base of the weighing unit with screws before use.




- **Errors due to airflow and measures to take**

□ Where the influence of ambient airflow is great such as: close to an air conditioner, door or passage way. Even very subtle airflow that is hard to be detected may influence the weighing operation.

- Avoid those areas as a weighing site.
- If weighing is to be performed in such an area, use a breeze break or take other appropriate measures.




- **Errors due to vibration and measures to take**

□ Where the influence of vibration is great, such as:
(1) Soft ground (2) Second or higher floor (3) Near center of a floor far from pillars (4) Seismic isolated structures (5) Near tall buildings.
In the areas listed above, the weighing unit may yield unstable weight values on windy days or after an earthquake. Especially in case of (4) and (5), weight values may be unstable for a long period of time because of long lasting low-frequency vibration after strong winds or an earthquake. Also, when connection cable between the weighing unit and display unit is subject to vibration, there are cases when the weighing values become unstable. Take action so that the vibration does not cause negative effects to the cable as well as the weighing unit.

- **Errors due to other causes and measures to take**

□ Change in temperature or humidity
A sudden change in temperature or humidity can generate a draft and cause the weighing unit to absorb or exude moisture, which leads to unstable displays.

- Avoid sudden change in temperature or humidity.
- Use an air conditioner or humidifier to control the temperature or humidity.

## 2.4. During Use

- To minimize the affect by electrical noises, earth ground the weighing unit and the display unit.
- Do not drop things upon the weighing pan, or place a sample on the pan that is beyond the weighing capacity for weighing unit. Place a sample in the center of the weighing pan to minimize corner-load errors.
- To prevent possible errors, before each weighing, perform re-zero using the RS-232C command, or calculate the difference between the weight value before and after weighing.
- Even though the weighing unit is dust-protected and protected against splashing water, complying with IP65, be sure to clean the weighing pan and keep the conditions around the pan clean after weighing powdery, fluid samples or metallic strips.

## 2.5. After Use

- Avoid mechanical shock to the weighing unit. Do not drop the weighing unit.
- Periodically calibrate the weighing unit, using a calibration weight.
- Do not disassemble the weighing unit. Contact the local A&D dealer if the weigh module needs service or repair.
- Do not use organic solvents to clean the weighing unit. Clean the weighing unit with a lint free cloth.
- Avoid dust and water so that the weighing unit weighs correctly. Protect the internal parts from liquid spills and excessive dust.
- Use the original package box to transport the AD4212L.

**Error Messages**

If an error message is displayed, use the following countermeasures.

| Error message | Cause | Countermeasure |
|---|---|---|
| CS Er | Program checksum error | Repair is required. |
| Ad Er | Data cannot be acquired from the A/D converter. | Repair is required. |
| FrAEr | Correct data cannot be read from the nonvolatile memory ( FRAM ). | Initialize the module. If it cannot be resolved, repair is required. |
| C Err | Calibration data is incorrect. | Perform the calibration |
| C Er x | Calibration error. | Refer to **"3.2.2 Error Codes for Calibration ( C Er )"**. x: error number |
| Errdt | The setting value is out of range. | Check the setting value. |

# 3. Basic Operation

This section describes the following operations:

- Changing the weighing speed (response characteristics) and using stability detection
- Calibration
- Changing the baud rate and slave address

## 3.1. Changing the Weighing Speed and Stability Detection

Changing the weighing speed

The weighing speed can be changed by setting digital filter 1 and 2 of basic function (Fnc F).

The AD4212L has two digital filters. The cutoff frequency setting range is different for each.

- Digital filter 1 ( FnC05: None, 100.0Hz (high) to 0.7Hz (low))
- Digital filter 2 ( FnC06: None, 100.0Hz (high) to 0.07Hz (low))

Setting cutoff frequency

The cutoff frequency is the frequency where the vibration starts to decline.

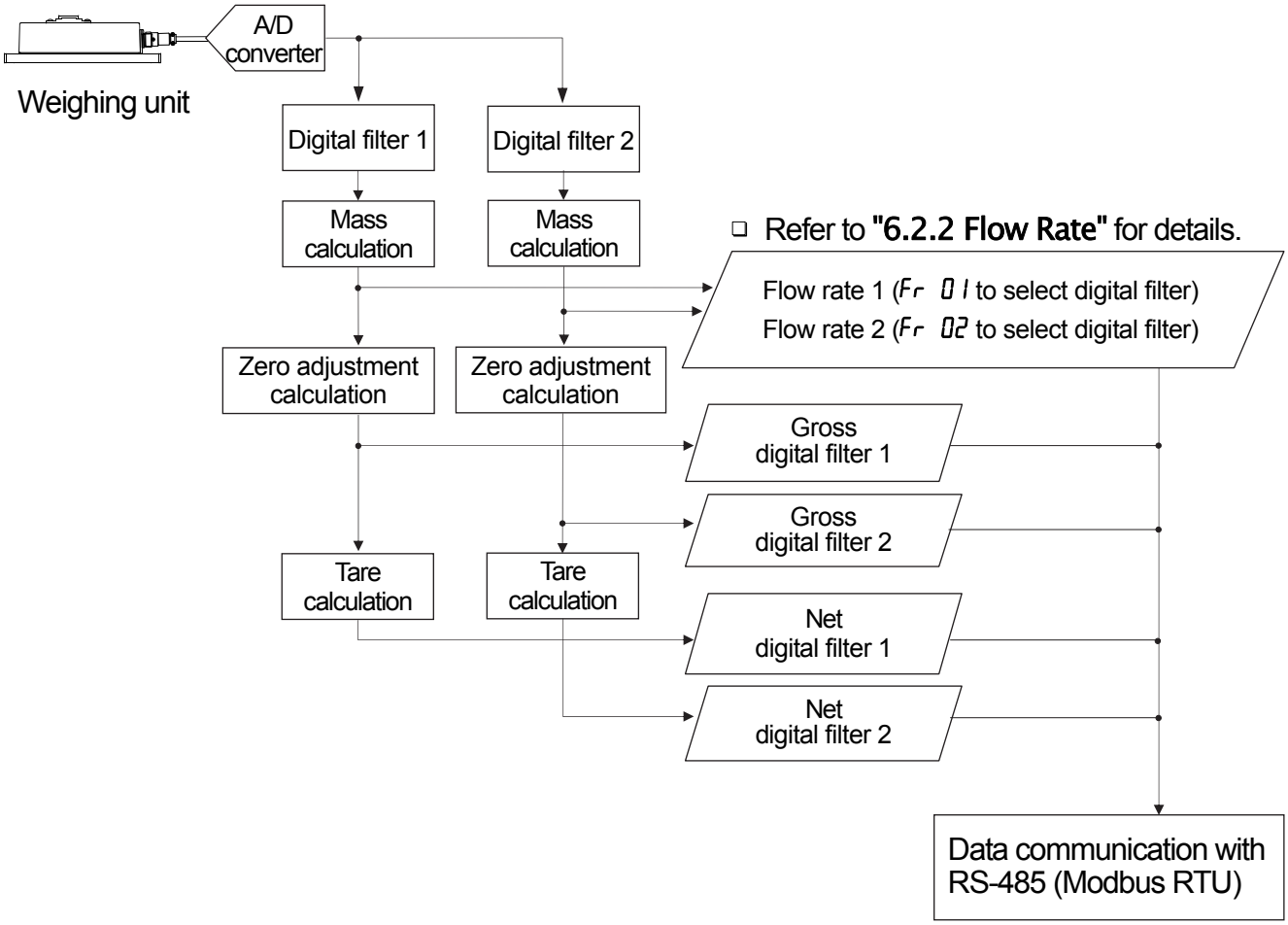
- If the weighing value is unstable, lower the cutoff frequency.
  ( Response rate is slow. Resistant to disturbance.)
- To make the response faster, higher the cutoff frequency.
  ( Response rate is fast. Susceptible to disturbance.)

It is possible to make adjustments while watching the effects of the digital filter.

Press the [→] key while setting values as shown in Step 4 in **"6.2.7.1 Procedure to Store New Parameters"** to check the weight displayed.

- The [↑] key changes the cutoff frequency. You can check the setting value on the LED status indicator (binary number).
- The [→] key returns to the value setting display. ( The setting value changed above using the [↑] key will be displayed )

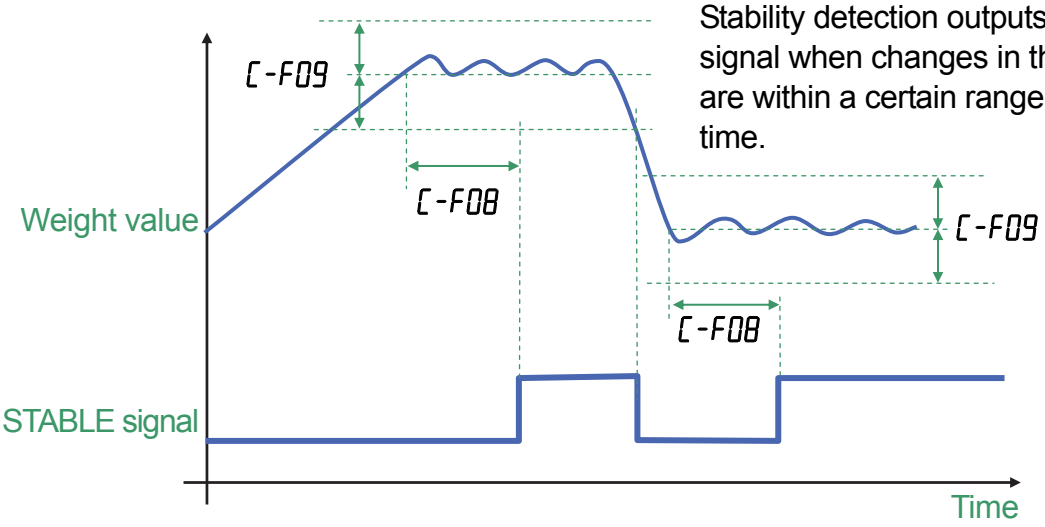
The digital filter flow chart is shown below.




The mass indicated on the display unit is the mass acquired by digital filter 1.
The mass acquired by digital filter 2 is not indicated on the display unit.

Stability detection

The stability detection time and stability detection width of calibration function (C-Fnc) can be changed.

| Item Name / Function code | Description, Range and Default value |
|---|---|
| C-F08<br>1008<br>Stability detection time | Stability detection is performed using this setting in combination with the setting of C-F09. When C-F08 holds 0.0, stability detection will not be performed. (Stable all the time) Scale: 0.1 seconds. 0.0 to [1.0] to 9.9 |
| C-F09<br>1009<br>Stability detection width | Stability detection is performed using this setting in combination with the setting of C-F08. When C-F09 stores 0, stability detection will not be performed. (Stable all the time) Scale: 1 d (minimum div). 0 to [2] to 100 |
|  | Stability detection outputs the STABLE signal when changes in the weight value are within a certain range during a certain time. |

Stability detection is performed using the mass value acquired by digital filter 1.

## 3.2. Calibrating the Display Unit

The weigh module measures the voltage of the load cell and displays it. Calibration corrects the signal from the load cell to convert it into mass correctly.

※Perform stable measurement during calibration to prevent measurement errors.

※During stable measurement, the S LED lights.

※The blinking decimal point means that the current value is not the weight value.

※When C Er with a number is displayed, it indicates that an error has occurred.
Refer to "**3.2.2 Error Codes for Calibration (C Er )**" for details.

※Before the calibration, allow the weigh module at least 30 minutes to warm up to avoid drift caused by changes in temperature.

### 3.2.1. Calibration Using a Weight (C-SEt)

Calibration is performed by loading and unloading a calibration weight.

Step 1 Turn off the display by pressing and holding the ENT key. Then, while holding the F key, press the ENT key. CAL will be displayed indicating calibration mode.

Step 2 Press the ENT key to enter calibration mode. C-SEt is displayed. To return to weighing mode, press the ESC key.

#### Zero Calibration

Step 3 Press the ENT key to display CAL 0.
To skip zero calibration, press the ↑ key and proceed to Step 5.

Step 4 Confirm that the S LED is lit, and then press the ENT key. Then ----- is displayed for 2 seconds. To skip span calibration, press the ESC key twice to return to weighing mode.

#### Span Calibration

Step 5 When C-SPn is displayed, press the ENT key. The current calibration weight value is displayed with the rightmost digit flashing. Specify a new value using the → and ↑ keys. To skip span calibration, press the ESC key three times to return to weighing mode.

Step 6 Place the weight on the weighing pan. Confirm that the S LED is lit and press the ENT key. Then ----- is displayed for 2 seconds.
It is recommended to use a weight of 50g for AD4212L-R50, and 100g for AD4212L-R100. When using a weight other than the recommended one, use a weight with 1/2 or more of the maximum capacity.

Step 7 When C-End is displayed, remove the weight from the weighing pan. To calibrate span again, press the ↑ key.

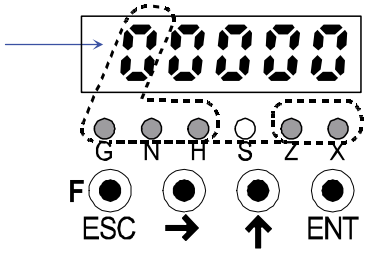
Step 8 Press the ESC key. Then C-SEt is displayed and calibration data is stored in nonvolatile memory (FRAM) of the weigh module.

Step 9 Press the ESC key to return to weighing mode.

**Note**

When the span calibration value is set to 100 g in Step 5, select the highest- order digit using the → key, and then make the status indicator LEDs light as shown below using the ↑ key.

Indicates that the value of the highest-order digit is “10”.




※The S LED lights when the display is stable.

## 3.2.2. Error Codes for Calibration (C Er )

When an error occurs during calibration, the error number is displayed. If calibration is finished without removing the error, the setting values will be restored to the state before calibration.

### Calibration errors and remedies

| Error No. | Description of cause | Treatment |
|---|---|---|
| C Er 1 | The display resolution (maximum capacity / minimum division) exceeds the specified value. | Make the minimum division greater or make the maximum capacity smaller. The specified value depends on specifications of the weighing system. |
| C Er2 | The voltage at zero calibration is excessive in the positive direction. | It seems that the display unit is damaged. Contact us or your local A&D dealer. |
| C Er3 | The voltage at zero calibration is excessive in the negative direction. | |
| C Er4 | The value of the calibration weight exceeds the maximum capacity. | Use an appropriate calibration weight and calibrate again. |
| C Er5 | The value of the calibration weight is less than the minimum division. | |
| C Er6 | The weighing unit sensitivity is not sufficient. | Confirm the weight value. |
| C Er7 | The voltage at span calibration is less than the voltage at the zero point. | Check the weighing unit connection. |
| C Er8 | The weighing unit output voltage is too high when the mass of maximum capacity is weighed. | Confirm the weight value. |

# 3.3. Changing the Baud Rate and Slave Address

**Changing the baud rate**

The baud rate can be changed by setting the baud rate of the RS-485 Function (rS F).

| Item Name | Function code | Description, Range and Default value |
|---|---|---|
| rS 03 Baud rate | 2103 | 5 : 9600 bps 7 : 38400 bps<br>6 : 19200 bps 8 : 115200 bps |

Refer to "**6.2.7.1 Procedure to Store New Parameters**" for details.

**Changing the slave address**

The slave address is set to "1" at shipment. When using multiple AD4212L units, make sure that the same value is not set more than once.

| Item Name | Function code | Description, Range and Default value |
|---|---|---|
| rS 08 Slave address | 2108 | 0 : None 1 to 99 |

Refer to "**6.2.7.1 Procedure to Store New Parameters**" for details.

## 3.3.1. Initializing Parameters

The initialization mode restores the parameters to the default values in the FRAM.
Three types of initialization mode are available as shown below.

| Initialization mode | Display | Description |
|---|---|---|
| RAM initialization | ini r | RAM memory is initialized. The center of zero and tare value will be restored to 0. |
| General function initialization | ini F | Data of the general functions stored in the FRAM and the RAM are reset to factory settings. |
| All data initialization | ini A | All data stored in the FRAM, general functions and RAM are initialized. Data related to calibration is also initialized, so calibration must be performed again. |

### 3.3.1.1. Initializing Mode for RAM and Function Parameters

Step 1 Press the F key while holding the ENT key ( ENT + F ) to display FnC for general functions mode. To return to weighing mode, press the ESC key.

Step 2 Press the ENT key while holding the → key ( → + ENT ) to display CHc for check mode.

Step 3 Select initialization mode ini using the ↑ key. Press the ENT key.

Step 4 Select an item to be initialized using the ↑ key. Press the ENT key.

Step 5 Check that all LED status are blinking.
To perform the initialization, hold the ENT key for 3 seconds or more.

After initialization, all segments will illuminate and return to weighing mode.
To cancel the initialization, press the ESC key to return to weighing mode.

### 3.3.1.2. Initializing All Data

Step 1 In OFF mode ( Standby: While turning off the module ), press F + ENT keys to display CAL for calibration mode.
To return to weighing mode, press the ESC key.

Step 2 Press the ENT key to enter into calibration mode.

Step 3 Press the ↑ key four times to select initialization all data mode and press the ENT key.

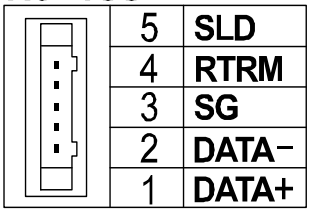
Step 4 Check that all LED status lights are blinking.
To initialize, hold the ENT key for 3 seconds or more.
After initialization, all segments illuminate and return to weighing mode.
To cancel the initialization, press the ESC key to return to weighing mode.

# 4. Communication Specification

The AD4212L enables bi-directional communication using the RS-485 interface. (If the RS-485 is set to interval output, only data from the AD4212L can be transmitted)
The AD4212L is set to Modbus RTU at shipment.
The RS-485 has two kinds of communication modes ( rS 02 ).

- Modbus RTU ( rS 02 = 5 )
- Interval output ( rS 02 = 6, 7, 8 )

**RS-485**




| Pin No. | Symbol | Description |
|---|---|---|
| 5 | SLD | Connected with FG ground terminal on the power supply connector. |
| 4 | RTRM | Terminating resistor (100Ω) is connected to Pin 1. Enable the terminating resistor with short-circuited to Pin 2. |
| 3 | SG | Signal ground |
| 2 | DATA− | Minus side of the RS-485 communication line. |
| 1 | DATA+ | Plus side of the RS-485 communication line. |

### Communication Specifications

| Item | Data transfer mode ( rS 02 ) | |
|---|---|---|
| | Modbus RTU | Interval output |
| Baud rate ( rS 03 ) | rS 03 ( 9600, 19200, 38400, 115200 bps ) | |
| Start bit length | 1 bit | |
| Character bit length | Fixed 8 bits | |
| Parity ( rS 04 ) | Fixed even number | rS 04 |
| Stop bit length ( rS 06 ) | Fixed 1 bit | rS 06 |
| Terminator ( rS 07 ) | Time | rS 07 |
| Code | Binary | ASCII |
| Slave address ( rS 08 ) | 1 to 99 ( 0 : No address setting ) | Not used |

### Modbus RTU

AD4212L is a slave device of the Modbus RTU. Refer to **"6.3.5 Modbus RTU Data Address".**

### Interval output

Weighing display value is output periodically.

| Communication mode | Interval output | Reference |
|---|---|---|
| 6 | 10 millisecond output ( 100 times/second) | The output data format is common. Output data is weighing display value. |
| 7 | 5 millisecond output ( 200 times/second) | |
| 8 | 2 millisecond output ( 500 times/second) | |

NOTE :100 times/second : Set the baud rate over 19200bps.
200 times/second : Set the baud rate over 38400bps.
500 times/second : Set the baud rate over 115200bps.

## Data address

### Weighing values

| Data Address ( Holding Register ) | R/W | Item | Remarks |
|---|---|---|---|
| 400001 - 400002 | R | Displayed value (Digital filter 1) | |
| 400003 - 400004 | | Gross value (Digital filter 1) | |
| 400005 - 400006 | | Net value (Digital filter 1) | |
| 400007 - 400008 | | Tare value | |
| 400009 - 400010 | | Status indicator (Status LED) | #6 |
| 400043 - 400044 | | Displayed value (Digital filter 2) | |
| 400045 - 400046 | | Gross value (Digital filter 2) | |
| 400047 - 400048 | | Net value (Digital filter 2) | |

#6 **Bit address of status indicators ( Data address : 400009 - 400010 )**

| Data Address ( Holding Register ) | R/W | Item | Remarks |
|---|---|---|---|
| 400009. 15-00 | R | Reserved internally | 0 fixed |
| 400010. 15-07 | | Reserved internally | 0 fixed |
| 400010. 06 | | Z : Zero | LED to turn on = 1<br>LED to turn off = 0 |
| 400010. 05 | | S : Stable | |
| 400010. 04 | | G : Gross | |
| 400010. 03 | | N : Net | |
| 400010. 02 | | H : Hold, Hold busy | |
| 400010. 01 | | X : Basic function | |
| 400010. 00 | | Reserved internally | 0 fixed |

# 5. Troubleshooting

The weigh module has check mode function for confirming operations.
When making inquiries, please inform us of the user settings.

## 5.1. Check Mode

The check mode can be used to check the performance of the display, key switches and external I/O.

### 5.1.1. Entering Check Mode

Step 1 Press the F key while holding the ENT key ( ENT + F ) to display Fnc.
To return to weighing mode, press the ESC key.

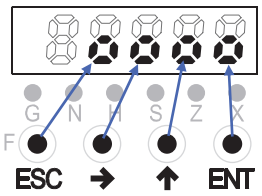
Step 2 Press the ENT key while holding the ➔ key ( ➔ + ENT ) to display CHc in check mode. Press the ENT key to display the check item.

Step 3 Select the checked item using the ↑ key. Press the ENT key to enter it.
Press the ESC key to exit.

| Display symbol | Item |
|---|---|
| CHKEY | Key check |
| CH io | Control I/O check |
| CH CL | Standard serial output check |
| CH rS | RS-485 check |
| CH Ad | A/D converter output check ( weighing unit check ) |
| CH in | Internal count check |
| CHPrG | Program version |
| CH Sn | Serial number |
| CSPrG | Program checksum |
| CSFrA | Memory checksum |
| CF dt | C-Fnc check ( C-F01 to C-F28 ) |

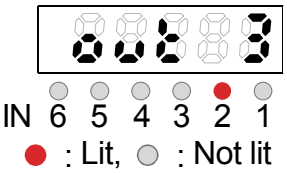
## 5.1.2. Verifying the Switch Operation

When pressing the key, the corresponding segment moves. "▫" & "▫".
To stop the current check mode, press the [ESC] key twice.




## 5.1.3. Checking the Control I/O

When pressing the [↑] key when the terminal number of the control I/O is displayed, the output turns on sequentially ( out 0 is all OFF ).
When turning on the input of the control I/O, the LED illuminates.




## 5.1.4. Checking the Standard Serial Output

Test data "ST,GS,+00000.0kg<CR><LF>" is output using a preset baud rate every time the [ENT] key is pressed.

## 5.1.5. Checking the RS-485 Output

Test data "ST,GS,+00000.0kg<CR><LF>" is output using a preset baud rate, parity and stop bit length every time the [ENT] key is pressed.

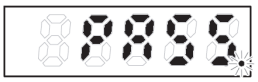
When "Figure data with a sign <CR><LF>" is output, the data is displayed.

- For numbers with a decimal point, the figure before the decimal point is output.
  For instance of 123.4, only 123 is displayed.

Example 1: "ST,GS,+0001357kg<CR><LF>"

Example 2: "+54321<CR><LF>"

Example 3: There is no figure. "ABC<CR><LF>"



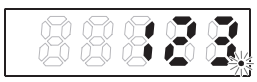
## 5.1.6. Monitoring the A/D Converter ( for Load Cell Output )

The voltage output rate of the weighing unit is displayed in units of mV/V.

Example: When the internal count is 1.2345 mV/V and the output rate is above ±7 mV/V, a weighing unit damage or connection error may occur. Refer to **"5.3 Verifying Weighing Unit Connections Using Multimeter"**.

## 5.1.7. Monitoring the Internal Value

The current internal count ( 10 times of weighing value ) is displayed.
When the internal count is 123, the example display is as follows:



### 5.1.8. Monitoring the Program Version

The program version is displayed.
Example: Version 1.00 is as follows:


### 5.1.9. Monitoring the Serial Number

The last five digits of the serial number is displayed.


### 5.1.10. Monitoring the Checksum of the Program

The checksum of the program is displayed.
Example: Checksum is EF.


### 5.1.11. Monitoring the Checksum of an Internal FRAM

The checksum of FRAM is displayed. Memory of the general function is not checked.
Example: Checksum is EF.


### 5.1.12. Displaying Function Parameters for the Calibration (C-F01~28)

The calibration function can be displayed.

# 5.2. Verifying Weighing Unit Connections ( DIAGNOS )

## 5.2.1. Guideline to Verify Weighing Unit Connections

Faulty wiring or disconnection of the weighing unit can be checked using the display unit. This verification is useful for new settings, pre-measurement inspections and periodic inspections.

| No. | Diagnostic item | Diagnostic point | Judgment Criteria ( General ) |
|---|---|---|---|
| 1 | Weighing unit input voltage | Between SEN+ ⇔ SEN− | 3 V or more |
| 2 | SEN+ voltage | Between SEN+ ⇔ AGND | 4 V or more |
| 3 | SEN− voltage | Between SEN− ⇔ AGND | 1 V or less |
| 4 | Weighing unit output voltage | Between SIG+ ⇔ SIG− | Within ±35 mV |
| 5 | Weighing unit output rate | Between SIG+ ⇔ SIG− | Within ±7 mV/V |
| 6 | SIG+ voltage | Between SIG+ ⇔ AGND | 1 V to 4 V |
| 7 | SIG− voltage | Between SIG− ⇔ AGND | 1 V to 4 V |
| 8 | Internal temperature | | −20 °C to +60 °C |

AGND : Internal analog circuit ground
EXC− : Weighing unit excitation voltage (−)
EXC+ : Weighing unit excitation voltage (+)
SIG− : Weighing unit output (−)
SIG+ : Weighing unit output (+)
SHLD : Shield. Frame ground.
SEN− : Sensing input (−)
SEN+ : Sensing input (+)

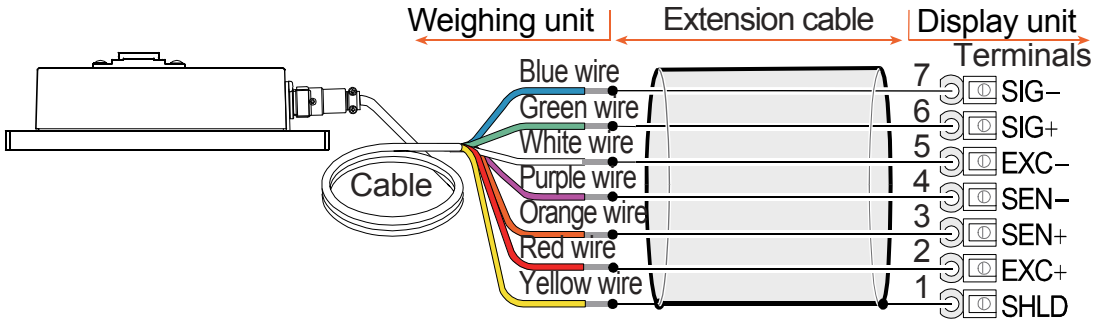



**Illustration 8 Weighing unit wire names**

## 5.2.2. Verifying Weighing Unit Connections with Switch Operation

Step 1 Press the F key while holding the ENT key ( ENT + F ) to display FnC.
To return to weighing mode, press the ESC key.

Step 2 Press the ENT key while holding the → key ( → + ENT ) to display check mode CHc.

Step 3 Press the ↑ key twice to select weighing unit connections diagnosis diAG and then press the ENT key to enter it. Each item is automatically diagnosed. After approx.16 seconds, the diagnosis is displayed. Also, each diagnosis is checked by selecting items pressing the ↑ key.
Press the ESC key to return to the display diAG.

## 5.2.3. Verifying Using the RS-485

Switch to Modbus RTU (5) for the Communication mode ( rS 02 ) and write commands to the coils so that the diagnosis is started.

Step 1 Write "1" to the self-check start ( Data Address 000403 ) coil.
d iAG is displayed and each item is automatically diagnosed.
During the self-checking, the "During an internal write cycle / Write result" holding register is "15".

Step 2 After approx.16 seconds, the diagnosis is displayed, then the result is output to the "During an internal write cycle / Write result" holding register.

"During an internal write cycle / Write result" holding register = 0 : No error
1 : Error

When an error occurs, the details are output to "error code" and "error sub code" holding registers.
Refer to **"6.3.1.2** Error Code of the Modbus RTU ( Data Address : 400065 - 400068 )**"** for more details.

Step 3 Write "1" to the "self-check stop" ( Data Address 000404 ) coil and the diagnosis is finished.

- During the diagnosis from Step 1 to Step 3, weighing mode stops. So, the parameters of the holding register about the weighing ( mass ) and the parameters of the coil about the status display will be unstable.
  Reading and writing of the holding register related to functions can be performed normally.

## 5.2.4. Verifying Using Control I/O

Step 1 When the input terminal of the control I/O is set to "diagnose" and remains "ON" for 1 second or more, the display shows d iAG and checks each item automatically. After approx. 16 seconds, the diagnosis is displayed.

- When the control I/O is set to "OFF", the diagnosis ends. Keep "ON" until the diagnosis is displayed.

Step 2 Turn off the input terminal of the control I/O set to "diagnose" and display unit returns to weighing mode.

## 5.2.5. Display and Output of Verification

Items that have not been diagnosed are also totaled as errors. Refer to **"5.2.1** Guideline to Verify Weighing Unit Connections**"** concerning the detail of the diagnosis point and judgment criteria.
When scanning and changing items, d iAG is displayed.

The diagnostic results of the scanning are displayed as follows:

There are no errors: Good

There is an error: Er XXX ( a code XXX in which error codes are accumulated.)

When more than one error occurs, the total value of the error codes is displayed.
Ex. When errors are weighing unit excitation voltage ( No.1 ) and Internal temperature ( No.8 ):

1 + 128 = 129 129 is the error code of XXX

| No. | Check item | Status LED<br>G N H S Z X | Display Range | Error Code |
|---|---|---|---|---|
| 1 | Weighing unit excitation voltage | ● ● ○ ○ ○ ● | 0.001 V | 1 |
| 2 | SEN+ voltage | ● ● ○ ○ ● ○ | 0.001 V | 2 |
| 3 | SEN− voltage | ● ● ○ ○ ● ● | 0.001 V | 4 |
| 4 | Weighing unit output voltage | ● ● ○ ● ○ ○ | 0.001 mV | 8 |
| 5 | Weighing unit output rate | ● ● ○ ● ○ ● | 0.0001 mV/V | 16 |
| 6 | SIG+ voltage | ● ● ○ ● ● ○ | 0.001 V | 32 |
| 7 | SIG− voltage | ● ● ○ ● ● ● | 0.001 V | 64 |
| 8 | Internal temperature | ● ● ● ○ ○ ○ | 0.1 °C | 128 |

● : Lit, ○ : Not lit

## 5.3. Verifying Weighing Unit Connections Using Multimeter

The weighing unit connection can be checked easily using a digital multimeter.
The measurement points of the weighing unit connection are shown below:

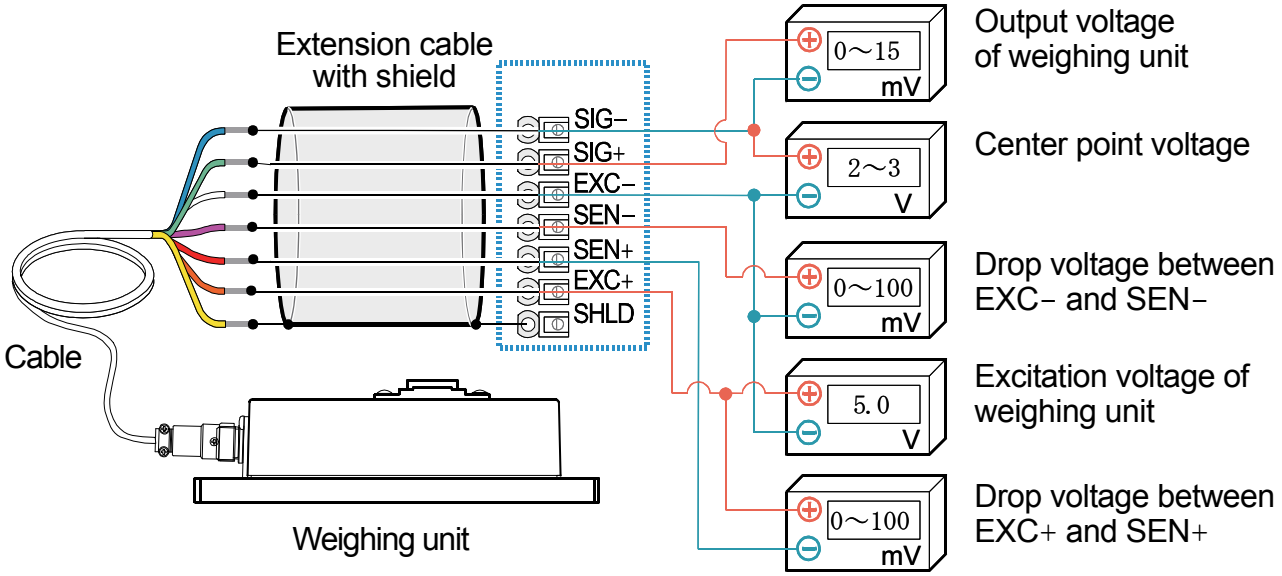



**Illustration 9 Weighing unit connection check**

### 5.3.1. Check List for Weighing Unit Connections

| Measurement points | | Description | Conditions |
|---|---|---|---|
| EXC+ | SEN+ | Drop voltage of cable on EXC+ side. | Normally it is 100 mV or less. However, it may exceed 1V when an extremely long weighing unit cable is used. |
| EXC+ | EXC− | Input voltage | Normal range is between 4.75 V to 5.25 V. |
| SEN− | EXC− | Drop voltage of cable on EXC− side. | Normally it is 100 mV or less. However, it may exceed 1V when an extremely long weighing unit cable is used. |
| SIG− | EXC− | Center point voltage | Approximately 2.5 V, about a half of excitation voltage. |
| SIG+ | SIG− | Output voltage | Generally, it is within 0 V to 15 mV. The theoretical value is calculated from the weighing unit rated capacity, actual load and excitation voltage. |

When the weigh module cannot be operated properly, write the required items in the table below and contact us or your local A&D dealer.

Model name ☐ AD4212L-R50
☐ AD4212L-R100

| Measurement points | | Measurement contents | Measurement result |
|---|---|---|---|
| EXC+ | SEN+ | Drop voltage of cable on EXC+ side. | [mV] |
| EXC+ | EXC− | Input voltage | [V] |
| SEN− | EXC− | Drop voltage of cable on EXC− side. | [mV] |
| SIG− | EXC− | Center point voltage | [V] |
| SIG+ | SIG− | Output voltage | [mV] |

# 6. Display Unit Detailed Descriptions

## 6.1. Specifications

### 6.1.1. Digital Parts ( Display and Keys )

| | | |
|---|---|---|
| Display element | Measurement display | 5-digit 7-segment red LED<br>5.3 mm Character height,<br>1-digit red LED for negative polarity |
| | Status indicators | 6 red LEDs |
| Measurement display | Numerical display | Switches between NET and GROSS |
| | Decimal point | Selectable decimal places ( $10^1$, $10^2$, $10^3$, $10^4$ ) |
| | Overflow display | All the digits turn OFF.<br>( When the polarity is negative, the minus sign LED appears at the highest-order digit.) |
| Status indicators | **G**: GROSS, **N**: NET, **H**: HOLD / HOLD BUSY, **S**: STABLE, **Z**: ZERO,<br>**X**: Preset function selected at *FnC04* in the basic function. | |
| Key switches | **F/ESC**, ➔ ( ZERO ), ↑ ( TARE ), **ENT** | |

### 6.1.2. General

#### 6.1.2.1. Interface

| Interface | Specification | Connector |
|---|---|---|
| RS-485 | Refer to **"6.3.1 RS-485"** | Power clamp connector ( 3M ) |
| Control I/O | Refer to **"6.3.2 Control I/O"** | MDR connector 20 pins female<br>Connector is not included |
| Standard serial output | Refer to **"6.3.3 Standard Serial Output ( Current Loop )"** | |
| USB | USB 2.0 ( High-speed ) | Micro-B<br>Cable is not included |

### 6.1.2.2. Weighing Functions

| | |
|---|---|
| Zero operation | Set the gross weight to zero by pressing the [→(ZERO)] key.<br>Disable or enable operation when unstable.<br>Zero value is stored in nonvolatile memory.<br>Zero adjustable range: Can be set optionally in the range of 1 to 100% of the maximum capacity.<br>The LED on **Z** will illuminate when the weighing value is within the center-zero range. |
| Zero tracking | Tracks the weight drift around the zero point to maintain zero.<br>Zero tracking time: 0.0 to 5.0 second Can be set optionally within the range<br>Zero tracking band: 0.0 to 9.9 d Can be set optionally within the range |
| Tare | Set the net weight to zero by pressing the [↑(TARE)] key. The tare function can be toggled on/off when the weighing value is unstable and negative. The tare value is stored in nonvolatile memory ( FRAM ).<br>Tare range: Gross weight ≦ Maximum capacity |
| Stability detection | Turns ON the stabilization indicator **S** when the variation amount of the weight value per sampling is within the set band in the set time.<br>Detection time: 0.0 to 9.9 seconds Can be set optionally within the range<br>Detection band: 0 to 9 d Can be set optionally within the range |
| Digital filter 1 | Cutoff frequency ( −3 dB ) range: 0.7 to 100 Hz |
| Digital filter 2 | Cutoff frequency ( −3 dB ) range: 0.07 to 100 Hz |
| Near-zero detection | Detects whether there is a load or not and outputs the result as near zero. |
| Upper or lower limit detection | Compares the measurement with HI/OK/LO limits and outputs the results. |
| Hold function | Displays the measurement value held.<br>Select from normal hold, peak hold, and average hold. |
| Flow rate calculation | Calculate mass change value per unit time. |

# 6.2. Operations

## 6.2.1. General Functions

### 6.2.1.1. Zero Operation

- The zero operation sets the gross weight to zero. It is performed by pressing the [➔(ZERO)] key.
- The zero range is set in C-F05 ( Zero range ) and is expressed as a percent of the maximum capacity with the calibration zero point as the center.
- When A/D converter overflow occurs, zero operation is disabled, even within the zero range.
- A ZERO error is output if zero operation is not performed because the value is unstable or out of range.
- The zero value is stored in the non-volatile memory and is saved even if the power is disconnected.
- Clear the zero value with the [F] key assigned to clear the zero value.

- **Functions Related to Zero Operation**
  - C-F05 ( Zero range ): Values between 0% and 100% can be specified.
  - C-F10 ( Tare and zero when unstable ):
    Enable or disable tare and zero operation when unstable.
    0: Disable both functions 1: Enable both functions
  - C-F16 ( Zero when power is turned on ):
    Choose whether or not to perform zero when power is turned on.
    0: Disable 1: Enable

### 6.2.1.2. Zero Tracking

- The zero tracking function tracks the gross weight drift around the zero point to maintain zero.
- The zero tracking time is set in C-F06 ( Zero tracking time ) and the zero tracking band is set in C-F07 ( Zero tracking band ). When the gross weight drift is within the specified range, zero tracking is performed automatically.
- A ZERO error is not output even if zero tracking is not performed.

- **Functions Related to Zero Tracking**
  - C-F06 ( Zero tracking time ): Values between 0.0 and 5.0 seconds can be specified.
  - C-F07 ( Zero tracking band ): Values between 0.0 and 9.9 d can be specified.
    ( d = minimum division )
    Zero tracking does not function when either of the settings is 0.0.

### 6.2.1.3. Tare Function

- The tare function stores the gross weight as a tare value and sets the net weight to zero. It is performed by pressing the [↑(TARE)] key.
- The tare value is stored in the non-volatile memory and is saved even if the power is disconnected.
- Clear the tare value with the [F] key assigned to clear the tare value.

- **Functions Related to the Tare Function**
  - C-F10 ( Tare and zero when unstable ): Enable or disable tare and zero operation when unstable.
    0: Disable both functions 1: Enable both functions
  - C-F11 ( Tare when the gross weight is negative ): Enable or disable tare when the gross weight is negative.
    0: Disable tare 1: Enable tare

### 6.2.1.4. Clearing the Tare Value and Zero Operation

To clear the tare value and zero operation, hold the [↑(TARE)] key and turn on the module. Or: In off mode, hold the [↑(TARE)] key and press the [ENT] key.

### 6.2.1.5. Customizing the Functions of the F Key

Assign a function to the [F] key from the functions of FnC02 ( [F] key ) below:

0 : None
1 : Manual print command
2 : Hold
3 : Operation switch 1
4 : Operation switch 2
5 : Display exchange
6 : Tare clear
7 : Zero clear
8 : Weighing start / Pause / Restart
9 : Actual free fall input
10 : One shot, Small flow
11 : Sequence flow rate monitor
12 : mV/V monitor
13 : Digital filter 2

The factory setting is 5

- C-F 15 ( Clear the zero value ): Enable or disable clearing of the zero value.
  0: Disable 1: Enable

**Operation switch 1 and 2**

By assigning the [F] key to the operation switches, manual input is possible.
The output is from the control output ( 34: Output operation switch is on or off ).
To ensure that the operation switch is ON or OFF, the status indicator X, a red LED, is assigned to the operation switch status.

These switches work as follows:

Operation switch 1:
Press and release the switch once to save to turn ON or OFF.
Press the switch again to turn it OFF or ON.

Operation switch 2:
While the switch is being pressed, the switch is ON. When it is released, it is OFF.

**Additional monitor**

The decimal point of other data flashes to separate from weighing data, both LEDs of G: gross and N: Net are illuminated. When pressing the [F] key again, the AD4212L returns to weighing mode.

mV/V : Output voltage of load cell in the unit of mV/V.
Digital filter 2 : Response of weighing data by digital filter 2

### 6.2.1.6. Customizing the Function of the x Display

Assign a function to the **x** display ( a red LED ) from the functions of Fnc04 ( x display ) below:

0: None
1: Zero tracking in progress
2: Alarm ( Zero range setting error, over, failure tare calculation )
3: Display operation switch status as on or off
4: Near-zero
5: HI output
6: OK output
7: LO output
8: Large flow
9: Medium flow
10: Small flow
11: Over
12: OK
13: Under
14: Full
15: Weighing sequence end
16: In weighing sequence
17: Weighing sequence error
18: Normal batch/Loss-in-weight, Identification
19 to 24: State of Coil IN 1 to 6
25 to 32: Setting of Coil OUT 1 to 8

### 6.2.1.7. Memory Backup

- Zero value, tare value, display status, calibration data and function data are written into non-volatile memory. The data retention period is more than 10 years. This module is not equipped with a battery.

### 6.2.1.8. Near-Zero Detection

- Near-zero detects whether an object has been placed on the weighing pan.
  The near-zero state is defined when the weighing value is within the preset value for the near-zero range.

- **Related functions**
  - Fnc08 ( Near-zero ): The value of near-zero.
  - Fnc09 ( Near-zero comparison weight ): Selection of the gross weight or net weight to compare the value of near-zero.
    1: Gross weight 2: Net weight

### 6.2.1.9. Upper or Lower Limit Detection Function

- This function detects whether the weighed value is above an upper limit value or below a lower limit value.

- **Related Functions**
  - Comparative upper or lower limit values can be set with Fnc 10 ( Upper limit value ) or Fnc 11 ( Lower limit value ).

| Result of Detection | Required value |
|---|---|
| HI | Weighing value ＞ Upper limit value |
| OK | Upper limit value ≧ Weighing value ≧ Lower limit value |
| LO | Lower limit value ＞ Weighing value |

  - Fnc 12 ( Comparison mass of upper and lower limit ): Select value to be compared with the upper or lower limit from gross weight or net weight.
    1: Gross weight 2: Net weight

### 6.2.1.10. Full Value Detection Function

The full value detection function detects that a weighing value has reached the maximum value.

- **Functions Related to the Detection Function**
  - Fnc 13 ( Full ): The comparative value of the full value can be preset.
    For information on detection conditions, refer to **"6.2.7.1 Procedure to Store New Parameters".**

### 6.2.1.11. Digital Filter 1 and 2 ( Fnc05 and Fnc06 )

The AD4212L has two digital filters. The cutoff frequency setting range is different for each.

- Digital filter 1 ( Fnc05: None, 100.0Hz (high) to 0.7Hz (low))
- Digital filter 2 ( Fnc06: None, 100.0Hz (high) to 0.07Hz (low))

Setting cutoff frequency

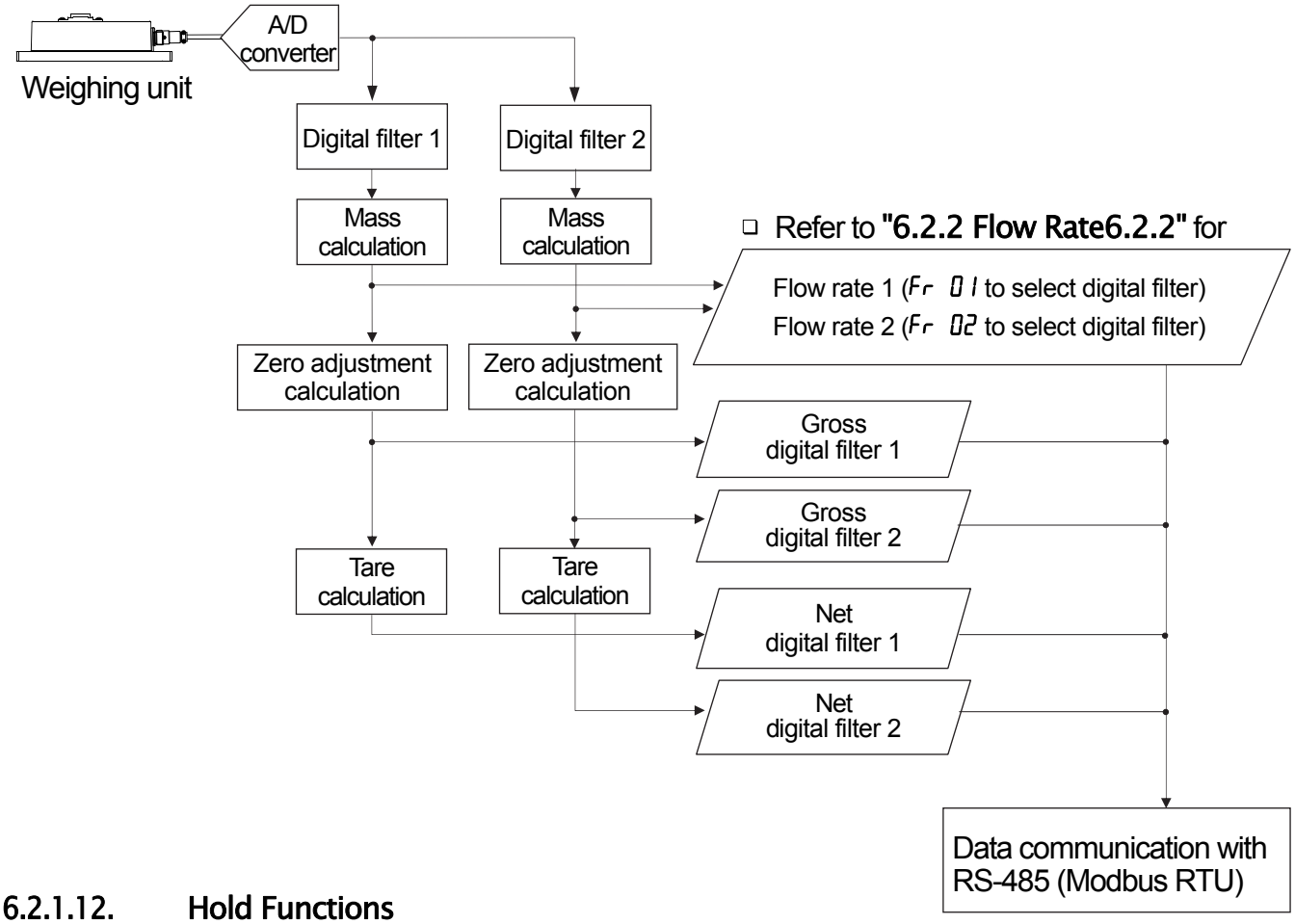
The cutoff frequency is the frequency where the vibration starts to decline.

- If the weighing value is unstable, lower the cutoff frequency.
  ( Response rate is slow. Resistant to disturbance.)
- To make the response faster, higher the cutoff frequency.
  ( Response rate is fast. Susceptible to disturbance.)

It is possible to make adjustments while watching the effects of the digital filter.
Press the [➔] key while setting values as shown in Step 4 in **"6.2.7.1 Procedure to Store New Parameters"** to check the weight displayed.

- The [↑] key changes the cutoff frequency. You can check the setting value on the LED status indicator (binary number).
- The [➔] key returns to the value setting display. ( The setting value changed above using the [↑] key will be displayed )

The digital filter flow chart is shown below.




### 6.2.1.12. Hold Functions

Hold functions are selected from the hold operations in FnC07.

- **Normal hold**
  The normal hold function saves the value displayed at the time the hold command was received.
- **Peak hold**
  The peak hold function saves the maximum value reached after the hold command was received.
- **Averaging hold**
  The averaging hold function averages weighing data over a certain period of time and then saves the result.

Hold operations are controlled by the following.

- F key : FnC02 ( F key function ) 2
- Control input : in 01 ~ in 06 ( hold ) 9
- Modbus RTU : Coil
- Above near-zero and stable : HLd03 ( Automatic start condition ) 1
- Above near-zero : HLd03 ( Automatic start condition ) 2

The hold is released by the following.

- F key : FnC02 ( F key function ) 2
- Control input : in 01 ~ in 06 ( hold ) 9
- Modbus RTU : Coil
- HLd04, HLd05, HLd06, HLd07 : Release the hold by each function required.

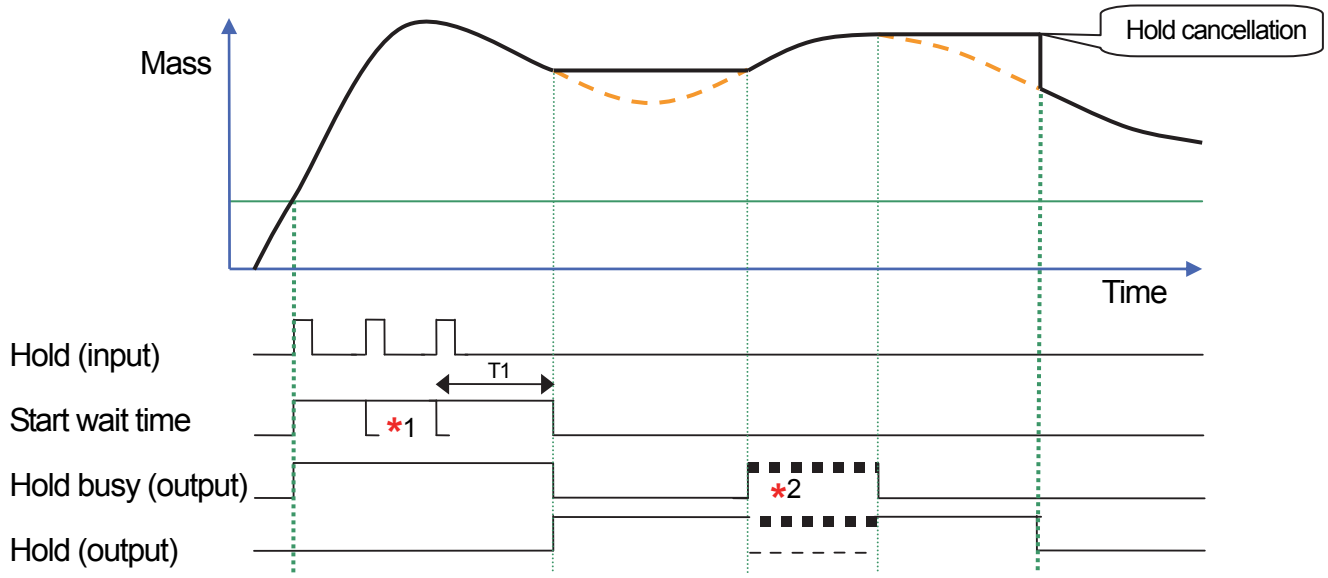
Hold functions are shown below.

| Operating conditions | | Hold operation ( FnC07 ) | | |
|---|---|---|---|---|
| | | Normal hold | Peak hold | Averaging hold |
| Average time | HLd01 | Not available | Not available | Available |
| Start wait time | HLd02 | Not available | Available | Available |
| Automatic start condition | HLd03 | Not available | Available *4 | Available *4 |
| Release using control input | HLd04 | Not available | Available | Available |
| Release time | HLd05 | Not available | Available | Available |
| Release using fluctuation range | HLd06 | Not available | Available *2 | Available *3 |
| Release at near-zero | HLd07 | Not available | Available *1 | Available |

The weighing value held is the weight that is displayed on the main display.
The gross, net, stable/unstable, and upper/lower limit detection result ( HI / OK / LO ) are also held. Near-zero is not held.
The weighing value held is output from the standard serial output and the RS−485.

*1 : When the function is set to release at near zero, peak hold does not work at the near zero.
*2 : In case of a peak hold, only a negative variation can be released.
*3 : The basic value is the weighing value when the average time is started.
*4 : When hold is initiated by automatic start, it can be released either when the F key is pressed or hold is input from the control input.

## Peak hold

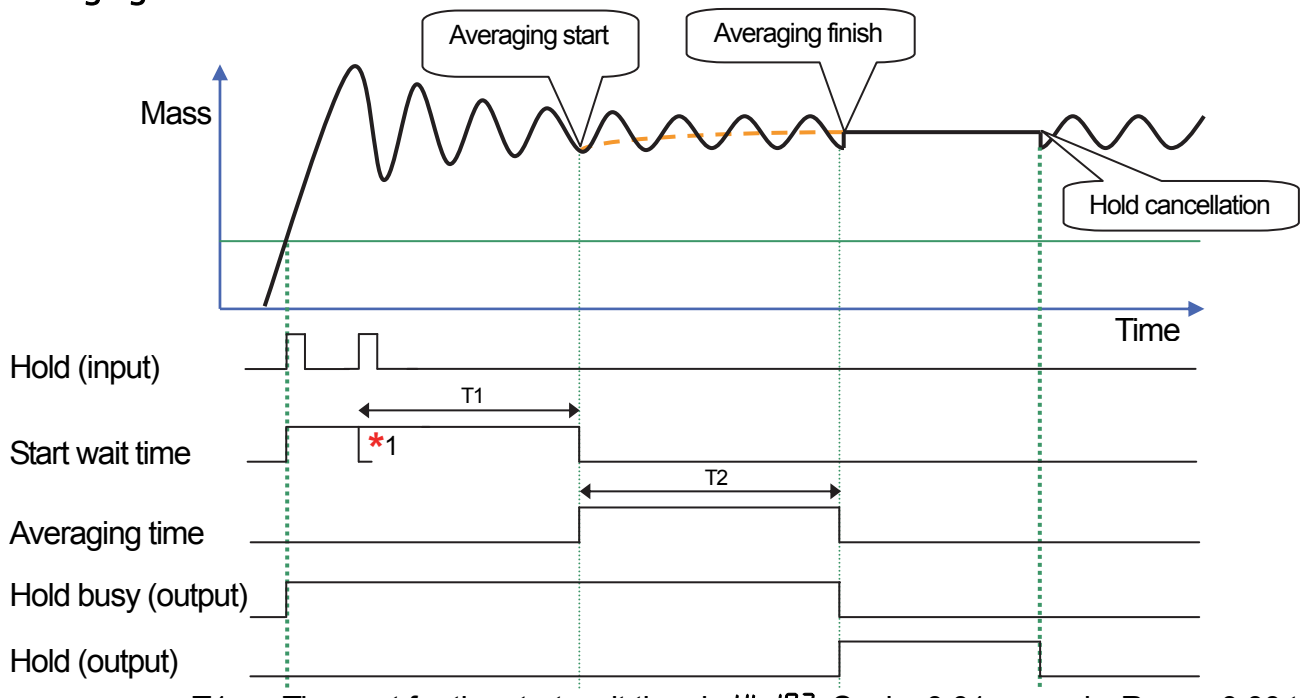



T1 : Time set for the start wait time in HLd02. Scale: 0.01 second Range 0.00 to 9.99 seconds

*1 : Each additional hold input resets the start wait time.

*2 : When the hold value is updated, the hold ( output ) and the hold busy signals turn on and off.
( The hold busy variation depends on the change of the mass value ).

## Averaging hold




T1 : Time set for the start wait time in HLd02. Scale: 0.01 second Range 0.00 to 9.99 seconds

T2 : Time set for the averaging time in HLd01. Scale: 0.01 second Range 0.00 to 9.99 seconds

*1 : Each additional hold input resets the start wait time.

**Illustration 2 Peak hold / Averaging hold**

## 6.2.2. Flow Rate

Flow rate is the movement of mass over time.
Weighing unit has two digital filters so that two flow rates can be output.

- Functions Related to flow rate
  - Fr 01 ( Filter of flow rate 1 )
  - Fr 02 ( Filter of flow rate 2 )
    1: Digital filter 1  2: Digital filter 2

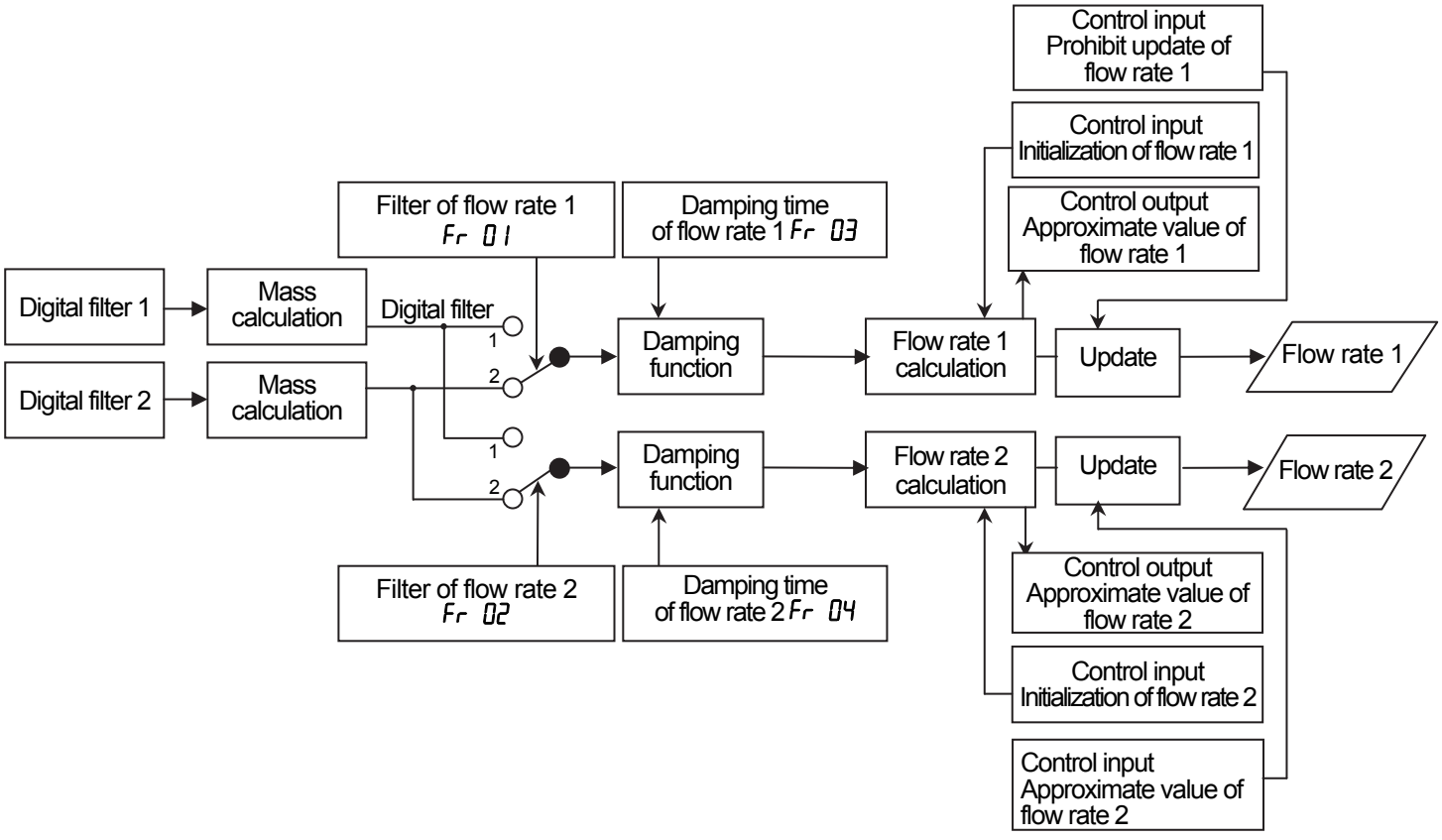
In addition to the digital filters, a damping time can be set to suppress unstable flow rates.
This can be set with the damping time setting which is a moving average time of the weighing values.
Ex. Damping time is 5 seconds: moving average is 5 seconds

Damping time settings can be set for flow rate 1 and flow rate 2 individually.

- Functions related to the flow rate
  - Fr 03 ( Damping time for flow rate 1 )
  - Fr 04 ( Damping time for flow rate 2 )  Range: 1 to 1000 seconds

- Confirming with control input / output
  - Control input
    Prohibits update of flow rate : Holds the flow rate value.
    Initializes flow rate : Deletes the data used for calculating the flow rate value.
  - Control output
    Approximate flow rate value : Indicates the flow rate value is not calculated correctly.
    Initialization causes uncertainty for a certain period of time.

The following is a flow-chart of flow rate calculation after digital filtering.



## 6.2.3. Batch Weighing

Batch weighing is a procedure to automatically weigh up to the final value.
Select a weighing mode ( 59 07 ) from the following:

0 : Disable
1 : Normal batch sequence
2 : Loss-in-weight sequence
3 : Specifying with control input
4 : Specifying with Modbus RTU

■ **Feeding process**

1. Input the weighing start signal.
2. When the weighing start input delay time ( 5922 ) has passed, the large flow, medium flow and small flow outputs turn ON.
3. When the large flow comparison disable time ( 59 23 ) has passed, the large flow output turns OFF under the large flow off output conditions.
4. When the medium flow comparison disable time ( 5924 ) has passed, the medium flow output turns OFF under the medium flow off output conditions.
5. When the small flow comparison disable time ( 5925 ) has passed, the small flow output turns OFF under the small flow off output conditions.
6. When the judging delay time ( 5926 ) has passed and the net value is stable ( 59 12 ), the net value is judged.
7. The weighing end output turns ON and the OK / Over / Under output of the judgment result turns ON.
8. When the weighing end output time ( 59 27 ) has passed, the weighing end output turns OFF and the OK / Over / Under output of the judgment result turns OFF.

❑ The OK / Over / Under output can be always output by setting the OK / Over / Under output timing ( 59 11 ).

■ Weighing start / pause / restart / emergency stop.
When restarted from the pause, the weighing starts with one flow below the previous flow.

Relation between inputs and outputs ( Example : with the large flow to turn on )

| Start and stop command | | Large flow | Medium flow | Small flow | Weighing end | Weighing error | Ref. |
|---|---|---|---|---|---|---|---|
| Weighing start | | **ON** | **ON** | **ON** | OFF | OFF | |
| Pause during flowing | | OFF | OFF | OFF | OFF | **ON** | |
| Restart from pause | First | OFF | **ON** | **ON** | OFF | OFF | |
| | Second | OFF | OFF | **ON** | OFF | OFF | |
| | Third or later | OFF | OFF | **ON** | OFF | OFF | |
| Restart from emergency stop | First | OFF | **ON** | **ON** | OFF | OFF | |
| | Second | OFF | OFF | **ON** | OFF | OFF | |
| | Third or later | OFF | OFF | **ON** | OFF | OFF | |
| Emergency stop during flowing | | OFF | OFF | OFF | OFF | **ON** | |
| Stop after comparison ( Normally finished ) | | OFF | OFF | OFF | **ON** | OFF | |

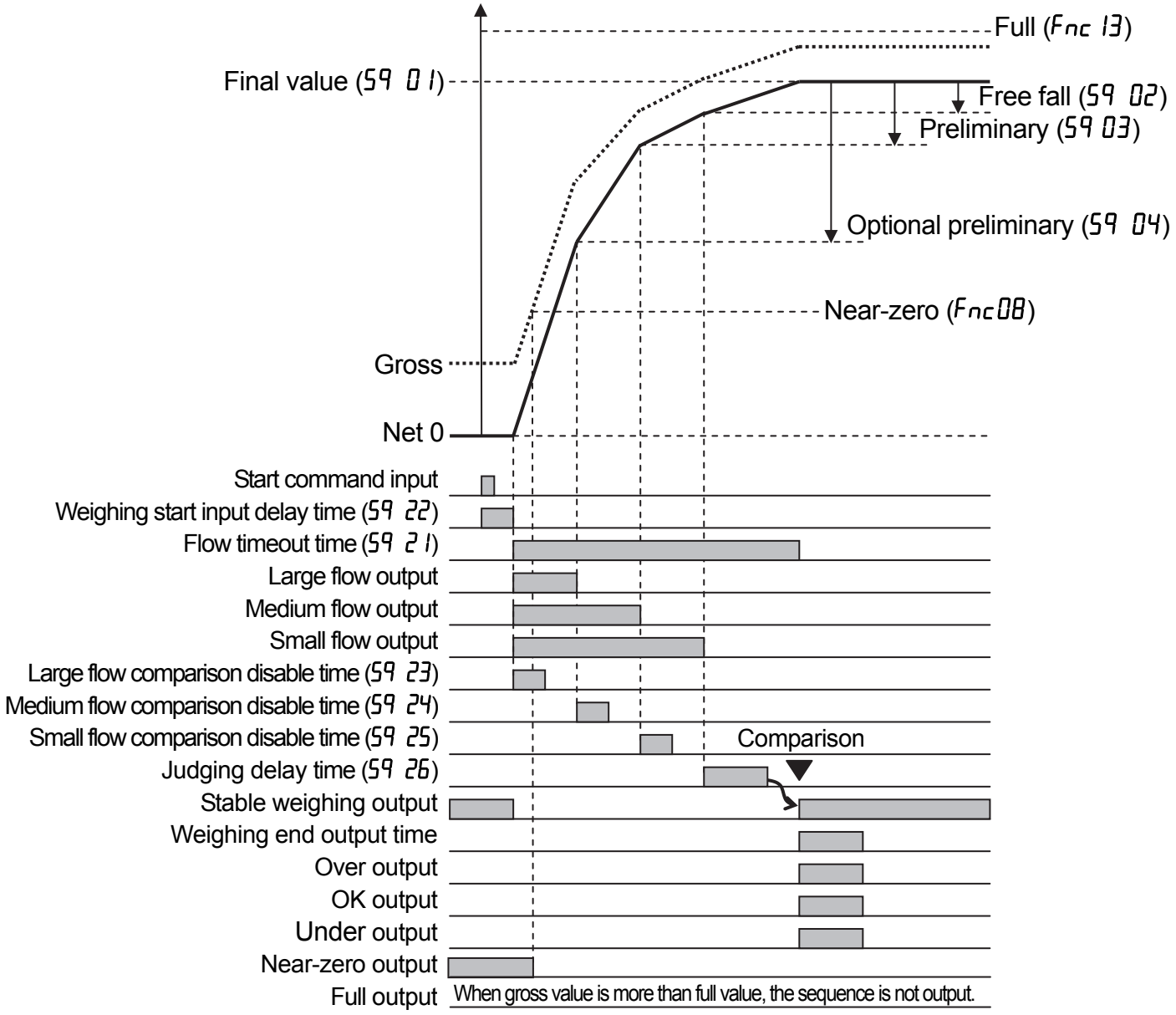
❑ Weighing end means weighing sequence end.

❑ Weighing error means weighing sequence error.

### 6.2.3.1. Sequential Weighing

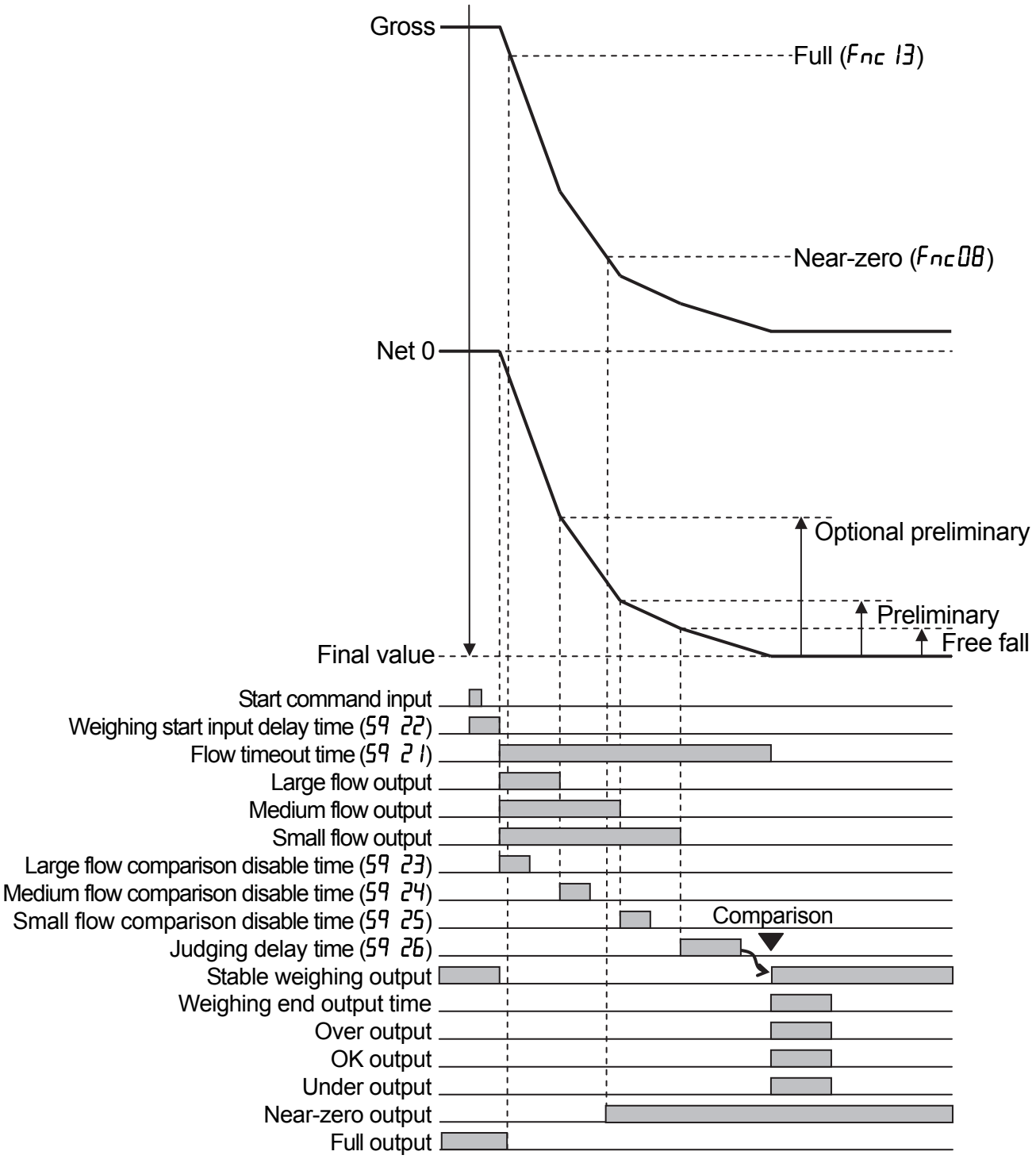
■ **Normal batch sequence**

| Output terminal | Output conditions | Reference |
|---|---|---|
| Near-zero | Gross ≦ Near-zero | Comparison weight can be changed to net weight with FnC09 |
| Full | Gross ≧ Full | |
| Large flow off | Net ≧ Final value − Optional preliminary | |
| Medium flow off | Net ≧ Final value − Preliminary | |
| Small flow off | Net ≧ Final value − Free fall | |
| Over | Net > Final value + Over | |
| OK | Final value + Over ≧ Net ≧ Final value − Under | |
| Under | Net < Final value − Under | |



■ **Loss-in-weight sequence**

| Output terminal | Output conditions | Reference |
|---|---|---|
| Near-zero | Gross ≦ Near-zero | Comparison weight can be changed to net weight with Fnc09 |
| Full | Gross ≧ Full | |
| Large flow off | −Net ≧ Final value − Optional preliminary | |
| Medium flow off | −Net ≧ Final value − Preliminary | |
| Small flow off | −Net ≧ Final value − Free fall | |
| Over | −Net > Final value + Over | |
| OK | Final value + Over ≧ −Net ≧ Final value − Under | |
| Under | −Net < Final value − Under | |



### 6.2.3.2. Weighing Sequence Error ( Output )

A weighing sequence error will occur in the following conditions.

- Weighing start has been input when: Gross ＋ Final value ≧ Weighing capacity.
- Weighing start has been input when it is over capacity including negative over capacity.
- The tare fails when tare condition ( tare when unstable ( C-F 10 ) and tare when the gross weight is negative ( C-F 11 )) have been selected and automatic tare at weighing start ( 59 13 ) has been enabled (1).
- When the time in weighing sequence reaches the flow timeout time.
- When pause has been input during the weighing sequence.
- When an emergency stop has been input during the weighing sequence.

### 6.2.3.3. Error Reset ( Input )

- When the error reset is input, the weighing sequence error output turns OFF.
- When the error reset is input during in weighing sequence, the weighing sequence will be initialized.

The initialization of the weighing sequence turns OFF all the outputs that are related to weighing sequence such as follows.

Large, medium and small flow output
OK / over / under output
In weighing sequence output
Weighing end output
Weighing sequence error output

### 6.2.3.4. One Shot Small Flow ( Input )

When the one shot small flow is input, the small flow output turns ON for the duration that is set for the one-shot time for small flow rate ( 59 28 ).

The small flow output time will be extended if the one shot small flow is input again while the small flow output has been on.

Example: 59 28 = 2.00 seconds and one-shot small flow is input three times repeatedly.

The small flow is output 2.00 seconds × 3 times ＝ 6.00 seconds

The one shot small flow is available during "in weighing sequence".

### 6.2.3.5. Full Open ( Output )

When full open is input while weighing sequence is not active, the large, medium and small flow output is on.

By level input, the large, medium and small flow output remains ON while the full open is input.

### 6.2.3.6. Actual Free Fall Input

It updates the parameters of 59 02 ( Free fall ) and 59 10 ( Free fall coefficient ) using the latest weighing results. "Active free fall compensation ( Updated coefficient )(3)" of 59 08 ( Automatic free fall compensation ) is not updated. It is used when adjusting the weigh module and changing weighing materials.

### 6.2.3.7. Automatic Free Fall Compensation

The automatic free fall compensation function reduces weighing errors during batch weighing. The weighing value may increase between closing the dribble gate and finishing weighing of a hopper scale and etc. This increased value is called "free fall". To minimize weighing errors, a free fall parameter and a real free fall value should be the same. As a way to do so, there is the "moving average of the last four real free fall", with which the next free fall setting is updated automatically.

The formula of batch error and real free fall are as follows:

Batch error = Net value when the batch is finished – Preliminary
Real free fall = Net value when the batch is finished – Net value when the dribble flow gate is OFF

When the weighing value passes Preliminary – Final value, the dribble flow gate is off.

When a batch error exceeds the effective range of the automatic free fall, the batch weighing is regarded as an error and excluded from the "moving average of the last four real free fall".

### 6.2.3.8. Active Free Fall Compensation

The active free fall compensation function modifies the free fall compensation in relation to the velocity passing through the gate ( flow rate ).
Example: When discharging a liquid ( water, oil ) in the hopper, the flow rate decreases as the remaining amount becomes smaller. In this case, the weighing results always become too small with the conventional free fall compensation. The same problem occurs with materials like honey with a viscosity that changes according to temperature.

Free fall coefficient = Actual free fall / Flow rate ( when the dribble flow gate is OFF )
Free fall = Free fall coefficient x Flow rate

When "Active free fall compensation ( fixed coefficient ) (2)" is set to 59 08 ( Automatic free fall compensation ), the free fall is calculated with the parameter of 59 10 ( Active free fall coefficient ). When "Active free fall compensation ( updated coefficient ) (3)" is set to 59 08, the free fall is calculated with the average of the last four weighing values. When a batch error exceeds an effective range of the automatic free fall, the batch weighing is regarded as an error and excluded from the "moving average of the last four real free fall".

### 6.2.3.9. Sequence Numbers

The status of batch weighing can be checked from the holding register of the Modbus RTU.

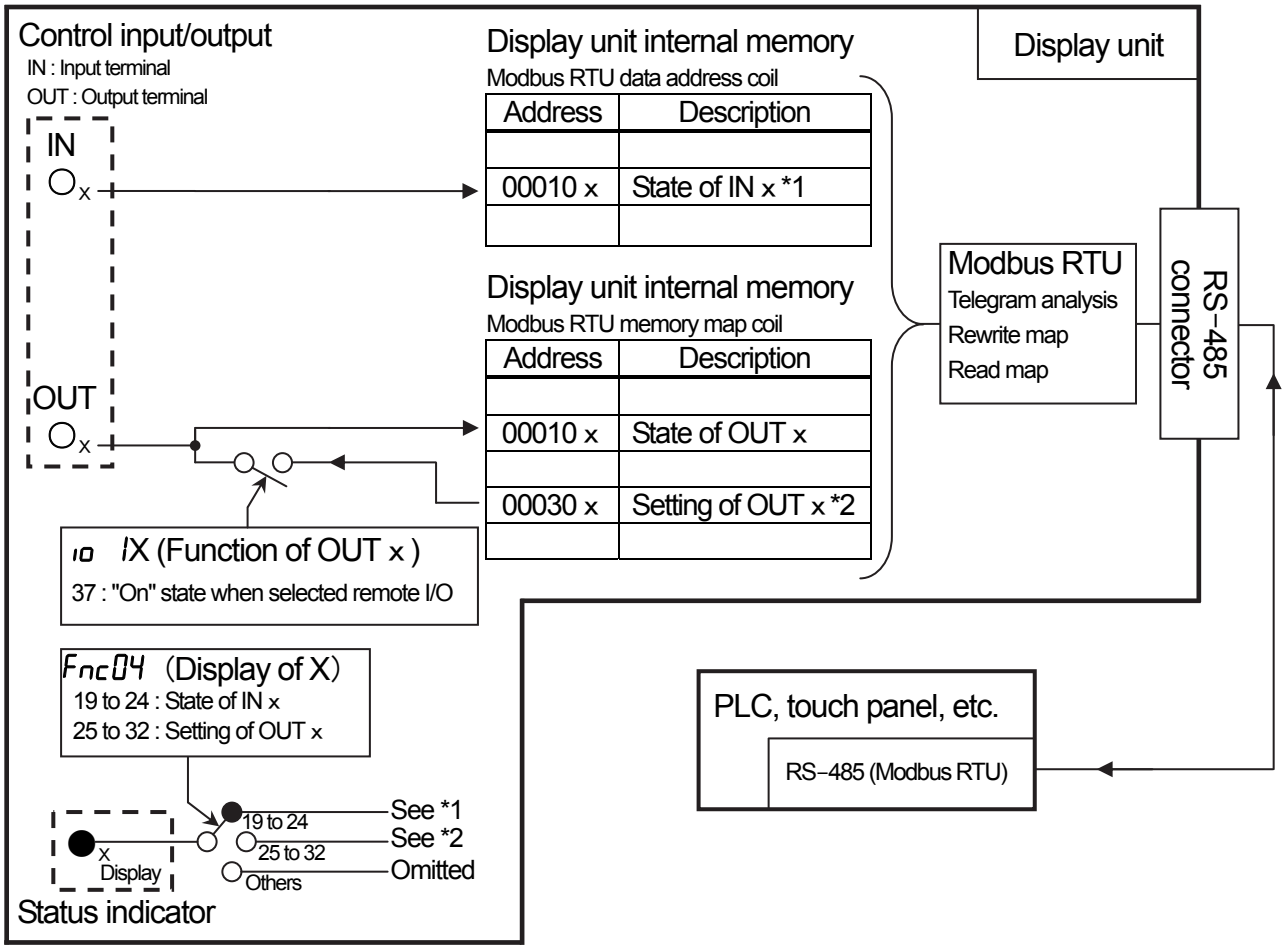
| Sequence number | Description |
|---|---|
| 0 | Waiting for the weighing start input. |
| 1 | Automatic tare |
| 2 | Confirming the start condition. |
| 3 | During the weighing start input delay, the large, medium and small flow turn ON after checking. |
| 4 | Waiting for the large flow comparison disable time. |
| 5 | During the large flow, turns OFF the large flow under the large flow off output conditions. |
| 6 | Waiting for the medium flow comparison disable time. |
| 7 | During the medium flow, turns OFF the medium flow under the medium flow off output conditions. |
| 8 | Waiting for the small flow comparison disable time. |
| 9 | During the small flow, turns OFF the small flow under the small flow off output conditions. |
| 10 | Waiting for the judging delay |
| 11 | Wait for the stable weighing value. |
| 12 | The comparison result is output. Weighing end is output. |

## 6.2.4. Remote I/O

The remote I/O is an I/O device with communication functions and use the RS-485 Modbus RTU interface. The I/O device uses the control input and output terminals.
The remote I/O function uses the Modbus RTU to perform "status monitor" and "setting control output on and off".

❑ **Diagram**

The diagram shows a configuration of one each of input and output terminals.
All the input terminals ( IN1 to IN6 ) and the output terminals ( OUT1 to OUT8 ) have the same structure.




❑ **Related functions**

| | | |
|---|---|---|
| Function of OUT1 ( io 11 ) to OUT8 ( io 18 ): | Remote I/O | 37 |
| Present function X ( FnC04 ): | State of memory map coil IN1 to IN6 | 19 to 24 |
| | Setting of memory map coil OUT1 to OUT8 | 25 to 32 |

## 6.2.5. State Diagram and Operation Switches

### 6.2.5.1. State Diagram

The nonvolatile memory always stores either OFF mode or other mode. It starts from the following state depending on the mode that has been kept when the automatic power is on.

- OFF mode ( standby ) : Starts from OFF mode.
- Other mode : Starts from Weighing mode.

State diagram can be switched as follows.

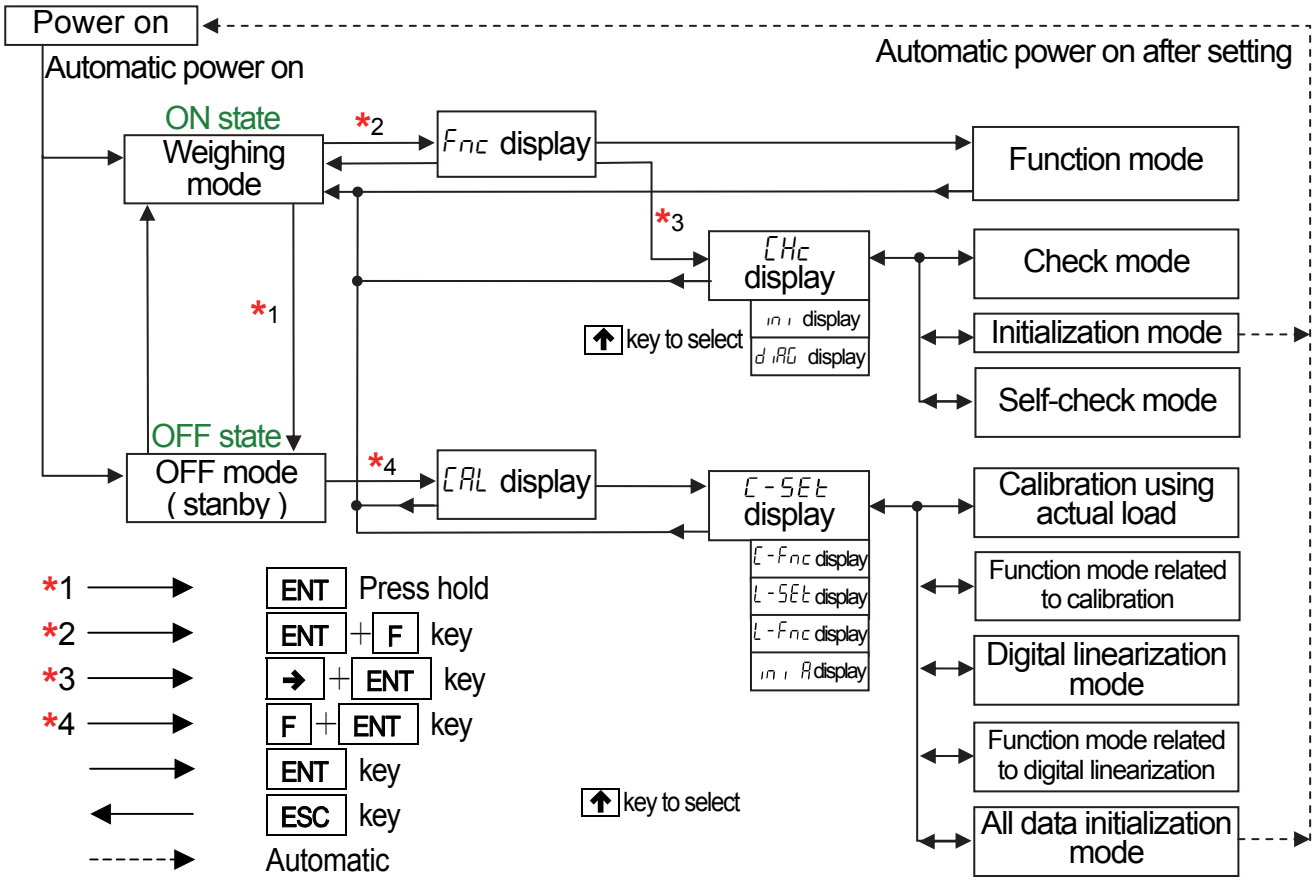



**Illustration 12 State diagram**

## 6.2.6. Calibration

In calibration mode, operations relating the load cell output voltage to the weighing value can be performed as well as operations directly related to weighing.

| | |
|---|---|
| Calibrating with a weight | Calibration is performed using a calibration weight.<br>■ Zero calibration:<br>Press ENT key when no load is applied.<br>■ Span calibration:<br>Enter the calibration weight value and load the calibration weight.<br>When the module enters calibration mode using an actual load, the tare value and the zero value will be automatically cleared. |
| Digital span | Calibration is performed without an actual load by the numerical input of the load cell output voltage ( mV/V ). Set the values in the calibration function.<br>■ Zero input voltage:<br>The numerical input of the load cell output at zero. C-F 17<br>■ Span input voltage:<br>The numerical input of the load cell output at span. C-F 18<br>( Load cell output at full capacity − load cell output at zero )<br>■ Calibration weight value at span:<br>The numerical input of the calibration weight value corresponding to the span input voltage. C-F 19<br>( These values relate the span input voltage and the calibration weight value.) |
| Gravity acceleration correction | Calculates and corrects the span error when gravity acceleration between the calibration location and usage location is different. |
| Digital linearization | Nonlinearity correction function for correcting weighing errors that occur halfway between the zero point and maximum capacity. Up to 4 points can be input in addition to the zero point. The intervals between each point will be calculated using curves. |
| Function related to the calibration | The function stores basic parameters of the module such as the minimum division and maximum capacity and other data directly related to weighing. Digital span calibration and gravity acceleration correction setting are also performed here. |
| All data initialization | All the data such as zero value, tare value, calibration data and function data are initialized. |

- ❑ All parameters in calibration mode are stored in the nonvolatile memory (FRAM).
- ❑ Actual load calibration and digital span can be performed at the same time.
  Example: For the zero calibration, an actual load is used. For the span calibration, the digital span is used.

### 6.2.6.1. Calibrating with a Weight ( C-SEt )

Refer to **"3.2 Calibrating the Display Unit"**.

### 6.2.6.2. Calibration Using a Weight with the RS-485 Modbus RTU

Calibration using weights with the RS-485 Modbus RTU is performed in weighing mode.
This is referred to in **"6.2.6.1 Calibrating with a Weight ( C-SEt )"**.

Step 1 Preset the related functions for the calibration .
The functions required for the calibration are as follows.

| Holding Register Address | Function No. | Description |
|---|---|---|
| 400101 - 400102 | C-F01 | Unit |
| 400103 - 400104 | C-F02 | Decimal point position |
| 400105 - 400106 | C-F03 | Minimum division |
| 400107 - 400108 | C-F04 | Weighing capacity |
| 400137 - 400138 | C-F19 | Span input voltage weight |

Step 2 Input "1" into the "CAL zero" coil.
The zero calibration will be performed.
The result is output into the "During an internal write cycle / write result" in the Holding register.

- When the zero calibration is not performed, skip Step 2 and go to Step 3.

Step 3 Place the calibration weight as set in C-F19 Span input voltage weight.
Input "1" into the "CAL span" coil.
The span calibration will be performed.
The result is output into the "During an internal write cycle / write result" in the Holding register.

- "During an internal write cycle / write result"
  - 0 : Calibration succeeded
  - 1 to 8 : Calibration error, refer to **"3.2.2 Error Codes for Calibration ( C Er )"** for details.
  - 15 : During calibration

### 6.2.6.3. Gravity Acceleration Correction

- When the scale ( weighing indicator ) has been calibrated in the same place as it is being used, gravity acceleration correction is not required.
- A span error will appear if gravity accelerations are different between the location of calibration and the location of use. Gravity acceleration correction calculates and corrects this span error with the gravity acceleration correction value for both points ( the location of calibration and the location of use ).
- **When the span is calibrated using actual load, the gravity acceleration correction settings are cleared, and the two gravity acceleration settings return to their default values.**
- **Functions Related to the Gravity Acceleration Correction**
  - C-F26 ( Gravity acceleration of the location of calibration ): The gravity acceleration where the module has been calibrated.
  - C-F27 ( Gravity acceleration of the location of use ): The gravity acceleration where the module is being used.

## Gravity Acceleration Table

| | | | | | |
|---|---|---|---|---|---|
| Amsterdam | 9.813 | $m/s^2$ | Manila | 9.784 | $m/s^2$ |
| Athens | 9.800 | $m/s^2$ | Melbourne | 9.800 | $m/s^2$ |
| Auckland NZ | 9.799 | $m/s^2$ | Mexico City | 9.779 | $m/s^2$ |
| Bangkok | 9.783 | $m/s^2$ | Milan | 9.806 | $m/s^2$ |
| Birmingham | 9.813 | $m/s^2$ | New York | 9.802 | $m/s^2$ |
| Brussels | 9.811 | $m/s^2$ | Oslo | 9.819 | $m/s^2$ |
| Buenos Aires | 9.797 | $m/s^2$ | Ottawa | 9.806 | $m/s^2$ |
| Calcutta | 9.788 | $m/s^2$ | Paris | 9.809 | $m/s^2$ |
| Chicago | 9.803 | $m/s^2$ | Rio de Janeiro | 9.788 | $m/s^2$ |
| Copenhagen | 9.815 | $m/s^2$ | Rome | 9.803 | $m/s^2$ |
| Cyprus | 9.797 | $m/s^2$ | San Francisco | 9.800 | $m/s^2$ |
| Djakarta | 9.781 | $m/s^2$ | Singapore | 9.781 | $m/s^2$ |
| Frankfurt | 9.810 | $m/s^2$ | Stockholm | 9.818 | $m/s^2$ |
| Glasgow | 9.816 | $m/s^2$ | Sydney | 9.797 | $m/s^2$ |
| Havana | 9.788 | $m/s^2$ | Tainan | 9.788 | $m/s^2$ |
| Helsinki | 9.819 | $m/s^2$ | Taipei | 9.790 | $m/s^2$ |
| Kuwait | 9.793 | $m/s^2$ | Tokyo | 9.798 | $m/s^2$ |
| Lisbon | 9.801 | $m/s^2$ | Vancouver, BC | 9.809 | $m/s^2$ |
| London (Greenwich) | 9.812 | $m/s^2$ | Washington DC | 9.801 | $m/s^2$ |
| Los Angeles | 9.796 | $m/s^2$ | Wellington NZ | 9.803 | $m/s^2$ |
| Madrid | 9.800 | $m/s^2$ | Zurich | 9.807 | $m/s^2$ |

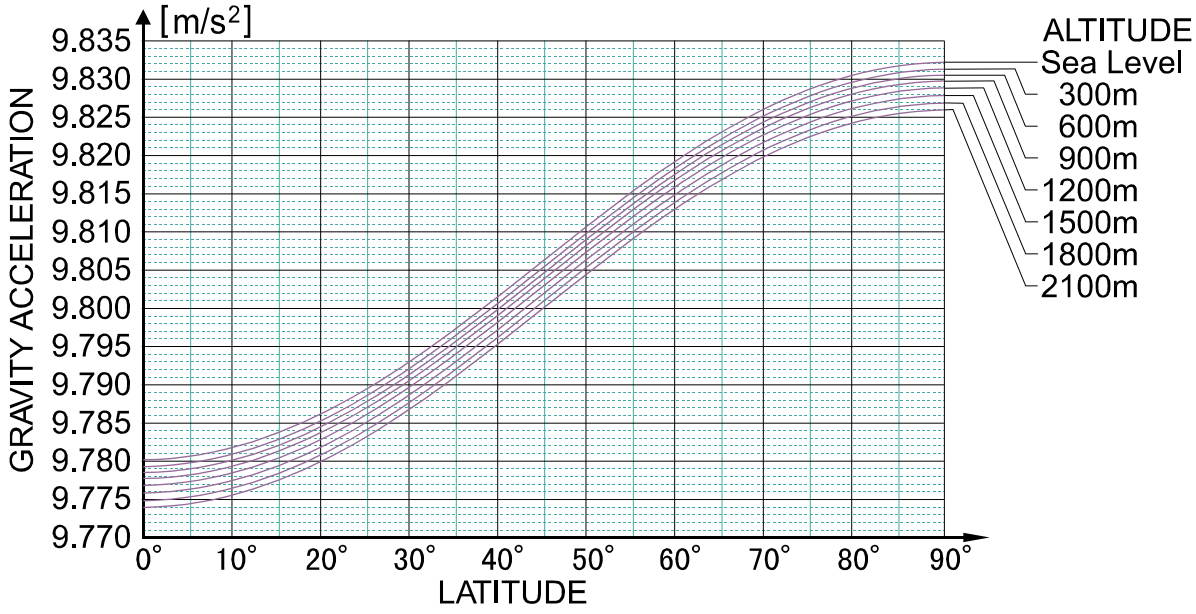



Illustration 13 Gravity acceleration graph

### 6.2.6.4. Digital Linearization

Even if zero and span calibration have been performed, weighing errors may occur between the zero point and maximum capacity. Digital linearization ( L-SEt ) is a corrective function designed to correct linearity weighing errors.

- It is possible to input up to four points in addition to the zero point.
- The zero point and each input point will be corrected to put them in a straight line.
- When the actual load input for digital linearization is performed, the calibrated data will be refreshed using zero point and final input point data. It is not necessary to calibrate again. If calibration is performed, the linearization data will not be updated.

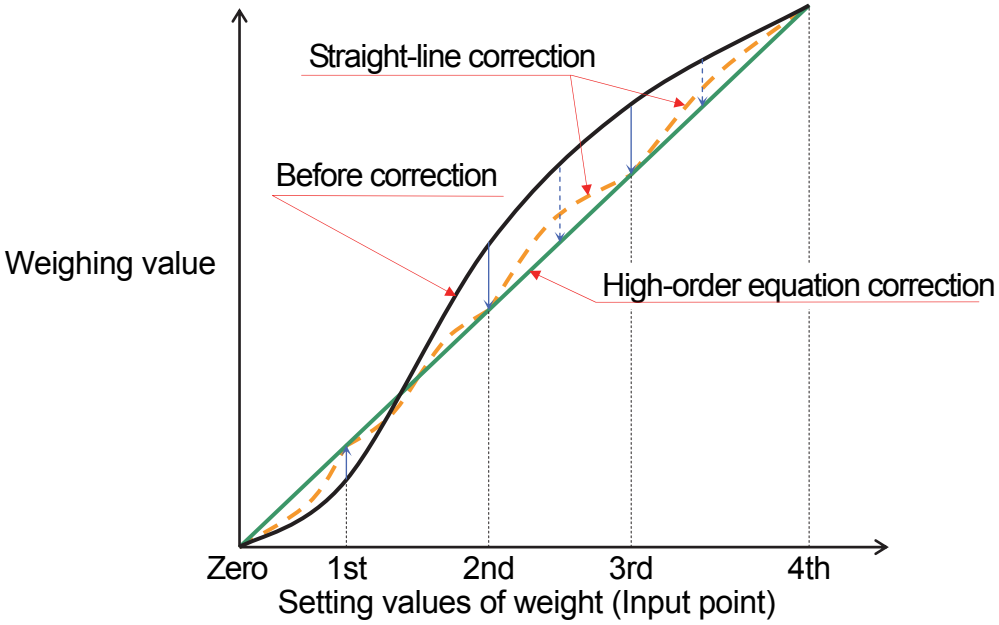


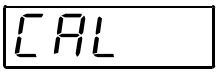

**Illustration 3 Digital linearization**

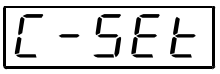
### 6.2.6.5. Actual Load Linearization Function ( L-SEt )

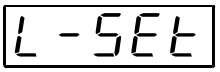
Set the digital linearization by loading/unloading masses.

- Warm up the module for at least ten minutes to avoid the effects of temperature drift.
- The input order should proceed from the smallest mass to the largest mass.

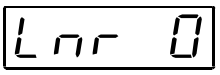
**Step 1** Press the **F** + **ENT** keys to enter to calibration mode and display CAL. Press the **ENT** key to start the calibration and display C-SEt. Select L-SEt pressing the ↑ key two times and press the **ENT** key.



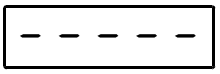



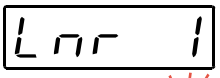

**Step 2** Lnr 0 is displayed.
If monitoring the current weighing value, press the → key.
Press the → key again to display Lnr 0.




**Step 3** With nothing on the pan wait for the stabilization ( **S** LED ). Press the **ENT** key. ----- is displayed for approximately two seconds.



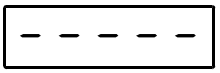

**Step 4** Lnr 1 is displayed.
If you want to check the current weighing value, press the → key. Press the → key again to display Lnr 1.
Press the **ENT** key. The weight value ( the current maximum capacity ) is displayed and the smallest digit of the value blinks. Correct the value using the → and ↑ keys so as to be the weight value used.



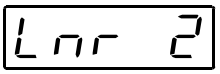


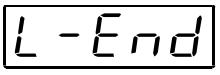

Sample

**Step 5** Place the weight on the pan. Wait for the stabilization ( **S** LED ). Press the **ENT** key.
----- is displayed for approximately two seconds.

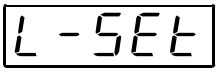



**Step 6** Lnr 2 is displayed. Repeat step 4 and step 5. The procedure proceeds in order of Lnr 3 → Lnr 4 → L-End.




**Step 7** Proceed to step 8 to finish the input operation.
To re-input the digital linearization, select the input point using the ↑ key. All data following the new input point will be cleared.




**Step 8** Press the **ESC** key. L-SEt is displayed and the input data will be stored in the FRAM. At the same time, the calibrated data is also refreshed. Press again the **ESC** key to return to weighing mode.

- When C Er **X** is displayed, an error occurred where **X** is the error number.
  Refer to **"3.2.2 Error Codes for Calibration ( C Er )"** for details.
- The blinking decimal point means that the current value is not the weight value.

### 6.2.6.6. Calibration Function ( C-Fnc )

All the values set in the calibration function are stored in the nonvolatile memory ( FRAM ).

Step 1 Press the F + ENT keys to enter to calibration mode and display CAL.
Press the ENT key to start the calibration and display C-SEt.
Press the ESC key to return to weighing mode.

Step 2 Select C-Fnc using the ↑ key and press the ENT key.

Step 3 Select the desired function item ( function group name with function number ) using the ↑ key and press the ENT key.
The current data is displayed.

Step 4 When changing data, two methods of parameter selection and digital input are available depending on the function.

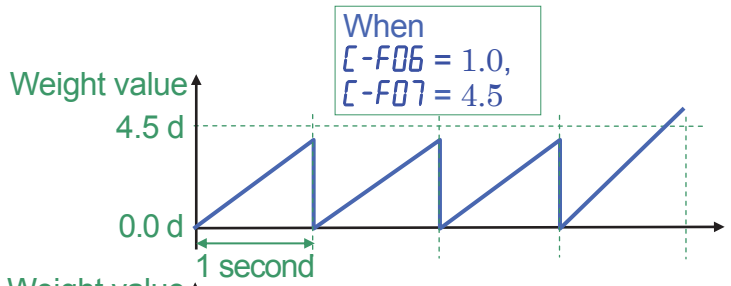
| Type | Description of method to change data |
|---|---|
| Parameter selection | Only the available parameter is displayed and blinks.<br>Select a number using the ↑ key. |
| Digital input | All the digits are displayed. The digit to be changed blinks.<br>Select a digit using the → key and<br>change the value using the ↑ key. |

After changing data, press the ENT key. The next function number is displayed.
When the value is not to be changed, press the ESC key to return to the function number display.

Step 5 Press the ESC key to store new data in FRAM and C-Fnc is displayed.
Press again the ESC key to return to weighing mode.

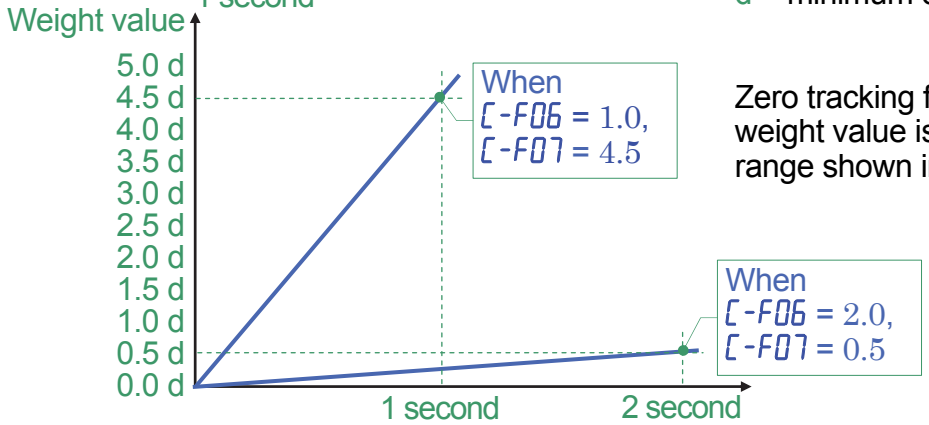
- **The blinking decimal point means that the current value is not the weight value.**
- **If digital input data is out of range, Errdt is displayed, and the data is canceled.**
- **The function code on the next page is used for command of the USB.**

| Item Name | Function code | Description, Range and Default value |
|---|---|---|
| C-F01 Unit | 1001 | 1: g |
| C-F02 Decimal point position | 1002 | Decimal point position of the weighting value<br>3: 0.000 |
| C-F03 Minimum division | 1003 | Minimum division (d) of the weighting value<br>1: 1 2: 2 3: 5 4: 10 5: 20 6: 50 |
| C-F04 Maximum capacity | 1004 | Maximum capacity of the module. Weighing is possible up to the value of this setting plus 8 digits. If the value exceeds this, overflow will occur and will not be displayed. The decimal point position depends on C-F02 (Decimal point position).<br>AD4212L-R50: 50000<br>AD4212L-R100: 100000 |
| C-F05 Zero range | 1005 | The range to enable zero operation by the → (ZERO) key expressed as a percentage of the maximum capacity with the calibration zero point as the center. For example, if 2 is set, the value in the range of ±2% of the maximum capacity with the center at the calibration zero point will be to zero. When a power-on zero is performed, the initial zero point will be the center.<br>0 to 2 to 100 |
| C-F06 Zero tracking time | 1006 | Zero tracking is performed using this setting in combination with the setting of C-F07. When C-F06 holds 0.0, zero tracking will not be performed.<br>Scale: 0.1 seconds. 0.0 to 5.0 |
| C-F07 Zero tracking width | 1007 | Zero tracking is performed using this setting in combination with the setting of C-F06. When C-F07 holds 0.0, zero tracking will not be performed.<br>Scale: 0.1 d (minimum division). 0.0 to 9.9 |



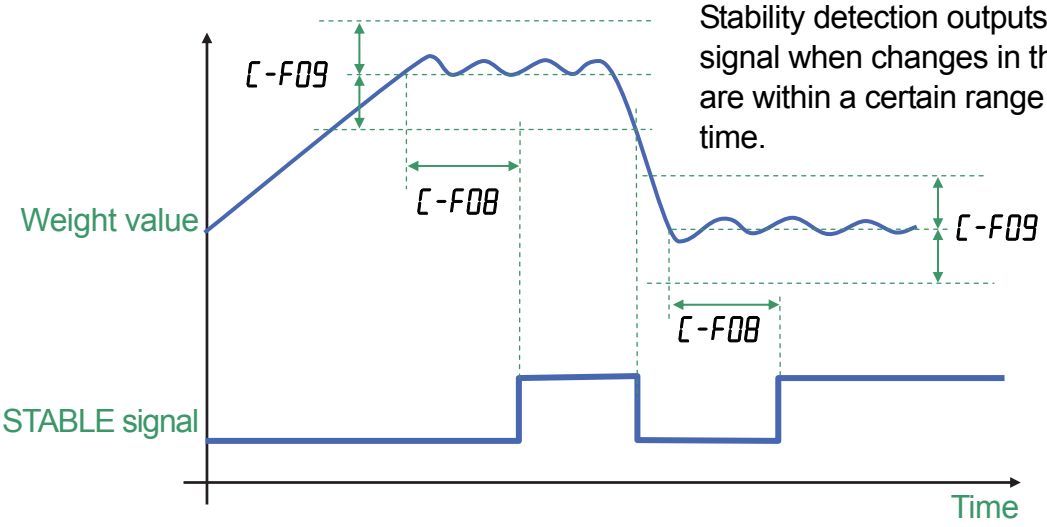

Zero tracking follows the weight value drifting around the zero point and adjusts to display as zero.

d = minimum division = 1 digit

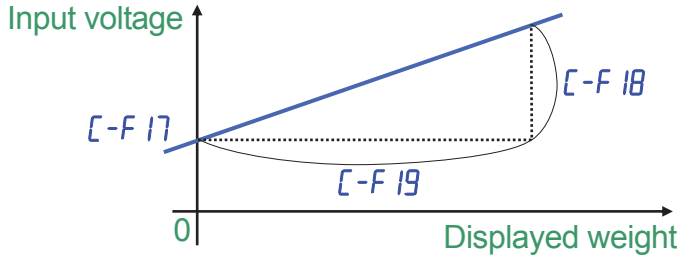



Zero tracking functions when the weight value is drifting within the range shown in the graph.

❑ The function code is used for the USB command.

| Item Name / Function code | Description, Range and Default value |
|---|---|
| C-F08 1008<br>Stability detection time | Stability detection is performed using this setting in combination with the setting of C-F09. When C-F08 holds 0.0, stability detection will not be performed. (Stable all the time) Scale: 0.1 seconds. 0.0 to [1.0] to 9.9 |
| C-F09 1009<br>Stability detection width | Stability detection is performed using this setting in combination with the setting of C-F08. When C-F09 stores 0, stability detection will not be performed. (Stable all the time) Scale: 1 d (minimum div). 0 to [2] to 100 |
|  | Stability detection outputs the STABLE signal when changes in the weight value are within a certain range during a certain time. |
| C-F10 1010<br>Tare and zero when unstable | Tare and zero operation when unstable<br>0: Disable both functions<br>[1]: Enable both functions |
| C-F11 1011<br>Tare when the gross weight is negative | Tare when the gross weight is negative.<br>0: Disable tare<br>[1]: Enable tare |
| C-F12 1012<br>Output when out of range and unstable | Standard serial output when the weight value overflows or is unstable.<br>0: Disable output<br>[1]: Enable output |
| C-F13 1013<br>Excessive negative gross weight | To judge when the negative gross weight is exceeded.<br>[1]: Gross weight < -99999<br>2: Gross weight < Negative maximum capacity<br>3: Gross weight < -19 d |
| C-F14 1014<br>Excessive negative net weight | To judge when the negative net weight is exceeded.<br>[1]: Net weight < -99999<br>2: Net weight < Negative maximum capacity |
| C-F15 1015<br>Clear the zero value | Select whether or not to clear the zero value.<br>0: Disable<br>[1]: Enable |
| C-F16 1016<br>Zero when power is turned on | Choose whether or not to perform zero when power is turned on. The available range of the zero setting is ±10% of the maximum capacity with the calibration zero point as the center.<br>[0]: Disable<br>1: Enable |

| Item Name / Function code | Description, Range and Default value |
|---|---|
| C-F 17 1017<br>Input voltage at zero | Input voltage from a load cell at zero. Scale: mV/V.<br>This value is determined in zero calibration during the calibration with an actual load. Scale: 0.0001 mV/V. −7.0000 to 7.0000 |
| C-F 18 1018<br>Span input voltage | Input voltage from a load cell at span. This value and the value of C-F 19 are determined in span calibration during the calibration with an actual load. Scale: 0.0001 mV/V. 0.0100 to 9.9999 |
| C-F 19 1019<br>Span input voltage weight | The calibration weight value corresponding to the input voltage at span of C-F 18. When performing digital span, C-F 17, C-F 18 and C-F 19 are required for the calibration. The decimal point position depends on C-F02 (Decimal point position). 1 to 100000 |




- **Record the setting values of C-F 17, C-F 18 and C-F 19 in the "Function list" at the end of the manual to prepare for a malfunction.**
- **By changing the parameters of C-F 17, C-F 18 and C-F 19, "Zero calibration" and "Span calibration" can be adjusted optionally. ( Digital span accuracy approximately 1/5000. The accuracy varies depending on the load cell output accuracy and the conditions of the calibration.)**

| | |
|---|---|
| C-F26 1026<br>Gravity acceleration of the calibration location | Gravity acceleration of the place where the scale is calibrated.<br>Scale: 0.0001 m/s$^2$. 9.7500 to [9.7980] to 9.8500 |
| C-F27 1027<br>Gravity acceleration of usage location | Gravity acceleration of the place where the scale is being used.<br>Scale: 0.0001 m/s$^2$. 9.7500 to [9.7980] to 9.8500 |
| C-F28 1028<br>Disable hold function | [0]: Enable<br>1 : Disable |

### 6.2.6.7. Linearization Functions (L-Fnc)

- Confirm and change linearity settings.
  To use this function, select [L-Fnc] in the same way as the function related to the calibration are selected.

| Item Name / Function code | Description, Range and [Default value] |
|---|---|
| L-F01 1101 Number of input points | The number of points where linear input was done. The linear-zero input is included as one point. Digital linearization is not performed when the set value is between 0 and 2. [0] to 5 |
| L-F02 1102 Linear−zero | Voltage for linear-zero input. Scale: 0.0001 mV/V. −7.0000 to [0.0000] to 7.0000 |
| L-F03 1103 Setting value for linear 1 | The setting value of weight for linear 1 input. The decimal point position depends on C-F02 (Decimal point position). [0] to 100000 |
| L-F04 1104 Span at linear 1 | The span voltage between linear-zero and linear 1 input. Scale: 0.0001 mV/V. [0.0000] to 9.9999 |
| L-F05 1105 Setting value for linear 2 | The setting value of weight for linear 2 input. The decimal point position depends on C-F02 (Decimal point position). [0] to 100000 |
| L-F06 1106 Span at linear 2 | The span voltage between linear-zero and linear 2 input. Scale: 0.0001 mV/V. [0.0000] to 9.9999 |
| L-F07 1107 Setting value for linear 3 | The setting value of weight for linear 3 input. The decimal point position depends on C-F02 (Decimal point position). [0] to 100000 |
| L-F08 1108 Span at linear 3 | The span voltage between linear-zero and linear 3 input. Scale: 0.0001 mV/V. [0.0000] to 9.9999 |
| L-F09 1109 Setting value for linear 4 | The setting value of weight for linear 4 input. The decimal point position depends on C-F02 (Decimal point position). [0] to 100000 |
| L-F 10 1110 Span at linear 4 | The span voltage between linear-zero and linear 4 input. Scale: 0.0001 mV/V. [0.0000] to 9.9999 |

## 6.2.7. List of General Functions

General functions are divided into groups according to function and are indicated by function item ( function group name with function number ).
All the settings selected in general functions are stored in the FRAM.

### 6.2.7.1. Procedure to Store New Parameters

Step 1 Press the ENT + F keys to enter to function mode and display Fnc.
Press the ENT key to start function mode.
To return to weighing mode, press the ESC key.

Step 2 Press the ↑ key to select the function group to be set.
Press the ENT key. The function group is as follows:

| Display | Group name |
|---|---|
| Fnc F | Basics function |
| HLd F | Hold function |
| 59 F | Sequence function |
| Fr F | Flow rate function |
| io F | Control I/O function |
| CL F | Standard serial output function |
| r5 F | RS-485 function |

Step 3 Press the ↑ key to select the function number to be set.
Press the ENT key. The current setting value is displayed.

Step 4 When changing parameter, two methods of parameter selection and digital input are available depending on the function.

| Type | Description of method to change data |
|---|---|
| Parameter selection | Only the available parameter is displayed and blinks.<br>Select a number using the ↑ key. |
| Digital input | All the digits are displayed. The digit to be changed blinks.<br>Select the digit using the → key.<br>Change the value using the ↑ key. |

After changing data, press the ENT key. The next function number is displayed.
When the value is not to be changed, press the ESC key to return to the function number display.

Step 5 Press the ESC key. The function number disappeared and the new parameters are stored in FRAM to return to Step 2. Press the ESC key again to return to weighing mode.

- **The blinking decimal point means that the current value is not the weight value.**
- **If a data exceeding the available range is input, Errdt is displayed, and the data is canceled.**
- **The function code on the next page is used for command of the USB.**

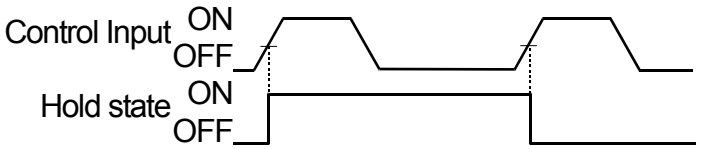
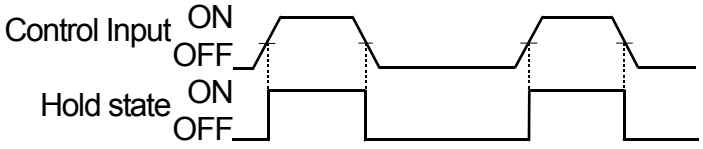
### 6.2.7.2. Basic Functions (Fnc F)

| Item / Function code / Name | Description, Range and [Default value] |
|---|---|
| FncO1 1201<br>Key switch disable | Each digit of the setting corresponds to a key switch. Only available in weighing mode. Key assignment to each binary digit.<br>0: Permission 1: Prohibition<br>4th [ESC] 3rd [→] 2nd [↑] 1st [ENT]<br>[0000] to 1111 |
| FncO2 1202<br>[F] key | 0: None<br>1: Manual print command<br>2: Hold<br>3: Operation switch 1<br>4: Operation switch 2<br>[5]: Display exchange<br>6: Tare clear<br>7: Zero clear<br>8: Weighing start / Pause / Restart<br>9: Actual free fall input<br>10: One shot, Small flow<br>11: Sequence flow rate monitor<br>12: mV/V monitor<br>13: Digital filter 2 |
| FncO3 1203<br>Display update rate | [1]: 20 times/second 2: 10 times/second 3: 5 times/second |
| FncO4 1204<br>x display | [0] : None<br>1: Zero tracking in progress<br>2: Alarm<br>3: Display operation switch status as on or off<br>4: Near-zero<br>5: HI output<br>6: OK output<br>7: LO output<br>8: Large flow<br>9: Medium flow<br>10: Small flow<br>11 : Over<br>12 : OK<br>13 : Under<br>14 : Full<br>15 : Weighing end<br>16 : In weighing sequence<br>17 : Weighing sequence, error<br>18 : Normal batch/Loss-in-weight, Identification<br>19 to 24 : State of Coil IN 1 to 6<br>25 to 32 : Setting of Coil OUT 1 to 8 |
| FncO5 1205<br>Digital filter 1 | Selects a cutoff frequency.<br>0 : None 6 : 20.0 Hz 12 : 2.8 Hz<br>1 : 100.0 Hz 7 : 14.0 Hz 13 : 2.0 Hz<br>2 : 70.0 Hz 8 : 10.0 Hz 14 : 1.4 Hz<br>3 : 56.0 Hz 9 : 7.0 Hz [15] : 1.0 Hz<br>4 : 40.0 Hz 10 : 5.6 Hz 16 : 0.7 Hz<br>5 : 28.0 Hz 11 : 4.0 Hz |
| FncO6 1206<br>Digital filter 2 | Selects a cutoff frequency.<br>0 : None 6 : 20.0 Hz 12 : 2.8 Hz 18 : 0.40 Hz<br>1 : 100.0 Hz 7 : 14.0 Hz 13 : 2.0 Hz 19 : 0.28 Hz<br>2 : 70.0 Hz 8 : 10.0 Hz 14 : 1.4 Hz 20 : 0.20 Hz<br>3 : 56.0 Hz 9 : 7.0 Hz [15] : 1.0 Hz 21 : 0.14 Hz<br>4 : 40.0 Hz 10 : 5.6 Hz 16 : 0.7 Hz 22 : 0.10 Hz<br>5 : 28.0 Hz 11 : 4.0 Hz 17 : 0.56 Hz 23 : 0.07 Hz |
| FncO7 1207<br>Hold | [1]: Normal hold 2 : Peak hold 3 : Averaging hold |
| FncO8 1208<br>Near-zero | Decimal point position depends on C-F02 (Decimal point position).<br>−99999 to [10] to 99999 |

| Item Name / Function code | Description, Range and Default value |
|---|---|
| FncO9 1209 Near-zero comparison weight | 1: Gross weight<br>2: Net weight |
| Fnc 10 1210 Upper limit value | The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to 10 to 99999 |
| Fnc 11 1211 Lower limit value | The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to −10 to 99999 |
| Fnc 12 1212 Comparison mass of upper and lower limit | 1: Gross weight<br>2: Net weight |
| Fnc 13 1213 Full | The reference value for the full value of gross weight.<br>The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to 99999 |

❑ The function code is used for the USB command.

### 6.2.7.3. Hold Functions (HLd F)

| Item Name / Function code | Description, Range and Default value |
|---|---|
| HLd01 1301 Averaging time | Time to perform the averaging. 0.00 is not averaged.<br>Scale: 0.01 seconds. 0.00 to 9.99 |
| HLd02 1302 Start wait time | Waiting time to commence a hold or average.<br>Scale: 0.01 seconds. 0.00 to 9.99 |
| HLd03 1303 Automatic start condition | The condition to commence a hold or average.<br>0: Disable 2 : Above the near-zero<br>1: Above the near-zero and stable |
| HLd04 1304 Release using control input | Release when control input of the hold terminal is falling.<br>0: Do not release<br>  <br>1: Release<br>  |
| HLd05 1305 Release time | Release after a set amount of time has passed. 0.00 is not averaged.<br>Scale: 0.01 seconds. 0.00 to 9.99 |
| HLd06 1306 Release using fluctuation range | Release when fluctuation of the holding value exceeds a set value.<br>The decimal point position depends on C-F02 (Decimal point position).<br>0 to 99999 |
| HLd07 1307 Release at near-zero | Release when the weighing value is in the near-zero.<br>0 : Do not release 1 : Release |

### 6.2.7.4. Weighing Sequence Functions (59 F)

| Item Name / Function code | Description, Range and [Default value] |
|---|---|
| 59 01 1401<br>Final value | The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to [0] to 99999 |
| 59 02 1402<br>Free fall | The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to [0] to 99999 |
| 59 03 1403<br>Preliminary | The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to [0] to 99999 |
| 59 04 1404<br>Optional preliminary | The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to [0] to 99999 |
| 59 05 1405<br>Over | The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to [0] to 99999 |
| 59 06 1406<br>Under | The decimal point position depends on C-F02 (Decimal point position).<br>−99999 to [0] to 99999 |
| 59 07 1407<br>Weighing mode | 0: Disable<br>[1]: Normal batch sequence<br>2: Loss-in-weight sequence<br>3: Specifying with control input<br>4: Specifying with Modbus RTU |
| 59 08 1408<br>Automatic free fall correction | [0]: Disable<br>1: Moving average of last four times<br>2: Real-time free fall compensation (fixed coefficient)<br>3: Real-time free fall compensation (updated coefficient) |
| 59 09 1409<br>Automatic free fall band | The decimal point position depends on C-F02 (Decimal point position).<br>Weighing end value is compensated automatically when net weight is within (final value ± this band).<br>[0] to 99999 |
| 59 10 1410<br>Active free fall coefficient | Active free fall coefficient.<br>Scale: 0.001 second<br>−99.999 to [0.000] to 99.999 |
| 59 11 1411<br>OK/Over/Under output timing | 1: Always<br>[2]: In synchronization with weighing end |
| 59 12 1412<br>Wait for the weight value to be stable before the judgment | 0: Disable<br>[1]: Enable |
| 59 13 1413<br>Automatic tare at weighing start | [0]: Disable<br>1: Enable |
| 59 21 1421<br>Flow timeout time | The period of the weighing sequence.<br>0: Disable<br>Scale: 1 second<br>[0] to 600 |
| 59 22 1422<br>Weighing start input delay time | Waiting time from the start of the weighing sequence to the output.<br>Scale: 0.1 second<br>[0.0] to 60.0 |

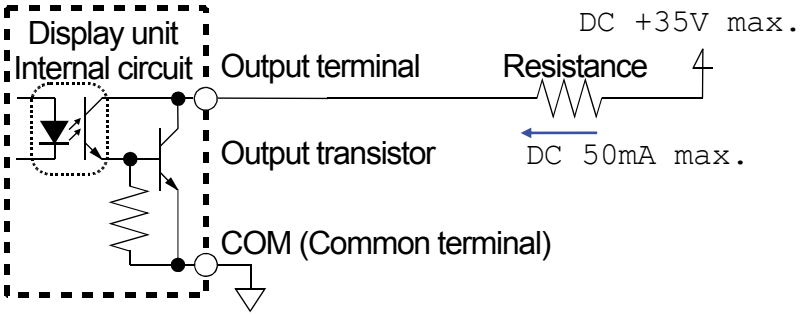
| Item Name / Function code | Description, Range and Default value |
|---|---|
| 59 23 1423 Large flow comparison disable time | Time for preventing the gate from malfunctioning due to vibration when opening and closing the gate.<br>Scale: 0.1 second<br>0.0 to 60.0 |
| 59 24 1424 Medium flow comparison disable time | |
| 59 25 1425 Small flow comparison disable time | |
| 59 26 1426 Judging delay time | Wait time between closing small flow gate and outputting comparison.<br>Scale: 0.1 second<br>0.0 to 0.1 to 60.0 |
| 59 27 1427 Weighing end output time | 0.0 : Until the next weighing start.<br>Scale: 0.1 second<br>0.0 to 60.0 |
| 59 28 1428 One-shot time for small flow rate | Scale: 0.01 second<br>0.00 to 6.00 |

### 6.2.7.5. Flow Rate Functions ( Fr F )

| Item Name / Function code | Description, Range and Default value |
|---|---|
| Fr 01 1901 Filter of flow rate 1 | 1 : Digital filter 1<br>2 : Digital filter 2 |
| Fr 02 1902 Filter of flow rate 2 | |
| Fr 03 1903 Damping time for flow rate 1 | Suppress changes in flow rates.<br>The higher value setting, the less changes.<br>Scale: 1 second<br>1 to 5 to 1000 |
| Fr 04 1904 Damping time for flow rate 2 | |
| Fr 05 1905 +/- flow rate 1 | 0 : according to calculation<br>1 : interchange +/-<br>2 : absolute value |
| Fr 06 1906 +/- flow rate 2 | |

### 6.2.7.6. Control I/O Functions ( io F )

| | Item Name / Function code | Description, Range and Default value | |
|---|---|---|---|
| IN | io 01 1601<br>Function of IN1 | 0 : Disable<br>1 to 6 : Reserved internally<br>7 : Zero<br>8 : Tare<br>9 : Hold<br>10 : Gross / Net exchange<br>11 : Diagnose<br>12 : Print command<br>13 : Weighing start<br>14 : Pause<br>15 : Restart<br>16 : Emergency stop OFF=Release ON=Stop<br>17 : Error reset<br>18 : Normal batch (=OFF)/ Loss-in-weight exchange(=ON)<br>19 : Actual free fall input<br>20 : One-shot small flow<br>21 : Full open OFF=Not open ON=Open<br>22 : Zero clear<br>23 : Tare clear<br>24 : Operation same as a F key *<br>25 : Prohibit update of flow rate 1 OFF=Update ON=Not update<br>26 : Prohibit update of flow rate 2 OFF=Update ON=Not update<br>27 : Initialize flow rate 1<br>28 : Initialize flow rate 2<br>* Not functioned for operation switch 2 | 0 to 7 to 28 |
| | io 02 1602<br>Function of IN2 | | 0 to 8 to 28 |
| | io 03 1603<br>Function of IN3 | | 0 to 28 |
| | io 04 1604<br>Function of IN4 | | 0 to 28 |
| | io 05 1605<br>Function of IN5 | | 0 to 28 |
| | io 06 1606<br>Function of IN6 | | 0 to 28 |
| OUT | io 11 1611<br>Function of OUT1 | 0 : Disable<br>1 to 8 : Reserved internally<br>9 : Stability<br>10 : Over capacity<br>11 : Net display<br>12 : During tare<br>13 : Hold<br>14 : Hold busy<br>15 : HI output<br>16 : OK output<br>17 : LO output<br>18 : Near-zero<br>19 : Full<br>20 : Over<br>21 : OK<br>22 : Under<br>23 : Large flow<br>24 : Medium flow<br>25 : Small flow<br>26 : Normal batch(=OFF)/Loss-in-weight(=ON), Identification<br>27 : In weighing sequence<br>28 : Weighing end<br>29 : Weighing sequence error<br>30 : In weighing (ON)<br>31 : In weighing (1 Hz)<br>32 : In weighing (50 Hz)<br>33 : Alarm<br>34 : Output operation switch is on or off<br>35 : Approximate flow rate value of flow rate 1<br>36 : Approximate flow rate value of flow rate 2<br>37 : Remote I/O | 0 to 18 to 37 |
| | io 12 1612<br>Function of OUT2 | | 0 to 9 to 37 |
| | io 13 1613<br>Function of OUT3 | | 0 to 37 |
| | io 14 1614<br>Function of OUT4 | | 0 to 37 |
| | io 15 1615<br>Function of OUT5 | | 0 to 37 |
| | io 16 1616<br>Function of OUT6 | | 0 to 37 |
| | io 17 1617<br>Function of OUT7 | | 0 to 37 |
| | io 18 1618<br>Function of OUT8 | | 0 to 37 |

| | Item Name | Function code | Description, Range and Default value |
|---|---|---|---|
| OUT | io 21 OUT1 Logic | 1621 | 1 : Inverting output<br>If data is "0" level, the output transistor turns ON.<br>2 : Non-inverting output<br>If data is "1" level, the output transistor turns ON.<br>  |
| | io 22 OUT2 Logic | 1622 | |
| | io 23 OUT3 Logic | 1623 | |
| | io 24 OUT4 Logic | 1624 | |
| | io 25 OUT5 Logic | 1625 | |
| | io 26 OUT6 Logic | 1626 | |
| | io 27 OUT7 Logic | 1627 | |
| | io 28 OUT8 Logic | 1628 | |

### 6.2.7.7. Standard Serial Output Functions (CL F)

| Item Name | Function code | Description, Range and Default value |
|---|---|---|
| CL 01 Serial data | 1701 | 1 : Weighing display 3 : Net 5 : Gross / Net / Tare<br>2 : Gross 4 : Tare |
| CL 02 Communication mode | 1702 | 1 : Stream 2 : Automatic print 3 : Manual print |
| CL 03 Baud rate | 1703 | 1 : 600 bps 2: 2400 bps |

### 6.2.7.8. RS-485 Functions (rS F)

| Item Name | Function code | Description, Range and Default value |
|---|---|---|
| rS 02 Communication mode | 2102 | 5: Modbus RTU<br>6 : Interval output at 100 times/second<br>7 : Interval output at 200 times/second<br>8 : Interval output at 500 times/second |
| rS 03 Baud rate | 2103 | 5: 9600 bps 7 : 38400 bps<br>6 : 19200 bps 8 : 115200 bps |
| rS 04 Parity | 2104 | 0 : None 1 : Odd 2: Even |
| rS 06 Stop bit length | 2106 | 1: 1 bit 2 : 2 bits |
| rS 07 Terminator | 2107 | 1 : CR (0Dh) 2: CR LF (0Dh, 0Ah) |
| rS 08 Slave address | 2108 | 0 : None 1 to 99 |

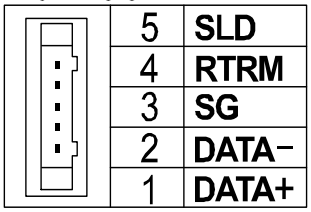
# 6.3. Interface

## 6.3.1. RS-485

The RS-485 has two kinds of communication modes ( rS 02 ).

- Modbus RTU ( rS 02 = 5 )
- Interval output ( rS 02 = 6, 7, 8 )

**RS-485**




| Pin No. | Symbol | Description |
|---|---|---|
| 5 | SLD | Connected with FG ground terminal on the power supply connector. |
| 4 | RTRM | Terminating resistor (100 Ω) is connected to Pin 1. Enable the terminating resistor with short-circuited to Pin 2. |
| 3 | SG | Signal ground |
| 2 | DATA− | Minus side of the RS-485 communication line. |
| 1 | DATA+ | Plus side of the RS-485 communication line. |

### Communication Specifications

| Item | Data transfer mode ( rS 02 ) | |
|---|---|---|
| | Modbus RTU | Interval output |
| Baud rate ( rS 03 ) | rS 03 ( 9600, 19200, 38400, 115200 bps ) | |
| Start bit length | 1 bit | |
| Character bit length | Fixed 8 bits | |
| Parity ( rS 04 ) | Fixed even number | rS 04 |
| Stop bit length ( rS 06 ) | Fixed 1 bit | rS 06 |
| Terminator ( rS 07 ) | Time | rS 07 |
| Code | Binary | ASCII |
| Slave address ( rS 08 ) | 1 to 99 ( 0 : No address setting ) | Not used |

#### 6.3.1.1. Modbus RTU

Display unit is a slave device of the Modbus RTU. Refer to **"6.3.5 Modbus RTU Data Address"**.

### Interval output

Weighing display value is output periodically.

| Communication mode | Interval output | Reference |
|---|---|---|
| 6 | 10 millisecond output ( 100 times/second) | The output data format is common. Output data is weighing display value. |
| 7 | 5 millisecond output ( 200 times/second) | |
| 8 | 2 millisecond output ( 500 times/second) | |

NOTE :100 times/second : Set the baud rate over 19200bps.
200 times/second : Set the baud rate over 38400bps.
500 times/second : Set the baud rate over 115200bps.

Output data format

| | Weighing display value | | Terminator ( rS 07 ) |
|---|---|---|---|
| Digit | Sign ( 1 char ) | Figure ( 7 chars ) | 1 or 2 chars |

NOTE: The state of the weighing display value, decimal point, and unit are not added to the weighing display value.

### 6.3.1.2. Error Code of the Modbus RTU ( Data Address : 400065 – 400068 )

| Error code | | Error sub code | | Reference |
|---|---|---|---|---|
| Error item | Code No. | Item | Code No. | |
| No error | 0 | N/A | 0 | |
| A/D converter error | 1 | N/A | 0 | |
| Nonvolatile memory error | 2 | N/A | 0 | |
| RAM error | 3 | N/A | 0 | |
| Calibration error | 4 | | 1 to 8 | Refer to "3.2.2 Error Codes for Calibration ( CAL Er )" |
| Weighing display error | 5 | N/A | 0 | |
| Verification of the load cell connections error | 6 | | 1 to 255 | Refer to the error code in "5.2.5 Display and Output of Verification". |

### 6.3.1.3. Bit Address of Status Indicators ( Data Address : 400009 – 400010 )

| Data Address ( Holding Register ) | R/W | Item | Reference |
|---|---|---|---|
| 400009. 15-00 | R | Reserved internally | 0 fixed. |
| 400010. 15-07 | | Reserved internally | 0 fixed. |
| 400010. 06 | | Z : Zero | LED to turn on = 1<br>LED to turn off = 0 |
| 400010. 05 | | S : Stable | |
| 400010. 04 | | G : Gross | |
| 400010. 03 | | N : Net | |
| 400010. 02 | | H : Hold, Hold busy | |
| 400010. 01 | | X : Basic function at FnC04 | |
| 400010. 00 | | Reserved internally | 0 fixed. |

### 6.3.1.4. Internal Write Cycle/Write Result ( Data Address : 400099 – 400100 )

| No. | Item | Reference |
|---|---|---|
| 0 | Write success | |
| 1 | Write failure | |
| 1 to 8 | Calibration error | Refer to "3.2.2 Error Codes for Calibration ( CAL Er ) " for details. |
| 15 | Internal write cycle | Writing in the nonvolatile memory. |
| Other | None | Not used. |

### 6.3.1.5. Access Interval Timer ( Data Address : 400097 – 400098 )

This is an interval timer to count up every 1 ms. When the values are read, the interval timer is initialized to "0". By reading the values periodically, an approximate communication time can be measured.

## 6.3.2. Control I/O

- Using a control input from peripherals, data can be monitored and be output.
- Using a control output, the weighing status and weighing result can be output.
- The input and output circuit is isolated from the DC power supply terminals and load cell terminals.
- DC +24 V is supplied between the power supply input terminal ( I/O PWR +24V ) and COM terminal.

**Part of input ( IN1 ~ IN6 )**

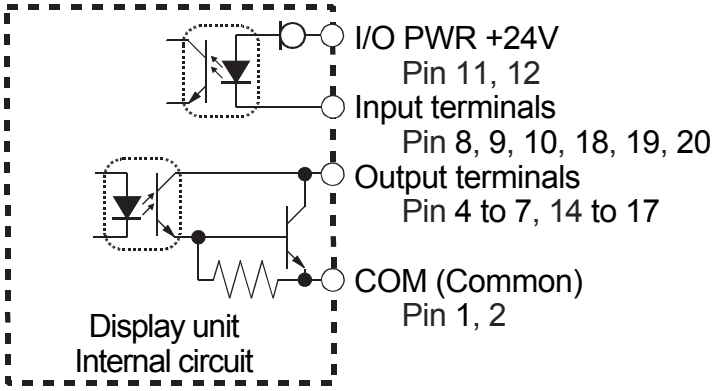
| | |
|---|---|
| Input circuit type | No-voltage contact input ( Photo coupler ) |
| Input open voltage | According to use |
| OFF current | 0.1 mA max. |
| ON current | 2.7 mA min. |
| Input threshold voltage | 2 V |

**Part of output ( OUT1 ~ OUT8 )**

| | |
|---|---|
| Output circuit type | Open collector |
| Isolation | Photo coupler |
| Output voltage | DC 35 V max. |
| Output current | 50 mA max. |
| Output saturation voltage | 1.1 V max. |

**Control I/O**

| | | | | |
|---|---|---|---|---|
| IN 6 | 20 | 10 | IN 5 | |
| IN 4 | 19 | 9 | IN 3 | |
| IN 2 | 18 | 8 | IN 1 | |
| OUT8 | 17 | 7 | OUT7 | |
| OUT6 | 16 | 6 | OUT5 | |
| OUT4 | 15 | 5 | OUT3 | |
| OUT2 | 14 | 4 | OUT1 | |
| | | | | |
| I/O PWR +24V | 12 | 2 | COM | |
| | 11 | 1 | | |

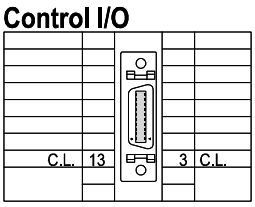


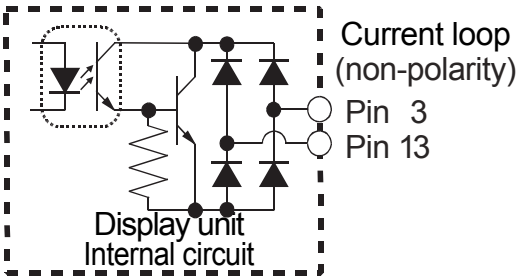

- **Assigning functions to terminals**
  - Assign functions to these input terminals : io 01 ( IN1 function ) to io 06 ( IN6 function )
  - Assign functions to these output terminals : io 11 ( OUT1 function ) to io 18 ( OUT8 function )
  - Assign logic to these output terminals : io 21 ( OUT1 logic ) to io 28 ( OUT8 logic )

## 6.3.3. Standard Serial Output ( Current Loop )

- The standard serial output ( C.L.) circuit is isolated from all terminals.
- The standard serial output can connect to the A&D external display and printer.
- The standard serial output needs DC current supplied from an external DC power source.
- The standard serial output terminals of the display unit have non-polarity.
- The standard serial output terminals are pin 3 and 13 of the control I/O connector.

| | |
|---|---|
| Transmission | 0 – 20mA, Current loop |
| Data length | 7 bits |
| Start bit | 1 bit |
| Parity bit | Even |
| Stop bit | 1 bit |
| Baud rate | 600 bps, 2400 bps |
| Code | ASCII |




### 6.3.3.1. Data Format of Serial Output

- The "A&D standard format" is used to the output format for communication with the A&D printer, and external display and consists of dual headers, data, unit and terminator.

**A&D standard format**

| Header 1 | | | Header 2 | | | Data ( Polarity, 8 digits including decimal point ) | | | | | | | | Unit | | Terminator | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S | T | , | G | S | , | + | 0 | 1 | 2 | 3 | . | 4 | 5 | SP | g | CR | LF |

| Item | ASCII code | Hexadecimal | Description |
|---|---|---|---|
| Header 1 | ST | [53 54] | **St**able |
| | US | [55 53] | **Un**stable |
| | OL | [4F 4C] | **O**verload |
| Header 2 | GS | [47 53] | **G**ro**s**s |
| | NT | [4E 54] | **Net** |
| | TR | [54 52] | **Tar**e |
| Punctuation | , | [2C] | Comma |
| Data ( ASCII code ) | 0 to 9 | [30 to 39] | Number |
| | + | [2B] | Positive sign |
| | – | [2D] | Negative sign |
| | SP | [20] | Space |
| | . | [2E] | Dot |

### Examples of the A&D standard format

| | Header 1 | | | Header 2 | | | Data (8 digits including decimal point, polarity) | | | | | | | | Unit | Terminator | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gross | S | T | , | G | S | , | + | 0 | 0 | 1 | 2 | 3 | 4 | 5 | SP g | CR | LF | Header 2 [GS] |
| Net | S | T | , | N | T | , | + | 0 | 0 | 1 | 0 | 0 | 0 | 0 | SP g | CR | LF | Header 2 [NT] |
| Tare | S | T | , | T | R | , | + | 0 | 0 | 0 | 2 | 3 | 4 | 5 | SP g | CR | LF | Header 2 [TR] |
| Including "." | S | T | , | G | S | , | + | 0 | 1 | 2 | 3 | . | 4 | 5 | SP g | CR | LF | Numerical part [.] |
| +Over | O | L | , | G | S | , | + | SP | SP | SP | SP | . | SP | SP | SP g | CR | LF | Header 1 [OL] |
| −Over | O | L | , | G | S | , | − | SP | SP | SP | SP | . | SP | SP | SP g | CR | LF | Header 1 [OL], Polarity [−] |
| Unstable | U | S | , | G | S | , | + | 0 | 1 | 2 | 3 | . | 4 | 5 | SP g | CR | LF | Header 1 [US] |
| Output data | O | L | , | G | S | , | + | SP | SP | SP | SP | . | SP | SP | SP g | CR | LF | Same as +Over |

The position of the decimal point is fixed even if data is out of range.

### 6.3.3.2. Transfer Mode of Serial Output

There are 3 types of current loop output ( CL 02 ): Stream, automatic print and manual print.

| | |
|---|---|
| Stream | The data is output at each display update. If the data cannot be output completely due to a slow baud rate, the data is output at the next update. The output data uses displayed data. Therefore, hidden data is not output. |
| Automatic printing | Automatic printing depends on the weighing mode setting.<br>1. Weighing mode ( 59 07 ) = 0<br>When a weighing value is 5d or more and is stable, the data is output only once. To output again, data is required to become less than 5d.<br>Select "Normal hold (1)" in FnC07 Hold function for the setting.<br>Note: When "stability detection time" (C-F08) and "stability detection width"(C-F09) are set to “0” (stability detection is not performed), the data is output only once when it becomes 5d or more.<br>2. Weighing mode ( 59 07 ) = 1 or more (When batch weighing is used)<br>Output once when the weighing sequence finished. |
| Manual printing | When "manual printing" is selected, data is output when receiving a printing command from the control input, pressing the assigned print key, or writing a coil from the Modbus RTU. |

## 6.3.4. USB

- The function settings can be input and output from a device that is connected to the Micro-B USB connector.
- When the USB is connected to a personal computer (PC), the PC recognizes the USB as a virtual COM port. The setting of virtual COM port is shown below.
  Baud rate: 9600 bps, Data bits: 7 bits, Parity: even, Stop bit: 1
- The communication tool can be downloaded at A&D website. Communication parameters are fixed.
- While weighing, do not perform cable connections. It may be easily influenced by environmental noise.
- Use the standard Micro-B USB connector.
- Reading is available whenever the power is on.
- Reading and writing of the function from the USB is valid except weighing mode.

### 6.3.4.1. Format

#### Monitoring Command

Function code (4 figures) Terminator

Example of the near-zero function (Fnc08)

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Command | 1 | 2 | 0 | 8 | CR | LF | | | | | | | | |
| Response | 1 | 2 | 0 | 8 | , | + | 0 | 0 | 0 | 0 | 1 | 0 | CR | LF |

Function code (4 figures) Data (7 figures) Terminator

#### Storing Command and Response

Function code (4 figures) Data (7 figures) Terminator

Example of the near-zero function (Fnc08)

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Command | 1 | 2 | 0 | 8 | , | + | 0 | 0 | 0 | 0 | 1 | 0 | CR | LF |
| Response | 1 | 2 | 0 | 8 | , | + | 0 | 0 | 0 | 0 | 1 | 0 | CR | LF |

Function code (4 figures) Data (7 figures) Terminator

- The response of the monitoring command is the same as the storing command.
- "+999999" means an irregular response. Ex.: In case that the function code is not correct and the command is not performed.

### 6.3.4.2. Monitoring the Function Setting

This specifies a function code in the command code and monitors the data.

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Command | N | N | N | N | CR | LF | | | | | | | | |
| Response | N | N | N | N | , | ± | X | X | X | X | X | X | CR | LF |

NNNN is code, ±XXXXXX is a number.

### 6.3.4.3. Storing the Function Setting

This specifies a function code in the command code and stores the data.

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Command | N | N | N | N | , | ± | X | X | X | X | X | X | CR | LF |
| Response | N | N | N | N | , | ± | X | X | X | X | X | X | CR | LF |

NNNN is code, ±XXXXXX is a number.

- For the parameter type, the branch number is stored.
- FnC01 (Key switch disable) is a decimal.

### 6.3.4.4. Reading the Whole Function Settings

All the functions can be read at once and a list of functions can be made.

| | | | | | | |
|---|---|---|---|---|---|---|
| Command | N | N | N | N | CR | LF |

NNNN is a command.

| Command code | Description |
|---|---|
| 0999 | All functions |
| 1000 | Calibration |
| 1100 | Linearity |
| 1200 | Basic |
| 1300 | Hold |
| 1400 | Sequence |
| 1600 | Control I/O |
| 1700 | Standard serial output |
| 1900 | Flow rate |
| 2100 | RS-485 |

### 6.3.4.5. Reading Data

The functions below can be monitored.

| | | | | | | |
|---|---|---|---|---|---|---|
| Command | N | N | N | N | CR | LF |

NNNN is a command.

| Command code | Description |
|---|---|
| 0101 | Program version |
| 0102 | Serial No. ( lower 5 digits ) |
| 0103 | Program checksum |
| 0104 | FRAM checksum |
| 0201 | Gross count |
| 0202 | Net count |
| 0203 | Tare count |
| 0204 | Load cell output. Scale: 1 nV/V |
| 0205 | Load cell output. Scale: 10 nV/V |

## 6.3.5. Modbus RTU Data Address

| Data Address ( Coil ) | R/W | Item | Description |
|---|---|---|---|
| 000001 | R | Near-zero | |
| 000002 | | Under | |
| 000003 | | Over | |
| 000004 | | OK | |
| 000005 | | Large flow | |
| 000006 | | Medium flow | |
| 000007 | | Small flow | |
| 000008 | | Reserved internally | |
| 000009 | | Weighing end | |
| 000010 | | Full | |
| 000011 | | Reserved internally | |
| 000012 | | HI | |
| 000013 | | OK | |
| 000014 | | LO | |
| 000015 | | Reserved internally | |
| 000016 | | Stability | |
| 000017 | | Gross/net ( 0/1) display | |
| 000018 | | In weighing sequence | |
| 000019 | | Weighing sequence error | |
| 000020 | | Over-capacity | Weighing display |
| 000021 | | Zero range setting error | |
| 000022 | | Tare error | |
| 000023 | | Reserved internally | |
| 000024 | | Reserved internally | |
| 000025 | | Reserved internally | |
| 000026 | | CAL operation error | |
| 000027 | | Tare status ( 1: During tare ) | |
| 000028 | | Normal batch/loss in weight ( 0/1) identification | |
| 000029 | | Update of flow rate 1 ( 0 : Enable ) | |
| 000030 | | Update of flow rate 2 ( 0 : Enable ) | |
| 000031 | | Approximate flow rate value of flow rate 1 ( 1:Approximate) | |
| 000032 | | Approximate flow rate value of flow rate 2 ( 1:Approximate) | |
| 000033 | | Net center of zero | |
| 000034 | | Gross center of zero | |
| 000035 | | Hold in progress ( 1: Hold ) | |
| 000036 | | Hold busy status ( 1: Hold busy ) | |
| 000037 | | Self-checking ( 1: Self-checking ) | |
| 000038 | | Net over | |
| 000039 | | Net under | |
| 000040 | | Gross over | |
| 000041 | | Gross under | |
| 000042 | | A/D over | |
| 000043 | | A/D under | |
| 000044 - 000100 | | Reserved internally | |

| | | | |
|---|---|---|---|
| 000101 | R | IN1 status | |
| 000102 | | IN2 status | |
| 000103 | | IN3 status | |
| 000104 | | IN4 status | |
| 000105 | | IN5 status | |
| 000106 | | IN6 status | |
| 000107 | | OUT1 status | |
| 000108 | | OUT2 status | |
| 000109 | | OUT3 status | |
| 000110 | | OUT4 status | |
| 000111 | | OUT5 status | |
| 000112 | | OUT6 status | |
| 000113 | | OUT7 status | |
| 000114 | | OUT8 status | |
| 000115 - 000200 | | Reserved internally | |

| Data Address ( Coil ) | R/W | Item | Description |
|---|---|---|---|
| 000201 | W *1 | Zero adjustment | |
| 000202 | | Tare | |
| 000203 | | Weighing start | |
| 000204 | | Emergency stop | |
| 000205 | | Reserved internally | |
| 000206 | | Reserved internally | |
| 000207 | | Tare clear | |
| 000208 | | Reserved internally | |
| 000209 | | Reserved internally | |
| 000210 | | Reserved internally | |
| 000211 | | Print command | |
| 000212 | | Zero clear | |
| 000213 | | Gross display | |
| 000214 | | Net display | |
| 000215 | | Pause | |
| 000216 | | Restart | |
| 000217 | | Reserved internally | |
| 000218 | | Reserved internally | |
| 000219 | | Error reset | |
| 000220 | | One-shot small flow | |
| 000221 | | Exchange normal batch sequence | |
| 000222 | | Exchange loss-in-weight sequence | |
| 000223 | | Permit update of flow rate 1 | |
| 000224 | | Prohibit update of flow rate 1 | |
| 000225 | | Initialize flow rate 1 | |
| 000226 | | Permit update of flow rate 2 | |
| 000227 | | Prohibit update of flow rate 2 | |
| 000228 | | Initialize flow rate 2 | |
| 000229 | | Actual free fall input | |
| 000230 | | Hold | |
| 000231 | | Hold cancellation | |
| 000232 - 000300 | | Reserved internally | |
| 000301 | | Setting of OUT1 to 1 | |
| 000302 | | Setting of OUT1 to 0 | |
| 000303 | | Setting of OUT2 to 1 | |
| 000304 | | Setting of OUT2 to 0 | |
| 000305 | | Setting of OUT3 to 1 | |
| 000306 | | Setting of OUT3 to 0 | |
| 000307 | | Setting of OUT4 to 1 | |
| 000308 | | Setting of OUT4 to 0 | |
| 000309 | | Setting of OUT5 to 1 | |
| 000310 | | Setting of OUT5 to 0 | |
| 000311 | | Setting of OUT6 to 1 | |
| 000312 | | Setting of OUT6 to 0 | |
| 000313 | | Setting of OUT7 to 1 | |

| Data Address ( Coil ) | R/W | Item | Description |
|---|---|---|---|
| 000314 | W *1 | Setting of OUT7 to 0 | |
| 000315 | | Setting of OUT8 to 1 | |
| 000316 | | Setting of OUT8 to 0 | |
| 000317 - 000400 | | Reserved internally | |
| 000401 | | CAL zero | |
| 000402 | | CAL span | |
| 000403 | | Self-check start | |
| 000404 | | Self-check stop ( Return to weighing mode ) | |
| 000405 - 000500 | | Reserved internally | |

*1 : The command is executed when "1" is written.

| Data Address ( Holding Register )*5 | R/W | Item | Description |
|---|---|---|---|
| 400001 - 400002 | R | Weighing display ( Digital filter 1 ) | |
| 400003 - 400004 | | Gross ( Digital filter 1 ) | |
| 400005 - 400006 | | Net ( Digital filter 1 ) | |
| 400007 - 400008 | | Tare weight | |
| 400009 - 400010 | | Status indicator ( Status LED ) | *3 |
| 400011 - 400012 | | Reserved internally | |
| 400013 - 400014 | | Reserved internally | |
| 400015 - 400016 | | Reserved internally | |
| 400017 - 400018 | | Gross value of weighing sequence end | |
| 400019 - 400020 | | Net value of weighing sequence end | |
| 400021 - 400022 | | Tare weight value of weighing sequence end | |
| 400023 - 400024 | | Sequence number | *1 |
| 400025 - 400026 | | Reserved internally | |
| 400027 - 400028 | | Flow rate 1 ( per second ) | |
| 400029 - 400030 | | Flow rate 2 ( per second ) | |
| 400031 - 400032 | | Flow rate 1 ( per minute ) | |
| 400033 - 400034 | | Flow rate 2 ( per minute ) | |
| 400035 - 400036 | | Flow rate 1 ( per hour ) | |
| 400037 - 400038 | | Flow rate 2 ( per hour ) | |
| 400039 - 400040 | | Flow rate 1 | Changes in a time set at Fr 03 |
| 400041 - 400042 | | Flow rate 2 | Changes in a time set at Fr 04 |
| 400043 - 400044 | | Weighing display ( Digital filter 2 ) | |
| 400045 - 400046 | | Gross ( Digital filter 2 ) | |
| 400047 - 400048 | | Net ( Digital filter 2 ) | |
| 400049 - 400050 | | Reserved internally | |
| 400051 - 400052 | | Reserved internally | |
| 400053 - 400054 | | Batch error | |
| 400055 - 400056 | | Actual free fall | |
| 400057 - 400058 | | Free fall ( Average ) | |
| 400059 - 400060 | | Active free fall coefficient ( average ) | |
| 400061 - 400062 | | Flow rate ( In small flow off ) | |
| 400063 - 400064 | | Flow rate ( Real time, per second ) | |
| 400065 - 400066 | | Error code | *2 |
| 400067 - 400068 | | Error sub code | *2 |
| 400069 - 400070 | | Program version | |
| 400071 - 400072 | | Serial number | |
| 400073 - 400074 | | Program checksum | |
| 400075 - 400076 | | Memory checksum | |
| 400077 - 400094 | | Reserved internally | |
| 400095 - 400096 | | Output voltage of load cell ( nV/V ) | |
| 400097 - 400098 | | Access interval timer ( ms ) | |
| 400099 - 400100 | | During an internal write cycle / Write result | *4 |

*1 : Refer to **"6.2.3.9 Sequence Numbers"** for details.
*2 : Refer to **"6.3.1.2 Error Code of the Modbus RTU ( Data Address : 400065 – 400068 )"** for details.
*3 : Refer to **"6.3.1.3 Bit Address of Status Indicators ( Data Address : 400009 – 400010 )"** for details.
*4 : Refer to **"6.3.1.4 Internal Write Cycle/Write Result ( Data Address : 400099 – 400100 )"** for details.
*5 : Double Word word order is low word first ( L/H ). Following data of Holding registers are the same.

| Data Address ( Holding Register ) | R/W | Item | Description |
|---|---|---|---|
| 400101 - 400102 | | C-F01 Unit | |
| 400103 - 400104 | | C-F02 Decimal point position | |
| 400105 - 400106 | | C-F03 Minimum division | |
| 400107 - 400108 | | C-F04 Maximum capacity | |
| 400109 - 400110 | | C-F05 Zero range | |
| 400111 - 400112 | | C-F06 Zero tracking time | |
| 400113 - 400114 | | C-F07 Zero tracking width | |
| 400115 - 400116 | | C-F08 Stability detection time | |
| 400117 - 400118 | | C-F09 Stability detection width | |
| 400119 - 400120 | | C-F 10 Tare and zero when unstable | |
| 400121 - 400122 | | C-F 11 Tare when the gross weight is negative | |
| 400123 - 400124 | | C-F 12 Output when out of range and unstable | |
| 400125 - 400126 | | C-F 13 Excessive negative gross weight | |
| 400127 - 400128 | | C-F 14 Excessive negative net weight | |
| 400129 - 400130 | | C-F 15 Clear the zero value | |
| 400131 - 400132 | | C-F 16 Zero when power is turned on | |
| 400133 - 400134 | | C-F 17 Input voltage at zero | |
| 400135 - 400136 | | C-F 18 Span input voltage | |
| 400137 - 400138 | | C-F 19 Span input voltage weight | |
| 400139 - 400150 | R/W | Reserved internally | |
| 400151 - 400152 | | C-F26 Gravity acceleration of the calibration location | |
| 400153 - 400154 | | C-F27 Gravity acceleration of the usage location | |
| 400155 - 400156 | | C-F28 Disable hold function | |
| 400157 - 400158 | | Reserved internally | |
| 400159 - 400160 | | Reserved internally | |
| 400161 - 400162 | | Reserved internally | |
| 400163 - 400164 | | Reserved internally | |
| 400165 - 400170 | | Reserved internally | |
| 400171 - 400172 | | Reserved internally | |
| 400173 - 400174 | | Reserved internally | |
| 400175 - 400176 | | Reserved internally | |
| 400177 - 400178 | | Reserved internally | |
| 400179 - 400180 | | Reserved internally | |
| 400181 - 400182 | | Reserved internally | |
| 400183 - 400184 | | Reserved internally | |
| 400185 - 400186 | | Reserved internally | |
| 400187 - 400188 | | Reserved internally | |
| 400189 - 400190 | | Reserved internally | |
| 400191 - 400200 | | Reserved internally | |

| Data Address ( Holding Register ) | R/W | Item | Description |
|---|---|---|---|
| 400201 - 400202 | R/W | Final value | The same as 400401 - 400412 |
| 400203 - 400204 | | Free fall | |
| 400205 - 400206 | | Preliminary | |
| 400207 - 400208 | | Optional preliminary | |
| 400209 - 400210 | | Over | |
| 400211 - 400212 | | Under | |
| 400213 - 400214 | | Full | |
| 400215 - 400216 | | Near-zero | The same as 400315 - 400316 |
| 400217 - 400218 | | Reserved internally | |
| 400219 - 400220 | | Upper limit value | The same as 400321 - 400322 |
| 400221 - 400222 | | Lower limit value | The same as 400323 - 400324 |
| 400223 - 400300 | | Reserved internally | |

| Data Address ( Holding Register ) | R/W | Item | Description |
|---|---|---|---|
| 400301 - 400302 | R/W | Fnc01 Key switch disable | |
| 400303 - 400304 | | Fnc02 F key | |
| 400305 - 400306 | | Fnc03 Display update rate | |
| 400307 - 400308 | | Fnc04 X display | |
| 400309 - 400310 | | Fnc05 Digital filter 1 | |
| 400311 - 400312 | | Fnc06 Digital filter 2 | |
| 400313 - 400314 | | Fnc07 Hold | |
| 400315 - 400316 | | Fnc08 Near-zero | The same as 400215 - 400216 |
| 400317 - 400318 | | Fnc09 Near-zero comparison weight | |
| 400319 - 400320 | | Fnc 10 Upper limit value | The same as 400219 - 400220 |
| 400321 - 400322 | | Fnc 11 Lower limit value | The same as 400221 - 400222 |
| 400323 - 400324 | | Fnc 12 Comparison mass of upper and lower limit | |
| 400325 - 400326 | | Fnc 13 Full | |
| 400327 - 400400 | | Reserved internally | |

| Data Address ( Holding Register ) | R/W | Item | Description |
|---|---|---|---|
| 400401 - 400402 | R/W | S9 01 Final value | The same as 400201 - 400212 |
| 400403 - 400404 | | S9 02 Free fall | |
| 400405 - 400406 | | S9 03 Preliminary | |
| 400407 - 400408 | | S9 04 Optional preliminary | |
| 400409 - 400410 | | S9 05 Over | |
| 400411 - 400412 | | S9 06 Under | |
| 400413 - 400414 | | S9 07 Weighing mode | |
| 400415 - 400416 | | S9 08 Automatic free fall correction | |
| 400417 - 400418 | | S9 09 Automatic free fall band | |
| 400419 - 400420 | | S9 10 Active free fall coefficient | |
| 400421 - 400422 | | S9 11 OK/Over/Under output timing | |
| 400423 - 400424 | | S9 12 Wait for the weight value to be stable before the judgment | |
| 400425 - 400426 | | S9 13 Automatic tare at weighting start | |
| 400427 - 400440 | | Reserved internally | |
| 400441 - 400442 | | S9 21 Flow timeout time | |
| 400443 - 400444 | | S9 22 Weighting start input delay time | |
| 400445 - 400446 | | S9 23 Large flow comparison disable time | |
| 400447 - 400448 | | S9 24 Medium flow comparison disable time | |
| 400449 - 400450 | | S9 25 Small flow comparison disable time | |
| 400451 - 400452 | | S9 26 Judging delay time | |
| 400453 - 400454 | | S9 27 Weighing end output time | |
| 400455 - 400456 | | S9 28 One-shot time for small flow rate | |
| 400457 - 400500 | | Reserved internally | |

| Data Address (Holding Register) | R/W | Item | Description |
|---|---|---|---|
| 400501 - 400502 | R/W | io 01 Function of IN1 | |
| 400503 - 400504 | | io 02 Function of IN2 | |
| 400505 - 400506 | | io 03 Function of IN3 | |
| 400507 - 400508 | | io 04 Function of IN4 | |
| 400509 - 400510 | | io 05 Function of IN5 | |
| 400511 - 400512 | | io 06 Function of IN6 | |
| 400513 - 400600 | | Reserved internally | |

| Data Address (Holding Register) | R/W | Item | Description |
|---|---|---|---|
| 400601 - 400602 | R/W | io 11 Function of OUT1 | |
| 400603 - 400604 | | io 12 Function of OUT2 | |
| 400605 - 400606 | | io 13 Function of OUT3 | |
| 400607 - 400608 | | io 14 Function of OUT4 | |
| 400609 - 400610 | | io 15 Function of OUT5 | |
| 400611 - 400612 | | io 16 Function of OUT6 | |
| 400613 - 400614 | | io 17 Function of OUT7 | |
| 400615 - 400616 | | io 18 Function of OUT8 | |
| 400617 - 400618 | | io 21 OUT1 Logic | |
| 400619 - 400620 | | io 22 OUT2 Logic | |
| 400621 - 400622 | | io 23 OUT3 Logic | |
| 400623 - 400624 | | io 24 OUT4 Logic | |
| 400625 - 400626 | | io 25 OUT5 Logic | |
| 400627 - 400628 | | io 26 OUT6 Logic | |
| 400629 - 400630 | | io 27 OUT7 Logic | |
| 400631 - 400632 | | io 28 OUT8 Logic | |
| 400633 - 400700 | | Reserved internally | |

| Data Address (Holding Register) | R/W | Item | Description |
|---|---|---|---|
| 400701 - 400702 | R/W | CL 01 Serial data | |
| 400703 - 400704 | | CL 02 Communication mode | |
| 400705 - 400706 | | CL 03 Baud rate | |
| 400707 - 400800 | | Reserved internally | |

| Data Address (Holding Register) | R/W | Item | Description |
|---|---|---|---|
| 400901 - 400902 | R/W | Reserved internally | |
| 400903 - 400904 | | rS 02 Communication mode | |
| 400905 - 400906 | | rS 03 Baud rate | |
| 400907 - 400908 | | rS 04 Parity | |
| 400909 - 400910 | | Reserved internally | |
| 400911 - 400912 | | rS 06 Stop bit length | |
| 400913 - 400914 | | rS 07 Terminator | |
| 400915 - 400916 | | rS 08 Slave address | |
| 400917 - 401000 | | Reserved internally | |

| Data Address (Holding Register) | R/W | Item | Description |
|---|---|---|---|
| 401201 - 401202 | R/W | HLd01 Averaging time | |
| 401203 - 401204 | | HLd02 Start wait time | |
| 401205 - 401206 | | HLd03 Automatic start condition | |
| 401207 - 401208 | | HLd04 Release using control input | |
| 401209 - 401210 | | HLd05 Release time | |
| 401211 - 401212 | | HLd06 Release using fluctuation range | |
| 401213 - 401214 | | HLd07 Release at near-zero | |
| 401215 - 401300 | | Reserved internally | |

| Data Address (Holding Register) | R/W | Item | Description |
|---|---|---|---|
| 401401 - 401402 | R/W | Fr 01 Filter of flow rate 1 | |
| 401403 - 401404 | | Fr 02 Filter of flow rate 2 | |
| 401405 - 401406 | | Fr 03 Damping time for flow rate 1 | |
| 401407 - 401408 | | Fr 04 Damping time for flow rate 2 | |
| 401409 - 401410 | | Fr 05 +/- flow rate 1 | |
| 401411 - 401412 | | Fr 06 +/- flow rate 2 | |
| 401413 - 401500 | | Reserved internally | |

# 6.4. Maintenance

## 6.4.1. Parameter

When performing maintenance, use the following list as a memorandum.
When making inquiries about the product, inform your local A&D dealer of the user settings.

### 6.4.1.1. Calibration Functions (C Fnc)

| Item Name / Function code | Description, Range and Default value | User setting |
|---|---|---|
| C-F01 Unit 1001 | 1: g | |
| C-F02 Decimal point position 1002 | 3: 0.000 | |
| C-F03 Minimum division 1003 | 1: 1 2: 2 3: 5<br>4: 10 5: 20 6: 50 | |
| C-F04 Maximum capacity 1004 | AD4212L-R50:50000<br>AD4212L-R100:100000 | |
| C-F05 Zero range 1005 | 0 to 2 to 100 | |
| C-F06 Zero tracking time 1006 | 0.0 to 5.0 | |
| C-F07 Zero tracking width 1007 | 0.0 to 9.9 | |
| C-F08 Stability detection time 1008 | 0.0 to 1.0 to 9.9 | |
| C-F09 Stability detection width 1009 | 0 to 2 to 100 | |
| C-F10 Tare and zero when unstable 1010 | 0: Disable both functions<br>1: Enable both functions | |
| C-F11 Tare when the gross weight is negative 1011 | 0: Disable tare<br>1: Enable tare | |
| C-F12 Output when out of range and unstable 1012 | 0: Disable output<br>1: Enable output | |
| C-F13 Excessive negative gross weight 1013 | 1: Gross weight < -99999<br>2: Gross weight < Negative maximum capacity<br>3: Gross weight < -19d | |
| C-F14 Excessive negative net weight 1014 | 1: Net weight < -99999<br>2: Net weight < Negative maximum capacity | |
| C-F15 Clear the zero value 1015 | 0: Disable<br>1: Enable | |
| C-F16 Zero when power is turned on 1016 | 0: Disable<br>1: Enable | |
| C-F17 1017 | −7.0000 to 7.0000 | |

| Item Name / Function code | Description, Range and Default value | User setting |
|---|---|---|
| Input voltage at zero | | |
| C-F 18 1018<br>Span input voltage | 0.0100 to 9.9999 | |
| C-F 19 1019<br>Span input voltage weight | 1 to 100000 | |
| C-F26 1026<br>Gravity acceleration of the calibration location | 9.7500 to 9.7980 to 9.8500 | |
| C-F27 1027<br>Gravity acceleration of the usage location | 9.7500 to 9.7980 to 9.8500 | |
| C-F28 1028<br>Disable hold function | 0: Enable<br>1: Disable | |

### 6.4.1.2. Linearization Functions (L-Fnc )

| Item Name / Function code | Description, Range and Default value | User setting |
|---|---|---|
| L-F01 1101<br>Number of input points | 0 to 5 | |
| L-F02 1102<br>Linear−zero | −7.0000 to 0.0000 to 7.0000 | |
| L-F03 1103<br>Setting value for linear 1 | 0 to 100000 | |
| L-F04 1104<br>Span at linear 1 | 0.0000 to 9.9999 | |
| L-F05 1105<br>Setting value for linear 2 | 0 to 100000 | |
| L-F06 1106<br>Span at linear 2 | 0.0000 to 9.9999 | |
| L-F07 1107<br>Setting value for linear 3 | 0 to 100000 | |
| L-F08 1108<br>Span at linear 3 | 0.0000 to 9.9999 | |
| L-F09 1109<br>Setting value for linear 4 | 0 to 100000 | |
| L-F 10 1110<br>Span at linear 4 | 0.0000 to 9.9999 | |

### 6.4.1.3. Basics Functions (Fnc F)

| Item Name / Function code | Description, Range and Default value | User setting |
|---|---|---|
| Fnc01 1201<br>Key switch disable | 0000 to 1111 | |
| Fnc02 1202<br>F key | 0: None<br>1: Manual print command<br>2: Hold<br>3: Operation switch 1<br>4: Operation switch 2<br>5: Display exchange<br>6: Tare clear<br>7: Zero clear<br>8: Weighing start / Pause / Restart<br>9: Actual free fall input<br>10: One shot, Small flow<br>11 : Sequence flow rate monitor<br>12 : mV/V monitor<br>13 : Digital filter 2 | |
| Fnc03 1203<br>Display update rate | 1: 20 times/second<br>2: 10 times/second<br>3: 5 times/second | |
| Fnc04 1204<br>x display | 0: None<br>1: Zero tracking in progress<br>2: Alarm<br>3: Display operation switch status as on or off<br>4: Near-zero<br>5: HI output<br>6: OK output<br>7: LO output<br>8: Large flow<br>9: Medium flow<br>10: Small flow<br>11 : Over<br>12 : OK<br>13 : Under<br>14 : Full<br>15 : Weighing end<br>16 : In weighing sequence<br>17 : Weighing sequence, error<br>18 : Normal batch/Loss-in-weight, Identification<br>19 to 24 : State of Coil IN 1 to 6<br>25 to 32 : Setting of Coil OUT 1 to 8 | |

| Item Name / Function code | Description, Range and Default value | User setting |
|---|---|---|
| Fnc05 1205<br>Digital filter 1 | 0: None 8:10.0 Hz 16: 0.7 Hz<br>1:100.0 Hz 9: 7.0 Hz<br>2: 70.0 Hz 10: 5.6 Hz<br>3: 56.0 Hz 11: 4.0 Hz<br>4: 40.0 Hz 12: 2.8 Hz<br>5: 28.0 Hz 13: 2.0 Hz<br>6: 20.0 Hz 14: 1.4 Hz<br>7: 14.0 Hz [15]: 1.0 Hz | |
| Fnc06 1206<br>Digital Filter 2 | 0: None 8:10.0 Hz 16: 0.7 Hz<br>1:100.0 Hz 9: 7.0 Hz 17: 0.56 Hz<br>2: 70.0 Hz 10: 5.6 Hz 18: 0.40 Hz<br>3: 56.0 Hz 11: 4.0 Hz 19: 0.28 Hz<br>4: 40.0 Hz 12: 2.8 Hz 20: 0.20 Hz<br>5: 28.0 Hz 13: 2.0 Hz 21: 0.14 Hz<br>6: 20.0 Hz 14: 1.4 Hz 22: 0.10 Hz<br>7: 14.0 Hz [15]: 1.0 Hz 23: 0.07 Hz | |
| Fnc07 1207<br>Hold | [1]: Normal hold<br>2: Peak hold<br>3: Averaging hold | |
| Fnc08 1208<br>Near-zero | -99999 to [10] to 99999 | |
| Fnc09 1209<br>Near-zero comparison weight | [1]: Gross weight<br>2: Net weight | |
| Fnc 10 1210<br>Upper limit value | -99999 to [10] to 99999 | |
| Fnc 11 1211<br>Lower limit value | -99999 to [-10] to 99999 | |
| Fnc 12 1212<br>Comparison mass of upper and lower limit | [1]: Gross weight<br>2: Net weight | |
| Fnc 13 1213<br>Full | -99999 to [99999] | |

### 6.4.1.4. Hold Functions (HLd F)

| Item Name / Function code | Description, Range and Default value | User setting |
|---|---|---|
| HLd01 Averaging time 1301 | 0.00 to 9.99 | |
| HLd02 Start wait time 1302 | 0.00 to 9.99 | |
| HLd03 Automatic start condition 1303 | 0: Enable<br>1: Above the near-zero, and stable<br>2: Above the near-zero | |
| HLd04 Release using control input 1304 | 0: Do not release<br>1: Release | |
| HLd05 Release time 1305 | 0.00 to 9.99 | |
| HLd06 Release using fluctuation range 1306 | 0 to 99999 | |
| HLd07 Release at near-zero 1307 | 0: Do not release<br>1: Release | |

### 6.4.1.5. Weighing Sequence Programs (SQ F)

| Item Name / Function code | Description, Range and Default value | User setting |
|---|---|---|
| SQ 01 Final value 1401 | −99999 to 0 to 99999 | |
| SQ 02 Free fall 1402 | −99999 to 0 to 99999 | |
| SQ 03 Preliminary 1403 | −99999 to 0 to 99999 | |
| SQ 04 Optional preliminary 1404 | −99999 to 0 to 99999 | |
| SQ 05 Over 1405 | −99999 to 0 to 99999 | |
| SQ 06 Under 1406 | −99999 to 0 to 99999 | |
| SQ 07 Weighing mode 1407 | 0: Disable<br>1: Normal batch sequence<br>2: Loss-in-weigh sequence<br>3: Specifying with control input<br>4: Specifying with Modbus RTU | |
| SQ 08 Automatic free fall correction 1408 | 0: Disable<br>1: Moving average of last four times<br>2: Real-time free fall compensation (fixed coefficient)<br>3: Real-time free fall compensation (updated coefficient) | |

| Item Name | Function code | Description, Range and [Default value] | User setting |
|---|---|---|---|
| 59 09 Automatic free fall band | 1409 | [0] to 99999 | |
| 59 10 Active free fall coefficient | 1410 | Scale: 0.001 second<br>−99.999 to [0.000] to 99.999 | |
| 59 11 OK/Over/Under output timing | 1411 | 1 : Always<br>[2]: In synchronization with weighing end | |
| 59 12 Wait for the weight value to be stable before the judgment | 1412 | 0 : Disable<br>[1]: Enable | |
| 59 13 Automatic tare at weighing start | 1413 | [0]: Disable<br>1 : Enable | |
| 59 21 Flow timeout time | 1421 | [0] to 600 | |
| 59 22 Weighing start input delay time | 1422 | [0.0] to 60.0 | |
| 59 23 Large flow comparison disable time | 1423 | [0.0] to 60.0 | |
| 59 24 Medium flow comparison disable time | 1424 | | |
| 59 25 Small flow comparison disable time | 1425 | | |
| 59 26 Judging delay time | 1426 | 0.0 to [0.1] to 60.0 | |
| 59 27 Weighing end output time | 1427 | [0.0] to 60.0 | |
| 59 28 One-shot time for small flow rate | 1428 | [0.00] to 6.00 | |

### 6.4.1.6. Flow Rate Functions (Fr F)

| Item Name | Function code | Description, Range and Default value | User setting |
|---|---|---|---|
| Fr 01 Filter of flow rate 1 | 1901 | 1 : Digital filter 1<br>2 : Digital filter 2 | |
| Fr 02 Filter of flow rate 2 | 1902 | | |
| Fr 03 Damping time for flow rate 1 | 1903 | Suppress changes in flow rate.<br>The higher the value setting, the less changes.<br>Scale: 1 second 1 to 5 to 1000 | |
| Fr 04 Damping time for flow rate 2 | 1904 | | |
| Fr 05 +/- flow rate 1 | 1905 | 0 : according to calculation<br>1 : interchange +/-<br>2 : absolute value | |
| Fr 06 +/- flow rate 2 | 1906 | | |

### 6.4.1.7. Control I/O Functions (io F)

| | Item Name | Function code | Description, Range and Default value | | User setting |
|---|---|---|---|---|---|
| IN | io 01 Function of IN1 | 1601 | 0 : Disable<br>1 to 6 : Reserved internally<br>7 : Zero<br>8 : Tare<br>9 : Hold<br>10 : Gross / Net exchange<br>11 : Diagnose<br>12 : Print command<br>13 : Weighing start<br>14 : Pause<br>15 : Restart<br>16 : Emergency stop<br>17 : Error reset<br>18 : Normal batch/Loss-in-weight exchange<br>19 : Actual free fall input<br>20 : One-shot small flow<br>21 : Full open<br>22 : Zero clear<br>23 : Tare clear<br>24 : Operation same as a F key<br>25 : Prohibit update of flow rate 1<br>26 : Prohibit update of flow rate 2<br>27 : Initialize flow rate 1<br>28 : Initialize flow rate 2 | 0 to 7 to 28 | |
| | io 02 Function of IN2 | 1602 | | 0 to 8 to 28 | |
| | io 03 Function of IN3 | 1603 | | 0 to 28 | |
| | io 04 Function of IN4 | 1604 | | 0 to 28 | |
| | io 05 Function of IN5 | 1605 | | 0 to 28 | |
| | io 06 Function of IN6 | 1606 | | 0 to 28 | |

| Item Name | Function code | Description, Range and Default value | | User setting |
|---|---|---|---|---|
| OUT | io 11 Function of OUT1 | 1611 | 0 : Disable<br>1 to 8 : Reserved internally<br>9 : Stability<br>10 : Over capacity<br>11 : Net display<br>12 : During tare<br>13 : Hold<br>14 : Hold busy<br>15 : HI output<br>16 : OK output<br>17 : LO output<br>18 : Near-zero<br>19 : Full<br>20 : Over<br>21 : OK<br>22 : Under<br>23 : Large flow<br>24 : Medium flow<br>25 : Small flow<br>26 : Normal batch/Loss-in-weight, Identification<br>27 : In weighing sequence<br>28 : Weighing end<br>29 : Weighing sequence error<br>30 : In weighing (ON)<br>31 : In weighing (1 Hz)<br>32 : In weighing (50 Hz)<br>33 : Alarm<br>34 : Output operation switch is on or off<br>35 : Approximate flow rate value of flow rate 1<br>36 : Approximate flow rate value of flow rate 2<br>37 : Remote I/O | 0 to 18 to 37 | |
| | io 12 Function of OUT2 | 1612 | | 0 to 9 to 37 | |
| | io 13 Function of OUT3 | 1613 | | 0 to 37 | |
| | io 14 Function of OUT4 | 1614 | | 0 to 37 | |
| | io 15 Function of OUT5 | 1615 | | 0 to 37 | |
| | io 16 Function of OUT6 | 1616 | | 0 to 37 | |
| | io 17 Function of OUT7 | 1617 | | 0 to 37 | |
| | io 18 Function of OUT8 | 1618 | | 0 to 37 | |
| OUT | io 21 OUT1 Logic | 1621 | 1: Inverting output<br>If data is "0" level, the output transistor conducts (ON).<br>2: Non-inverting output<br>If data is "1" level, the output transistor conducts (ON). | | |
| | io 22 OUT2 Logic | 1622 | | | |
| | io 23 OUT3 Logic | 1623 | | | |
| | io 24 OUT4 Logic | 1624 | | | |
| | io 25 OUT5 Logic | 1625 | | | |
| | io 26 OUT6 Logic | 1626 | | | |
| | io 27 OUT7 Logic | 1627 | | | |
| | io 28 OUT8 Logic | 1628 | | | |

### 6.4.1.8. Standard Serial Output Functions (CL F)

| Item Name / Function code | Description, Range and Default value | User setting |
|---|---|---|
| CL 01<br>1701<br>Serial data | 1: Weighing display<br>2: Gross<br>3: Net<br>4: Tare<br>5: Gross / Net / Tare | |
| CL 02<br>1702<br>Communication mode | 1: Stream<br>2: Automatic print<br>3: Manual print | |
| CL 03<br>1703<br>Baud rate | 1: 600 bps<br>2: 2400 bps | |

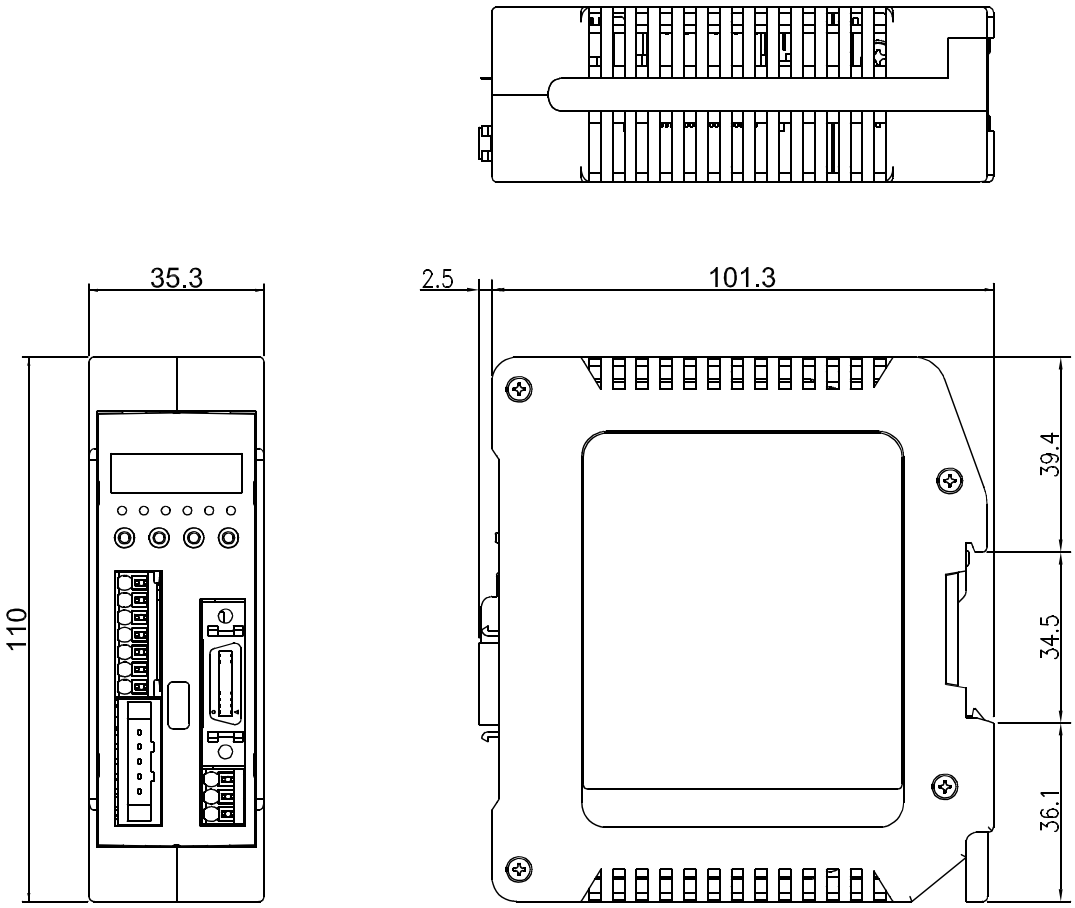
### 6.4.1.9. RS-485 Functions (rS F)

| Item Name / Function code | Description, Range and Default value | | | User setting |
|---|---|---|---|---|
| rS 02<br>2102<br>Communication mode | 5: Modbus RTU<br>6: Interval output at 100 times/second<br>7: Interval output at 200 times/second<br>8: Interval output at 500 times/second | | | |
| rS 03<br>2103<br>Baud rate | 5: 9600 bps<br>6: 19200 bps | 7: 38400 bps<br>8: 115200 bps | | |
| rS 04<br>2104<br>Parity | 0: None | 1: Odd | 2: Even | |
| rS 06<br>2106<br>Stop bit length | 1: 1 bit | 2: 2 bits | | |
| rS 07<br>2107<br>Terminator | 1: CR (0Dh) | 2: CR LF (0Dh, 0Ah) | | |
| rS 08<br>2108<br>Slave address | 0: None | 1 to 99 | | |

# 7. Specifications

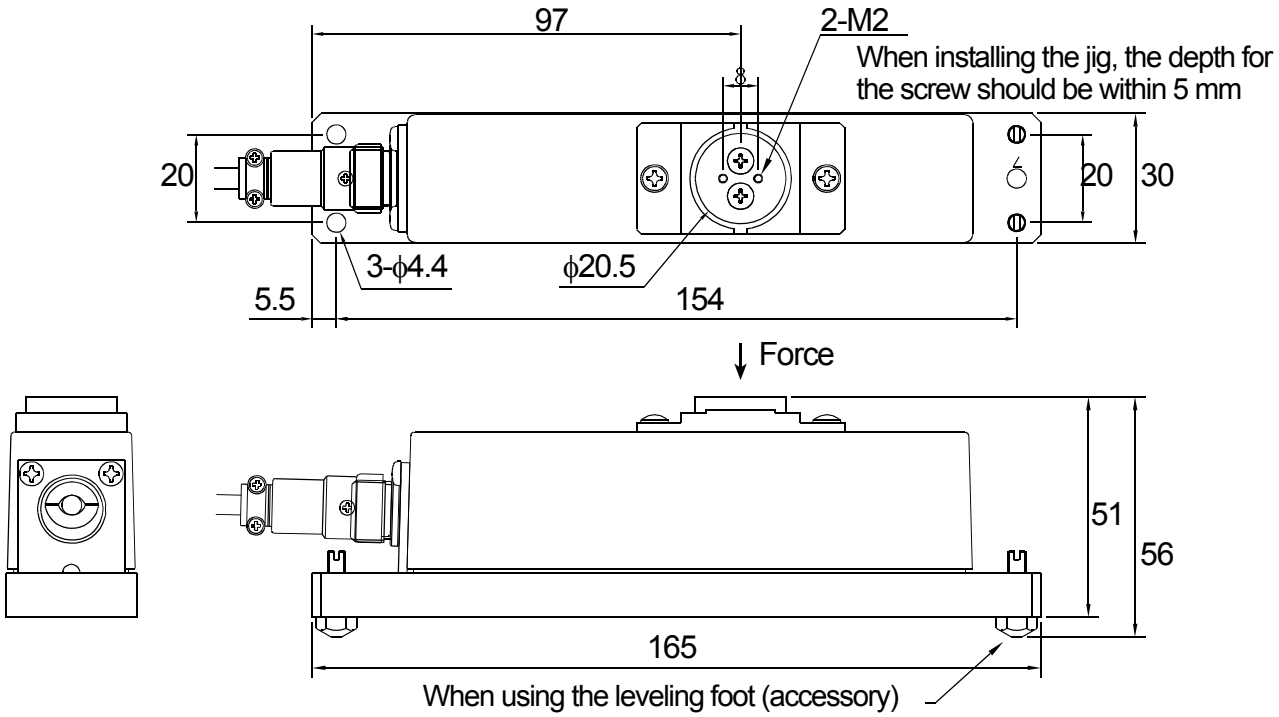
| Model | AD4212L-R50 | AD4212L-R100 |
|---|---|---|
| Weighing capacity | 51 g | 110 g |
| Maximum display | 51.008 g | 110.008 g * |
| Minimum weighing value (1 digit) | 0.001 g | 0.001 g |
| Repeatability (Standard deviation) | 0.001 g | 0.002 g |
| Linearity | ±0.002 g | ±0.002 g |
| Stabilization time in seconds (at an appropriate filter setting in a good environment) | 0 to 5 g approx. 0.3 second | 0 to 5 g approx. 0.3 second |
| | 5 to 51 g approx. 1.0 second | 5 to 110 g approx. 1.3 second |
| I/O unit | RS-485 (Modbus RTU), conform to USB USB 2.0 | |
| Sampling rate | 1000 times / second | |
| Sensitivity drift | ±30 ppm/°C typ | |
| Zero temperature coefficient | ±50 ppm/°C typ | |
| Operating environment | -10 °C to +40 °C, 85%RH or less (no condensation) | |
| Weighing pan dimension | ϕ20.5 mm | |
| Weighing unit external dimension/mass | 30 (W) × 165 (D) × 56 (H) mm/ approx. 400 g | |
| Display unit external dimension/mass | 35.3 (W) × 101.3 (D) × 110 (H) mm/ approx. 200 g | |
| Cable diameter/length/mass | ϕ4.5 mm/10 m/ approx. 350 g | |
| Power voltage | DC24V +10%/-15% | |
| Power consumption | 6W Max | |
| Memory back up | Nonvolatile memory, data storage duration: 10 years or more | |
| Ability of the stopper to withstand overload | 1 kg | |
| Allowable moment | 0.015 Nm or less | 0.03 Nm or less |
| Specific frequency | 65 Hz | 95 Hz |
| Water-proof level (weighing unit) | IP42 | |
| Accessories | RS-485 connector made by 3M: 35505-6200-A00 GF 2<br>Branch connector made by 3M: 35715-L010-A00 AK 1<br>Leveling feet 3 | |

* When exceeding 100 g, all digits blink. The largest digit "1" is not displayed.




Unit: mm

**Illustration 10 External dimensions (display unit)**




Unit: mm

**Illustration 11 External dimensions (weighing unit)**

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