AD-4430R

With RS-485 (Modbus RTU)

DIN Rail Weighing Module

INSTRUCTION MANUAL

A&D Company, Ltd.

1WMPD4003462B

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.

- This manual is subject to change without notice, at any time, to improve the product.
- The contents of the product specifications and this manual are subject to change without any obligation on the part of the manufacturer.
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Teflon is a registered trademark of DuPont.

Contents

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1. Compliance

1.1. Compliance with FCC rules

- Please note that this equipment generates, uses and can radiate radio frequency energy. This equipment has been tested and has been found to comply with the limits of a Class A computing device pursuant to Subpart J of Part 15 of FCC rules. These rules are designed to provide reasonable protection against interference when this equipment is operated in a commercial environment. If this unit is operated in a residential area it may cause some interference and under these circumstances the user would be required to take, at his/her own expense, whatever measures are necessary to eliminate the interference.
  (FCC = Federal Communications Commission in the U.S.A.)

1.2. Compliance with European Directives

CE This appliance complies with the statutory EMC (Electromagnetic Compatibility) directive 2004/108/EC and the Low Voltage Directive 2006/95/EC for the safety of electrical equipment designed for certain voltages.

Note: The displayed value may be adversely affected by extreme electromagnetic influences.

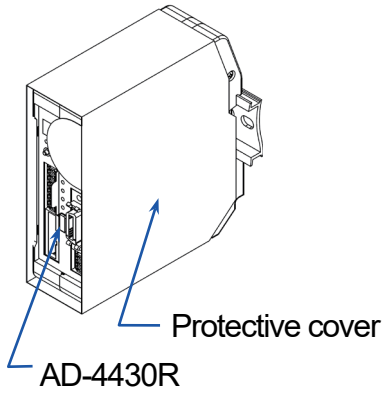
1.3. Precautions for Safety Use

Before use, confirm the following articles for safe operation.

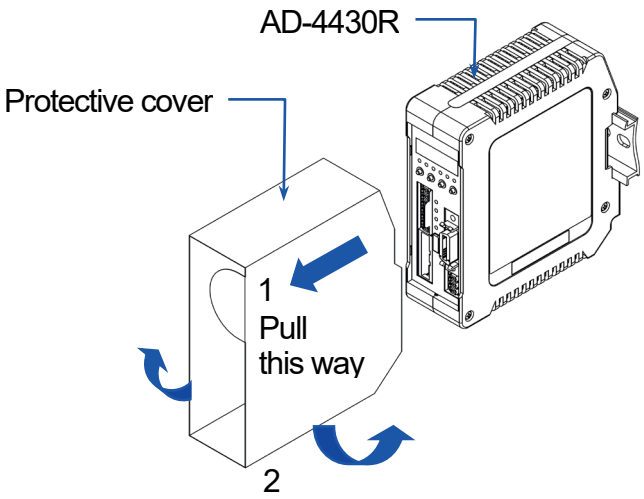
- **Grounding the Module**
  Ground the module to the DIN rail. Separate this earth ground line from others, such as ground lines for the motor, inverter or power source. Unless the indicator is grounded, it may result in electric shock, operation error or fire.
- **Proper Power Source and Power Cable**
  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. Use pole compression terminals to connect the power cable to the terminals.
- **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**
  Space out instruments to radiate heat sufficiently. Use a cooling fan to keep the operating temperature of the module within specifications.
  AD-4430R is covered with a protective transparent-resin cover. After the installation is complete, take off the protective cover prior to turning on the AD-4430R. 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.

AD-4430R with a protective cover



How to remove the protective cover



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

2. Outline and Features

The AD-4430R has the following features.

- The AD-4430R is a weighing indicator that amplifies electrical signals from a load cell, converts it to digital data and displays it as a weight value.

- This indicator has the following performance:
  - Input sensitivity ····· 0.15 μV/d (d = minimum division)
  - Display resolution ····· 99,999 d maximum
  - Sampling rate ····· 1000 times/second
  - Input voltage range ····· −35 to +35 mV (−7 to +7 mV/V)

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

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

- 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.

- 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.

- 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.

- Digital span mode
  Calibration is performed by numerical input of the load cell output (mV/V). Set the values of C-F 17, C-F 18, C-F 19 in the calibration function.

- Digital filter

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

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

3. Specifications

3.1. Analog Parts (Load cell Input, A/D Converter)

Input sensitivity		0.15 μV/d or greater (d = minimum division)
Input voltage range		−35 mV to +35 mV (−7 to +7 mV/V)
Zero range		−35 mV to +35 mV (−7 to +7 mV/V)
Load cell excitation voltage		5 VDC ±5%, 60 mA with remote sense capability (Maximum 4 x 350 Ω load cells)
Temperature coefficient	Zero	±0.02 μV/°C Typ. ±0.1 μV/°C max
	Span	±3 ppm/°C Typ. ±15 ppm/°C max
Non-Linearity		0.005% of full scale
A/D conversion method		Delta-sigma method
A/D resolution count		Approximately 16,000,000 counts
Display resolution		99,999 d max. (d = minimum division) within 20,000 d is recommended
Sampling rate		1000 times/second

3.2. Digital Parts (Display and Keys)

Display element	Measurement display	5−digit 7−segment red LED 5.3mm Character height, 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. (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, **X**: Preset function selected at FnC04 in the basic function.	
Key switches	**F/ESC**, ➔ (ZERO), ↑ (TARE), **ENT**	

3.3. General

3.3.1. Interface

Interface	Specification	Connector
Load cell input	Refer to **"3.1. Analog Parts (Load cell Input, A/D Converter)"**	Spring clamp terminal board 7 pins
RS−485	Refer to **"6.1. RS−485"**	Power clamp connector (3M)
Control I/O	Refer to **"6.2. Control I/O"**	MDR connector 20 pins female Connector is not included
Standard serial output	Refer to **"6.3. Standard Serial Output (Current Loop)"**	
USB	USB 2.0 (High-speed)	Micro−B Cable is not included

3.3.2. Weighing Functions

Zero operation	Set the gross weight to zero by pressing the [→(ZERO)] key. Disable or enable operation when unstable. Zero value is stored in nonvolatile memory. Zero adjustable range: Can be set optionally in the range of 1 to 100% of the maximum capacity. 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. Zero tracking time: 0.0 to 5.0 sec. Can be set optionally within the range 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). 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. Detection time: 0.0 to 9.9 sec. Can be set optionally within the range 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. Select from normal hold, peak hold, and average hold.
Flow rate calculation	Calculate mass change value per unit time.

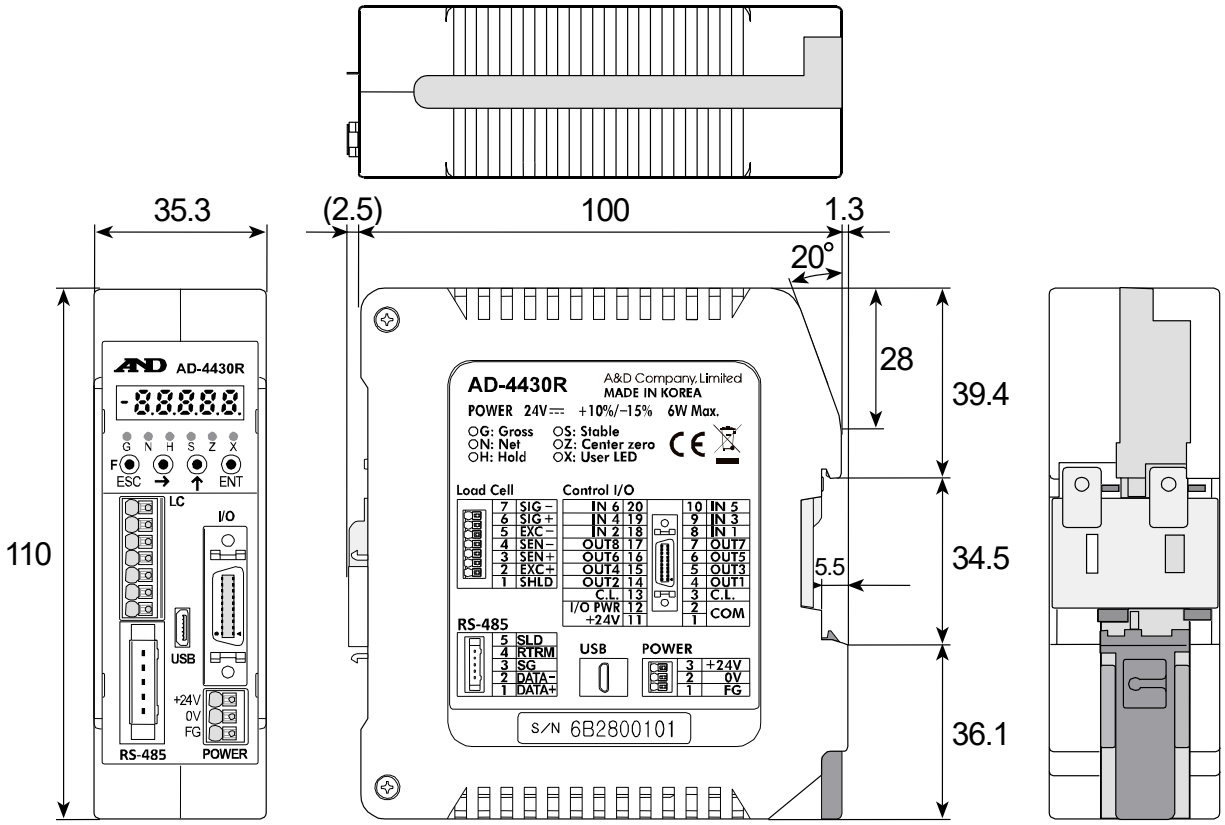
3.3.3. General

Data memory backup	Backed up using by nonvolatile memory. (More than 10 years)
Power source	DC 24 V, +10%, −15%
Power consumption	Approximately 6 W
Operating temperature Operating humidity	−10 °C to +50 °C, 85 %RH or less (no condensation)
Installation method	DIN rail mount
Weight	Approximately 200 g

3.3.4. Accessories

Item	Quantity	Model name
RS−485 connector	1	Power clamp wire mount socket, 3M, 35505−6200−A00 GF

3.3.5. Dimensions



Unit : mm

Illustration 1 Dimensions

3.4. Front Panel and Rear Panel

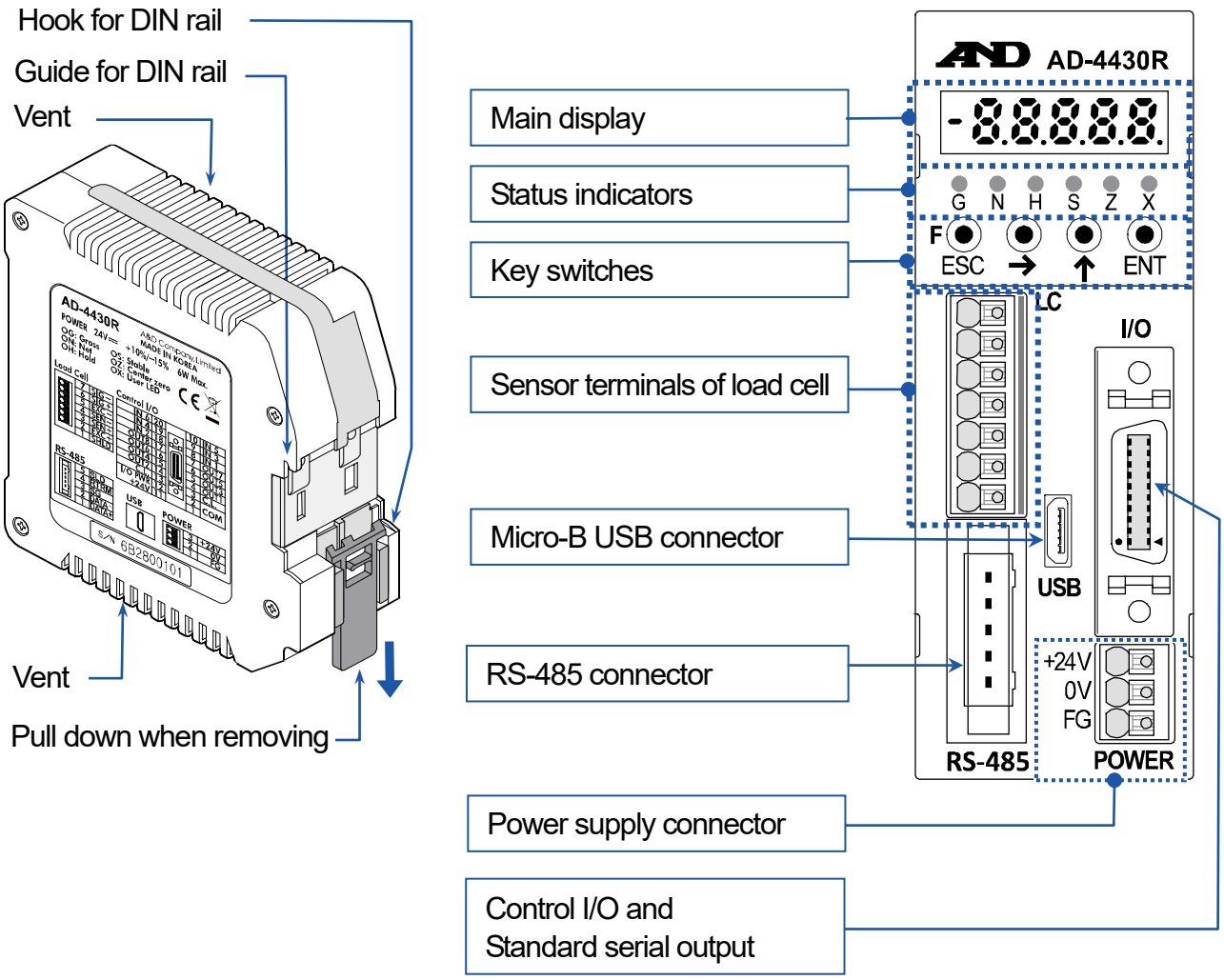


Illustration 2 Front panel & rear panel

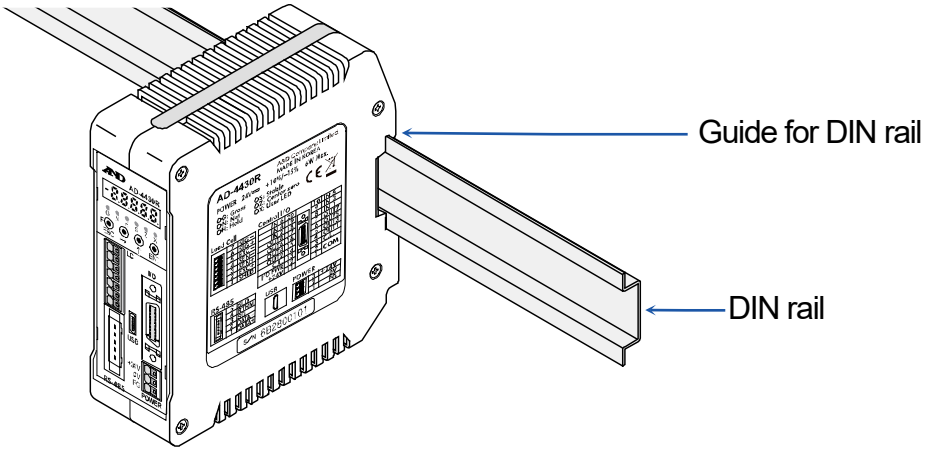


Illustration 3 Mounting the module

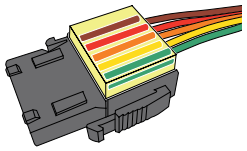
3.5. Procedure for Connecting the RS-485 Cable

Specifications of conforming cable

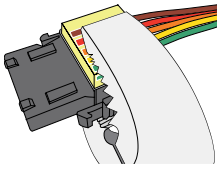
Wire outside diameter	ϕ1.6 ~ 2.0mm
Wire size	AWG#20 (0.5mm^2)

Procedure for connecting the cable.

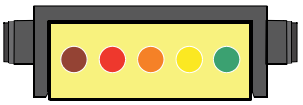
Step 1 Do not strip the cable jacket.
Insert the cable all the way into the yellow cover.



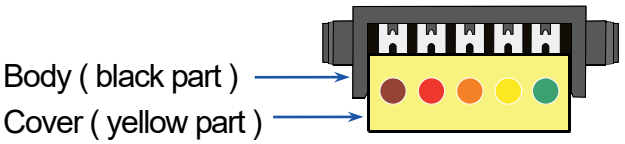
Step 2 Crimp the cover on the body using pliers from the side of the connector as shown in the illustration to the right.



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

4. Installation

This section describes the power terminal, load cell cable and how to connect them and the installation environment. Refer to each chapter for external I/O.

4.1. Conditions to Install the Module

- ❑ The module is a precision electronic instrument. Handle it carefully.
- ❑ The operating temperature is −10°C to +50°C.
- ❑ Do not install the module in direct sunlight.

4.2. Power Supply

⚠CAUTION
Ground the module to prevent electrical shock or indicator malfunction. 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 load cell and load cell 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).

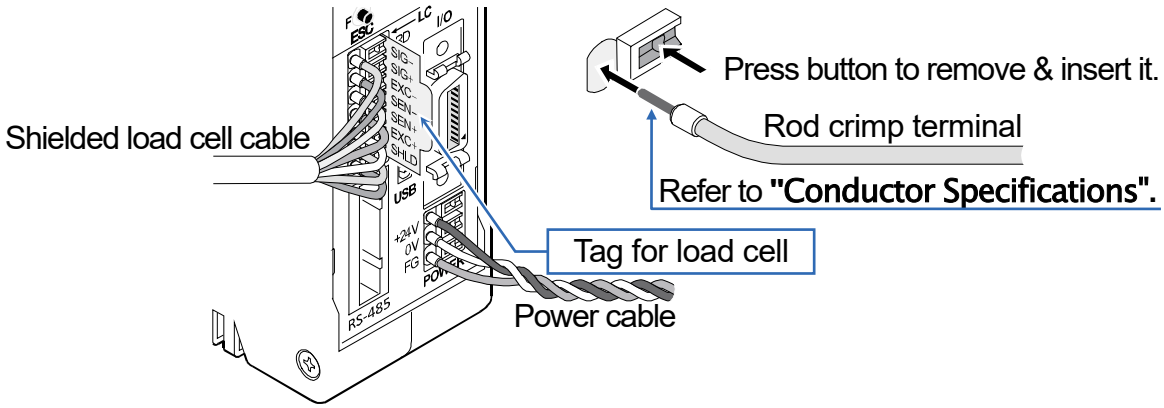


Illustration 4 Cables

The Conductor Specifications

Clamp range (typ.)		0.13 mm²	to	1.5 mm²
AWG		AWG24	—	AWG16
Solder plated wire		0.2 mm²	to	1.5 mm²
Twisted wire		0.2 mm²	to	1.5 mm²
Rod crimp terminal	DIN 46228 Part1	0.25 mm²	to	1.5 mm²
Rod crimp terminal with color	DIN 46228 Part4	0.25 mm²	to	0.75 mm²
Lead length		8 mm		

4.3. Connecting Load Cell Cable

Load Cell

- The cable that extends from the load cell is a part of the load cell. Do not cut the load cell cable even if there is excess cable.
- Bundle the load cell cable if there is excess cable.
- The load cell is compensated for temperature change including the resistance value of this cable.
- Connect the shield wire to a point of the shield terminal of the AD-4430R and do not ground it. If there are multiple ground points, noise may occur due to a ground loop.

Remote Sensing (Compensation for length of the extension cable)

- The AD-4430R is equipped with a compensation function that monitors drops in the excitation voltage and rectifies the A/D conversion value.
- Use a 6-wire extension cable to use the remote sensing function for the load cell.
- Connect terminals of SEN+ and SEN−. If they are not connected, measurements cannot be performed.
- When the 4-wire cable is used, connect the terminals of EXC+ and SEN+ and the terminals of EXC− and SEN− at the load cell terminal of the AD-4430R.

Load Cell Cable

- Load cell cables should have high electrical insulation and shield performance.
- Use shielded cables with the insulator that is made of materials with high insulation resistance such as Teflon and polyethylene. **NOTE: Teflon is a registered trademark of DuPont.**
- We recommend using the load cell extension cable produced by A&D Company, Limited when using it.

  AX-KO162-5M to 100M (5m to 100m)

  Cable diameter ..... ϕ9 mm

  Cross-sectional area of the conducting wire ..... 0.5 mm^2, 6-wire cable equipped

Terminal No.	Terminal name & Function of the AD-4430R	
7	SIG−	Load cell input (−)
6	SIG+	Load cell input (+)
5	EXC−	Load cell excitation voltage (−)
4	SEN−	Sensing input (−)
3	SEN+	Sensing input (+)
2	EXC+	Load cell excitation voltage (+)
1	SHLD	Shield

6-wire connection to load cell (Recommended)

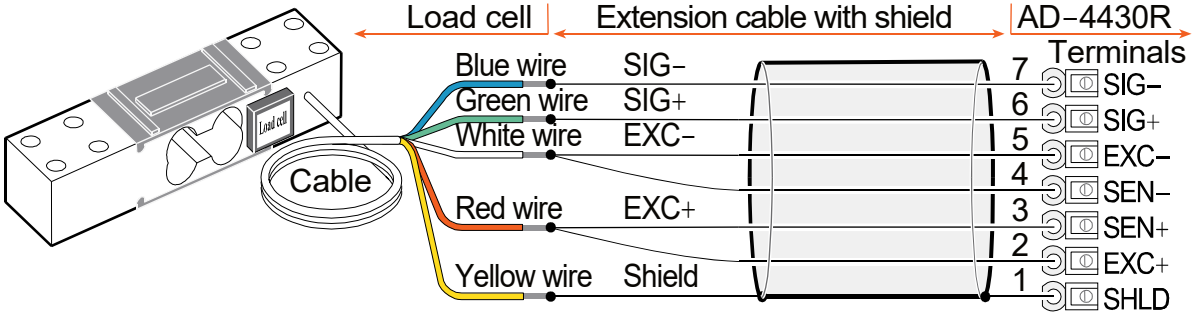
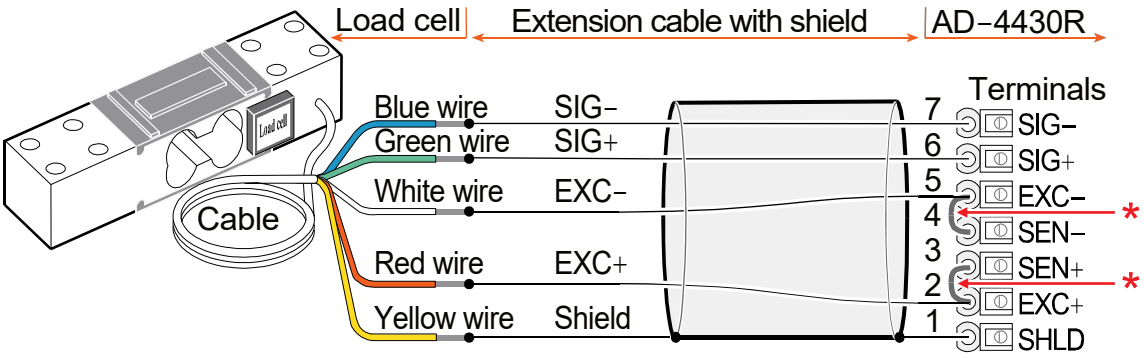
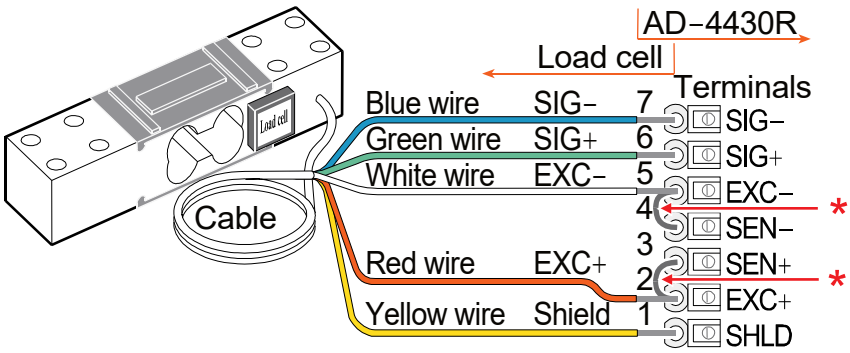


Illustration 5 Load cell connections (6-wire connection)

4-wire connection to load cell



Direct connection to load cell



* Be sure to connect terminals between EXC+ and SEN+ , SEN- and EXC-.

Illustration 6 Load cell connections (4-wire connection & direct connection)

4.4. Checking the Load Cell Cable

When the load cell connection is complete, perform a connection check using the following procedure.

- ❑ Perform a visual check to ensure that the wiring is correct.
- ❑ Turn the module on.
- ❑ Enter weighing mode.
- ❑ Enter check mode and check the load cell output value.
  Refer to **"7.2. Check Mode"** to enter to A/D check mode.
- ❑ Confirm that the displayed load cell output value matches the specified value. Normally the displayed value will be the load cell rated output value or less.
- ❑ If an error occurs, refer to **"7.4. Verifying Load Cell Connections (** DIAGNOS **)"** or **"7.5. Verifying Load Cell Connections Using Multimeter".**

5. Operations

5.1. General Functions

5.1.1. 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

5.1.2. 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.

5.1.3. 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-F 10 (Tare and zero when unstable): Enable or disable tare and zero operation when unstable.
    0: Disable both functions 1: Enable both functions
  - C-F 11 (Tare when the gross weight is negative): Enable or disable tare when the gross weight is negative.
    0: Disable tare 1: Enable tare

5.1.4. 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.

5.1.5. 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 AD-4430R 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

5.1.6. 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

5.1.7. 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.

5.1.8. 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

5.1.9. 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

5.1.10. 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 **"5.7.1. Procedure to Store New Parameters".**

5.1.11. Digital Filter 1 and 2 (Fnc05 and Fnc06)

The AD-4430R 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.

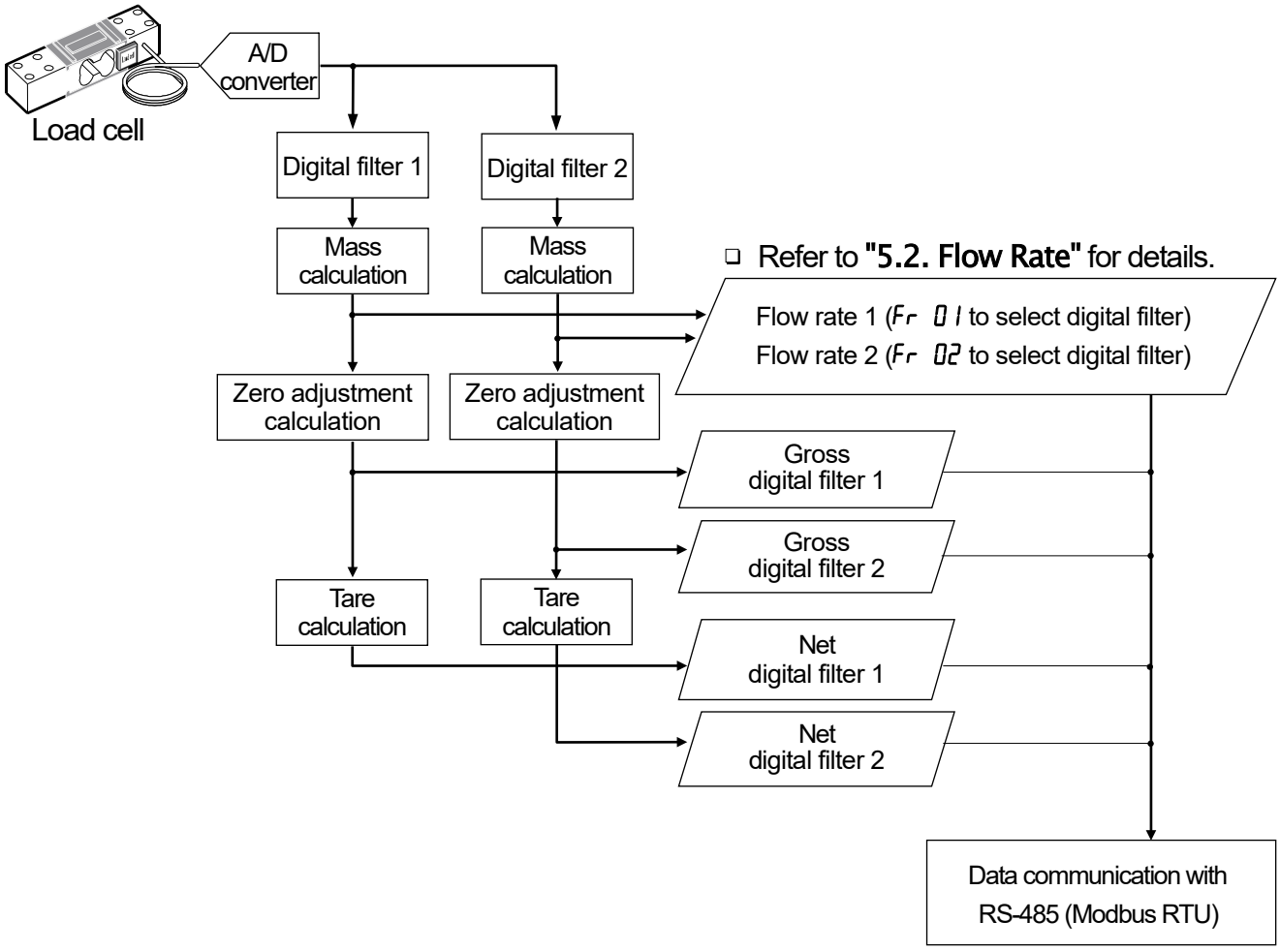
- If the weighing value is unstable, lower the cutoff frequency.
  (Response rate is slow. Resistant to disturbance.)
- To make the response faster, higher the cutoff frequency.
  (Response rate is fast. Susceptible to disturbance.)

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 **"5.7.1. 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.



5.1.12. 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.

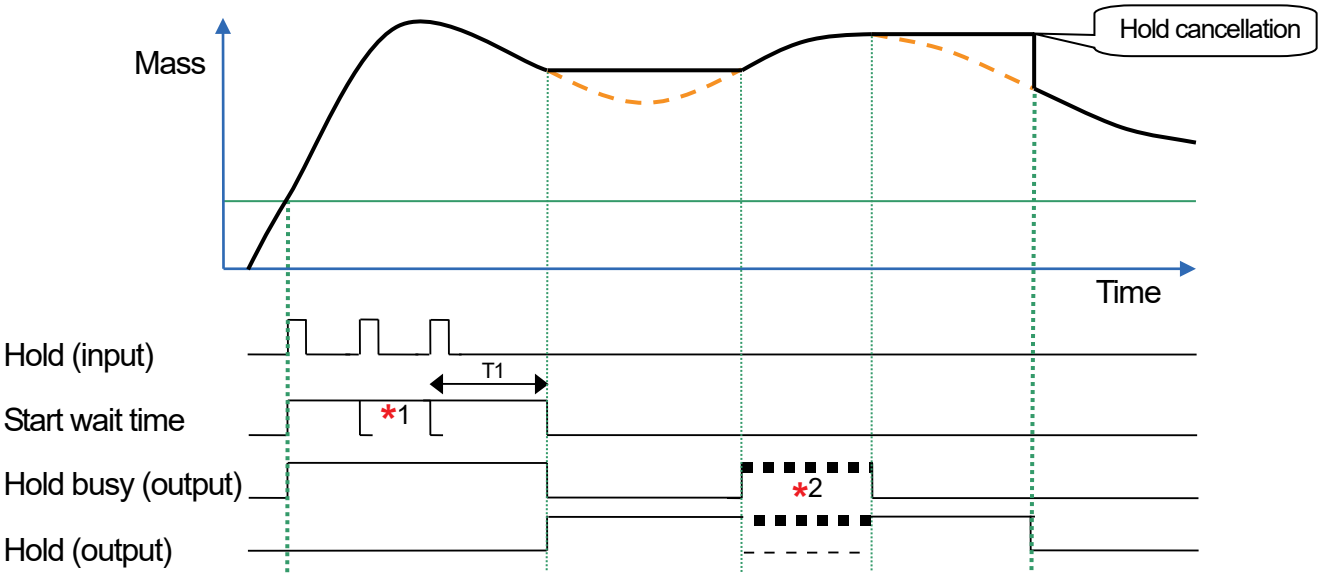
Hold functions are shown below.

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

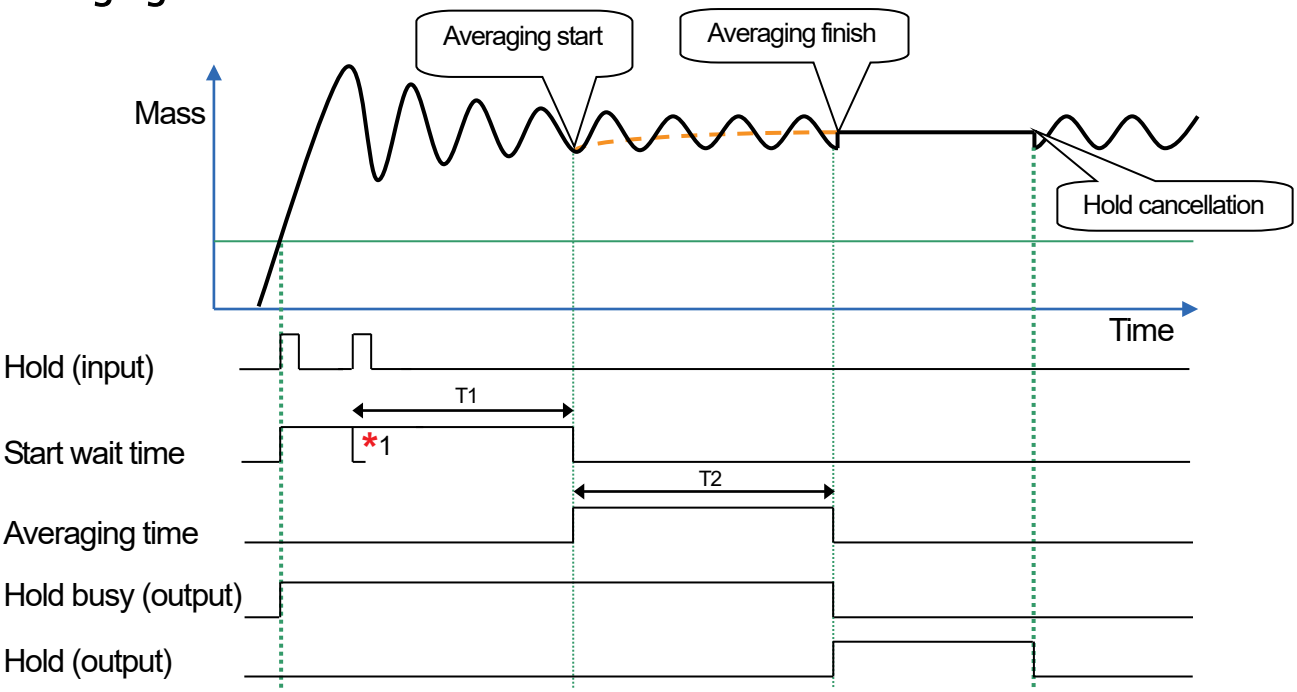


T1 : Time set for the start wait time in HLd02. Scale: 0.01 sec. Range 0.00 to 9.99 sec.

*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 sec. Range 0.00 to 9.99 sec.

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

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

Illustration 7 Peak hold / Averaging hold

5.2. Flow Rate

Flow rate is the movement of mass over time.
AD-4430R 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

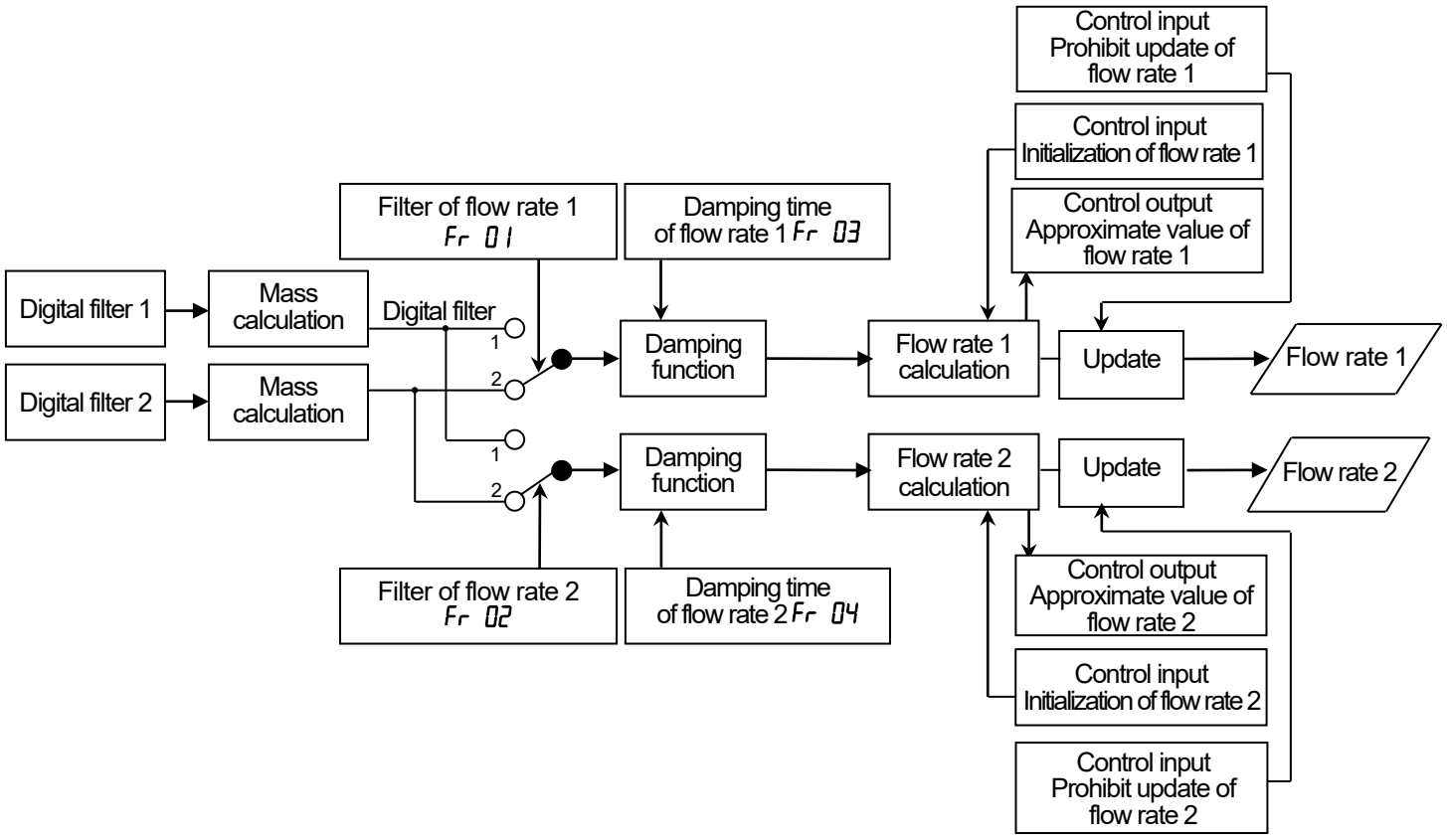
In addition to the digital filters, a damping time can be set to suppress unstable flow rates.
This can be set with the damping time setting which is a moving average time of the weighing values.
Ex. Damping time is 5 secs: moving average is 5 secs

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 sec.

- 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.



5.3. 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	

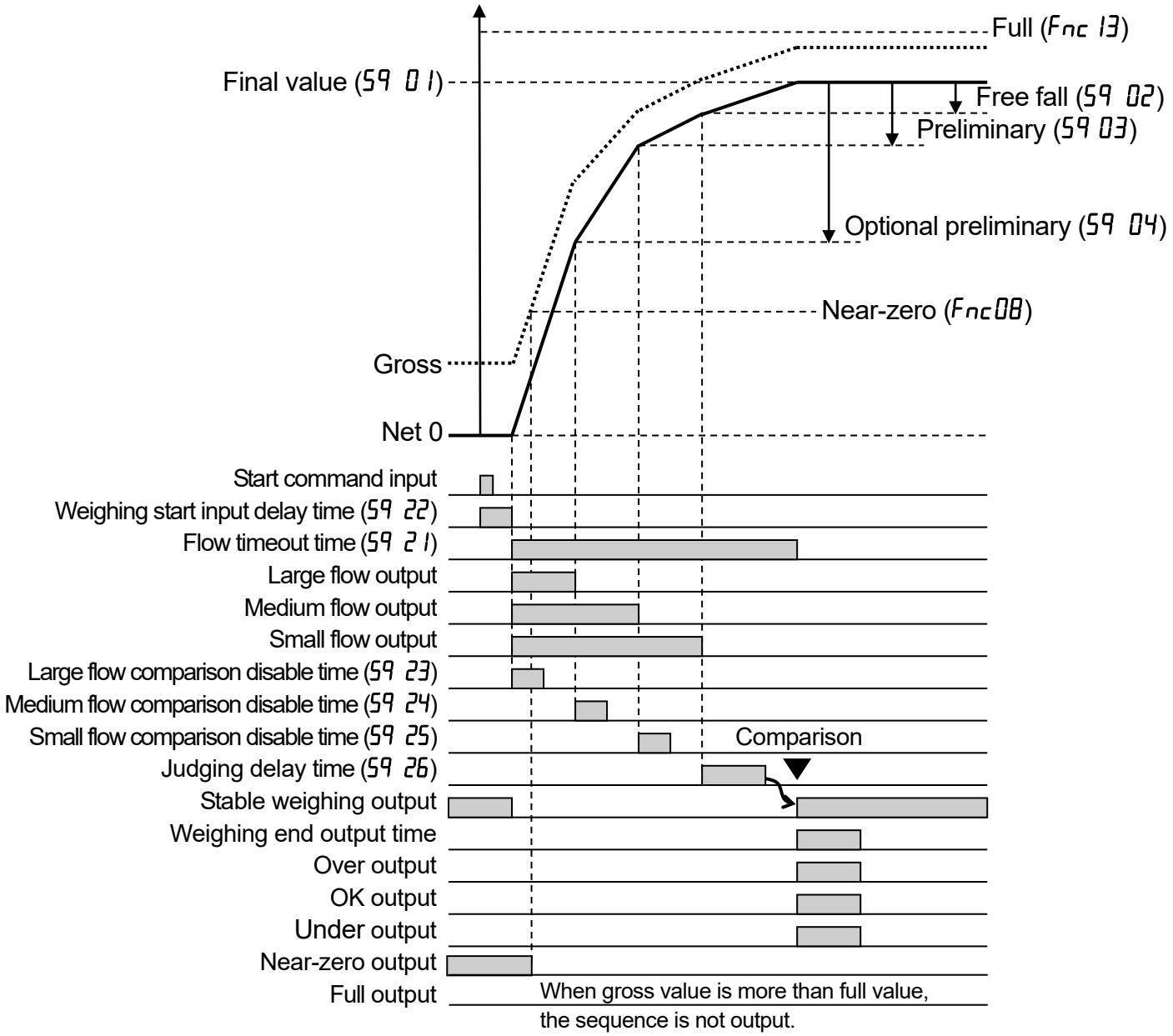
❑ Weighing end means weighing sequence end.

❑ Weighing error means weighing sequence error.

5.3.1. Sequential Weighing

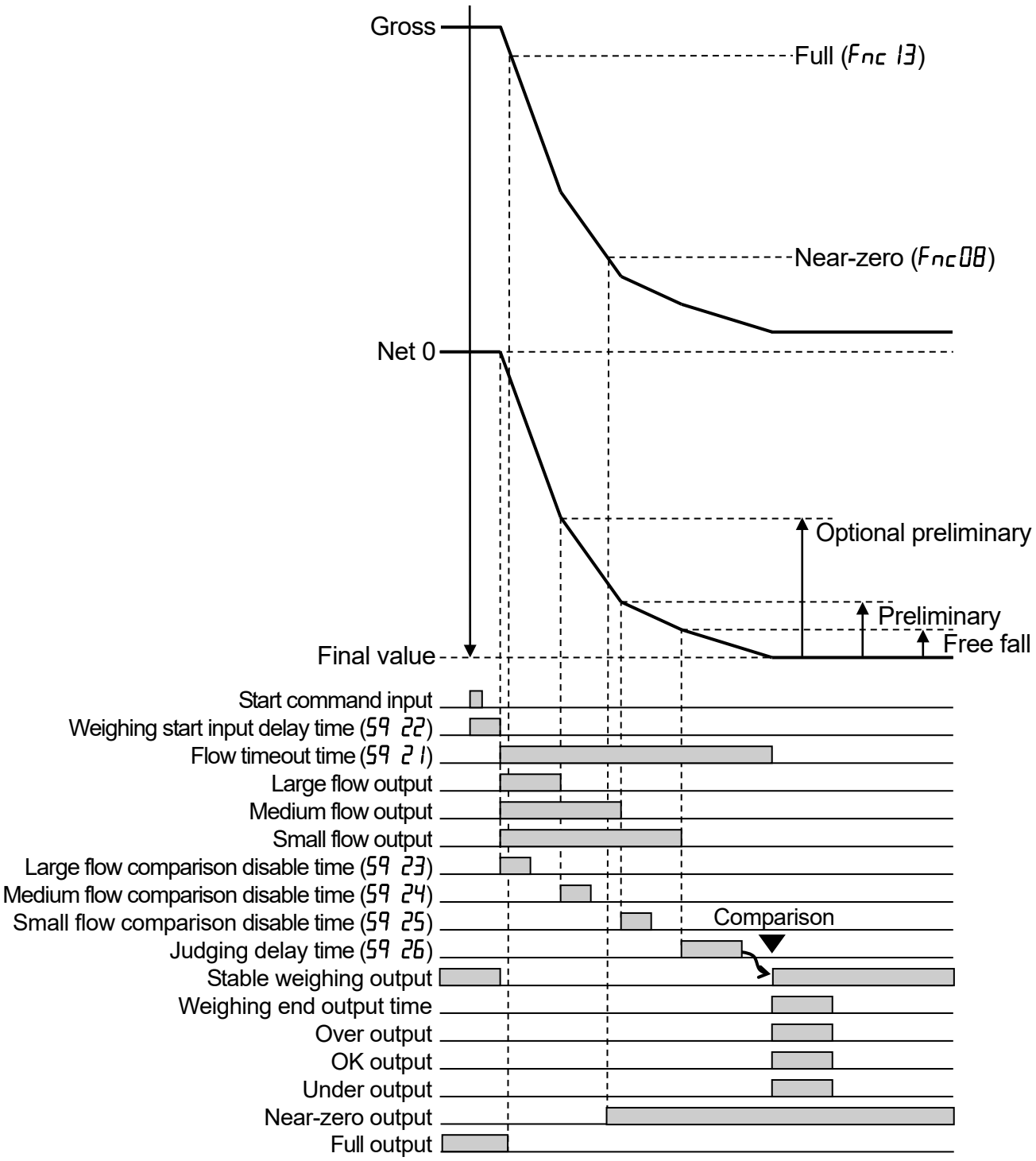
■ **Normal batch sequence**

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	



5.3.2. 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.

5.3.3. 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

5.3.4. 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".

5.3.5. 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.

5.3.6. 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 weighing module and changing weighing materials.

5.3.7. 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".

5.3.8. 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, cement, tar) 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".

5.3.9. Sequence Numbers

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

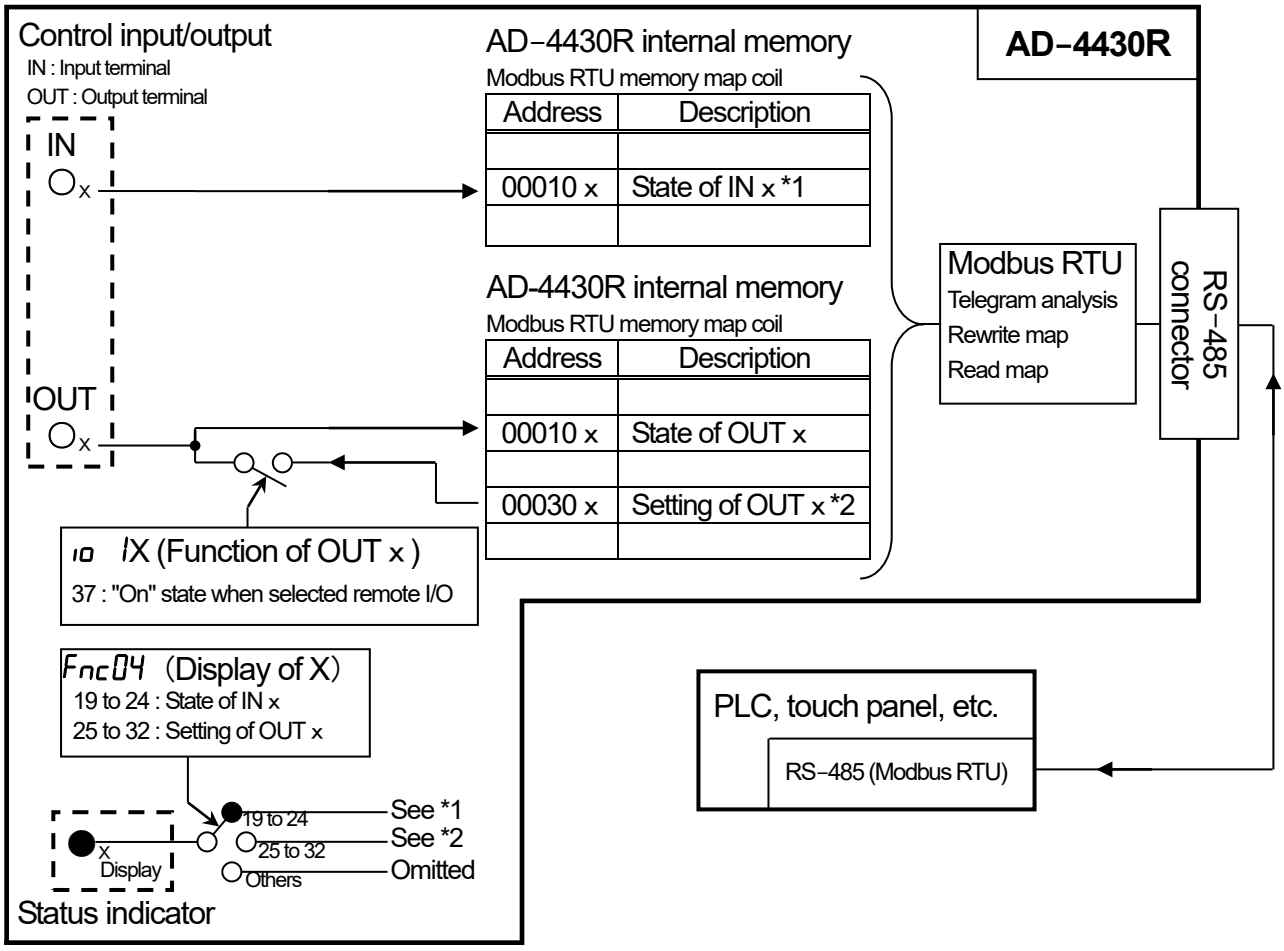
Sequence number	Description
0	Waiting for the weighing start input.
1	Automatic tare
2	Confirming the start condition.
3	During the weighing start input delay, the large, medium and small flow turn ON after checking.
4	Waiting for the large flow comparison disable time.
5	During the large flow, turns 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.

5.4. 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

5.5. State Diagram and Operation Switches

5.5.1. 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.

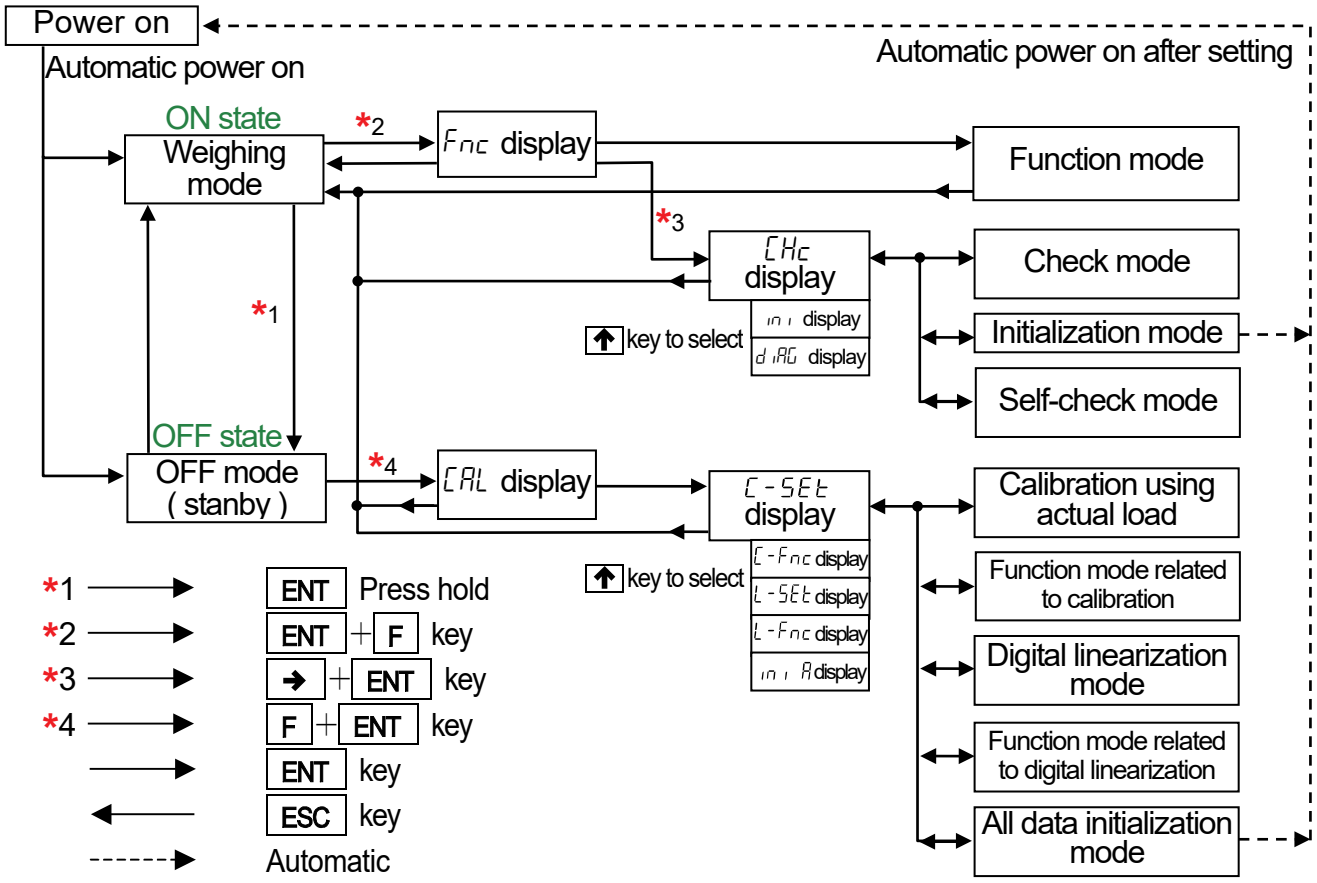


Illustration 8 State diagram

5.5.2. Operation Switches

Key	State	Function and Use
F	Weighing mode	The display toggles between gross and net in factory setting. The function key to select a function or use.
	Setting mode	The ESC key.
→	Weighing mode	The zero key.
	Setting mode	The key to change the selected item or move a flashing figure.
↑	Weighing mode	The tare key.
	Setting mode	The key to select a parameter or increase a number.
ENT	Weighing mode	Hold to turn the module off.
	OFF state (Standby)	The key to turn the module on.
	Setting mode	The key to store new settings.
ESC	Weighing mode	The function key (F key) to selects function or use.
	Setting mode	The return key or escape key.
ENT + F	Weighing mode	Proceed to the function mode from weighing mode.
→ + ENT	Setting mode	Proceed to the check mode from function mode.
F + ENT	OFF state (Standby)	Proceed to the calibration mode from OFF state (Standby).

5.6. 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. ■ Zero calibration: Press ENT key when no load is applied. ■ Span calibration: Enter the calibration weight value and load the calibration weight. 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. ■ Zero input voltage: The numerical input of the load cell output at zero. C-F 17 ■ Span input voltage: The numerical input of the load cell output at span. C-F 18 (Load cell output at full capacity − load cell output at zero) ■ Calibration weight value at span: The numerical input of the calibration weight value corresponding to the span input voltage. C-F 19 (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.

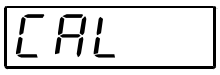
- ❑ All parameters in calibration mode are stored in the nonvolatile memory (FRAM).
- ❑ Actual load calibration and digital span can be performed at the same time.
  Example**:** For the zero calibration, an actual load is used. For the span calibration, the digital span is used.

5.6.1. Calibrating with a Weight (C-SEt)

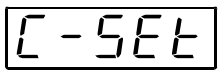
This calibration function is performed using a calibration weight. When performing the calibration for the first time, set C-F01 (Unit), C-F02 (Decimal point position), C-F03 (Minimum division) and C-F04 (Maximum capacity) to values necessary for the calibration.

Note To avoid drift caused by changes in temperature, warm up the indicator for ten minutes or more before performing the calibration with an actual load.

Step 1 In OFF mode (Standby), Press the F + ENT key to enter to calibration mode and display CAL .

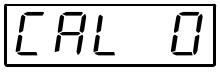


Step 2 Press the ENT key to start the calibration and display C-SEt . To return to weighing mode, press the ESC key.

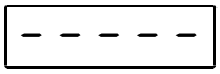


Zero Calibration

Step 3 Press the ENT key to display CAL 0 . If zero calibration is not to be performed, press the ↑ key. To check the current weighing value, press the → key. When pressing the → key again, CAL 0 is displayed.

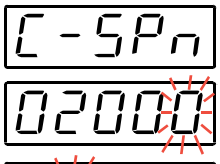


Step 4 Wait for the stabilization (S LED). Press the ENT key. ----- is displayed for approximately two seconds. If span calibration is not performed, press the ESC key twice to return to weighing mode.



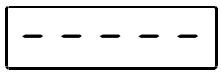
Span Calibration

Step 5 Press the ENT key when C-SPn is displayed. The calibration weight value (the current maximum capacity) is displayed and the least digit of the value blinks. Correct the value using the → and ↑ keys so as to be the value of the calibration weight used. If span calibration is not performed, press the ESC key three times to return to weighing mode.



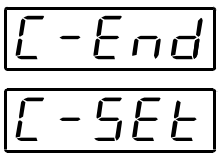
Example

Step 6 Place the calibration weight on the pan. Wait for the stabilization (S LED). Press the ENT key. ----- is displayed for approximately two seconds.



Step 7 C-End is displayed.

Step 8 Press the ESC key. C-SEt is displayed, and the calibration data is stored in the FRAM memory.



Step 9 The current state is the same as that of Step 2. To return to weighing mode, press the ESC key.

- If C Er X is displayed, an error has occurred. Refer to **"5.6.8. Error Codes for Calibration (C Er)"** to take corrective action. **X :** error number.
- The blinking decimal point means that the current value is not the weight value.

5.6.2. 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 **"5.6.1. 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 **"5.6.8. Error Codes for Calibration (C Er)"** for details.
  - 15 : During calibration

5.6.3. 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

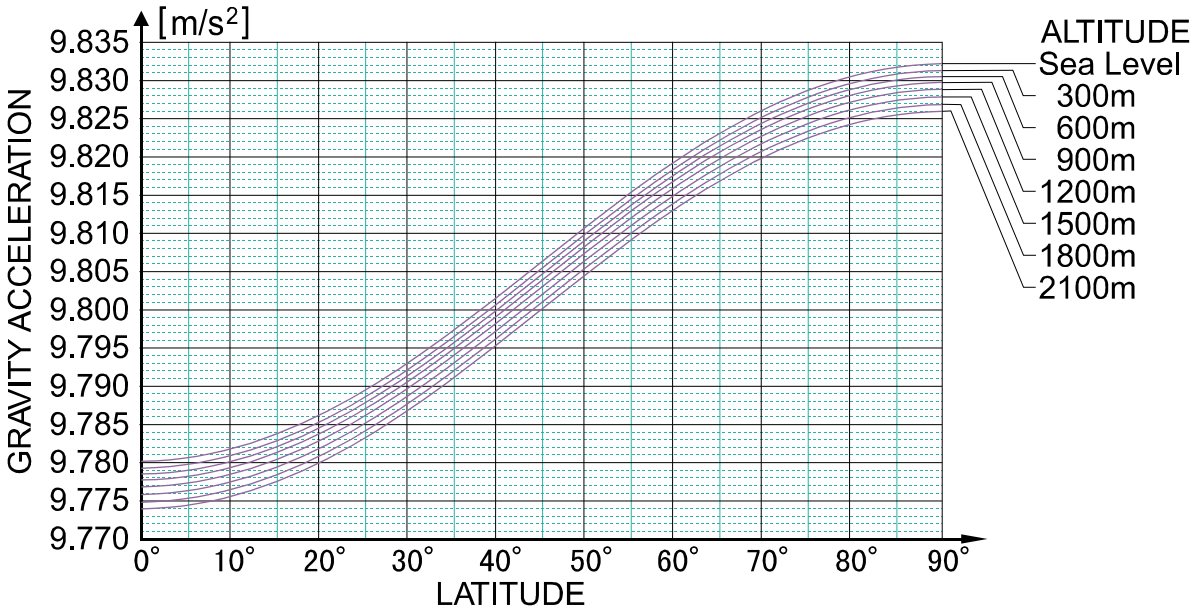


Illustration 9 Gravity acceleration graph

5.6.4. 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.

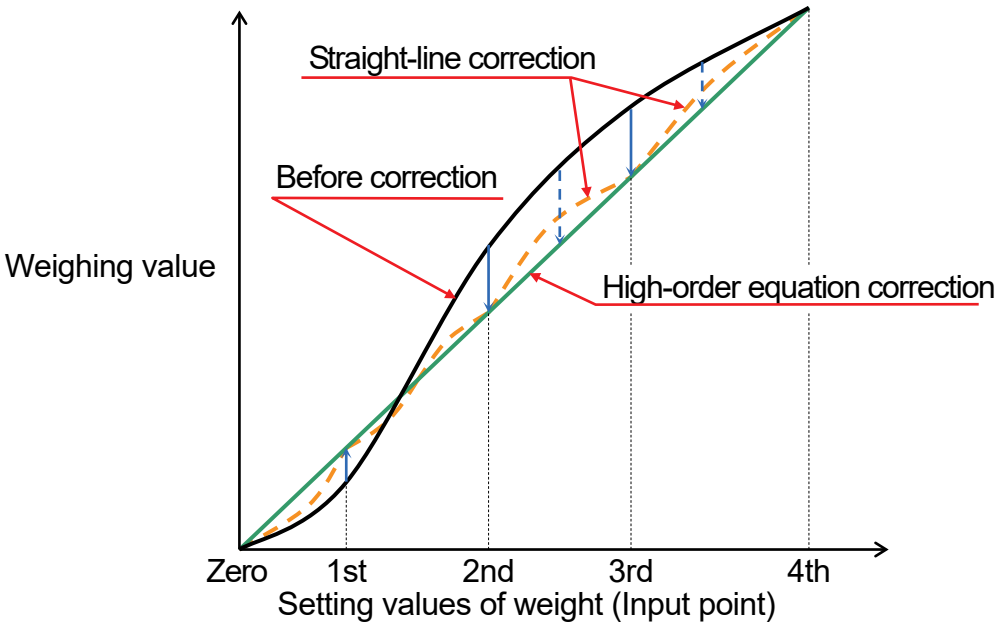


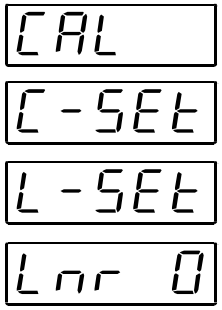
Illustration 10 Digital linearization

5.6.5. Actual Load Linearization Function (L-SEt)

Set the digital linearization by loading/unloading masses.

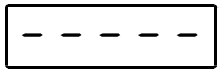
- Warm up the module for at least ten minutes to avoid the effects of temperature drift.
- The input order should proceed from the smallest mass to the largest mass.

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.

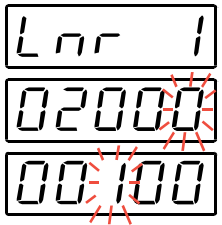


Step 2 [Lnr 0] is displayed.
If monitoring the current weighing value, press the → key. Press the → key again to display [Lnr 0].

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

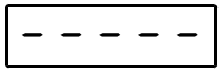


Step 4 [Lnr 1] is displayed.
If you want to check the current weighing value, press the → key. Press the → key again to display [Lnr 1]. Press the **ENT** key. The weight value (the current maximum capacity) is displayed and the smallest digit of the value blinks. Correct the value using the → and ↑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

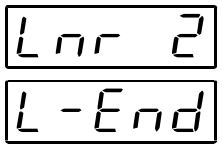


Sample

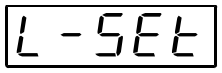
Step 5 Place the weight on the pan. Wait for the stabilization (**S** LED). Press the **ENT** key.
[-----] is displayed for approximately two seconds.



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 **"5.6.8. Error Codes for Calibration (C Er)"** for details.
- The blinking decimal point means that the current value is not the weight value.

5.6.6. 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.

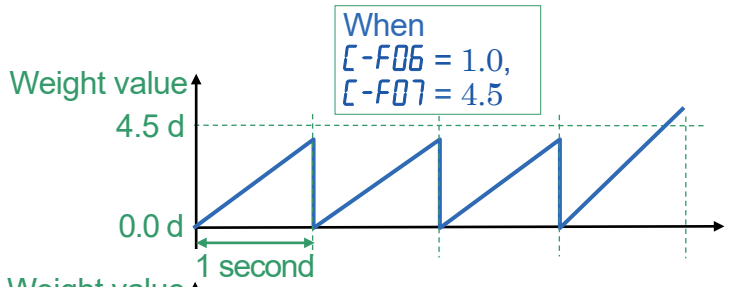
Type	Description of method to change data
Parameter selection	Only the available parameter is displayed and blinks. Select a number using the ↑ key.
Digital input	All the digits are displayed. The digit to be changed blinks. Select a digit using the → key and change the value using the ↑ key.

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.

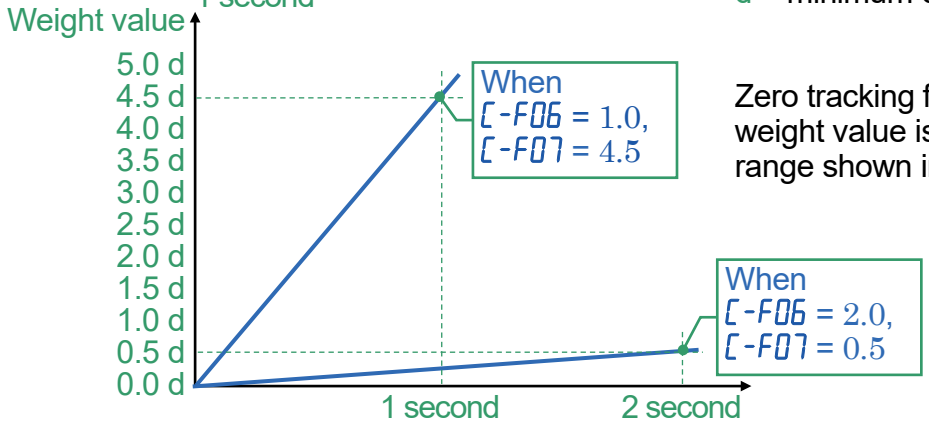
- **The blinking decimal point means that the current value is not the weight value.**
- **If digital input data is out of range, Errdt is displayed, and the data is canceled.**
- **The function code on the next page is used for command of the USB.**

Item Name	Function code	Description, Range and Default value
C-F01 Unit	1001	0 : Disable 1 : g 2 : kg 3 : t 4 : N 5 : kN
C-F02 Decimal point position	1002	Decimal point position of the weighting value 0: 0 1 : 0.0 2 : 0.00 3 : 0.000 4 : 0.0000
C-F03 Minimum division	1003	Minimum division (d) of the weighting value 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). 1 to 70000 to 99999
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. 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. 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. Scale: 0.1 d (minimum division). 0.0 to 9.9



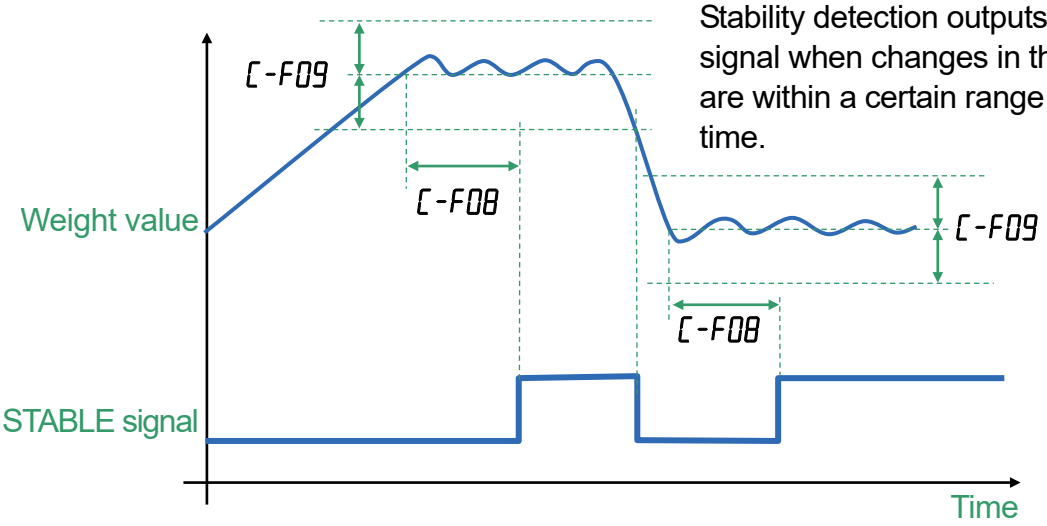
Zero tracking follows the weight value drifting around the zero point and adjusts to display as zero.

d = minimum division = 1 digit

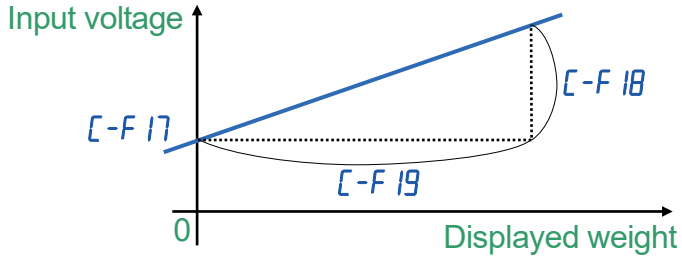


Zero tracking functions when the weight value is drifting within the range shown in the graph.

❑ The function code is used for the USB command.

Item Name	Function code	Description, Range and Default value
C-F08 Stability detection time	1008	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 Stability detection width	1009	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 Tare and zero when unstable	1010	Tare and zero operation when unstable 0: Disable both functions [1]: Enable both functions
C-F11 Tare when the gross weight is negative	1011	Tare when the gross weight is negative. 0: Disable tare [1]: Enable tare
C-F12 Output when out of range and unstable	1012	Standard serial output when the weight value overflows or is unstable. 0: Disable output [1]: Enable output
C-F13 Excessive negative gross weight	1013	To judge when the negative gross weight is exceeded. [1]: Gross weight < -99999 2: Gross weight < Negative maximum capacity 3: Gross weight < -19 d
C-F14 Excessive negative net weight	1014	To judge when the negative net weight is exceeded. [1]: Net weight < -99999 2: Net weight < Negative maximum capacity
C-F15 Clear the zero value	1015	Select whether or not to clear the zero value. 0: Disable [1]: Enable
C-F16 Zero when power is turned on	1016	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. [0]: Disable 1: Enable

Item Name	Function code	Description, Range and Default value
C-F 17 Input voltage at zero	1017	Input voltage from a load cell at zero. Scale: mV/V. This value is determined in zero calibration during the calibration with an actual load. Scale: 0.0001 mV/V. −7.0000 to [0.0000] to 7.0000
C-F 18 Span input voltage	1018	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 [3.2000] to 9.9999
C-F 19 Span input voltage weight	1019	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 [32000] to 99999



- ❑ **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 Gravity acceleration of the calibration location	1026	Gravity acceleration of the place where the scale is calibrated. Scale: 0.0001 m/s^2. 9.7500 to [9.8000] to 9.8500
C-F27 Gravity acceleration of usage location	1027	Gravity acceleration of the place where the scale is being used. Scale: 0.0001 m/s^2. 9.7500 to [9.8000] to 9.8500
C-F28 Disable hold function	1028	[0]: Enable 1: Disable

5.6.7. 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 99999
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 99999
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 99999
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 99999
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

5.6.8. 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.

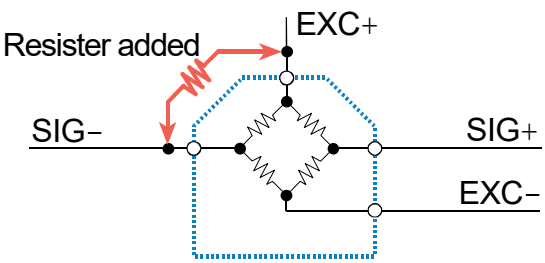
Calibration errors and remedies

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.	Check the load cell rating and connection. When nothing is wrong with the rating and connection, adjust the load cell output as described in the next section. When the load cell or A/D converter may be the cause of error, confirm this by using check mode.
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 load cell sensitivity is not sufficient.	Use a load cell with higher sensitivity or make the minimum division greater.
C Er7	The voltage at span calibration is less than the voltage at the zero point.	Check the load cell connection.
C Er8	The load cell output voltage is too high when the mass of maximum capacity is weighed.	Use a load cell with a greater rating or make the maximum capacity smaller.

5.6.9. Adjustment of the Load Cell Output

Add a resistor in the way shown below to adjust the load cell output.
Use a resistor with a high resistance value and a low temperature coefficient.

C Er2
When excessive in the positive direction.



C Er3
When excessive in the negative direction.

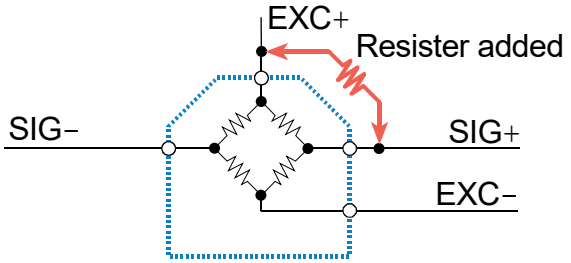


Illustration 11 Load cell output adjustment

- **Because the zero point of the module has a wide adjustable range, correcting the output of a normal load cell is hardly ever required.**
  Before output correction is carried out, check load cells (for deformation, wiring mistakes, contact with anything, or model selection etc.) and connections.

5.7. 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.

5.7.1. 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
SQ F	Sequence function
Fr F	Flow rate function
io F	Control I/O function
CL F	Standard serial output function
rS 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. Select a number using the ↑ key.
Digital input	All the digits are displayed. The digit to be changed blinks. Select the digit using the → key. 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.**

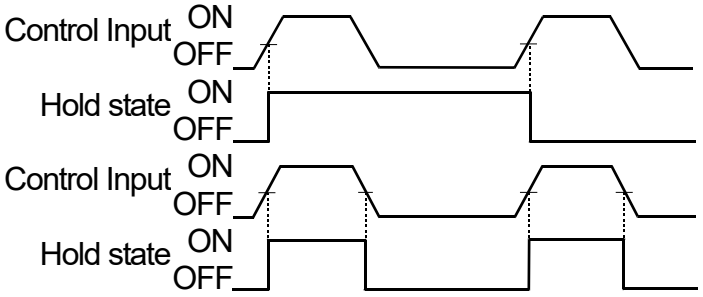
5.7.2. Basic Functions (Fnc F)

Item Function code Name	Description, Range and Default value
Fnc01 1201 Key switch disable	Each digit of the setting corresponds to a key switch. Only available in weighing mode. Key assignment to each binary digit. 0: Permission 1: Prohibition 4th: ESC 3rd: → 2nd: ↑ 1st: ENT 0000 to 1111
Fnc02 1202 F key	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
Fnc03 1203 Display update rate	1: 20 times/sec. 2: 10 times/sec. 3: 5 times/sec.
Fnc04 1204 x display	0: None 1: Zero tracking in progress 2: Alarm 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 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
Fnc05 1205 Digital filter 1	Selects a cutoff frequency. 0: None 1: 100.0 Hz 2: 70.0 Hz 3: 56.0 Hz 4: 40.0 Hz 5: 28.0 Hz 6: 20.0 Hz 7: 14.0 Hz 8: 10.0 Hz 9: 7.0 Hz 10: 5.6 Hz 11: 4.0 Hz 12: 2.8 Hz 13: 2.0 Hz 14: 1.4 Hz 15: 1.0 Hz 16: 0.7 Hz
Fnc06 1206 Digital filter 2	Selects a cutoff frequency. 0: None 1: 100.0 Hz 2: 70.0 Hz 3: 56.0 Hz 4: 40.0 Hz 5: 28.0 Hz 6: 20.0 Hz 7: 14.0 Hz 8: 10.0 Hz 9: 7.0 Hz 10: 5.6 Hz 11: 4.0 Hz 12: 2.8 Hz 13: 2.0 Hz 14: 1.4 Hz 15: 1.0 Hz 16: 0.7 Hz 17: 0.56 Hz 18: 0.40 Hz 19: 0.28 Hz 20: 0.20 Hz 21: 0.14 Hz 22: 0.10 Hz 23: 0.07 Hz
Fnc07 1207 Hold	1: Normal hold 2: Peak hold 3: Averaging hold
Fnc08 1208 Near-zero	Decimal point position depends on C-F02 (Decimal point position). −99999 to 10 to 99999

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

❑ The function code is used for the USB command.

5.7.3. 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. Scale: 0.01 seconds. 0.00 to 9.99
HLd02 1302 Start wait time	Waiting time to commence a hold or average. Scale: 0.01 seconds. 0.00 to 9.99
HLd03 1303 Automatic start condition	The condition to commence a hold or average. 0: Disable 2 : Above the near-zero 1: Above the near-zero and stable
HLd04 1304 Release using control input	Release when control input of the hold terminal is falling. 0: Do not release 1: Release 
HLd05 1305 Release time	Release after a set amount of time has passed. 0.00 is not averaged. 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. The decimal point position depends on C-F02 (Decimal point position). 0 to 99999
HLd07 1307 Release at near-zero	Release when the weighing value is in the near-zero. 0 : Do not release 1 : Release

5.7.4. Weighing Sequence Functions (59 F)

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

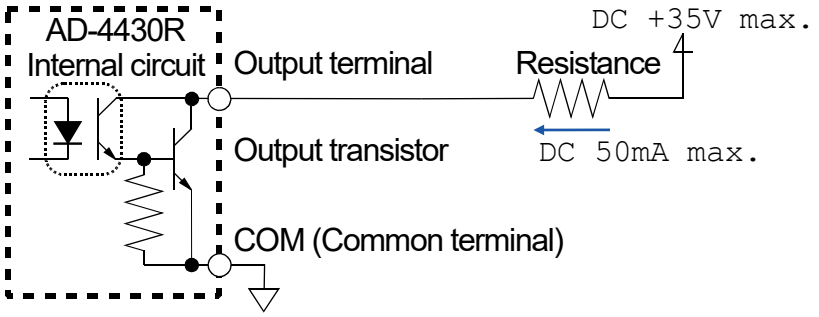
Item Name	Function code	Description, Range and [Default value]
59 23 Large flow comparison disable time	1423	Time for preventing the gate from malfunctioning due to vibration when opening and closing the gate. Scale: 0.1 sec. [0.0] to 60.0
59 24 Medium flow comparison disable time	1424	
59 25 Small flow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

5.7.5. Flow Rate Functions (Fr F)

Item Name	Function code	Description, Range and [Default value]
Fr 01 Filter of flow rate 1	1901	1 : Digital filter 1 [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 rates. The higher value setting, the less changes. Scale: 1 sec. 1 to [5] to 1000
Fr 04 Damping time for flow rate 2	1904	
Fr 05 +/- flow rate 1	1905	[0] : according to calculation 1 : interchange +/- 2 : absolute value
Fr 06 +/- flow rate 2	1906	

5.7.6. Control I/O Functions (io F)

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

	Item Name	Function code	Description, Range and Default value
OUT	io 21 OUT1 Logic	1621	1 : Inverting output If data is "0" level, the output transistor turns ON. 2 : Non-inverting output If data is "1" level, the output transistor turns 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	

5.7.7. 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 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

5.7.8. RS-485 Functions (rS F)

Item Name	Function code	Description, Range and Default value
rS 02 Communication mode	2102	5 : Modbus RTU 6 : Interval output at 100 times/sec. 7 : Interval output at 200 times/sec. 8 : Interval output at 500 times/sec.
rS 03 Baud rate	2103	5 : 9600 bps 7 : 38400 bps 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

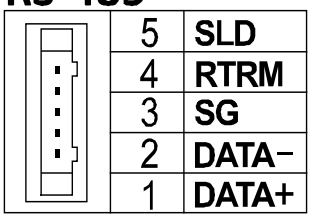
6. Interface

6.1. 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 (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

AD-4430R is a slave device of the Modbus RTU. Refer to **"6.5. Modbus RTU Data Address".**

Interval output

Weighing display value is output periodically.

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

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

6.1.1. 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 "**5.6.8. Error Codes for Calibration (E r)**"
Weighing display error	5	N/A	0	
Verification of the load cell connections error	6		1 to 255	Refer to the error code in **"7.4.5. Display and Output of Verification"**

6.1.2. 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 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 F n c 0 4	
400010. 00		Reserved internally	0 fixed.

6.1.3. 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 **"5.6.8. Error Codes for Calibration (E r)"** for details.
15	Internal write cycle	Writing in the nonvolatile memory.
Other	None	Not used.

6.1.4. 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.

6.2. 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)

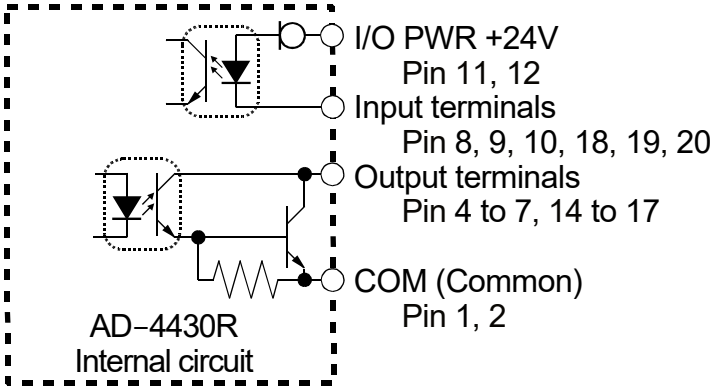
Input circuit type	No-voltage contact input (Photo coupler)
Input open voltage	According to use
OFF current	0.1 mA max.
ON current	2.7 mA min.
Input threshold voltage	2 V

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		



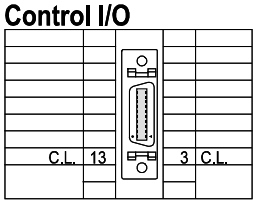
- **Assigning functions to terminals**
  - Assign functions to these input terminals : io 01 (IN1 function) to io 06 (IN6 function)
  - Assign functions to these output terminals : io 11 (OUT1 function) to io 18 (OUT8 function)
  - Assign logic to these output terminals : io 21 (OUT1 logic) to io 28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

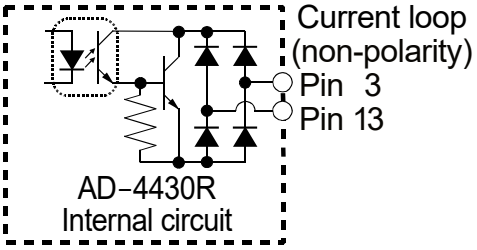
6.3. Standard Serial Output (Current Loop)

- 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 AD-4430R 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

Control I/O





6.3.1. 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	k	g	CR	LF

Item	ASCII code	Hexadecimal	Description
Header 1	ST	[53 54]	**St**able
	US	[55 53]	**Un**stable
	OL	[4F 4C]	**O**ver**l**oad
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
Unit (6 types)	SP SP	[20 20]	Not used
	SP g	[20 67]	g (gram)
	kg	[6B 67]	kg (kilogram)
	SP t	[20 74]	t (ton)
	SP N	[20 4E]	N
	k N	[6B 4E]	kN

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	k	g	CR	LF	Header 2 [GS]
Net	S	T	,	N	T	,	+	0	0	1	0	0	0	0	k	g	CR	LF	Header 2 [NT]
Tare	S	T	,	T	R	,	+	0	0	0	2	3	4	5	k	g	CR	LF	Header 2 [TR]
Including "."	S	T	,	G	S	,	+	0	1	2	3	.	4	5	k	g	CR	LF	Numerical part [.]
+Over	O	L	,	G	S	,	+	SP	SP	SP	SP	.	SP	SP	k	g	CR	LF	Header 1 [OL]
−Over	O	L	,	G	S	,	−	SP	SP	SP	SP	.	SP	SP	k	g	CR	LF	Header 1 [OL], Polarity [−]
Unstable	U	S	,	G	S	,	+	0	1	2	3	.	4	5	k	g	CR	LF	Header 1 [US]
Output data	O	L	,	G	S	,	+	SP	SP	SP	SP	.	SP	SP	k	g	CR	LF	Same as +Over

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

6.3.2. 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. 1. Weighing mode (59 07) = 0 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. Select "Normal hold (1)" in FnC07 Hold function for the setting. 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. 2. Weighing mode (59 07) = 1 or more (When batch weighing is used) 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.

6.4. 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.

6.4.1. Format

Monitoring Command

Function code (4 figures) Terminator

Example of the near-zero function (FnC08)

Command	1	2	0	8	CR	LF

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

Response	1	2	0	8	,	+	0	0	0	0	1	0	CR	LF

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

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

Response	1	2	0	8	,	+	0	0	0	0	1	0	CR	LF

- 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.

6.4.2. 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.

6.4.3. 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.

6.4.4. 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

6.4.5. 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

6.5. 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	

Data Address (Coil)	R/W	Item	Description
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		Gross (Digital filter 2)	
400045 - 400046		Net (Digital filter 2)	
400047 - 400048		Gross count (Digital filter 1)	
400049 - 400050		Net count (Digital filter 1)	
400051 - 400052		Tare count	
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 **"5.3.9. Sequence Number"** for details.
*2 : Refer to **"6.1.1. Error Code of the Modbus RTU (Data Address : 400065** – 400068)**"** for details.
*3 : Refer to **"6.1.2. Bit Address of Status Indicators (Data Address : 400009** – 400010)**"** for details.
*4 : Refer to **"6.1.3. 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	

7. Maintenance

7.1. 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 can not 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 **"5.6.8. Error Codes for Calibration (C Er)".** x: error number
Errdt	The setting value is out of range.	Check the setting value.

7.2. Check Mode

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

7.2.1. 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.

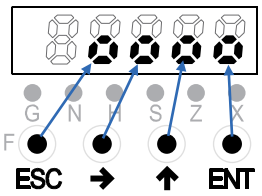
Step 2 Press the ENT key while holding the ➔ key (➔ + ENT) to display CHc in check mode. Press the ENT key to display the check item.

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 (Load cell 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)

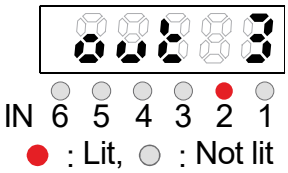
7.2.2. Verifying the Switch Operation

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



7.2.3. 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.



7.2.4. 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.

7.2.5. Checking the RS-485 Output

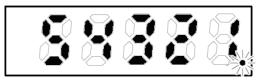
Test data "ST,GS,+00000.0kg<CR><LF>" is output using a preset baud rate, parity and stop bit length every time the ENT key is pressed.

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

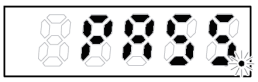
- For numbers with a decimal point, the figure before the decimal point is output. For instance of 123.4, only 123 is displayed.

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

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

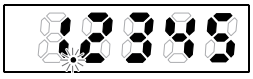


Example 3: There is no figure. "ABC<CR><LF>"



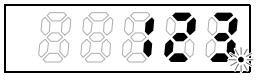
7.2.6. Monitoring the A/D Converter (for Load Cell Output)

The voltage output rate of the load cell 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 load cell damage or connection error may occur. Refer to **"7.5. Verifying Load Cell Connections Using Multimeter"**.



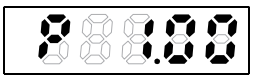
7.2.7. Monitoring the Internal Value

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



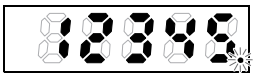
7.2.8. Monitoring the Program Version

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



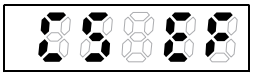
7.2.9. Monitoring the Serial Number

The last five digits of the serial number is displayed.



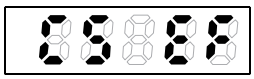
7.2.10. Monitoring the Checksum of the Program

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



7.2.11. 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.



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

The calibration function can be displayed.

7.3. 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	in r	RAM memory is initialized. The center of zero and tare value will be restored to 0.
General function initialization	in F	Data of the general functions stored in the FRAM and the RAM are reset to factory settings.
All data initialization	in 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.

7.3.1. 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 in 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.

7.3.2. 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.

7.4. Verifying Load Cell Connections (DIAGNOS)

7.4.1. Guideline to Verify Load Cell Connections

Faulty wiring or disconnection of the load cell can be checked using the AD-4430R. This verification is useful for new settings, pre-measurement inspections and periodic inspections.

No.	Diagnostic item	Diagnostic point	Judgment Criteria (General)
1	Load cell 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	Load cell output voltage	Between SIG+ ⇔ SIG−	Within ±35 mV
5	Load cell 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− : Load cell excitation voltage (−)
EXC+ : Load cell excitation voltage (+)
SIG− : Load cell output (−)
SIG+ : Load cell output (+)

SHLD : Shield. Frame ground.
SEN− : Sensing input (−)
SEN+ : Sensing input (+)

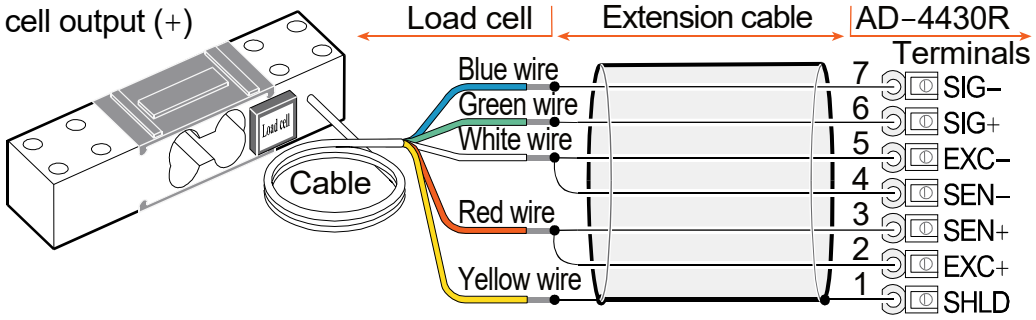


Illustration 12 Load cell wire names

7.4.2. Verifying Load Cell 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 load cell 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.

7.4.3. 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.
diAG 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 **"6.1.1. 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.

7.4.4. 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 diAG 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 AD-4430R returns to weighing mode.

7.4.5. Display and Output of Verification

Items that have not been diagnosed are also totaled as errors. Refer to **"7.4.1. Guideline to Verify Load Cell 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 Load cell excitation voltage (No.1) and Internal temperature (No.8):

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

No.	Check item	Status LED G N H S Z X	Display Range	Error Code
1	Load cell excitation voltage	● ● ○ ○ ○ ●	0.001 V	1
2	SEN+ voltage	● ● ○ ○ ● ○	0.001 V	2
3	SEN− voltage	● ● ○ ○ ● ●	0.001 V	4
4	Load cell output voltage	● ● ○ ● ○ ○	0.001 mV	8
5	Load cell 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

7.5. Verifying Load Cell Connections Using Multimeter

The load cell connection can be checked easily using a digital multimeter.
The measurement points of the load cell connection are shown below:
When a summing box is used, the same measurement points inside the summing box must be measured.

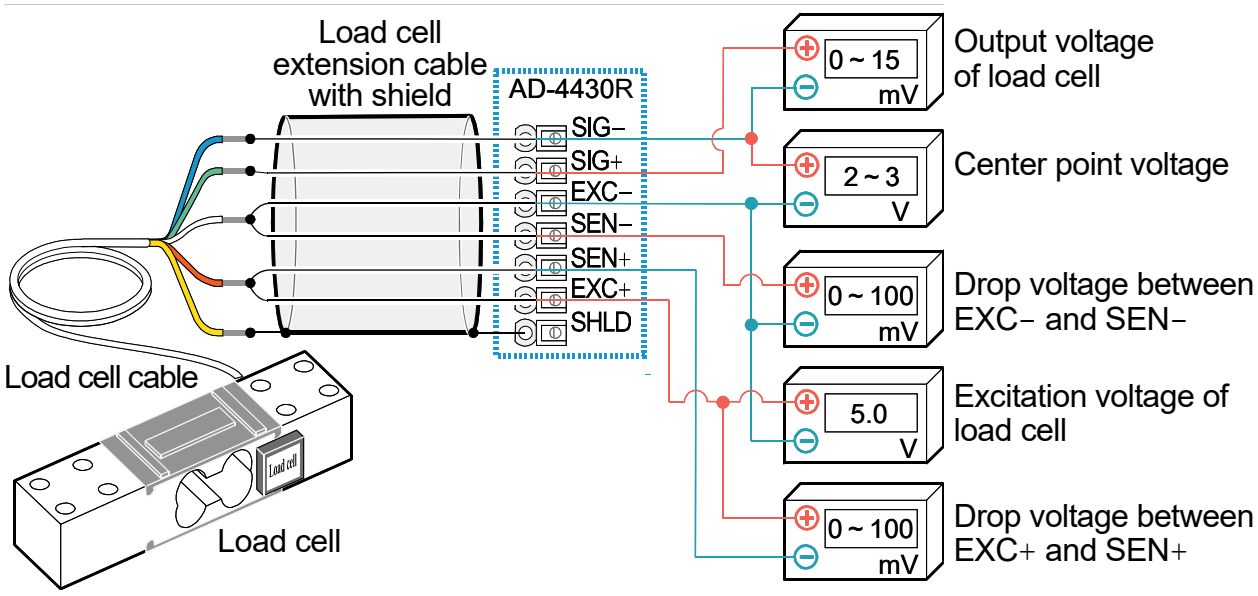


Illustration 13 Load cell connection check

7.5.1. Check List for load cell 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 load cell cable is used. For the 4−wire connection, it must be 0 V.
SEN−	EXC−	Drop voltage of cable on EXC− side.	
EXC+	EXC−	Input voltage	Normal range is between 4.75 V to 5.25 V.
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 load cell rated capacity, actual load and excitation voltage.

When the module does not operate properly, write the required items in the table below and contact your local A&D dealer.

Item	Usage circumstances, model number, rated, measurement value etc.	Note
Connection method	❑ 4−wire connection ❑ 6−wire connection	When using the 4−wire connection, connect between EXC+ and SEN+ and between EXC− and SEN−.
Model name & number		
Rated capacity	[Unit]	
Rated output	[mV/V]	
Allowable overload	[%]	
The number of load cells used	[pieces]	
Use of summing box		
Length of the extension cable	[m]	Length between the module and the summing box.
Initial load of weighing module	[Unit]	
Minimum division of weighing module	[Unit]	All digits including decimal figures. Ex: 0.002kg
Capacity of weighing module	[Unit]	All digits including decimal figures. Ex: 10.000kg
Output of load cell during initial load	[mV/V]	Between −0.1mV/V and rated sensitivity of load cell (using initial load)
Output of load cell when loaded to capacity or to a mass of choice.	Load cell output at load [Unit] [mV/V]	When loaded to capacity, the output value of the initial load + the rated output value of the load cell. (It must be within allowable overload.)

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]

7.6. 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.

7.6.1. Calibration Functions (C Fnc)

Item Name / Function code	Description, Range and [Default value]	User setting
C-F01 1001 Unit	0 : No used 1 : g [2] : kg 3 : t 4 : N 5 : kN	
C-F02 1002 Decimal point position	[0] : 0 1 : 0.0 2 : 0.00 3 : 0.000 4 : 0.0000	
C-F03 1003 Minimum division	[1] : 1 2 : 2 3 : 5 4 : 10 5 : 20 6 : 50	
C-F04 1004 Maximum capacity	1 to [70000] to 99999	
C-F05 1005 Zero range	0 to [2] to 100	
C-F06 1006 Zero tracking time	[0.0] to 5.0	
C-F07 1007 Zero tracking width	[0.0] to 9.9	
C-F08 1008 Stability detection time	0.0 to [1.0] to 9.9	
C-F09 1009 Stability detection width	0 to [2] to 100	
C-F10 1010 Tare and zero when unstable	0 : Disable both functions [1] : Enable both functions	
C-F11 1011 Tare when the gross weight is negative	0 : Disable tare [1] : Enable tare	
C-F12 1012 Output when out of range and unstable	0 : Disable output [1] : Enable output	
C-F13 1013 Excessive negative gross weight	[1] : Gross weight < -99999 2 : Gross weight < Negative maximum capacity 3 : Gross weight < -19d	
C-F14 1014 Excessive negative net weight	[1] : Net weight < -99999 2 : Net weight < Negative maximum capacity	
C-F15 1015 Clear the zero value	0 : Disable [1] : Enable	
C-F16 1016 Zero when power is turned on	[0] : Disable 1 : Enable	
C-F17 1017 Input voltage at zero	−7.0000 to [0.0000] to 7.0000	

Item Name / Function code	Description, Range and Default value	User setting
C-F 18 1018 Span input voltage	0.0100 to 3.2000 to 9.9999	
C-F 19 1019 Span input voltage weight	1 to 32000 to 99999	
C-F26 1026 Gravity acceleration of the calibration location	9.7500 to 9.8000 to 9.8500	
C-F27 1027 Gravity acceleration of the usage location	9.7500 to 9.8000 to 9.8500	
C-F28 1028 Disable hold function	0: Enable 1: Disable	

7.6.2. Linearization Functions (L-Fnc)

Item Name / Function code	Description, Range and Default value	User setting
L-F01 1101 Number of input points	0 to 5	
L-F02 1102 Linear−zero	−7.0000 to 0.0000 to 7.0000	
L-F03 1103 Setting value for linear 1	0 to 99999	
L-F04 1104 Span at linear 1	0.0000 to 9.9999	
L-F05 1105 Setting value for linear 2	0 to 99999	
L-F06 1106 Span at linear 2	0.0000 to 9.9999	
L-F07 1107 Setting value for linear 3	0 to 99999	
L-F08 1108 Span at linear 3	0.0000 to 9.9999	
L-F09 1109 Setting value for linear 4	0 to 99999	
L-F 10 1110 Span at linear 4	0.0000 to 9.9999	

7.6.3. Basics Functions (Fnc F)

Item Name / Function code	Description, Range and Default value	User setting
Fnc01 1201 Key switch disable	0000 to 1111	
Fnc02 1202 F key	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	
Fnc03 1203 Display update rate	1: 20 times/sec. 2: 10 times/sec. 3: 5 times/sec.	
Fnc04 1204 x display	0: None 1: Zero tracking in progress 2: Alarm 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 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	

Item Name	Function code	Description, Range and Default value	User setting
FncO5 Digital filter 1	1205	0: None 8:10.0 Hz 16: 0.7 Hz 1: 100.0 Hz 9: 7.0 Hz 2: 70.0 Hz 10: 5.6 Hz 3: 56.0 Hz 11: 4.0 Hz 4: 40.0 Hz 12: 2.8 Hz 5: 28.0 Hz 13: 2.0 Hz 6: 20.0 Hz 14: 1.4 Hz 7: 14.0 Hz [15]: 1.0 Hz	
FncO6 Digital Filter 2	1206	0: None 8:10.0 Hz 16: 0.7 Hz 1: 100.0 Hz 9: 7.0 Hz 17: 0.56 Hz 2: 70.0 Hz 10: 5.6 Hz 18: 0.40 Hz 3: 56.0 Hz 11: 4.0 Hz 19: 0.28 Hz 4: 40.0 Hz 12: 2.8 Hz 20: 0.20 Hz 5: 28.0 Hz 13: 2.0 Hz 21: 0.14 Hz 6: 20.0 Hz 14: 1.4 Hz 22: 0.10 Hz 7: 14.0 Hz [15]: 1.0 Hz 23: 0.07 Hz	
FncO7 Hold	1207	[1]: Normal hold 2: Peak hold 3: Averaging hold	
FncO8 Near-zero	1208	−99999 to [10] to 99999	
FncO9 Near-zero comparison weight	1209	[1]: Gross weight 2: Net weight	
Fnc 10 Upper limit value	1210	−99999 to [10] to 99999	
Fnc 11 Lower limit value	1211	−99999 to [−10] to 99999	
Fnc 12 Comparison mass of upper and lower limit	1212	[1]: Gross weight 2: Net weight	
Fnc 13 Full	1213	−99999 to [99999]	

7.6.4. Hold Functions (HLd F)

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

7.6.5. Weighing Sequence Programs (59 F)

Item Name / Function code	Description, Range and [Default value]	User setting
59 01 1401 Final value	−99999 to [0] to 99999	
59 02 1402 Free fall	−99999 to [0] to 99999	
59 03 1403 Preliminary	−99999 to [0] to 99999	
59 04 1404 Optional preliminary	−99999 to [0] to 99999	
59 05 1405 Over	−99999 to [0] to 99999	
59 06 1406 Under	−99999 to [0] to 99999	
59 07 1407 Weighing mode	0: Disable [1]: Normal batch sequence 2: Loss-in-weigh sequence 3: Specifying with control input 4: Specifying with Modbus RTU	
59 08 1408 Automatic free fall correction	[0]: Disable 1: Moving average of last four times 2: Real-time free fall compensation (fixed coefficient) 3: Real-time free fall compensation (updated coefficient)	
59 09 1409 Automatic free fall band	[0] to 99999	
59 10 1410 Active free fall coefficient	Scale: 0.001 sec. −99.999 to [0.000] to 99.999	
59 11 1411 OK/Over/Under output timing	1: Always [2]: In synchronization with weighing end	
59 12 1412 Wait for the weight value to be stable before the judgment	0: Disable [1]: Enable	
59 13 1413 Automatic tare at weighing start	[0]: Disable 1: Enable	
59 21 1421 Flow timeout time	[0] to 600	

Item Name	Function code	Description, Range and Default value	User setting
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	

7.6.6. 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 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. The higher the value setting, the less changes. Scale: 1 sec. 1 to 5 to 1000	
Fr 04 Damping time for flow rate 2	1904		
Fr 05 +/- flow rate 1	1905	0 : according to calculation 1 : interchange +/- 2 : absolute value	
Fr 06 +/- flow rate 2	1906		

7.6.7. 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 1 to 6 : Reserved internally 7 : Zero 8 : Tare 9 : Hold 10 : Gross / Net exchange 11 : Diagnose 12 : Print command 13 : Weighing start 14 : Pause 15 : Restart 16 : Emergency stop 17 : Error reset 18 : Normal batch/Loss-in-weight exchange 19 : Actual free fall input 20 : One-shot small flow 21 : Full open 22 : Zero clear 23 : Tare clear 24 : Operation same as a F key 25 : Prohibit update of flow rate 1 26 : Prohibit update of flow rate 2 27 : Initialize flow rate 1 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 1 to 8 : Reserved internally 9 : Stability 10 : Over capacity 11 : Net display 12 : During tare 13 : Hold 14 : Hold busy 15 : HI output 16 : OK output 17 : LO output 18 : Near-zero 19 : Full 20 : Over 21 : OK 22 : Under 23 : Large flow 24 : Medium flow 25 : Small flow 26 : Normal batch/Loss-in-weight, Identification 27 : In weighing sequence 28 : Weighing end 29 : Weighing sequence error 30 : In weighing (ON) 31 : In weighing (1 Hz) 32 : In weighing (50 Hz) 33 : Alarm 34 : Output operation switch is on or off 35 : Approximate flow rate value of flow rate 1 36 : Approximate flow rate value of flow rate 2 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 If data is "0" level, the output transistor conducts (ON). 2: Non-inverting output 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			

7.6.8. Standard Serial Output Functions (CL F)

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

7.6.9. RS-485 Functions (rS F)

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

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