

F159 NJ series

*PLUG-IN WEIGHT MODULE
for the OMRON SYSMAC NJ SERIES PLC*

OPERATION MANUAL

UNIPULSE

**01 NOV. 2014
Rev. 1.00**

INTRODUCTION

Thank you very much for purchasing our Loadcell Interface F159.

For good performance, and proper and safe use of the F159, be sure to read this operation manual and properly understand the contents of it before use. Also, carefully keep this operation manual so that it can be referred to at any time.

Compatible versions of the NJ series

Machine automation controller:	NJ series CPU unit	ver 1.06 or later
Automation software:	Sysmac Studio	ver 1.07 or later

SAFETY PRECAUTIONS

For safety reasons, please read the following safety precautions thoroughly.

Please assign only persons with electrical technical knowledge to set up, service or inspect F159. For the safe use of F159, safety precautions that should be complied with have been categorized and indicated as " WARNING" and " CAUTION" in this Operation Manual. The safety precautions mentioned in this Operation Manual are crucial for safety. Therefore, use F159 only after you have correctly understood the safety contents given.

WARNING

This sign forewarns the presence of hazards that could result in serious injury or fatality when incorrectly handled.

CAUTION

This sign forewarns the presence of hazards that could result in personnel injury or property damage when incorrectly handled.



WARNING

This sign forewarns the presence of hazards that could result in serious injury or fatality when incorrectly handled.

Warning on design

- Before using the F159 as described below, be sure to consult with our sales personnel.
 - Use in environments not described in the operation manual.
 - Use in environments that greatly affects human life and assets, such as medical devices, transport equipment, recreational equipment, and safety devices.

Warning on installation

- Do not modify the F159. Doing so may cause fire or electric shocks.
- Do not install in the following environments.
 - Places containing corrosive gas or flammable gas.
 - Where the product may be splashed with water, oil or chemicals.

Warning on wiring

- Do not connect a commercial power source directly to the signal input/output terminals.
- Be sure to ground the protective ground terminal.
- Before performing the following, make sure that no power is applied.
 - Wiring/connection of cables to the terminal blocks.
- For connection to the signal input/output terminals, check the signal names and pin assignment numbers, and then carry out wiring properly.
- Do not connect anything to unused terminal(s).
- Before applying power, carefully check the wiring, etc.

Warning during startup and maintenance

- Use at a proper power supply voltage.
- Do not touch any terminal while applying power. Doing so may cause electric shocks or malfunctions.
- If the cover of the main body is opened, it may cause an electric shock internally. Even if the power is off, the internal capacitor is charged. Contact us for internal inspection or repair.
- In the case of smoke, an abnormal smell or strange sound, immediately turn off the power, and disconnect the power cable.



CAUTION

This sign forewarns the presence of hazards that could result in personnel injury or property damage when incorrectly handled.

Caution on installation

- Do not install in the following environments.
 - Where the temperature/humidity exceeds the range of the specifications.
 - Where the temperature changes severely or there is a danger of freezing or condensation.
 - Places exposed to direct sunlight.
 - Outdoors, or where the altitude exceeds 2000m.
 - Dusty places
 - Places containing large quantities of salt or iron powder.
 - Where the main body is directly affected by vibrations or shocks.
- Take adequate shielding measures when using at the following locations.
 - Near a power line.
 - Where a strong electric field or magnetic field is formed.
 - Where static electricity, relay noise or the like is generated.
- Install the F159 as far away as possible from devices that generate high frequency, high voltage, large current, surge, etc. Also, carry out wiring separately from their power lines. Do not carry out parallel wiring and common wiring.

Caution on wiring

- For sensors and external outputs use shielded cables.

Caution during startup and maintenance

- For turning on/off the power, be sure to keep intervals of 5 seconds or more.
- After power-on, be sure to warm up the F159 for 30 minutes or more before use.
- If the F159 is not used by the specified method, its protective performance may be impaired.
- Do not use it, broken down.
- Maintenance
 - When performing maintenance, disconnect the power.
 - Do not wipe with a wet rag, or with benzine, thinner, alcohol, etc. Doing so may cause discoloration or deformation of the F159. In the case of heavy contamination, wipe off the contamination with a cloth after dipping it into a diluted neutral detergent and wringing it well, and then wipe with a soft, dry cloth.

Caution during transportation

- When the F159 is shipped, spacers made of corrugated cardboard are used as cushioning materials.

Though it is factory-designed so that shocks can sufficiently be absorbed, breakage may result if shocks are applied when the spacers are reused for transportation. If you send the F159 to us for repair, etc., take adequate measures against shocks by using polyurethane materials, etc., separately.

Caution during disposal

- If you dispose of the product, handle it as industrial waste.

STATEMENT OF CONFORMATION TO EC DIRECTIVES

Unipulse F159 Loadcell Interface conforms to the EC Directives (based on Council of the European Communities, and is allowed to affix CE mark on it.

- * EMC Directives EN61131-2
 (EN55011, EN61000-4-2, EN61000-4-3,
 EN61000-4-4, EN61000-4-5, EN61000-4-6,
 EN61000-4-8, EN61000-4-11)

The following notice must be observed when you install F159 unit.

1. F159 is an electrical device that are incorporated in machines and manufacturing installations.
 F159 conforms to the related EMC standards so that the devices and machines into which F159 is built can more easily conform to EMC standards.
 The actual F159 has been checked for conformity to EMC standards.
 Whether these standards are satisfied for the actual system, however, must be checked by the customer.
 EMC-related performance will vary depending on the configuration, wiring, and other conditions of the machine or device in which the F159 is installed.
 The customer must, therefore, perform final checks to confirm that the overall machine or device conforms to EMC standards.
2. Use shielded cables for connection with load cell.

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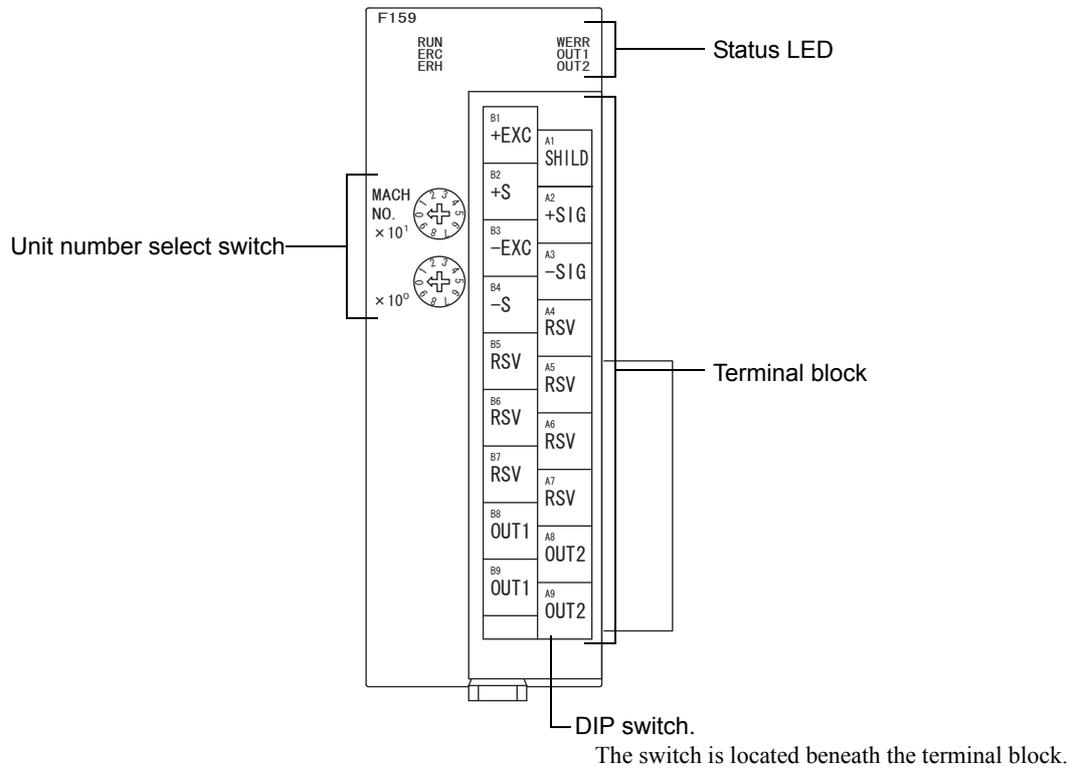
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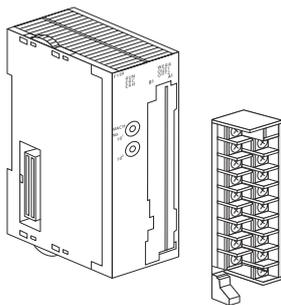
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1. APPEARANCE DESCRIPTION

1-1. Front Panel



⚠ CAUTION



Terminal block can be detached by pulling down the lever. Normally, the lever should be in upper position.

Always turn off the NJ's voltage source before trying to attach/detach the terminal block.

1-2. Status LED

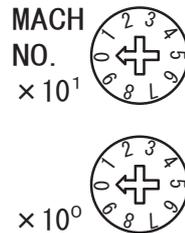
Status LEDs display the current operating status of the unit. The following table summaries their names and meanings.

LED	Name	State	Description
RUN (Green)	Operation status	ON	Normal operation
		OFF	Data exchange with CPU has been aborted
ERC (Red)	Error detected by the unit	ON	Error occurred in F159
		OFF	Normal operation
ERH (Red)	CPU error	ON	Error occurred during data exchange with CPU
		OFF	Normal operation
WERR (Red)	Weight error	ON	One or more of the following alarms are in place: ±LOAD, OFL1, OFL2, OFL3, ZALM
		OFF	Normal operation
OUT1 (Orange)	OUT1 output	ON	OUT1 =ON
		OFF	OUT1 = OFF
OUT2 (Orange)	OUT2 output	ON	OUT2 = ON
		OFF	OUT2 = OFF

1-3. Unit Number Select Switch

F159 acts as a high performance weighing processing module for Omron SYS-MAC CJ1 series PLC. The data exchange between CPU unit and F159 are carried out by the high performance relay area of I/O and DM area.

Relay and DM number used by F159 can be selected by the unit number selection switch located on the front panel.



Switch No.	Unit No.	Channel number allocated to the I/O unit relay area	DM number allocated to the I/O unit DM area
0	0	2000 - 2009CH	D20000 - 20099
1	1	2010 - 2019CH	D20100 - 20199
2	2	2020 - 2029CH	D20200 - 20299
3	3	2030 - 2039CH	D20300 - 20399
4	4	2040 - 2049CH	D20400 - 20499
5	5	2050 - 2059CH	D20500 - 20599
6	6	2060 - 2069CH	D20600 - 20699
7	7	2070 - 2079CH	D20700 - 20799
8	8	2080 - 2089CH	D20800 - 20899
9	9	2090 - 2099CH	D20900 - 20999
10	10	2100 - 2109CH	D21000 - 21099
}	}	}	}
n	n	2000+n×10 - 2000+n×10+9CH	D20000+n×100 - D20000+n×100+99
}	}	}	}
95	95	2950 - 2959CH	D29500 - 29599

1-3-1. Unit Configuration

For the NJ series, it is necessary to create a unit configuration that is recognized by the CPU unit as positive with the unit editor of the unit configuration / unit setting of Sysmac Studio.

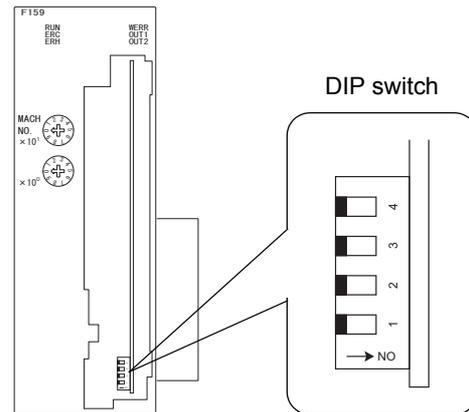
For creation of the unit configuration, see the NJ series CPU Unit Software User's Manual.

The created unit configuration is automatically checked at power-on, and I/O ports are automatically registered. Access from your program is enabled by assigning device variables to these I/O ports.

1-4. DIP Switch

DIP switch is used to LOCK calibration and restore default settings.

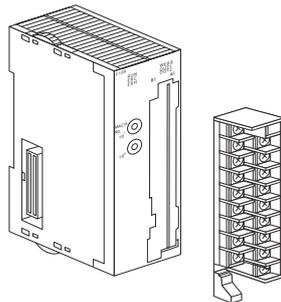
Switch No.	State	
	ON	OFF
1	Calibration LOCK ON	Calibration LOCK OFF
2	Default set ON	Default set OFF
3	Undefined	Undefined
4	Undefined	Undefined



When switch 2 is set to ON position, F159 initializes set value whenever F159 is powered on.

Switch 3 and 4 are undefined: they should always be set to OFF position. When they are set to ON position, F159 can't operate normally.

⚠ CAUTION



Terminal block can be detached by pulling down the lever. Normally, the lever should be in upper position.

Always turn off the NJ's voltage source before trying to attach/detach the terminal block.

2. CONNECTION

2-1. F159 Block Terminal

+EXC	B1	A1	SHIELD
+S	B2	A2	+SIG
-EXC	B3	A3	-SIG
-S	B4	A4	RSV
RSV	B5	A5	RSV
RSV	B6	A6	RSV
RSV	B7	A7	RSV
OUT1	B8	A8	OUT2
OUT1	B9	A9	OUT2

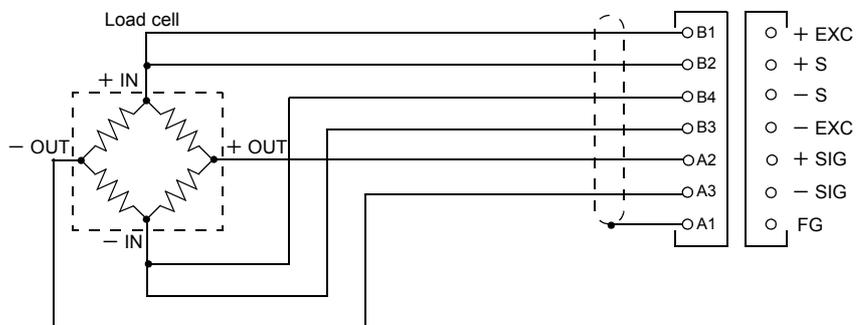
2-2. Load Cell Connection

Connect leads from the load cell to F159 terminal block.

F159	Load cell signal	
	6-wire connection	4-wire connection
+EXC	+EXC	+EXC
+S	+S	connected to +EXC
-EXC	-EXC	-EXC
-S	-S	connected to -EXC
+SIG	+SIG	+SIG
-SIG	-SIG	-SIG
SHIELD	SHIELD	SHIELD

2-2-1. 6-wire Connection

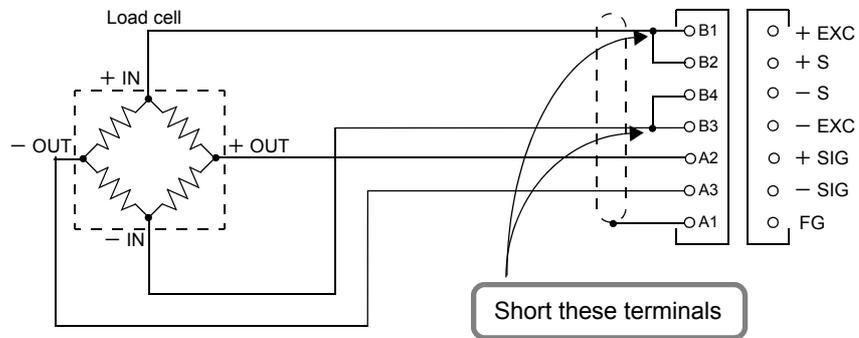
F159 input uses an accurate 6-wire load cell connection (remote sense method). Use shielded 6-core cable for this connection and route it apart from noisy lines (power and digital devices) and AC power lines.



* Remote sense method can apply correct voltage to the load cell compensating cable resistance change due to temperature variation along the cable. It is capable of stabilizing excitation voltage in the vicinity of the load cell.

2-2-2. 4-wire Connection

F159 is also capable of 4-wire connection, in which case additional jumper connections between B1 and B2, and B3 and B4 are required. Although the system may function apparently correctly with B2 and B4 open, this configuration can produce over-voltage excitation, resulting in over heating and damage of the load cell. Connect these terminals using the supplied short-bars.



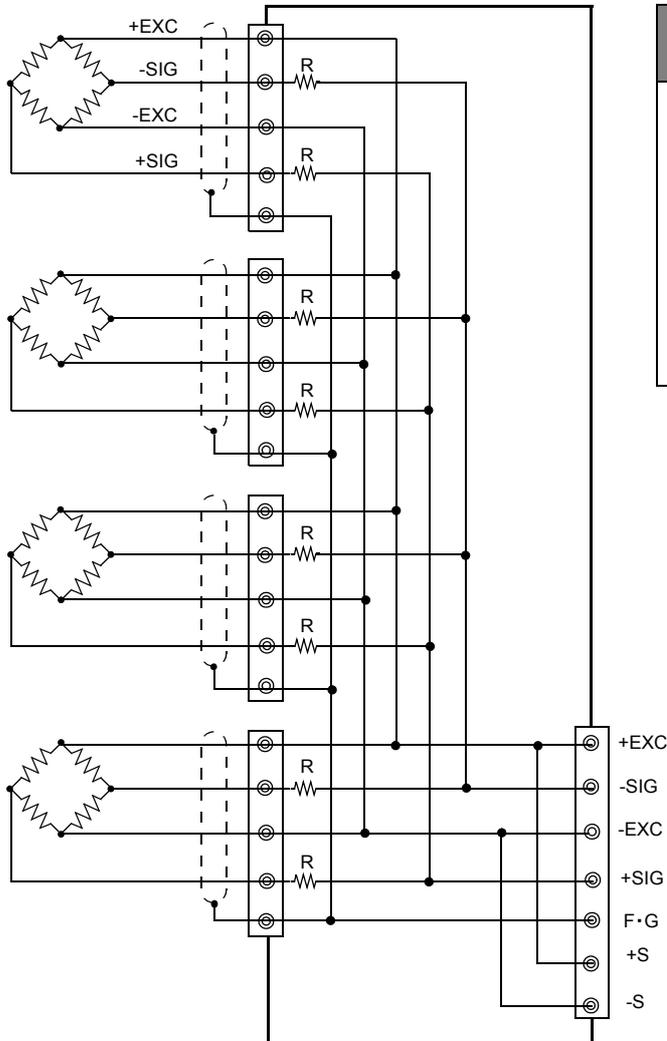
⚠ CAUTION

- F159 supplies 10V excitation voltage. Use a load cell with rated excitation voltage of 10V or higher, otherwise abnormal heating and damage to the cell may result.
- If you use F159 using 4-wire connection configuration, never fail to connect between +EXC and +S, and -EXC and -S. Although the system may function apparently well without these jumpers, over-voltage excitation can occur any time resulting in anomalous heating and damage to the load cell.

2-2-3. Connecting Load Cells in Parallel

Some industrial applications require multiple of load cells connected in parallel to configure, for example, a hopper scales or track scale. A typical parallel connection is shown below.

Parallel connection can easily realized using the 4-point multi load cell summing box (e.g. B41X series provided by UNIPULSE).



⚠ CAUTION

Parallel connection of multiple of load cells can drastically change power consumption. Power supply with sufficient capacity should be selected. See next page for proper evaluation of power requirement.

Seen from F159, the parallel connection of n load cells is considered to be a single load cell with a capacity multiplied by n and the same sensitivity with the constituent load cells.

The averaging resistor (R) takes the value between 300 and 500Ω, with the same relative ratio and low temperature coefficients. They are not required if the load cell is specifically designed for parallel connection application.

Request

If you connect multiple of load cells in parallel, use load cells with extra capacity margin. Biased loading or mechanical shock may result in overload in some of the cells.

2-2-3-1. Power consumption evaluations for parallel connection

Power consumed by a F159 can vary depending on the number of load cells connected in parallel. For an each additional 350Ω load cell, power requirement will increase by approx.0.13 A.

Number of 350Ω load cells connected in parallel	Power consumption [A]
1	0.30
2	0.43
3	0.56
4	0.69

Design your system after due consideration of power consumption so that the total power consumption of the F159, CPU unit of the NJ series, and each constituent unit of the CJ series will not exceed the maximum supply current of the power unit.

The number of constituent units is up to 10 per rack (CPU rack or extension rack) according to the specifications of the NJ series.

Request

For the power consumption of each constituent unit usable for the NJ series, see the OMRON NJ series Manual "CPU Unit User's Manual (Hardware)".

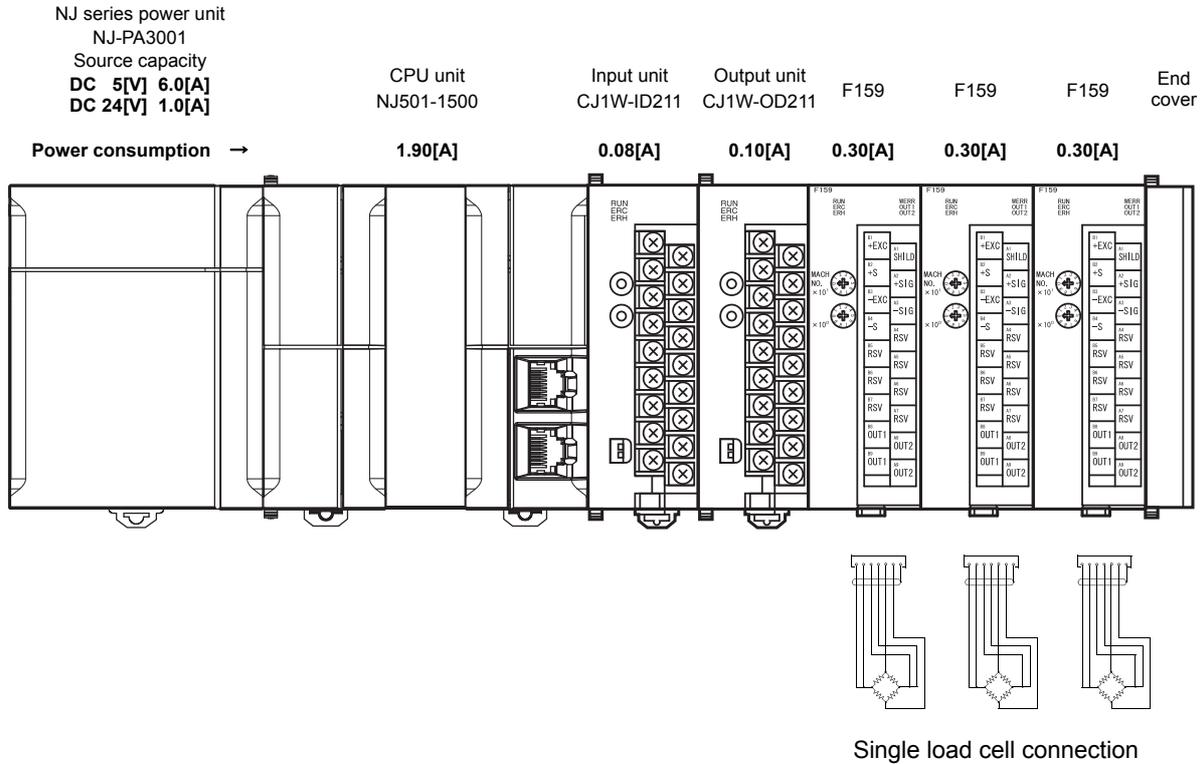
CAUTION

Do not combine a CPU unit of the NJ series and a power unit of the CJ series, or a CPU unit of the CJ series and a power unit of the NJ series. (Operation will fail.)

2.CONNECTION

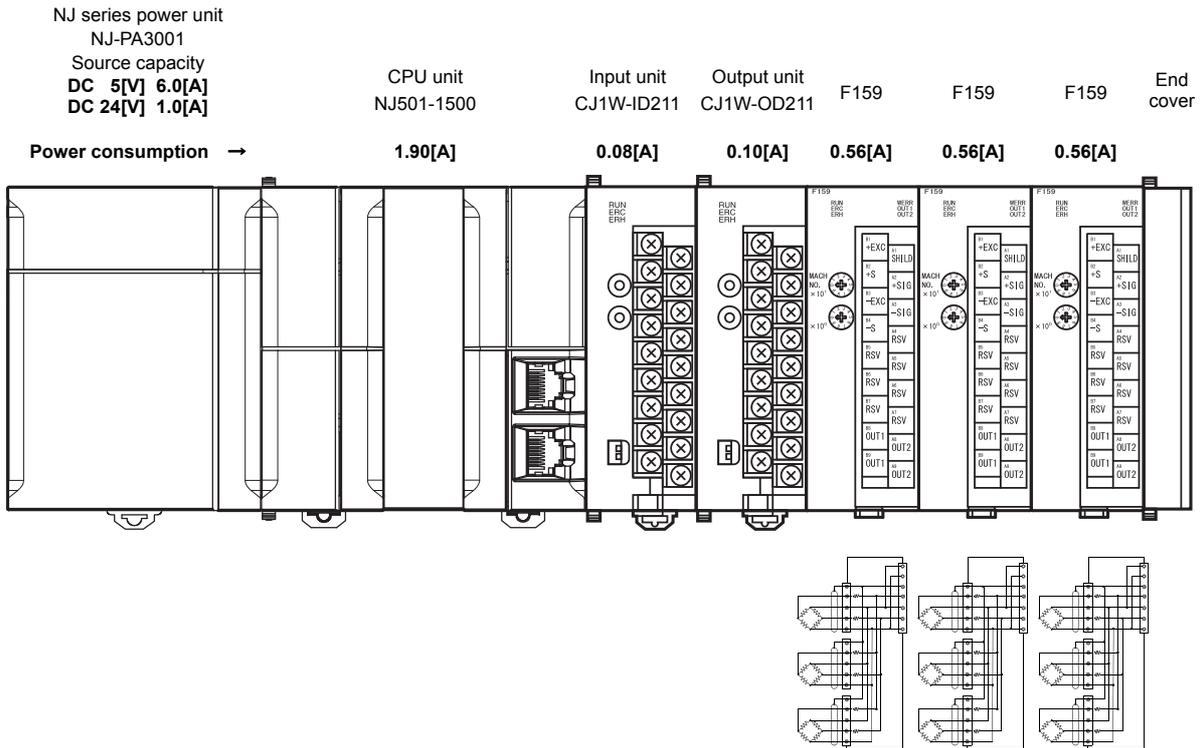
Connection of single 350Ω load cell (CPU rack)

The CPU rack consists of a CPU unit of the NJ series, power unit of the NJ series, each constituent unit of the CJ series, and end cover of the CJ series. (The number of constituent units is up to 10.)



Unit type	Unit name	Qty	Power consumption (A) (5V)	Power consumption (A) (24V)
CPU unit	NJ501-1500	1	1.90A	—
Input unit	CJ1W-ID211	1	0.08A	—
Output unit	CJ1W-OD211	1	0.10A	—
Weight module	F159	3	0.90A	—
Consumption current	Calculation		$1.90 + 0.08 + 0.10 + 0.90$	—
	Result		2.98A ($\leq 6.0A$)	—
Consumption power	Calculation		$2.98 \times 5V = 14.9W$	—
	Result		14.9W ($\leq 30W$)	

Connection of three 350Ω load cells in parallel



Three load cells are connected in parallel

Unit type	Unit name	Qty	Power consumption (A) (5V)	Power consumption (A) (24V)
CPU unit	NJ501-1500	1	1.90A	—
Input unit	CJ1W-ID211	1	0.08A	—
Output unit	CJ1W-OD211	1	0.10A	—
Weight module	F159	3	1.68A	—
Consumption current	Calculation		$1.90 + 0.08 + 0.10 + 1.68$	—
	Result		3.76A ($\leq 6.0A$)	—
Consumption power	Calculation		$3.76 \times 5V = 18.8W$	—
	Result		18.8W ($\leq 30W$)	—

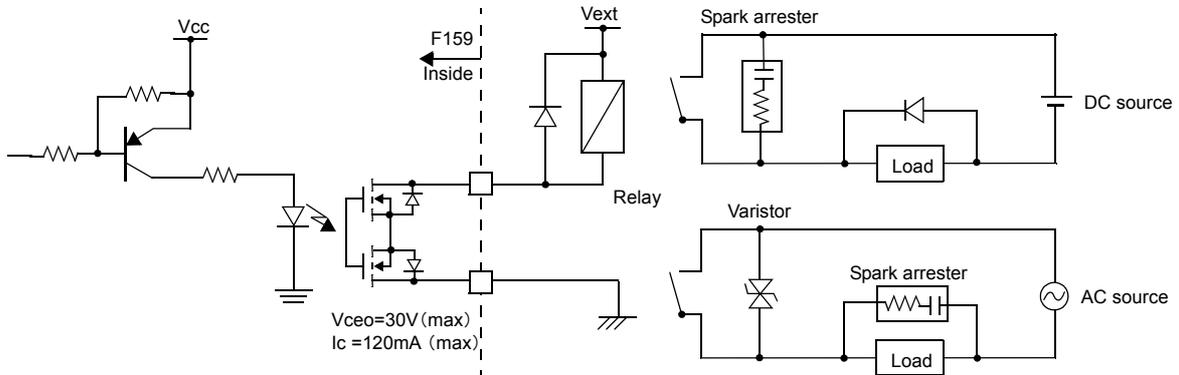
2-2-4. Sensors Cable

Cable colors of sensors may differ from one manufacturer to another (it may even differ from one model to another for some products). Refer to the sensor manual (or data sheet) and check signal names and colors in order to connect the cables correctly.

2-3. Output Connection

2-3-1. Equivalent Circuit

F159 uses non-polar MOS FET relays for signal output.



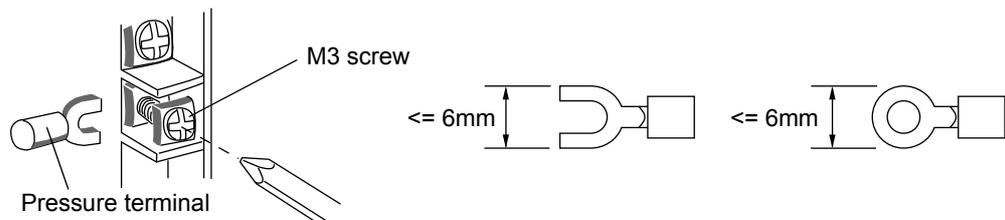
Output data	MOS FET relay
0	OFF
1	ON

- User must provide an external power unit ($V_{ext} \leq 30$ VDC) to drive the output relay.
- Do not short circuit the load (such as a relay coil). This may damage the output relay.
- Use surge absorbing devices appropriately in the relay circuit (see the diagram above) to suppress surge voltage from occurring. These devices are effective to reduce noise-related problems and to extend the relay life.

2-4. Connections to Terminal Block

Use pressure terminals to connect cables to the terminal. Tighten the pressure terminal securely to the terminal block using a M3 screw. Correct tightening torque is 0.5Nm.

The width of the pressure terminal should be 6mm or less (see the figure below).



Request

Input and output signal lines should be routed separately from noisy power lines and AC lines.

⚠ CAUTION

A4 to A7 and B5 to B7 are unnecessary in this specification, please do not connect input and output signal lines to them.

Do not apply the voltage from the outside, or do not short-circuit with parts. It may cause malfunction of F159 and external equipment.

3. DATA EXCHANGE WITH CPU

Connection with the NJ series

The F159 can be incorporated in the CPU rack or extension rack of the NJ series as a constituent unit with which the CPU unit of the NJ series can exchange data.

Compatible versions	
NJ series CPU unit	ver 1.06 or later
Sysmac Studio	ver 1.07 or later

Request

For system configuration, see the NJ series Manual “CPU Unit User's Manual (Hardware)”.

The F159 exchanges data with CPU using the following devices: High performance I/O unit relay area (Weight and Status data) and high performance I/O unit DM area (weighing setting and initial setting data).

Weight data

Analog signal from the load cell is converted into digital Weight data.

Weight data is allocated to one of the relay area of the CPU units' high performance I/O unit based upon the unit number. The data is exchanged regularly every time I/O refresh takes place.

Status data

Status data includes various status and error information.

Status data is allocated to one of the relay areas of the high performance I/O unit in the CPU unit based on the unit number. The data is exchanged regularly every time I/O refresh takes place.

Weighing setting data

Settings for performing Weight measurement.

One F159 is allocated, based on its unit number, to a selected DM area for high performance I/O unit (inside CPU unit). Data is written to the DM area in synchronization with: power-on, refresh start, and request bit (On-edge). Data is also read out using the request bit's On-edge: the bit can be used both for reading and writing depending on R/W bit status.

Initial setting data

Parameter settings for using F159 as a Weight Module.

A set of initial setting data for each F159 is allocated, based on its unit number, to a DM area for high performance I/O unit (inside CPU unit), and is written to this area when the unit is powered on, or a refresh cycle is started.

3.DATA EXCHANGE WITH CPU

On the NJ series, these data are accessed from the user program with variables.

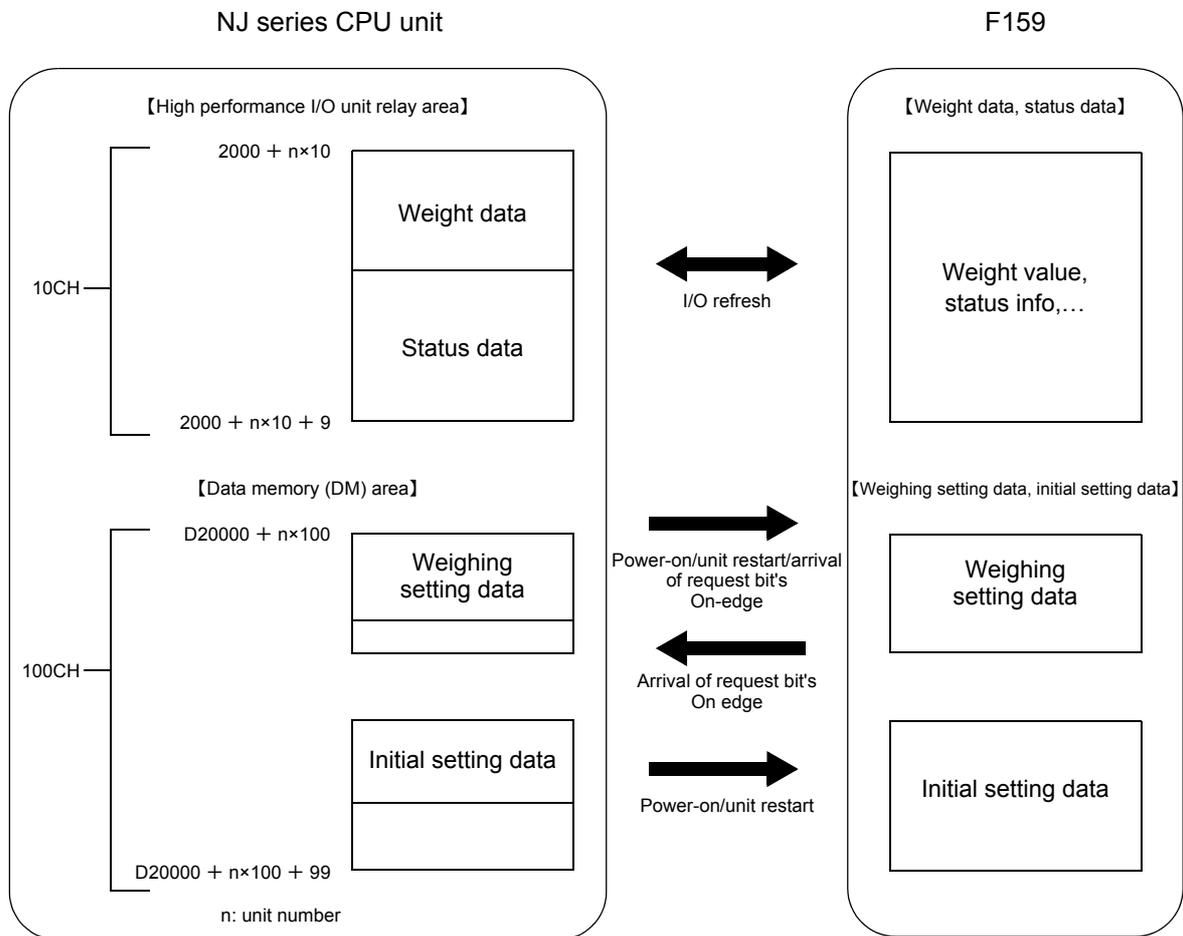
Access from the user program with variables is enabled by assigning device variables to the I/O ports that are automatically created when a unit configuration is created.

For how to assign variables, see the NJ series CPU Unit Software User's Manual.

In the above manual, three methods are explained to register device variables.

- Method of newly inputting device variable names
- Method of automatically creating device variable names
- Method of selecting variables that have already been registered in the variable table

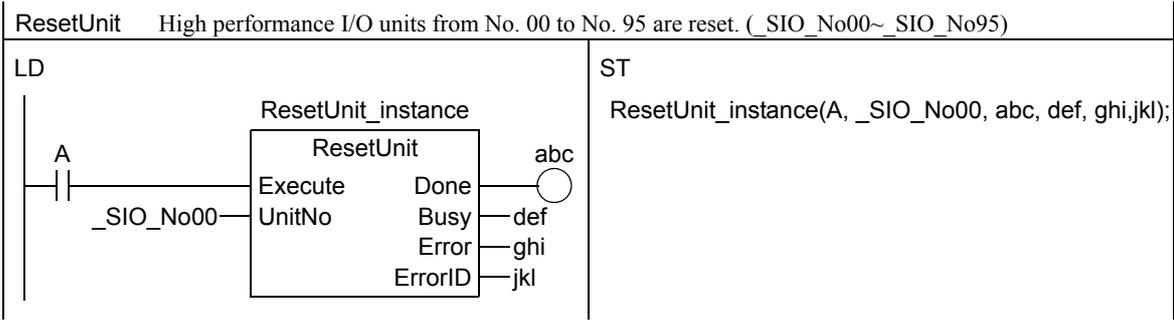
Since the I/O port names are reflected in the automatically-created device variable names, the I/O ports described in this manual can easily be referred to.



3-1. High Performance I/O Unit Restart

When the user restart the unit after he has modified data memory or removed the cause of failure, the user have to either power up the NJ main unit again, or execute the high performance I/O unit restart command.

* For commands, see the NJ series Manual “Machine Automation Controller Instructions Reference Manual”.



3-2. Relay Area

3-2-1. Allocation of Weight and Status Data, and I/O Port Name

OUT (CPU unit → F159)

n CH	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Signal name
			soft LOCK		SEQ STOP	SEQ START	Judge	FF CPS.		Feed/ Discharge	Digital tare subtraction	HOLD	DZ OFF	DZ ON	TARE OFF	TARE ON	TARE ON
n+1 CH		R/W	SoftLock		SeqStop	SeqStart	Judge	FFCPS		FeedDisch	DigitTare Subtract		DigitZeroOff	DigitZeroOn	TareOff	TareOn	I/O port name
				Request											Span calibration	Zero calibration	Signal name
		ReadWrite		Request											SpanCalib	ZeroCalib	I/O port name

IN (F159 → CPU unit)

n+2 CH	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Signal name			
			Gross weight 10 ³		Gross weight 10 ²		Gross weight 10 ¹		GrossWeight								Gross weight 10 ⁰			I/O port name
	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1				
n+3 CH	Over	Go	Under	Complete	SP3	SP2	SP1	Near zero	Decimal place		Gross weight sign		8	4	2	1	Gross weight 10 ⁴			
	Over	Go	Under	Complete	SP3	SP2	SP1	NearZero	Gw Decimal2		GwSign						GrossWeightEx	I/O port name		
n+4 CH	8	4	2	1	8	4	2	1	8	4	2	1	8	4	2	1	Net weight 10 ⁰	Signal name		
			Net weight 10 ³		Net weight 10 ²		Net weight 10 ¹		NetWeight								Net weight 10 ⁰			I/O port name
n+5 CH	Feed/ Discharge	TareSubtract Prog	HOLD in progress	ZT in progress	CZ	Stable	Upper limit	Lower limit	Decimal place		Net weight sign		8	4	2	1	Net weight 10 ⁴	Signal name		
	FeedDisch Cl	TareSubtract Prog	HoldProg	Zero Tracking	CenterZero	Stable	UpperLimit	LowerLimit	Nw Decimal2		NwSign						NetWeightEx	I/O port name		
n+6 CH		Normally ON	ERR ON	Cyclic bit					NOV RAM		Span calibration in progress	Zero calibration in progress	8	4	2	1	DIP SW	Signal name		
		NormallyOn	ErrOn	CyclicBit					NovRam		SpanCalib Prog	ZeroCalib Prog					DipSw	I/O port name		
n+7 CH	Calibration error	ExcAlm	Zero error	OFL3	OFL2	OFL1	+LOAD	-LOAD	Error assistance code				8	4	2	1	Error code	Signal name		
	CalbErr	ExcAlm	ZeroErr	OFL3	OFL2	OFL1	PosLoad	NegLoad	ErrCode									I/O port name		
n+8 CH			soft LOCK	SEQ STOP	SEQ START	Judge response	Judge response	FF CPS. response	Feed/ Discharge response		Digital tare subtraction response	HOLD response	DZ OFF response	DZ ON response	TARE OFF response	TARE ON response	TARE ON response	Signal name		
			SoftLock Resp	SeqStop Resp	SeqStart Resp	JudgeResp	JudgeResp	FFCPSResp	Feed DischargeResp		DigitTare SubtractResp	HoldResp	DigitZeroOff Resp	DigitZeroOn Resp	TareOffResp	TareOnResp	TareOnResp	I/O port name		
n+9 CH		R/W response	Request response	RequestResp											Span calibration response	Zero calibration response	Zero calibration response	Signal name		
		ReadWrite Resp	RequestResp	RequestResp											SpanCalib Resp	ZeroCalib Resp	ZeroCalib Resp	I/O port name		

n = 2000 + (unit number × 10)

3-2-2. OUT (CPU unit → F159)**TARE ON (I/O pert name: TareOn)**

ON edge (0 → 1) triggers tare subtraction, nulling the Net weight. Note, however, the user can place some restrictions on tare subtraction (see 5-12. "Restriction on Tare Subtraction"), in which case this function can be activated only when the reading is "Stable".

The range of tare subtraction is selectable from: whole range, or $0 \leq \text{Tare} < \text{Capacity}$.

"Tare subtraction in progress" bit (14th bit of n+5 CH) becomes 1 while this process is underway.

* Tare subtraction is reset when turning off power.

TARE OFF (I/O pert name: TareOff)

ON edge (0 → 1) disables tare subtraction function. Set value for tare subtraction remains intact.

DZ ON (I/O pert name: DigiZeroOn)

ON edge (0 → 1) triggers Digital Zeroing (Gross weight is zero cleared). Allowable range of digital zeroing is within the range set by DZ regulation value. "Zero Error" occurs if the reading is out of this range.

* Digital Zero is reset when turning off power.

DZ OFF (I/O pert name: DigiZeroOff)

ON edge (0 → 1) disables Digital Zero function. "Zero Error" message will also be cleared.

HOLD (I/O pert name: Hold)

While this bit is on "1", Weight value and Comparison Value remain unchanged (hold).

HOLD bit (13th bit of n+5 CH: HoldProg) remains high while HOLD is activated.

Digital tare subtraction (I/O pert name: DigiTareSubtract)

If "relay" is selected for tare subtraction trigger, this bit determines ON/OFF of Digital tare subtraction function.

1: Digital tare subtraction is ON

0: Digital tare subtraction is OFF

Feed / Discharge (I/O pert name: FeedDisch)

If "relay" is selected in Weighing mode setting, this bit determines ON/OFF of Feed/Discharge switching.

1: Discharge control

0: Feed control

FF CPS. (I/O pert name: FFCPS)

If "relay" is selected in FF CPS. setting, this bit determines ON/OFF of FF CPS..

1: FF CPS. ON

0: FF CPS. OFF

Judge (I/O port name: Judge)

This bit is used for two purposes:

If Over/Under decision is to be triggered by Judge input, this signal triggers Over/Under judgment.

If Upper/Lower limit decision is to be triggered by Judge input, this signal triggers Upper/Lower limit judgment.

1: Judgment ON

0: Judgment OFF

SEQ START (I/O port name: SeqStart)

If Sequence mode is selected in Mode selection, ON edge (0 → 1) in this signal starts a new sequence.

SEQ STOP (I/O port name: SeqStop)

While sequence control is underway, ON edge (0 → 1) in this signal will abort the control sequence resulting in “Sequence error 2” (Error assistance code =3, Error code =2).

While the system is in the state of sequence error (Error assistance code =3), ON edge (0 → 1) in this signal resets the sequence error.

soft LOCK (I/O port name: SoftLock)

Soft LOCK enables/disables setting modification for Zero calibration and Span calibration. If Soft LOCK is set to “1”, any attempt to change current settings for Zero/Span calibration is inhibited.

Therefore, user must set this bit to “0” before trying to alter calibration settings.

Zero calibration (I/O port name: ZeroCalib)

ON edge (0 → 1) in this signal initiates Zero calibration. Note, however, this input is ignored when “Soft LOCK” is set to “1”, “LOCK SW”(DIP switch) is ON, or a preceding calibration process is still underway.

Span calibration (I/O port name: SpanCalib)

ON edge (0 → 1) in this signal initiates Span calibration. Note, however, this input is ignored when “Soft LOCK” is set to “1”, “LOCK SW”(DIP switch) is ON, or a preceding calibration process is still underway.

Request (I/O port name: Request)

ON edge (0 → 1) in this signal triggers F159 to exchange the set of weighing settings (m – m+19 CH in DM area) with CPU unit. Direction of data transfer (CPU → F159, or F159 → CPU) is determined by R/W bit.

R/W (I/O port name: ReadWrite)

The state of this line (I/O) at the time of REQUEST trigger (0 → 1) determines the direction of data transfer between F159 and CPU.

1: Write (CPU unit → F159)

0: Read (F159 → CPU unit)

3-2-3. IN (F159 → CPU unit)**Gross weight 100 - 104 (I/O pert name: GrossWeight/GrossWeightEx)**

Indicates Gross weight.

Gross weight sign (I/O pert name: GwSign)

“1” when Gross weight becomes negative

Decimal place (I/O pert name: GwDecimal1/GwDecimal2)

Indicates the position of decimal point.

2	1	Decimal place
OFF	OFF	0
OFF	ON	0.0
ON	OFF	0.00
ON	ON	0.000

Near zero (I/O pert name: NearZero)

“1” when Weight \leq Near zero setting.

Weight : Weight value Near zero

SP1, SP2, SP3 (I/O pert name: SP1/SP2/SP3)

Simple comparison mode

SP1: “1” if Weight \geq Final setting - Set point 1 setting

SP2: “1” if Weight \geq Final setting - Set point 2 setting

SP3: “1” if Weight \geq Final setting - FF CPS.setting

Sequence mode

Each bit is initialized to “1” when weighing sequence is started by SEQ Start’s ON edge.

SP1: “0” if Weight \geq Final setting - Set point 1 setting

SP2: “0” if Weight \geq Final setting - Set point 2 setting

SP3: “0” if Weight \geq Final setting - FF CPS.setting

Weight: Weight for Over/Under comparison

Complete (I/O pert name: Complete)

Simple comparison mode

Timing of Complete bit output is determined by the selection made in Weighing function 2 (Complete signal output mode). Time duration for which this signal is held “1” depends on the setting in complete signal output.

Sequence mode

Over/Under judgment enabled:

Criteria: Other than “Comparison OFF”, and non-zero Judging times have been selected for Over/Under comparison.

Timing of Complete bit output is determined by the selection made in Weighing function 2 (Complete signal output mode). Time duration for which this signal is held “1” depends on the setting in complete signal output.

Over/Under judgment disabled:

Criteria: Judging times is set to "0" (Over/Under judgment OFF)

Complete bit becomes "1" if SP3 goes low (OFF edge, 1 → 0) ignoring the setting in the complete signal output mode (Weighing function 2).

Time duration for which this signal is held "1" depends on the setting in complete signal output.



- After an Complete signal output, Weight value must fall below the 25% level of Final setting. Otherwise, Complete for next run cannot change to "1".
- If the value for Final is set to "0", Complete may spontaneously change to "1" when the F159 is powered.

Under, Go, Over (I/O pert name: Under/Go/Over)

Simple comparison mode

Judgment criteria is selected in Over/Under comparison mode (Weighing function 2)

Under: "1" if Weight < Final setting - Under setting

Over: "1" if Weight > Final setting + Over setting

Go: "1" if Final setting + Over setting >= Weight >= Final setting - FF CPS. setting

Sequence mode

Judgment is carried out when Complete bit is ON, irrespective of Over/Under comparison mode (Weighing function 2) settings. Weight value will be frozen (if judgment is enabled).

Under: "1" if Weight < Final setting - Under setting

Over: "1" if Weight > Final setting + Over setting

Go: "1" if Final setting + Over setting >= Weight >= Final setting - FF CPS. setting

Net weight 10⁰ - 10⁴ (I/O pert name: NetWeight/NetWeightEx)

Indicates Net weight

Net weight sign (I/O pert name: NwSign)

"1" when Net weight becomes negative

Upper/Lower limit (I/O pert name: LowerLimit/UpperLimit)

Timing of judgment is selected in Upper/Lower limit comparison mode: continuous comparison, or comparison synchronized with Judge input. The latter case requires Judge bit to be "1".

Lower limit: "1" if Weight < Lower limit setting

Upper limit: "1" if Weight > Upper limit setting

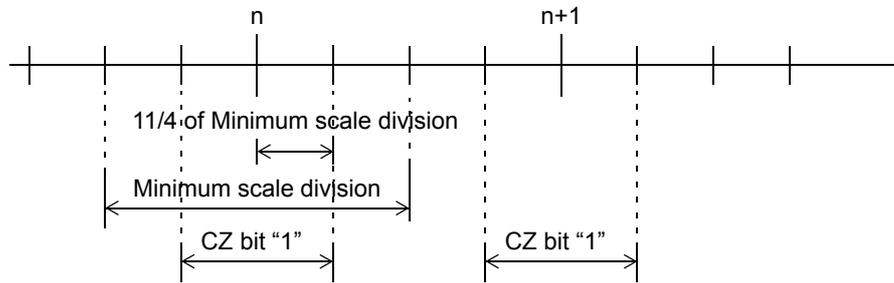
Stable (I/O pert name: Stable)

This bit turns "1" when Weight value comes stabilized.

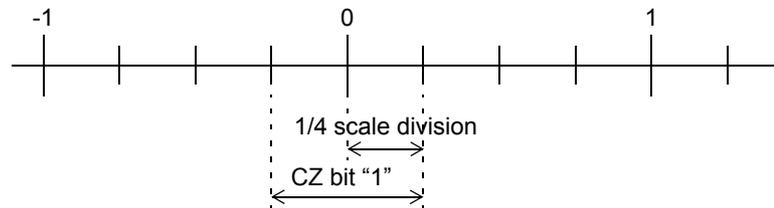
* For more information, see Section 5-4. "Motion Detection (MD)", page40.

CZ (I/O pert name: CenterZero)

CZ (Center Zero) bit helps the user find out the center of scale interval. The Minimum scale division is divided into four sub-divisions, and CZ bit becomes “1” if reading falls within the central two sub-divisions.



When 1/4 scale division is disabled, CZ becomes “1” only if reading coincides with true zero point.



ZT in progress (I/O pert name: ZeroTracking)

ZT in Progress bit becomes “1” when Zero tracking is enabled.

* For more information, see Section 5-5. "Zero Tracking (ZT)" , page41.

HOLD in progress (I/O pert name: HoldProg)

HOLD in Progress bit becomes “1” while Weight value is frozen.

Tare subtraction in progress (I/O pert name: TareSubtractProg)

This bit becomes “1” while tare subtraction function is enables (Tare must have non zero value).

Feed / Discharge (I/O pert name: FeedDischCtl)

This bit becomes “1” when Feed control is enabled, and “0” when Discharge control is enabled. This selection is made in Weighing mode.

DIP SW 1 - 4 (I/O pert name: DipSw)

These bits indicate the status of DIP switch selections.

A “1” in these bits indicates that the corresponding switch is ON, and a “0” indicates that the switch is OFF.

Zero calibration in progress (I/O pert name: ZeroCalibProg)

This bit becomes “1” while Zero calibration is in progress.

Span calibration in progress (I/O port name: SpanCalibProg)

This bit becomes “1” while Span calibration is in progress.

NOV RAM (I/O port name: NovRam)

This bit becomes “1” when NOV RAM is being accessed.

Do not remove power from F159 while this bit is “1”.

Cyclic bit (I/O port name: CyclicBit)

This bit toggles between “1” and “0” in approx. one second interval.

ERR ON (I/O port name: ErrOn)

This bit becomes “1” if there are one more unresolved errors (non-zero error code).

Normally ON (I/O port name: NormallyOn)

This bit is always “1”.

Error code (I/O port name: ErrCode)

Combination of this bit and Error Assistance Code bit identify the nature of the error. Error Code “0” indicates that the system is currently error free.

Error assistance code (I/O port name: ErrCode)

Combination of this bit and Error Code bit identify the nature of the error. Error Assistance Code “0” indicates that the system is currently error free.



For detailed information about Error Code and Error Assistance Code, see Section 9-1. "Error Code and Error Assistance Code" , page71.

-LOAD (I/O port name: NegLoad)

This bit is set “1” when input signal from the load cell overshoots to negative range.

+LOAD (I/O port name: PosLoad)

This bit is set “1” when input signal from the load cell overshoots to positive range.

OFL1 (I/O port name: OFL1)

This bit is set “1” when Net weight > Net Over setting.

OFL2 (I/O port name: OFL2)

This bit is set “1” when Gross weight > Capacity + 9 scale intervals.

OFL3 (I/O port name: OFL3)

This bit is set “1” when Gross weight > Gross Over setting.

Zero error (I/O port name: ZeroErr)

Performing zero-clear operation (Digital Zero or Zero tracking) when reading is over the Digital Zero regulation value produce Zero Error, raising this bit.

To remove this error and reset Zero Error bit, perform Digital Zero Reset of Zero calibration.

EXC ALM (I/O port name: ExcAlm)

This bit changes to “1” when the load cell excitation voltage falls below the specified level.

Calibration error (I/O port name: CalibErr)

This bit turns on “1” when one or more irregularities were found during zero/Span calibration and the process did not complete normally.

TARE ON response (I/O port name: TareOnResp)

Returns the state of TARE ON bit.

TARE OFF response (I/O port name: TareOffResp)

Returns the state of TARE OFF bit.

DZ ON response (I/O port name: DigiZeroOnResp)

Returns the state of DZ ON bit.

DZ OFF response (I/O port name: DigiZeroOffResp)

Returns the state of DZ OFF bit.

HOLD response (I/O port name: HoldResp)

Returns the state of HOLD bit.

Digital tare subtraction response (I/O port name: DigiTareSubtractResp)

Returns the state of Digital tare subtraction bit.

Feed / Discharge response (I/O port name: FeedDischargeResp)

Return the state of Feed/Discharge bit.

Free fall compensation response (I/O port name: FFCPSResp)

Returns the state of FF CPS. bit.

Judge response (I/O port name: JudgeResp)

Returns the state of Judge bit.

SEQ START response (I/O port name: SeqStartResp)

Returns the state of SEQ START bit.

SEQ STOP response (I/O port name: SeqStopResp)

Returns the state of SEQ STOP bit.

Soft LOCK response (I/O pert name: SoftLockResp)

Return the state of Soft LOCK bit.

Zero calibration response (I/O pert name: ZeroCalibResp)

Returns the state of Zero Calibration bit.

Span calibration response (I/O pert name: SpanCalibResp)

Return the state of Span calibration bit.

Request response (I/O pert name: RequestResp)

Returns the state of REQUEST bit.

R/W response (I/O pert name: ReadWriteResp)

Returns the state of R/W bit.

3-2-4. Register Allocations for Weighing Control, and I/O Port Name

UpperLimitCfg	m	10 ³	10 ²	10 ¹	10 ⁰	Upper limit	00000 - 99999
	m+1				10 ⁴		
LowerLimitCfg	m+2	10 ³	10 ²	10 ¹	10 ⁰	Lower limit	00000 - 99999
	m+3				10 ⁴		
NearZeroCfg	m+4	10 ³	10 ²	10 ¹	10 ⁰	Near zero	00000 - 99999
	m+5				10 ⁴		
SetPoint1Cfg	m+6	10 ³	10 ²	10 ¹	10 ⁰	Set point 1	00000 - 99999
	m+7				10 ⁴		
SetPoint2Cfg	m+8	10 ³	10 ²	10 ¹	10 ⁰	Set point 2	00000 - 99999
	m+9				10 ⁴		
FreeFallCompCfg	m+10	10 ³	10 ²	10 ¹	10 ⁰	Free fall compensation	0000 - 9999
OverCfg	m+11		10 ²	10 ¹	10 ⁰	Over	000 - 999
UnderCfg	m+12		10 ²	10 ¹	10 ⁰	Under	000 - 999
FinalCfg	m+13	10 ³	10 ²	10 ¹	10 ⁰	Final	00000 - 99999
	m+14				10 ⁴		
PreTareValCfg	m+15	10 ³	10 ²	10 ¹	10 ⁰	Preset tare value	00000 - 99999
	m+16				10 ⁴		
	m+17					Undefined	
	m+18					Undefined	
	m+19					Undefined	

$$m = D20000 + \text{Unit No.} \times 100$$

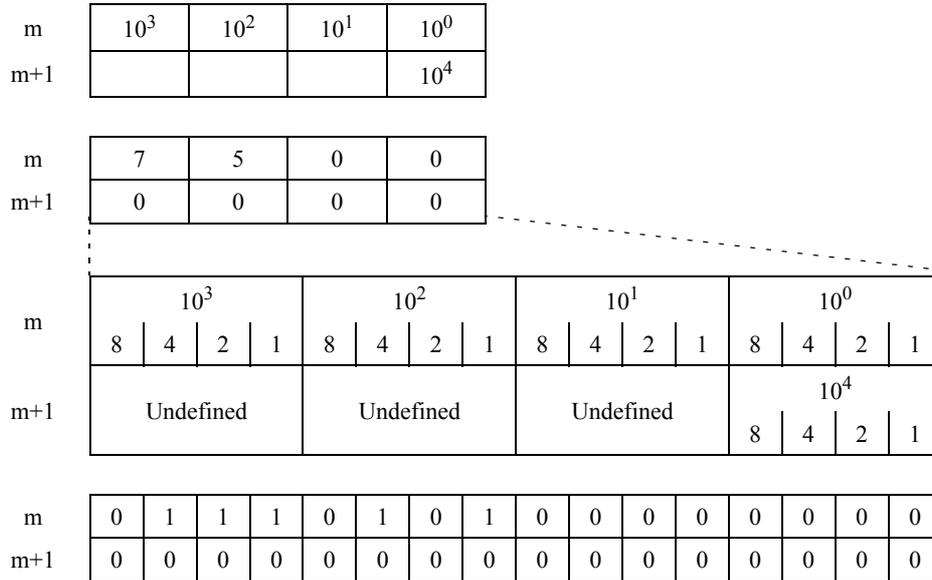
3-2-5. Register Allocations for Initial Settings, and I/O Port Name

CmpInhibitTimeCfg	m+20		10 ⁰	10 ⁻¹	10 ⁻²	Comparison inhibit time	0.00 - 9.99
CmpTimeCfg	m+21		10 ⁰	10 ⁻¹	10 ⁻²	Compare time	0.00 - 9.99
CompleteOutTimeCfg	m+22		10 ⁰	10 ⁻¹	10 ⁻²	Complete output time	0.00 - 9.99
AutoJogTimeCfg	m+23		10 ⁰	10 ⁻¹	10 ⁻²	Auto jog timer	0.00 - 9.99
AutoZeroJudgeTimeCfg	m+24	10 ¹	10 ⁰	10 ¹	10 ⁰	Auto zero times/ Judging times	
FFCPSReguCfg	m+25	10 ³	10 ²	10 ¹	10 ⁰	FF CPS. regulation	00000 - 99999
	m+26				10 ⁴		
WeightFun1Cfg	m+27	10 ⁰	10 ⁰	10 ⁰	10 ⁰	Weighing function 1	
WeightFun2Cfg	m+28	10 ⁰	10 ⁰	10 ⁰	10 ⁰	Weighing function 2	
WeightFun3Cfg	m+29	10 ⁰	10 ⁰	10 ⁰	10 ⁰	Weighing function 3	
OutSelCfg	m+30			10 ⁰	10 ⁰	Output selection	
RestrictTareSubtract	m+31	10 ⁰	10 ⁰	10 ⁰	10 ⁰	Restriction on the tare subtraction	
SeqModeCfg	m+32	10 ⁰	10 ⁰	10 ⁰	10 ⁰	Sequence mode	
MotionDetectCfg	m+33	10 ⁰	10 ⁻¹	10 ¹	10 ⁰	Motion detection	
ZeroTrackPeriodCfg	m+34			10 ⁰	10 ⁻¹	Zero tracking (Period)	0.0 - 9.9
ZeroTrackRangeCfg	m+35	10 ³	10 ²	10 ¹	10 ⁰	Zero tracking (Range)	0000 - 9999
FilterCfg	m+36	10 ⁰	10 ²	10 ¹	10 ⁰	Filter	
StableModeCfg	m+37			10 ⁰	10 ⁰	Stable mode	
FunSelCfg	m+38			10 ⁰	10 ⁰	Function selection	
BalWtValCfg	m+39	10 ³	10 ²	10 ¹	10 ⁰	Balance weight value	00000 - 99999
	m+40				10 ⁴		
CapacityCfg	m+41	10 ³	10 ²	10 ¹	10 ⁰	Capacity	00000 - 99999
	m+42				10 ⁴		
MinSelDivCfg	m+43		10 ²	10 ¹	10 ⁰	Minimum scale division	000 - 100
NetOverCfg	m+44	10 ³	10 ²	10 ¹	10 ⁰	Net Over	00000 - 99999
	m+45				10 ⁴		
GrossOverCfg	m+46	10 ³	10 ²	10 ¹	10 ⁰	Gross Over	00000 - 99999
	m+47				10 ⁴		
DigiZeroRegValCfg	m+48	10 ³	10 ²	10 ¹	10 ⁰	DZ regulation value	00000 - 99999
	m+49				10 ⁴		
GravityAccAreaNoCfg	m+50			10 ¹	10 ⁰	Gravitational acceleration (Area number input)	00 - 16
GravityAccelerationCfg	m+51	10 ⁰	10 ⁻¹	10 ⁻²	10 ⁻³	Gravitational acceleration (Acceleration input)	9.700 - 9.999
	m+52						Undefined
	m+53						Undefined
	⋮						
	⋮						
	⋮						
	⋮						
	m+99						Undefined

m = D20000 + Unit No.×100

F159 and CPU unit exchange data in BCD format.

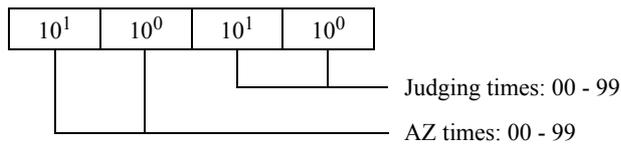
Example: How to set "7500" to Upper limit



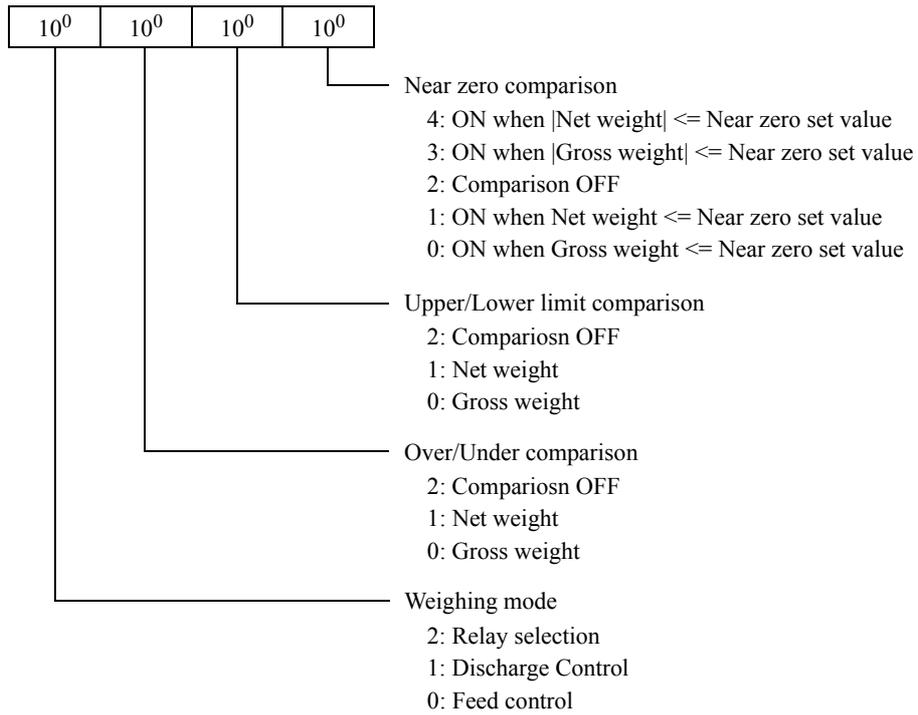
CAUTION

F159 and CPU unit exchange data in BCD format. Violation of this rule will cause an unexpected operational failure. Data in "undefined" area is ignored: it is strongly recommended that these areas are filled up with "0"s.

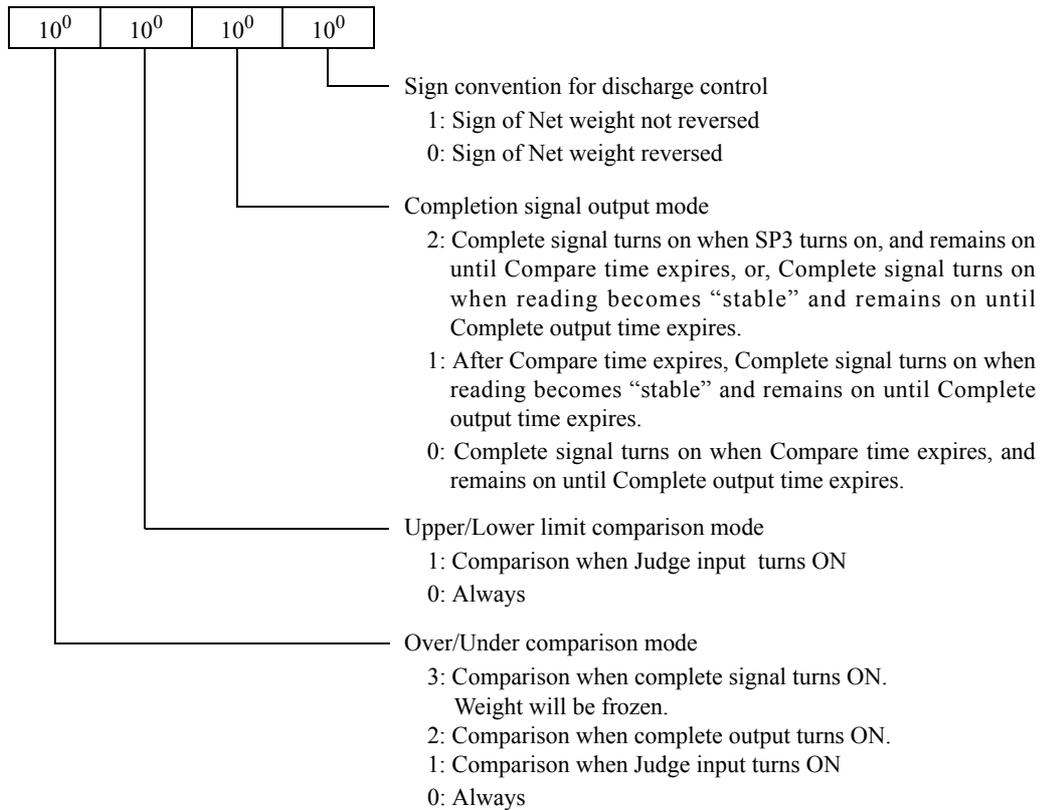
Auto zero times /Judging times (AutoZeroJudgeTimeCfg)



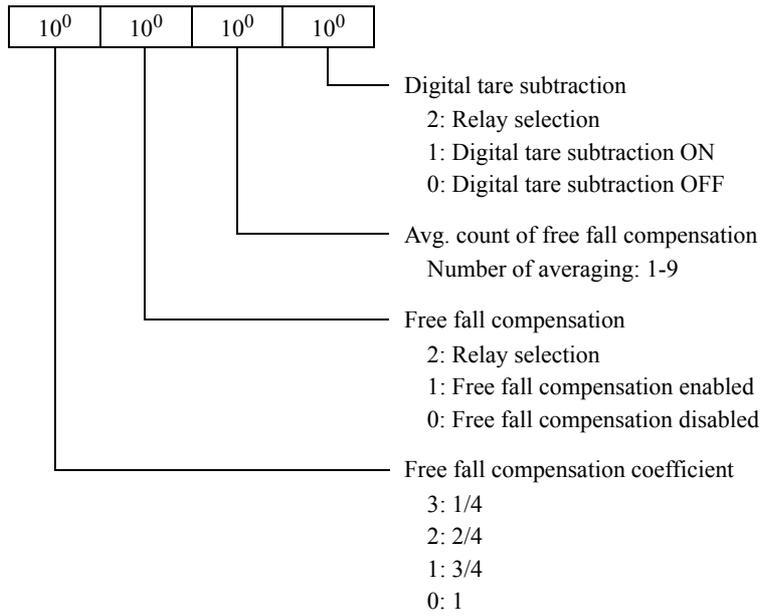
Weighing function 1 (WeightFun1Cfg)



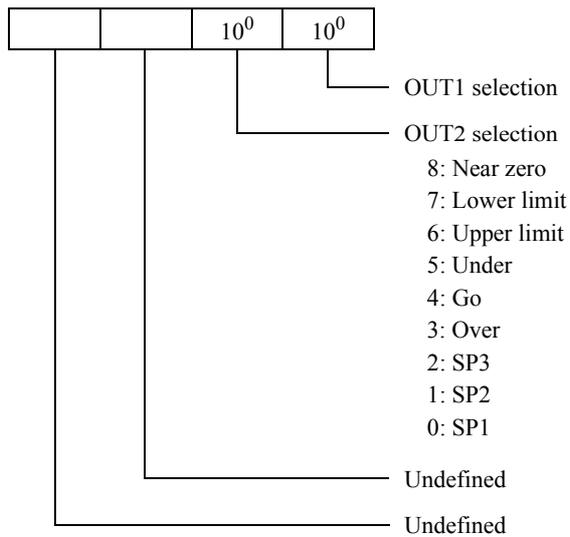
Weighing function 2 (WeightFun2Cfg)



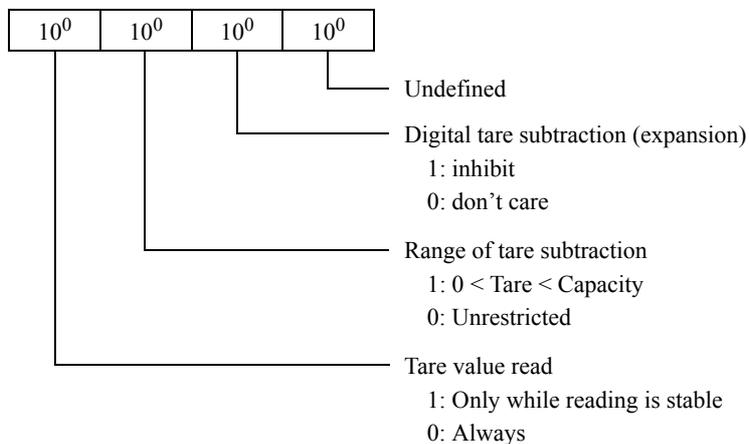
Weighing function 3 (WeightFun3Cfg)



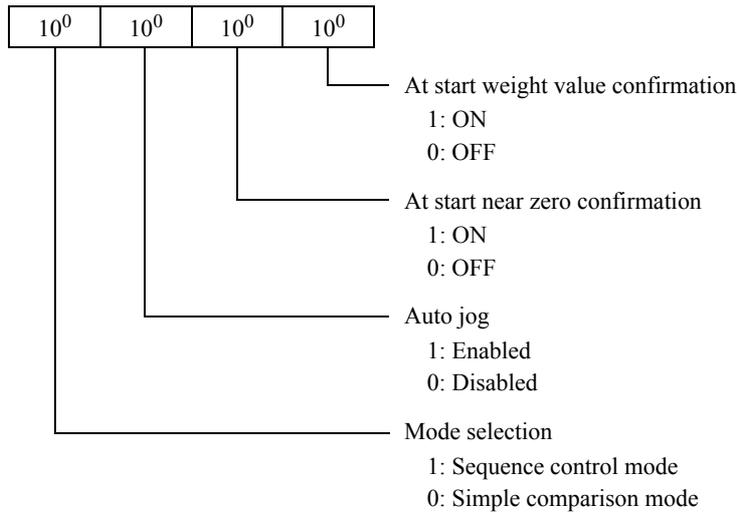
Output selection (OutSelCfg)



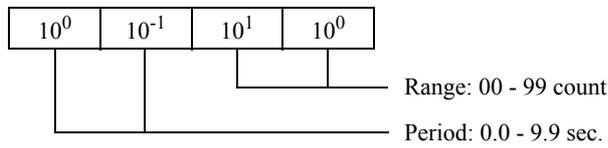
Restriction on the tare subtraction (RestrictTareSubtract)



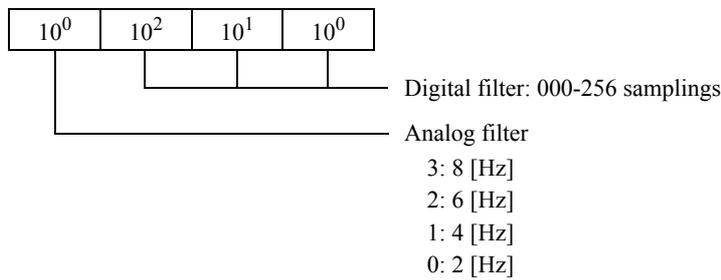
Sequence mode (SeqModeCfg)



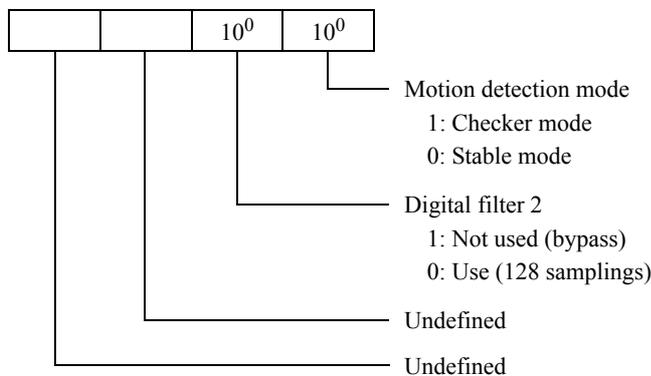
Motion detection (MotionDetectCfg)



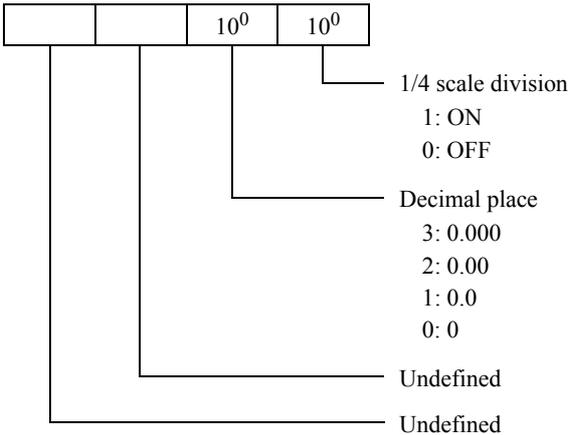
Filer (FilterCfg)



Stable mode (StableModeCfg)



Function selection (FunSelCfg)

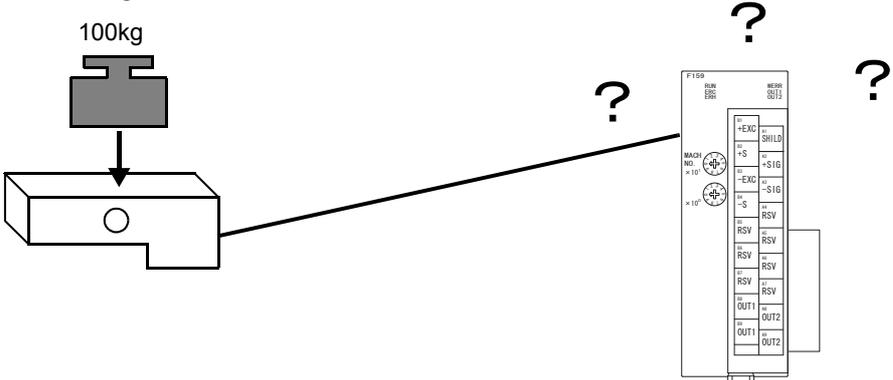


4. CALIBRATION

4-1. What is Calibration?

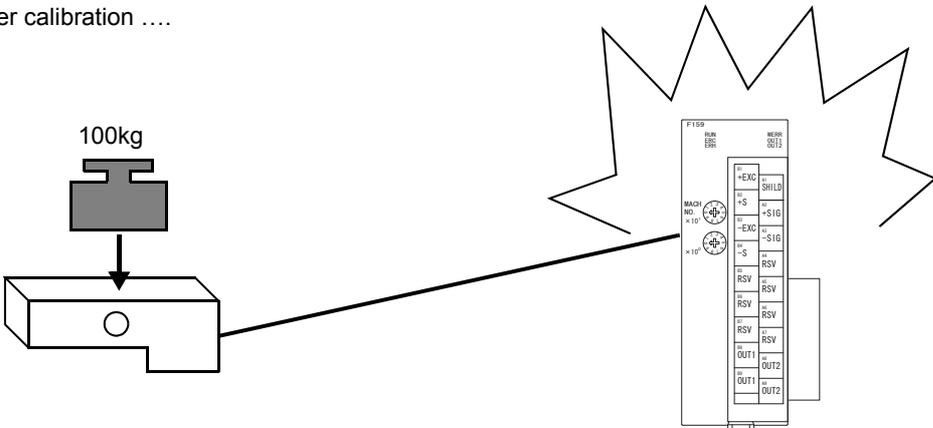
Calibration designates a procedure to adjust F159 so that it indicates correct reading corresponding to the actual weight placed on the load cell. That is, F159 must be properly adjusted to indicate 100 kg when an actual load (Weight) of 100 kg is placed on the load cell (sensing device). This process is called an actual loading calibration.

Just connecting an load cell to F159...



F159 indicates random values

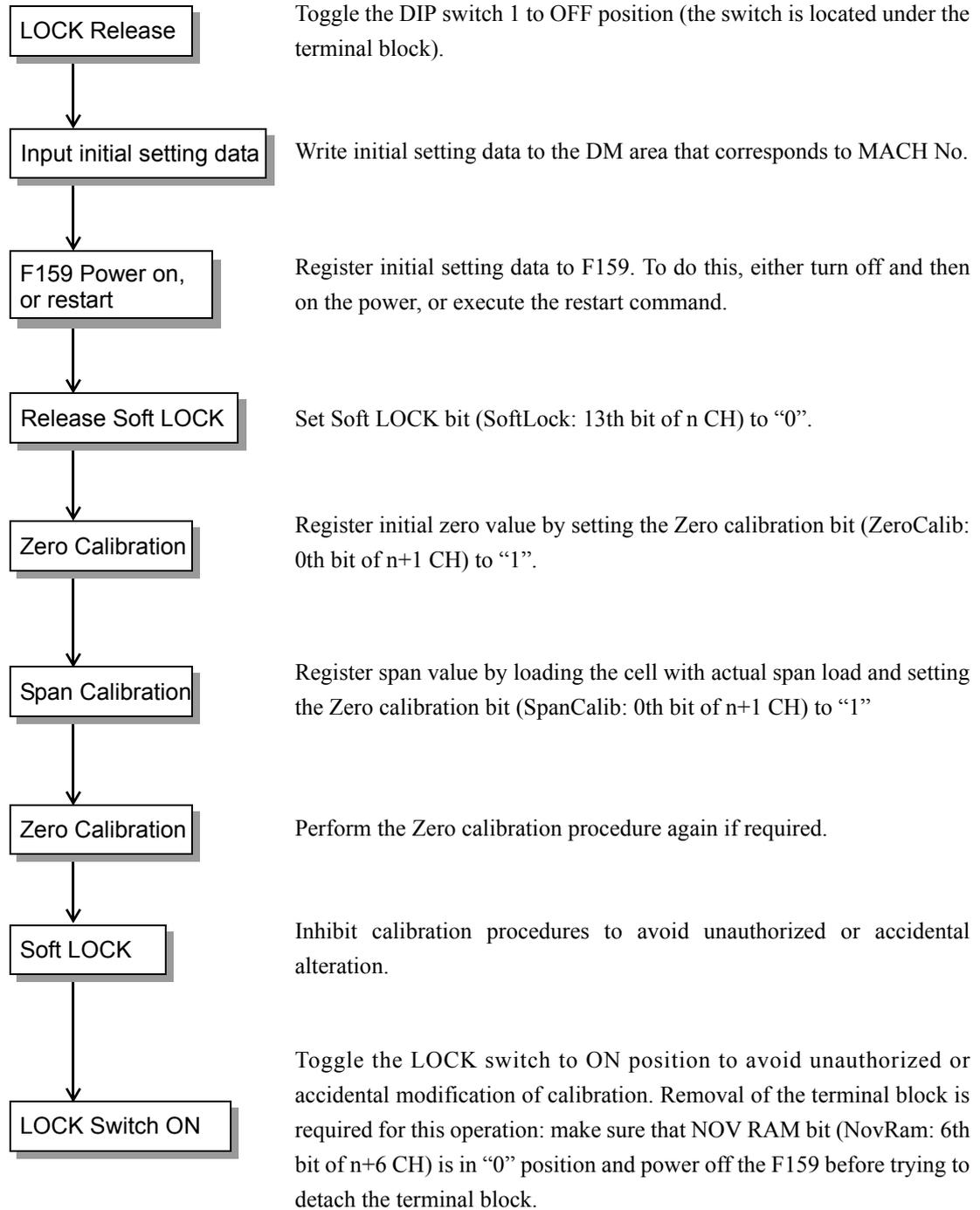
After calibration



F159 and the load cell constitute a well-tuned metering system

4-2. Actual Load Calibration Procedure

Steps required to perform actual load calibration are as follows:

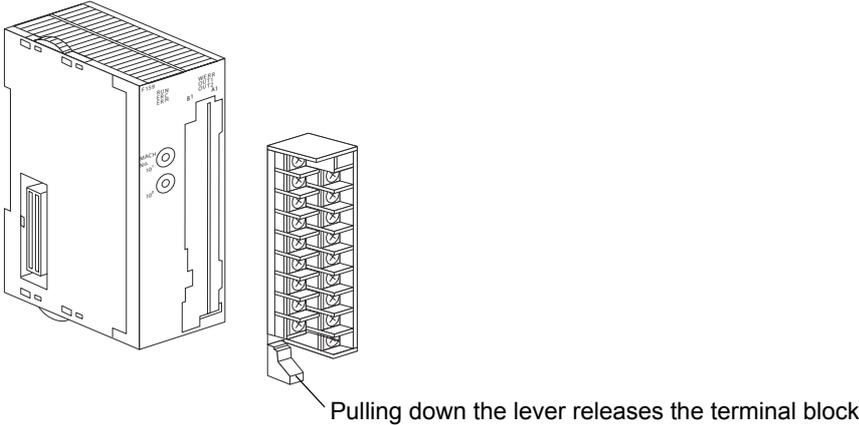


4-3. Preparation for Calibration

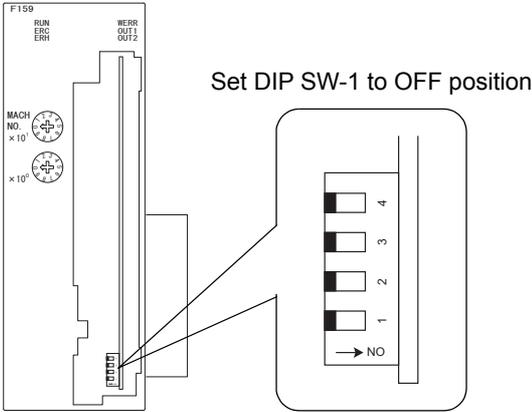
4-3-1. LOCK Release

F159 provides two types of LOCK features to avoid unauthorized or accidental alteration of calibration and setting values. The Soft LOCK is enabled by setting a bit in a register, and hardware LOCK is activated by setting a DIP switch. The user must disable both of the LOCK features before trying to perform calibration procedures.

1.Remove the terminal block (F159 must be turned off before terminal block removal)



2.Set DIP switch 1 to OFF position



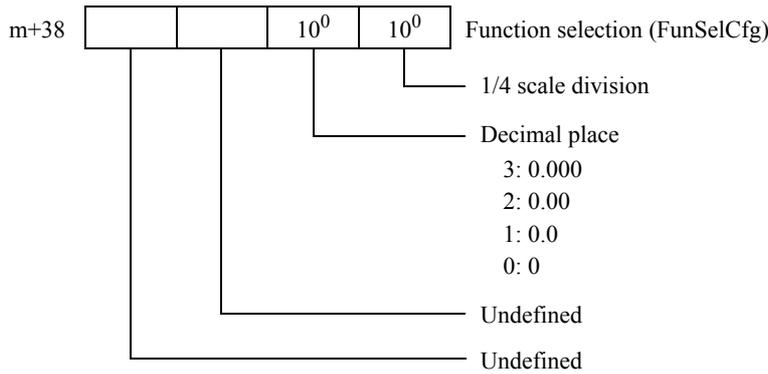
3.Turn on F159 and set Soft LOCK bit (13th bit of n CH) to “0”.

4-3-2. Setting Initial Data

Minimum data items required for performing proper calibration are: Decimal place, Balance weight value, Capacity, and Minimum scale division. Initial setting data are registered when F159 is powered on or it restarts.

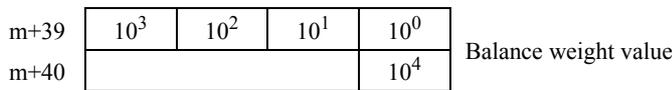
Decimal place

Decimal place specifies numerical format used for reading display and setting parameters. The format can be selected from 0, 0.0, 0.00, 0.000.



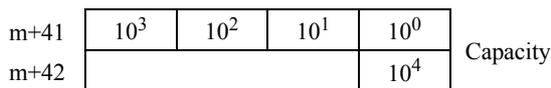
Balance weight value (BalWtValCfg)

Specify Weight value for Span calibration (Input range: 0 - 99999).



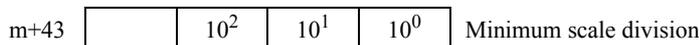
Capacity (CapacityCfg)

Defines maximum allowable weight that can be measured by the system (Input range: 0 - 99999). "OFL2" error occurs if actual weight exceeds this value by nine scale divisions.



Minimum scale division (MiniSelDivCfg)

Defines the Minimum scale division or scale interval (Input range: 1 - 100).



Gravitational acceleration (GravityAccAreaNoCfg/Cg1_GravityAccelerationCfg)

This factor compensates regional difference in Gravitational acceleration. This factor needs not be specified if the system is used in the same area where actual load calibration took place.

Two methods are provided to enter correct Gravitational acceleration: One method uses area numbers and the other requires direct input of Gravitational acceleration value.

In the former method, the user enters a area number (01-16) from the GA correction table for the region where actual load calibration will take place, and then select a area number corresponding to the region where the system is installed. Correct Gravitational acceleration compensation will be performed using these two area numbers. The latter method, direct input of Gravitational acceleration, is selected by specifying area number "00".

(Input range: 00-16 (Area number))

(Input range: 9.700-9.999 (Gravitational acceleration))

m+50			10^1	10^0	Area number
m+51	10^0	10^{-1}	10^{-2}	10^{-3}	Gravitational acceleration

Gravitational acceleration

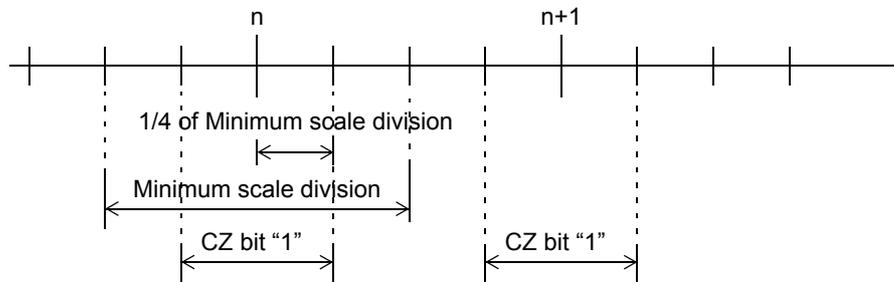
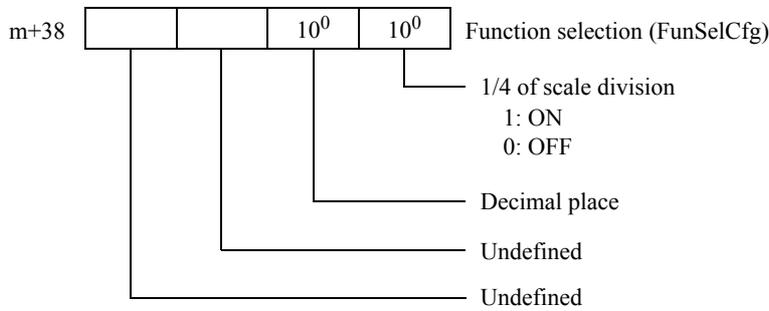
01	9.806	02	9.805	03	9.804	04	9.803
05	9.802	06	9.801	07	9.800	08	9.799
09	9.798	10	9.797	11	9.796	12	9.795
13	9.794	14	9.793	15	9.792	16	9.791



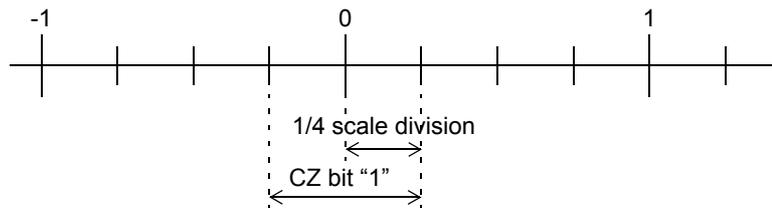
Amsterdam	9.813m/s ²	Manila	9.784m/s ²
Athens	9.800m/s ²	Melbourne	9.800m/s ²
Auckland NZ	9.799m/s ²	Mexico City	9.779m/s ²
Bangkok	9.783m/s ²	Milan	9.806m/s ²
Birmingham	9.813m/s ²	New York	9.802m/s ²
Brusseles	9.811m/s ²	Oslo	9.819m/s ²
Buenos Aires	9.797m/s ²	Ottawa	9.806m/s ²
Calcutta	9.788m/s ²	Paris	9.809m/s ²
Capetown	9.796m/s ²	Rio de janeiro	9.788m/s ²
Chicago	9.803m/s ²	Rome	9.803m/s ²
Copenhagen	9.815m/s ²	San Francisco	9.800m/s ²
Cyprus	9.797m/s ²	Singapore	9.781m/s ²
Djakarta	9.781m/s ²	Stockholm	9.818m/s ²
Frankfurt	9.810m/s ²	Sydney	9.797m/s ²
Glasgow	9.816m/s ²	Taichung	9.789m/s ²
Havana	9.788m/s ²	Tainan	9.788m/s ²
Helsinki	9.819m/s ²	Taipei	9.790m/s ²
Kuwait	9.793m/s ²	Tokyo	9.798m/s ²
Lisbon	9.801m/s ²	Vancouver,BC	9.809m/s ²
London (Greenwich)	9.812m/s ²	Washinton DC	9.801m/s ²
Los Angelse	9.796m/s ²	Wellington NZ	9.803m/s ²
Madrid	9.800m/s ²	Zurich	9.807m/s ²

1/4 Scale Division

This function facilitates finding the central portion within the Minimum scale division. If this function is enabled, the width of Minimum scale division is further divided into four equal width portions. If reading falls within the central two portions, CZ bit (CenterZero: 11th bit of n+5 CH) will be set to “1”. This function can be enabled/disabled by the user.



When 1/4 scale division is disabled, CZ becomes “1” only if reading coincides with true zero point.



4-4. Zero Calibration

Follow the steps below to define correct initial value:

1. Make sure that the load cell (sensing device) is free from unnecessary load, such as foreign object placed on the weighing plate, or contact with peripheral devices.
2. Make sure that the “stable” bit (Stable: 10th bit of n+5 CH) is set to “1”.
(Calibration procedures must be performed while reading is stable)
3. Toggle the Zero calibration bit (ZeroCalib: 0th bit of n+1 CH) from “0” to “1”.
4. F159 starts Zero calibration procedures when it acknowledges an ON edge (0 → 1) of the Zero calibration bit.
5. Zero calibration in progress bit (ZeroCalibProg: 4th bit of n+6 CH) turns on “1”. Do not touch the sensing portion (load cell) while this bit in on.
6. Make sure Weight reading shows “00000”.
7. Toggle the Zero calibration bit (ZeroCalib: 0th bit of n+1 CH) back to “0”.



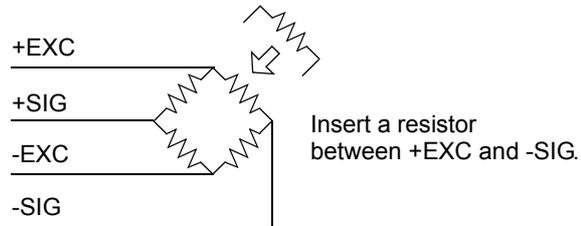
If any of calibration errors occur, the user must take appropriate measures to correct the error, and retry Zero calibration.

For further information about the error codes, see Section 9-1. "Error Code and Error Assistance Code" , page71.

Calibration Error 2

Initial dead load exceeds the zero adjustable range of the F159. Check if the cell is loaded with any extra object.

If the **Calibration Error 2** persists while the system is loaded correctly, Zero calibration must be performed again after inserting a resistor between +EXC and -SIG terminals of the load cell for shifting zero point. The relation between input signal shift and resistor values are summarized in the table below.



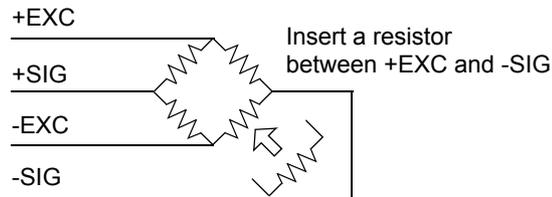
Resistor		Voltage shift equivalent strain	
Calculated	Approximate value	μ-STRAIN	mV/V
875 kΩ	866 kΩ	200	0.1
437 kΩ	442 kΩ	400	0.2
291 kΩ	294 kΩ	600	0.3
219 kΩ	221 kΩ	800	0.4
175 kΩ	174 kΩ	1000	0.5
146 kΩ	147 kΩ	1200	0.6
125 kΩ	124 kΩ	1400	0.7
109 kΩ	110 kΩ	1600	0.8
97 kΩ	97.6 kΩ	1800	0.9
87.3 kΩ	86.6 kΩ	2000	1.0
79.4 kΩ	78.7 kΩ	2200	1.1
72.7 kΩ	73.2 kΩ	2400	1.2
67.1 kΩ	66.5 kΩ	2600	1.3
62.3 kΩ	61.9 kΩ	2800	1.4
58.2 kΩ	57.6 kΩ	3000	1.5
54.5 kΩ	54.9 kΩ	3200	1.6
51.3 kΩ	51.1 kΩ	3400	1.7
48.4 kΩ	48.7 kΩ	3600	1.8
45.9 kΩ	46.4 kΩ	3800	1.9
43.6 kΩ	43.2 kΩ	4000	2.0
41.5 kΩ	41.2 kΩ	4200	2.1
39.6 kΩ	39.2 kΩ	4400	2.2
37.9 kΩ	38.3 kΩ	4600	2.3
36.3 kΩ	36.5 kΩ	4800	2.4
34.8 kΩ	34.8 kΩ	5000	2.5

- The values contained in the table assume single 350Ω load cell configuration.
- Temperature coefficient of the resistor directly affect reading accuracy. Use resistor with temperature coefficient better than 50ppm/ °C (5ppm/ °C class recommended)

Calibration Error 3

Initial dead load overshoots to negative range. Check if the cell is loaded in opposite direction, or +SIG and -SIG of the load cell are connected in reverse order.

If Calibration Error 3 persists while load direction and cable connections are correct, Zero calibration must be performed again after inserting a resistor between +EXC and -SIG terminals of the load cell for shifting zero point. See the table in the previous section "Calibration Error 2" for determining the resistor to be inserted.



4-5. Span Calibration

In this procedure, a known test load is placed on the cell to adjust the meter to indicate the desired reading.

1. Place a Weight with exactly the same value as defined in Balance weight value on the load cell. (Heavier than 50% Capacity load is recommended for better linearity.)
2. Check the load cell is free from undesired extra loading: extra foreign object on the weighing plate, or contact with peripheral object.
3. Make sure that the "stable" bit (Stable: 10th bit of n+5 CH) is set to "1".
(Calibration procedures must be performed while reading is stable)
4. Toggle the Span calibration bit (SpanCalib: 1st bit of n+1 CH) from "0" to "1".
5. F159 starts Zero calibration procedures when it acknowledges an ON edge (0 → 1) of the Span calibration bit.
6. Span calibration in progress bit (SpanCalibProg: 5th bit of n+6 CH) turns on "1". Do not touch the sensing portion (load cell) while this bit in on.
7. Make sure that the reading exactly coincides with the desired value (e.g., Balance weight value).
8. Toggle the Span calibration bit (SpanCalib: 1st bit of n+1 CH) back to "0".



If any of calibration errors occur, the user must take appropriate measures to correct the error, and retry Zero calibration.

For further information about the error codes, see Section 9-1. "Error Code and Error Assistance Code" , page71.

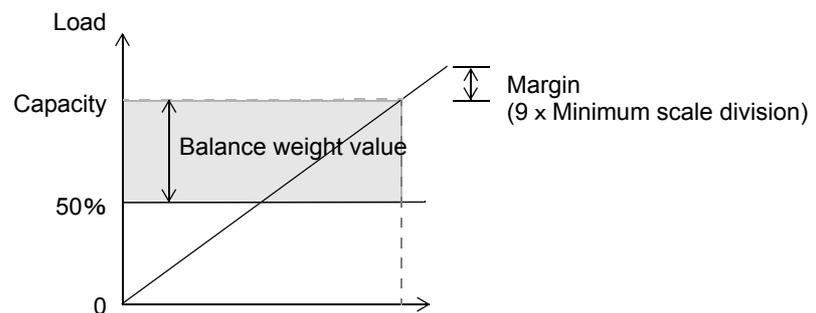
Calibration Error 1

Zero calibration must be performed again. In standard calibration procedures, Zero calibration is performed first, followed by Span calibration. However, if the result of the Span calibration is significantly off the target, F159 displays “Calibration Error 1”. If this happens you must perform Zero calibration. Correctly performed Zero calibration will clear the error message.

Calibration Error 4

Value set for Balance weight and/or Span calibration is larger than Capacity setting. Modify setting for Balance weight and/or Span calibration and retry Span calibration.

Capacity and Balance weight value



For accurate Span calibration, Balance weight value should be selected between 50%-100% of Capacity.

Calibration Error 5

Balance weight value is preset to “00000”. Select a proper non-zero value.

Calibration Error 6

The load cell output falls short of the F159’s allowable span adjustment range. Check if the load cell is loaded properly, and if its output specification meets F159 requirements. Then, perform Span calibration again.

Calibration Error 7

Load cell output varies in negative range. Check if the cell is loaded in opposite direction, or +SIG and -SIG of the load cell are connected in reverse order. Then, perform Span calibration again.

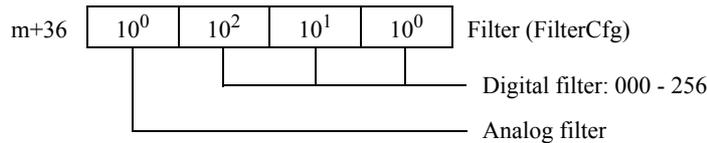
Calibration Error 8

Load cell output is outside the F159’s allowable span adjustment range. Check if the load cell is properly loaded, and the its rated output falls within the F159’s span adjustable range. Perform Span calibration again. Then, perform Span calibration again.

5. DISPLAY SETTINGS

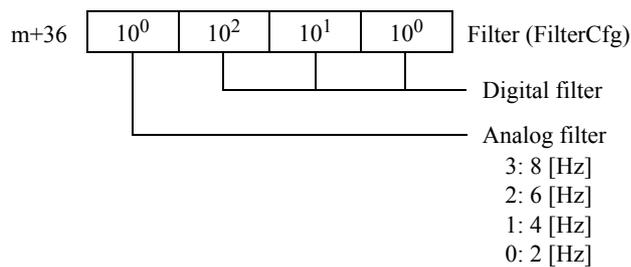
5-1. Digital Filter

This filter calculates moving average of A/D converter output to reduce reading fluctuation. Averaging width (number of data points) can be any between 0 (averaging OFF) to 256. Larger averaging width will enhance reading stability, but reduce response performance. Vice versa, shorter averaging width reduces reading stability, but enhance response velocity. Select optimal value according to the characteristics of each application.



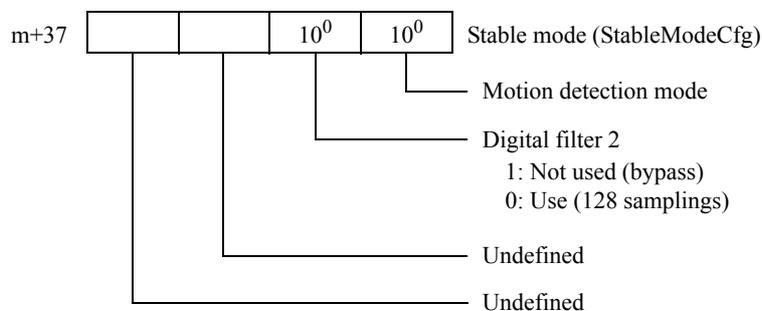
5-2. Analog Filter

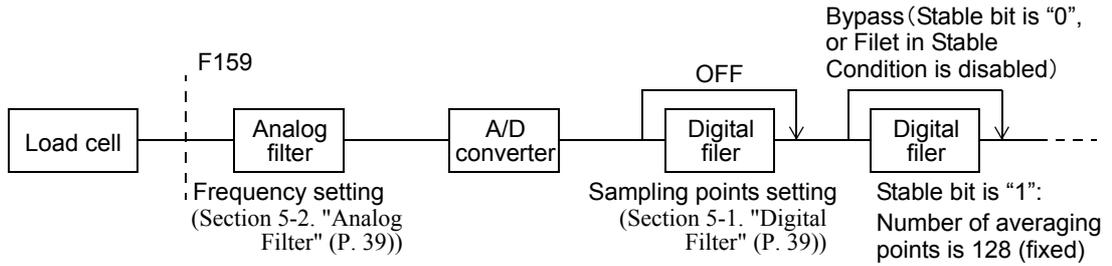
Analog low-pass filter to remove undesirable noise components from the load cell input. Cut-off frequency can be selected from 2, 4, 6, 8 Hz. Higher cut-off frequency will enhance filter response, but more noise components pass through the filter. Select optimal value according to the characteristics of each application.



5-3. Digital Filter 2

When reading becomes sufficiently stable, this function automatically inserts a digital filter to further reduce reading fluctuation. This is a user selectable optional function. For further information on stability criteria, see Section 5-4. "Motion Detection (MD)", page40.

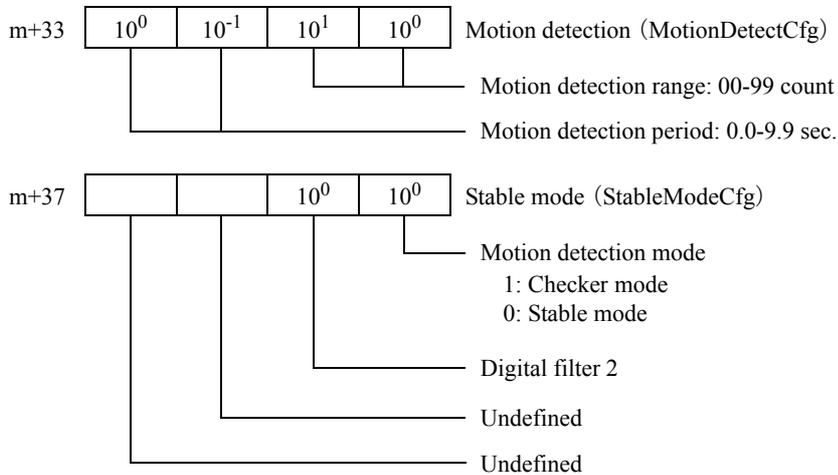




5-4. Motion Detection (MD)

MD (Motion detection) evaluates stability of weight reading and set a value to the criteria parameter accordingly. When weight reading remains within a specified range for a specified period of time, the system considers the reading stabilized and set Stable bit (Stable: 10th bit of n+5 CH) to "1".

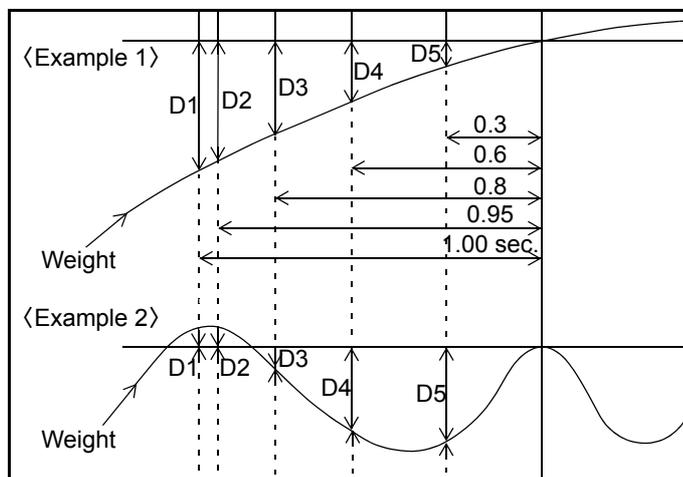
Motion detection has two operation modes: Stable mode and Checker mode.



Stable mode

Each A/D conversion data is compared with five previously acquired data (D1-D5, see diagram below). If any one of the five difference values falls out of the specified range, Stable bit is immediately turns off "0".

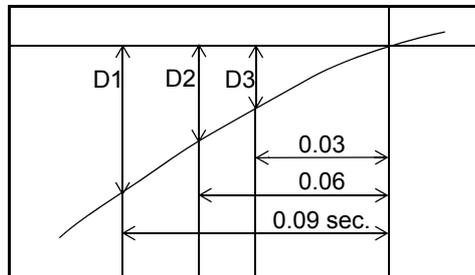
* D1 represents the weight difference between current data and the data one second before.



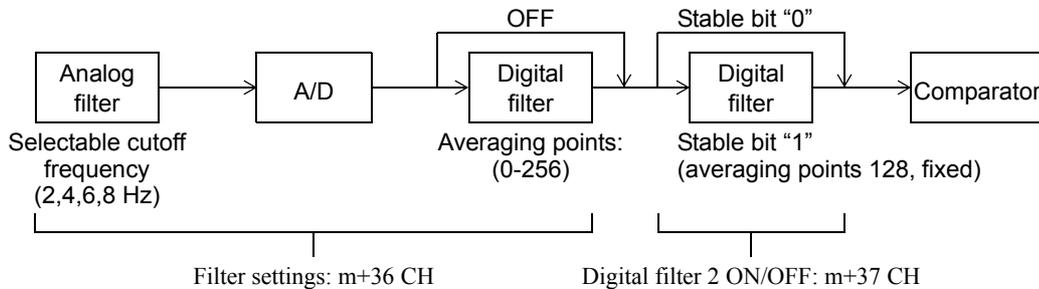
Checker mode

Each A/D conversion data is compared with three previously acquired data (D1-D3, see diagram below). If any one of the three difference values falls out of the specified range, Stable bit is immediately turns off “0”.

* D1 represents the weight difference between current data and the data 0.09 second before.



The user can optionally insert digital filter when Stable bit becomes “1” to further reduce weight reading fluctuation. (See Section 5-3. "Digital Filter 2", page39.)



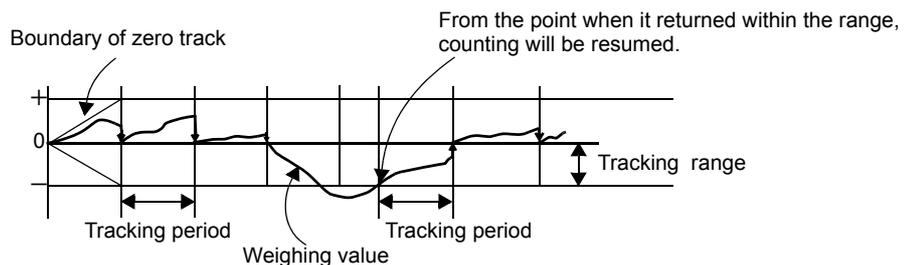
5-5. Zero Tracking (ZT)

Zero tracking automatically compensates slow system drift, as well as small zero-point shift due to residue objects on the scale such as debris, dirt and dust.

m+34			10^0	10^{-1}	Zero tracking period (ZeroTrackPeriodCfg): 0.0 - 9.9 sec.
m+35	10^3	10^2	10^1	10^0	Zero tracking range (ZeroTrackRangeCfg): 0 - 9999



- Zero tracking clear Final to zero at every specified period, if zero shift during that period remains within the specified range.
 - Allowed tracking period is from 0.0 to 9.9 seconds, and Zero tracking range is from 0 to 9999 in 1/4 of scale division unit. (0002=0.5 divisions, 0012=3 divisions)
- Zero tracking is disabled if zero is specified for the period or range.



5-6. Digital Zero (DZ)

Digital Zero forces Gross weight to be zero-cleared.

Net weight varies according to the following expression: Net weight = Gross weight - Tare

If Digital zero operation is performed while Gross weight exceeds DZ regulation value, Zero Error bit (ZeroErr: 13th bit of n+7 CH) is set to notify that an irregular operation has been done. In this case, DZ regulation value is subtracted from Gross weight.

* In case where Gross weight is not zero-cleared after DZ operation, or Zero Error bit is raised, check the following:

Cause	Suggested Action
Digital Zero is performed while reading is outside the DZ regulation value.	<ul style="list-style-type: none"> - Change DZ regulation setting and try Digital Zero operation again (this is a temporary measure. Perform Zero calibration at an earliest occasion.) - Remove debris and dirt from the weighing vessel. - Check if some mechanical obstruction hinders proper measurement.

* Digital Zero is cleared when turning off power.

5-7. Digital Zero Clear

This function clears digital zero. Perform this function when Zero Error bit is raised (ZeroErr: 13th bit of n+7 CH) to clear digital zero and reset Zero Error bit "0".

5-8. DZ Regulation

Set value for DZ regulation specifies a range that allows Digital Zero and Zero tracking function to compensate zero point (correction of shift from calibrated zero). If Digital Zero is performed or Zero tracking is triggered while reading exceeds the limit set by DZ regulation, Zero Error bit (ZeroErr: 13th bit of n+7 CH) is raised "1" to notify that an irregular operation has been done.

m+48	10 ³	10 ²	10 ¹	10 ⁰	DZ regulation value (DigiZeroRegValCfg): 0 - 99999
m+49				10 ⁴	

5-9. One-Touch Tare Subtraction

This function clears Net weight by equalizing Gross weight and Tare.

Note this function is activated only if reading is stable: stability criteria are defined in Restriction on Tare Subtraction Function.

Allowed range of Tare subtraction: All range or $zero < Tare \leq Capacity$.

* In case where Net weight is not zero-cleared after One-Touch Tare Subtraction, check the following:

Cause	Suggested Action
Gross weight is displayed.	Net weight is displayed in n+4, n+5 CH. Gross weight is displayed in n+2, n+3 CH. Make sure you are checking correct area.
Reading is not stable (check stability criteria).	Make sure reading is stable: "1" on the 10th bit of n+5 CH indicates that reading satisfies stability criteria. Check this bit before trying to clear Net weight.
Reading is outside the allowed tare subtraction range (check range setting).	Use this function while reading is within the allowable range for tare subtraction.

* Tare subtraction is reset when turning off power.

5-10. One-Touch Tare Subtraction Reset

Tare subtraction can be reset by the user. Resetting tare subtraction zero-clears the set value for Tare, equalizing Net weight and Gross weight.

* If Net weight and Gross weight are not equalized by resetting tare subtraction, check the following:

Cause	Suggested Action
Digital tare subtraction is enabled	Zero-clear the set value for Tare, or disable Digital tare subtraction.

5-11. Digital Tare Subtraction

This function enables you to subtract arbitrary value (as tare) from Net weight.

Set a value for tare (m+15, m+16 CH) and set the Digital tare subtraction bit to "1" to perform Digital tare subtraction.

m+15	10^3	10^2	10^1	10^0	Preset tare value (PreTareValCfg): 0 - 99999
m+16				10^4	

m+29	10^0	10^0	10^0	10^0	Weighing function 3 (WeightFun3Cfg) Digital tare subtraction 2: Relay selection 1: Digital tare subtraction ON 0: Digital tare subtraction OFF Avg. count of free fall compensation Free fall compensation Free fall compensation coefficient
------	--------	--------	--------	--------	--

5-12. Restriction on Tare Subtraction

The user can apply some restrictions on the action of Digital tare subtraction and One-Touch Tare Subtraction.

Tare value read

Specifies condition for reading in tare value.

Always: F159 can read in tare value anytime.

Stable: F159 read in tare value only when stable bit (Stable: 10th bit of n+5 CH) is raised “1”.

Range of Tare Subtraction

Specifies allowable tare range for subtraction.

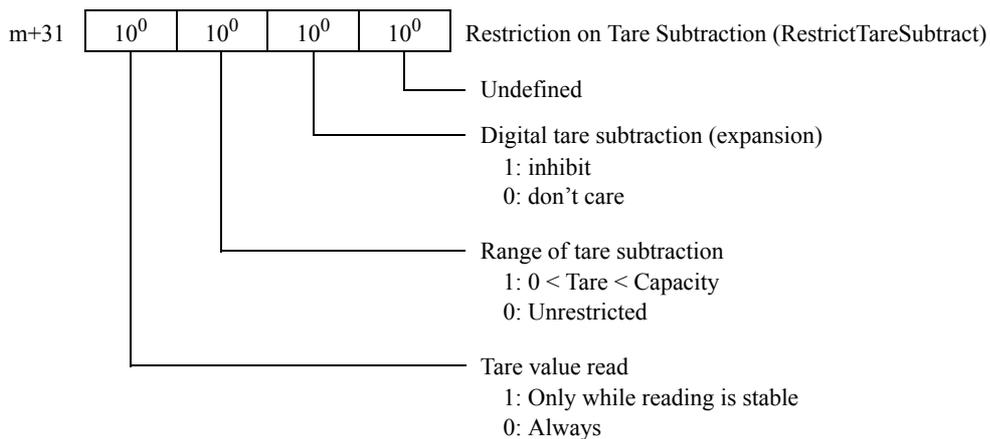
Whole range: any value is acceptable as tare

$0 < \text{tare} \leq \text{Capacity}$: a value within this range is acceptable

Digital tare subtraction (expansion)

Using this function, the user can inhibit two tare subtraction related actions while tare subtraction is enabled: modification of tare set value and ON/OFF toggling of Digital tare subtraction.

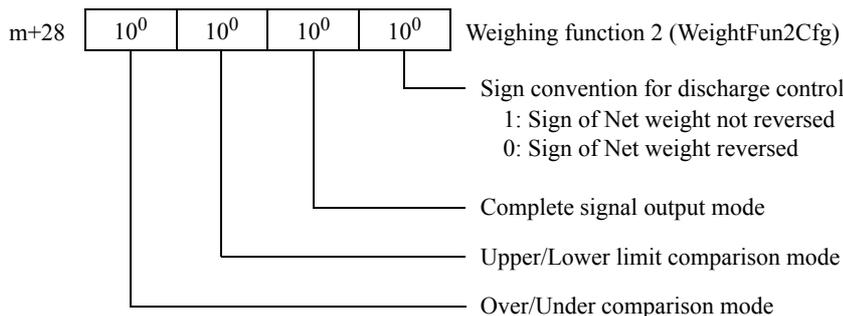
Select “1” in the relevant bit in the following register to inhibit these two actions while tare subtraction is enabled.



5-13. Sign Reversal during Discharge Control

When measuring weight of raw material tank from which a fixed quantity of material is drawn (Discharge weighing), Net weight will increase in negative direction. Using this sign reversing function, the user can obtain Net weight as a positive value.

To reverse the sign of Net weight output, select “1” in the relevant bit in the following register.



6. WEIGHING MODE SETTING AND OPERATION

Weighing mode is a method to draw specified amount of material accurately from the raw material storage (e.g. hopper, tank).

Quite an exact amount of material can be drawn from the source vessel by using a combination of such parameters and techniques including: Final, Set point 1, Set point 2, Free fall compensation, Over/Go/Under criteria, timers for Comparison Inhibit, and Judge.

This control mode has variants depending the material discharging methods: Feed weighing and Discharge weighing, simple comparison and sequence control.

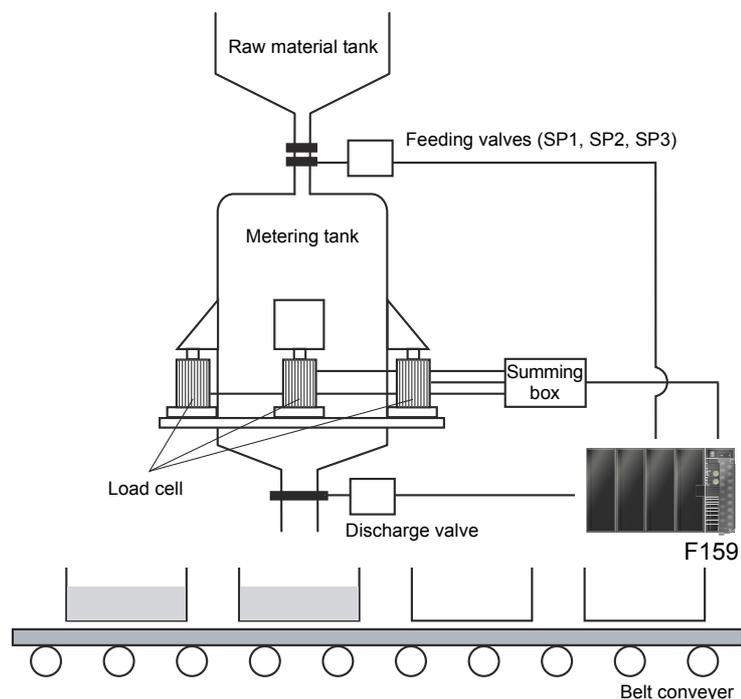
6-1. Feed Weighing and Discharge Weighing

6-1-1. Feed Weighing

This method controls weight of the metering tank (e.g. hopper) as it is being filled with raw material.

Example of Feed Weighing

In this example the metering tank is fed with raw material from the raw material tank. At first, the feeding valves are to be fully opened to feed, and closed in the order of large → medium, and medium → small at the time of Final-SP1, and Final-SP2, respectively. The feeding valves are to be completely closed at the time of Final-FF CPS.. The weighed raw materials are to be discharged to a container by opening the Discharge valves.



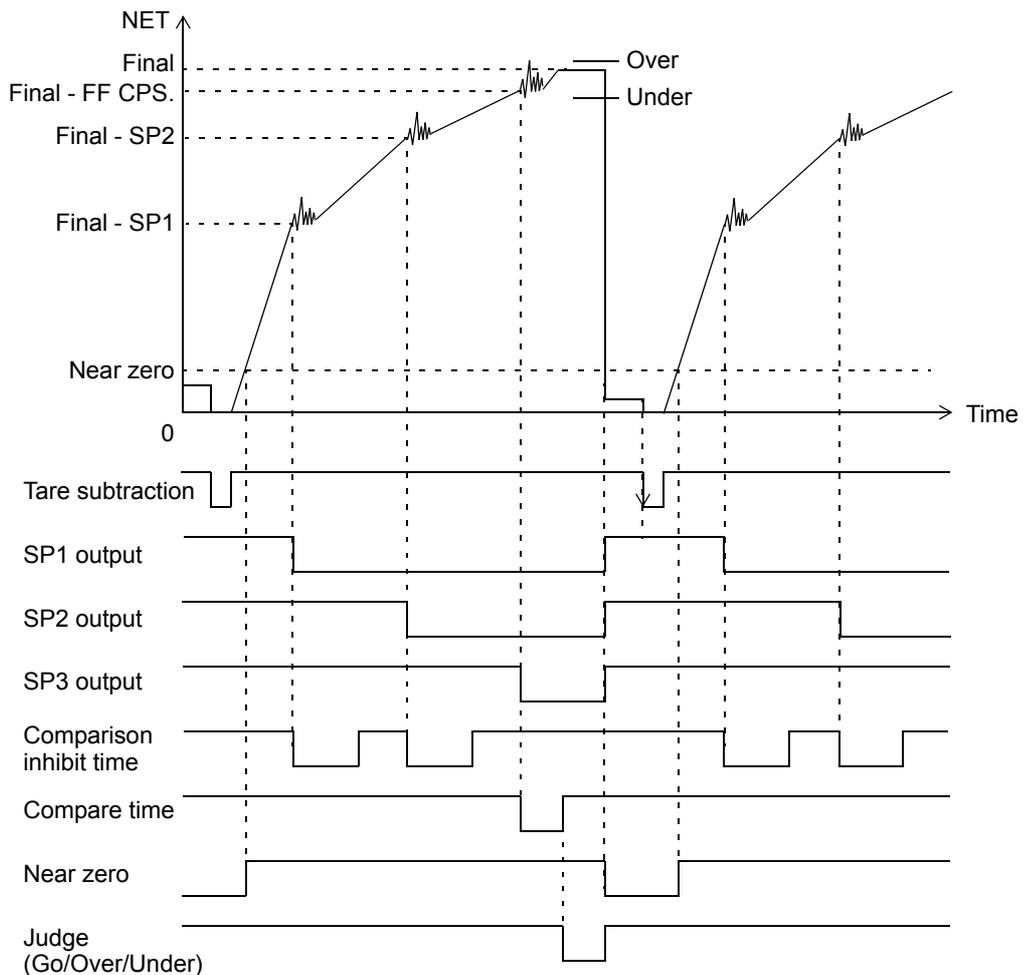
- (1) ON edge (0 → 1) of Tare subtraction bit (TareOn: 0th bit of n CH) triggers tare subtraction, zero-clearing Net weight.
- (2) Feeding starts with all valves full open. When the weight reaches (Final - SP1), SP1 signal turns ON (SP1: 9th bit of n+3 CH) and the Comparison inhibit time starts (if enabled). Travel of the raw material tank valve changes from “large” to “medium”.

6.WEIGHING MODE SETTING AND OPERATION

- (3) When the weight reaches (Final - SP2), SP2 signal turns ON (SP2: 10th bit of n+3 CH) and the Comparison inhibit time starts (if enabled). Travel of the raw material tank valve changes from “medium” to “small”.
- (4) When the weight reaches (Final - FF CPS.), SP3 signal turns ON (SP3: 11th bit of n+3 CH) and the Compare time starts (if enabled). Feed valve is totally closed.
- (5) When the Compare time expires, Over/Under judgment is made. If the weight exceeds the range of Over/Under set values, Over signal (Over: 15th bit of n+3 CH) or Under signal (Under: 13th bit of n+3 CH) is raised.
- (6) Open the metering tank valve to discharge the material into the container. Completion of discharge can be confirmed by checking Near zero signal (NearZero: 8th bit of n+3 CH). Repeat steps (1) to (5) for the next container.



Use NJ or appropriate relay sequencers to open/close the Feed/Discharge valves, and these sequencers are controlled by F159.

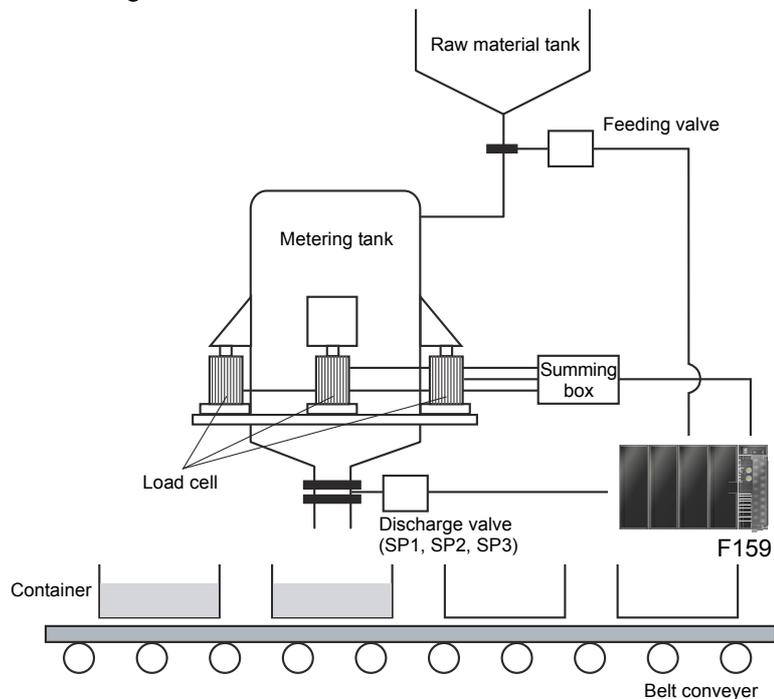


6-1-2. Discharge Weighing

This method controls weight of the metering tank (e.g. hopper) as it discharges material to the container. The metering tank is fed with the material from the raw material storage before discharging process begins.

Example of discharge weighing

In Discharge weighing, the amount of discharge can be weighed by adding negative weighed values. In this example system, raw materials are to be fed from the raw material tank to the metering tank, and a fixed quantity of raw materials are to be discharged from the metering tank to a container. At first, the Discharge valves of the weighing tank are to be fully opened to discharge raw materials, and the Discharge valves are to be closed in the order of large \rightarrow medium, and medium \rightarrow small at the time of Final-Set point 1, and Final-Set point 2, respectively. The Discharge valves are to be completely closed at the time of Final - FF CPS., when one measurement is completed. When the weighing tank runs short, the feeding valves are to be opened to replenish the metering tank with raw materials from the raw material tank to weigh.



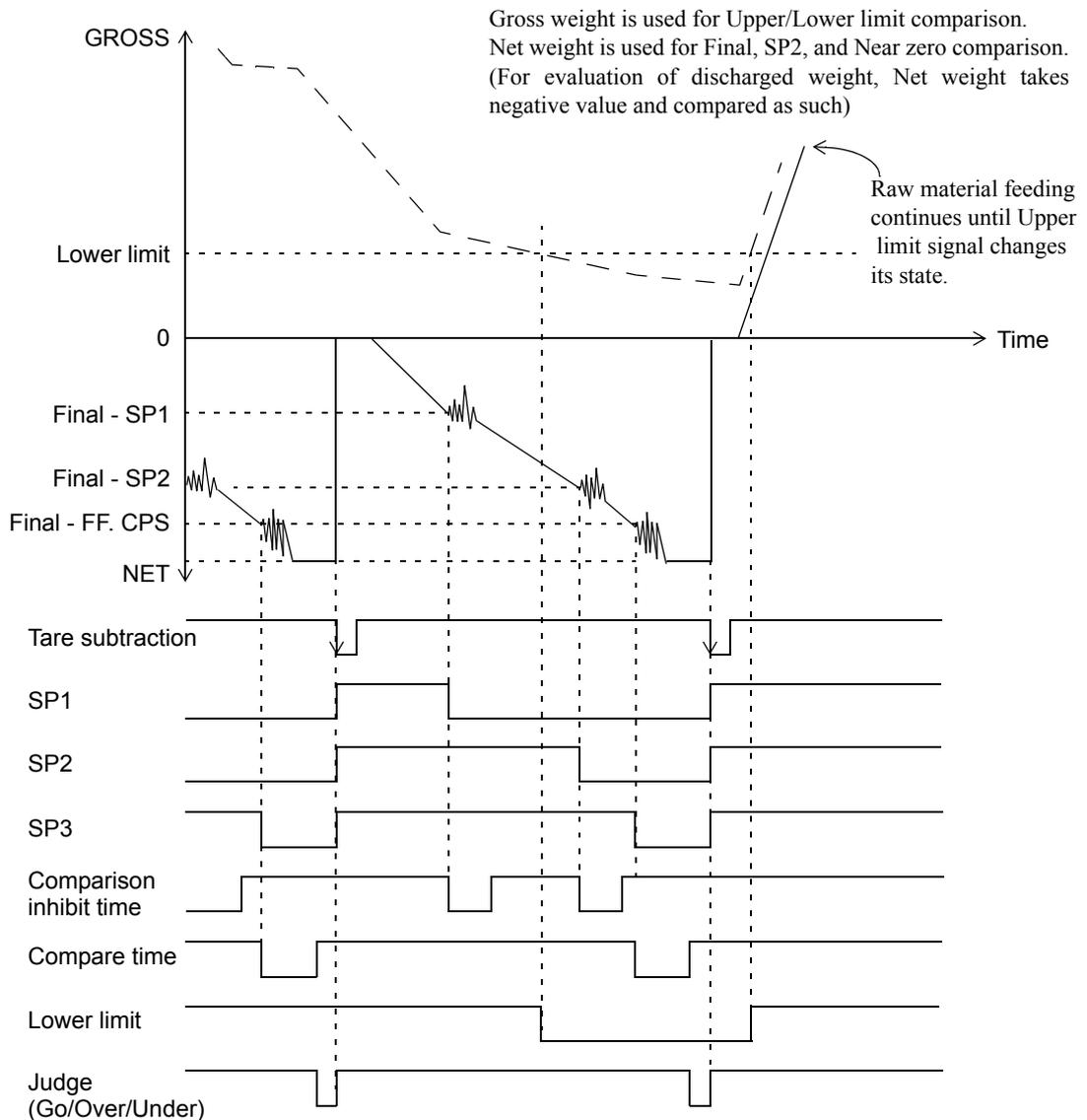
- (1) Toggling of Lower limit signal (LowerLimit: 8th bit of n+5 CH) opens the raw material tank, starting to feed the metering tank.
- (2) When the metering tank is fully packed with raw material, Upper limit signal (UpperLimit: 9th bit of n+5 CH) changes and the valve closes.
- (3) ON edge (0 \rightarrow 1) initiates tare subtraction (TareOn: 0th bit of n CH) zero-clearing Net weight.
- (4) Discharge starts with all valves full open. When the weight reaches (Final - SP1), SP1 signal turns ON (SP1: 9th bit of n+3 CH) and the Comparison inhibit time starts (if enabled). Travel of the raw material tank valve changes from “large” to “medium”.
- (5) When the weight reaches (Final - SP2), SP2 signal turns ON (SP2: 10th bit of n+3 CH) and the Comparison inhibit time starts (if enabled). Travel of the raw material tank valve changes from “medium” to “small”.

6.WEIGHING MODE SETTING AND OPERATION

- (6) When the weight reaches (Final - FF CPS.), SP3 signal turns ON (SP3: 11th bit of n+3 CH) and the Compare time starts (if enabled). Feed valve is totally closed.
- (7) When the Compare time expires, Over/Under judgment is made. If the weight exceeds the range of Over/Under set values, Over signa (Over: 15th bit of n+3 Ch) or Under (Under: 13th bit of n+3 CH) signal is raised. Repeat steps (1) to (5) for the next container.
- (8) When raw material in the metering tank decreases to the Lower limit, Lower limit signal (LowerLimit: 8th bit of n+5 CH) turns ON, opening the raw material tank valve to replenish metering tank.



Use NJ or appropriate relay sequencers to open/close the Feed/Discharge valves, and these sequencers are controlled by F159.

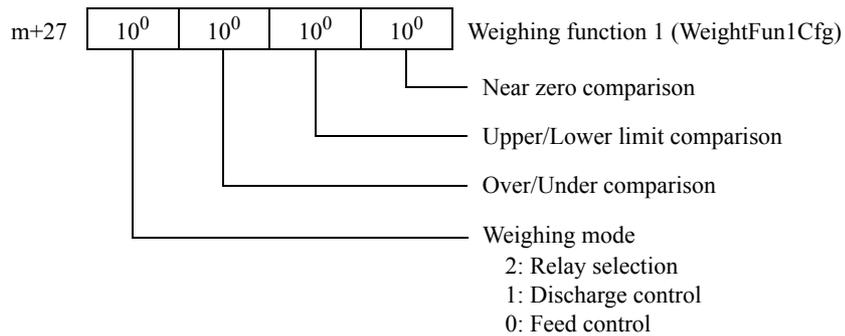




Near zero signal is used to detect completion of discharge, as in the case of Feed weighing.

6-1-3. Weighing Mode

This register defines settings for Feed/Discharge control. You can select one of three options (Feed, Discharge, or Relay selection).



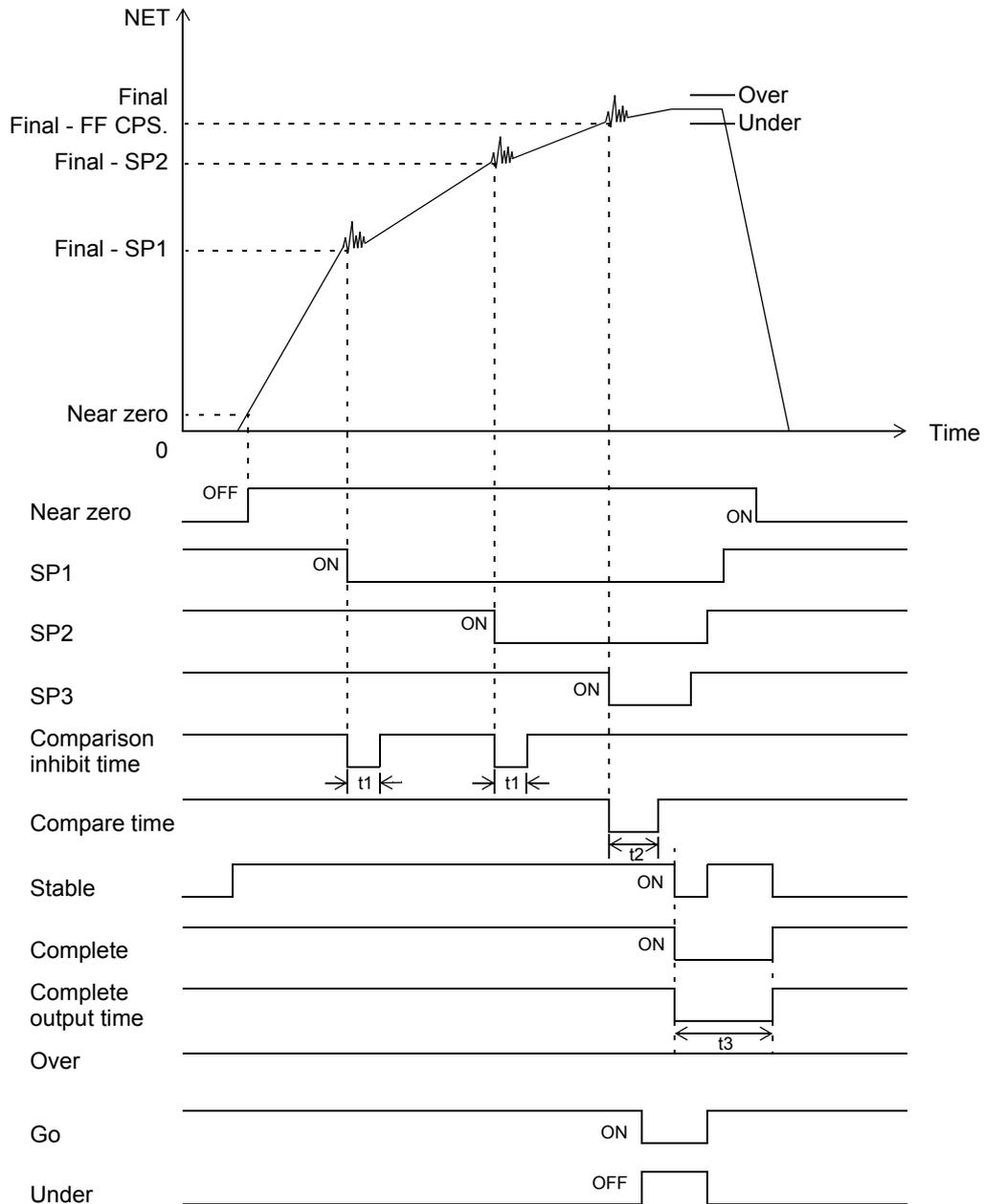
If you choose “2: Relay selection”, specify the type of Weighing mode by selecting Feed/Discharge bit (6th bit of n CH): “1” for Discharge control, “0” for Feed control.

6-2. Simple Comparison Control and Sequence Control

6-2-1. Simple Comparison Control

The simple comparison method compares the measured weight value with the discharge setting at a regular interval. The system outputs “1” when the preset condition is satisfied.

In this control method, the next control operation is only enabled when measured weight falls below 75% of the previous Final value.



- Triggering schedule of Over/Under comparison is determined by parameter settings for the Over/Under comparison mode (WeightFun2Cfg: Weighing function 2 parameters for m+28CH). The figure illustrates operation with "Regularly" selected.
- "Complete" is output according to the conditions specified for the complete signal output mode (WeightFun2Cfg: Weighing function 2 parameters for m+28CH).
- t1: Comparison inhibit time CmpInhibitTimeCfg (m+20CH)
t2: Compare time CmpTimeCfg (m+21CH)
t3: Complete output time CompleteOutTimeCfg (m+22CH)
- Conditional expressions:
 - Near zero outputs "1" when Weight value \leq Near zero set value
 - SP1 outputs "1" when Weight value \geq Final - SP1
 - SP2 outputs "1" when Weight value \geq Final - SP2
 - SP3 outputs "1" when Weight value \geq Final - FF. CPS
 - Under outputs "1" when Weight value $<$ Final - Under
 - Over outputs "1" when Weight value $>$ Final + Over
 - Go outputs "1" when Final + Over \geq Weight value \geq Final - Under
- Near zero comparison uses either signed values (Gross weight / Net weight) or absolute values ($|$ Gross weight $|$ / $|$ Net weight $|$) depending on the Weighing function 1 settings for m+27CH (WeightFun2Cfg).
- Data used for SP1/SP2/SP3 outputs and Over/Go/Under comparison can be either Gross or Net weight depending on Weighing function 1 settings for m+27CH (WeightFun2Cfg).

6-2-2. Sequence Control

Sequence control starts comparing the measured value (weight) with the weighing parameters when the system receives a start signal. SP1, SP2, and SP3 outputs are all initialized to "1", and one of these outputs subsequently changes to "0" depending on the result of control calculation.

Sequence control can be classified into following categories:

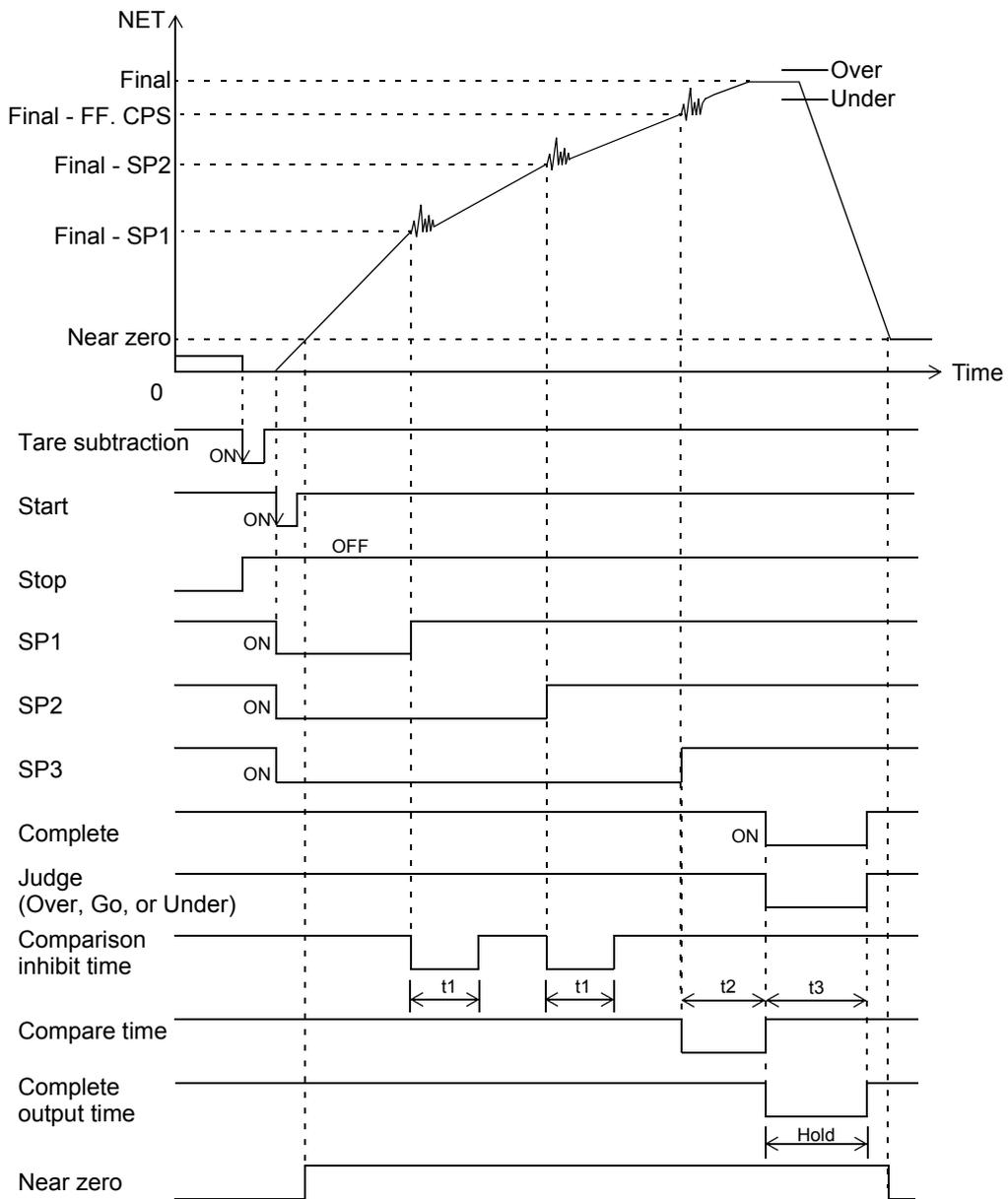
1) Normal sequence control

Control operation (weighing) starts when the system receives a start signal, and is terminated when the system sends off "Complete" signal.

2) Sequence control with Auto jog

This control mode is accompanied by Auto jog after the weighing procedures completed.

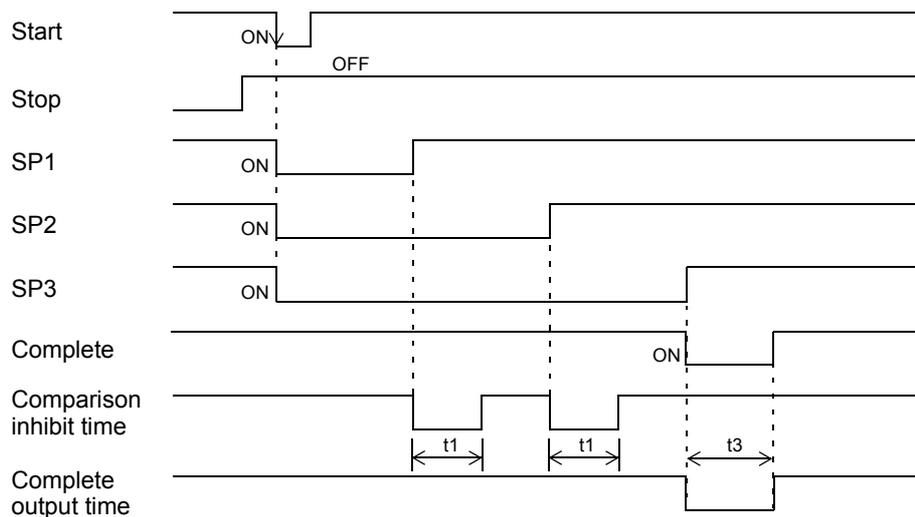
① Normal sequence control (with Over/Under comparison)



- Scheduling of "Complete" signal output is determined by parameter settings for the complete signal output mode (WeightFun2Cfg: Weighing function 2 parameters for m+28CH).
- Over/Under comparison is performed when complete output 1 is sent out and the weight value at that moment is held. Thus, settings for Over/Under comparison mode (WeightFun2Cfg: Weighing function 2 parameters for m+28CH) are ignored.
- Upper/Lower limit comparison is automatically performed at a regular interval, ignoring settings for the Upper/Lower limit comparison mode (WeightFun2Cfg: Weighing function 2 parameters for m+28CH).
- t1: Comparison inhibit time CmpInhibitTimeCfg (m+20CH)
t2: Compare time CmpTimeCfg (m+21CH)
t3: Complete output time CompleteOutTimeCfg (m+22CH)

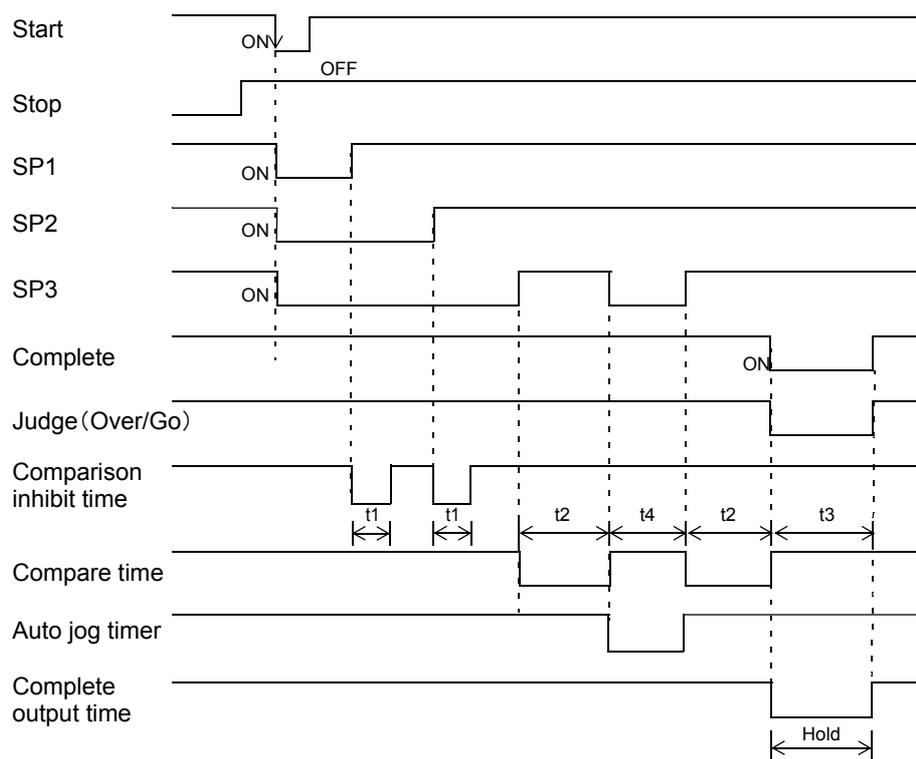
- Conditional expressions:
 - Near zero outputs "1" when Weight value \leq Near zero set value
 - * Start signal's ON-edge (0 \rightarrow 1) brings SP1, SP2, and SP3 outputs to "1".
 - SP1 outputs "0" when Weight value \geq Final - SP1
 - SP2 outputs "0" when Weight value \geq Final - SP2
 - SP3 outputs "0" when Weight value \geq Final - FF. CPS
 - Under outputs "1" when Weight value $<$ Final - Under
 - Over outputs "1" when Weight value $>$ Final + Over
 - Go outputs "1" when Final + Over \geq Weight value \geq Final - Under
- Near zero comparison uses either Gross or Net weight as a reference depending on the Weighing function 1 settings for m+27CH (WeightFun2Cfg).
- Reference Weight value used for SP1/SP2/SP3 outputs and Over/Go/Under comparison can be either Gross or Net weight depending on Weighing function 1 settings for m+27CH (WeightFun2Cfg).

② Normal sequence control (without Over/Under comparison)



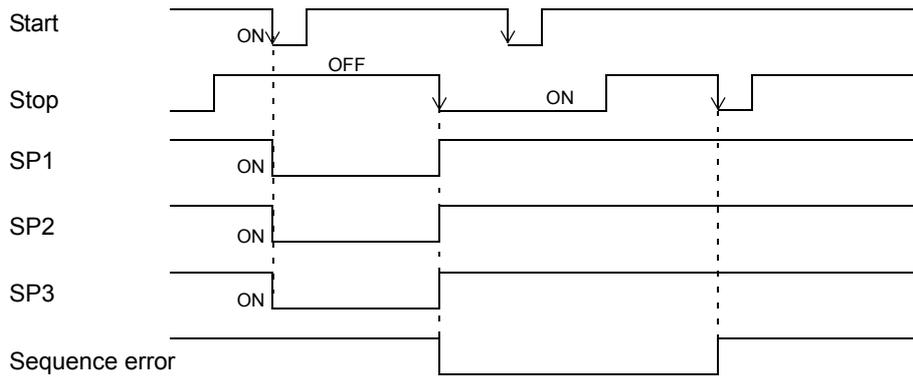
- Over/Under determination is skipped if Judging times (JudgeTimeCfg: m+24CH) is set to "00".
- Complete signal output is triggered by the transition of Final signal (OFF-edge: 1 \rightarrow 0). Note that the settings for complete signal output mode (WeightFun2Cfg: Weighing function 2 parameters for m+28CH) do not have effect here.
- t_1 : Comparison inhibit time CmpInhibitTimeCfg (m+20CH)
- t_3 : Complete output time CompleteOutTimeCfg (m+22CH)

③ Sequence with Auto jog



- Set Auto jog (SeqModeCfg: m+32CH Sequence mode) to "ON"
- Scheduling of Complete output is determined by the settings for complete signal output mode (WeightFun2Cfg: Weighing function 2 for m+28CH).
- Over/Under comparison is performed when complete output 1 is sent out and the Weight value at that moment is held. Thus, settings for Over/Under comparison mode (WeightFun2Cfg: Weighing function 2 parameters for m+28CH) are ignored.
- Upper/Lower limit comparison is automatically performed at a regular interval, ignoring settings for the Upper/Lower limit comparison mode (WeightFun2Cfg: Weighing function 2 parameters for m+28CH).
- t1: Comparison inhibit time CmpInhibitTimeCfg (m+20CH)
t2: Compare time CmpTimeCfg (m+21CH)
t3: Complete output time CompleteOutTimeCfg (m+22CH)
t4: Auto jog timer AutoJogTimeCfg (m+23CH)

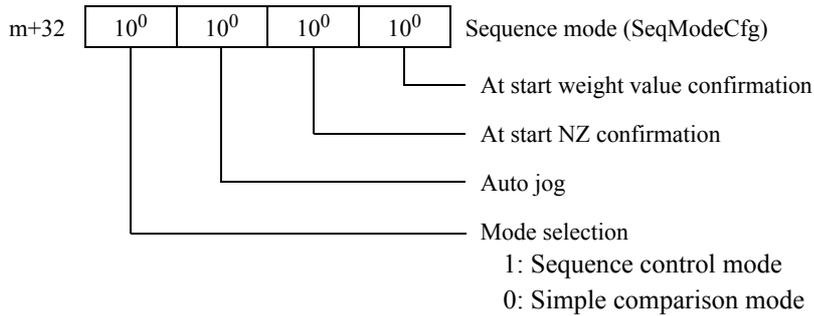
Stop signal



- When the stop signal turns "ON", three output signals (SP1, SP2, and SP3) are simultaneously brought to "0".
- Sequence error occurs if the start signal changes to "ON" while the stop signal is "ON".
- To recover the system from sequence error, enter stop signal again.

6-2-3. Mode Selection

This parameter is used for defining simple comparison and sequence control mode operation.



6-3. FF CPS. Regulation Value / Free Fall Compensation / Avg. Count of FF CPS. / FF CPS. Coefficient

Free fall compensation automatically correct fluctuation of free fall, which is one of the major causes of measurement error, thus enabling accurate weighing.

Principle of Free fall compensation

Sampling the Weight value when the complete signal turns ON after Set point 3 finished. Record “n” times (A) the difference (D) between set Final value and actual weight value, average the difference and multiplied by compensation coefficient(C), then add/subtract the result of FF CPS. value.

$$\frac{(D_1 + D_2 + D_3 \cdots D_A)}{A} \times C$$

Value added/subtracted to/from the FF CPS. set value

To minimize error, user can set a regulation value to D. Compensation can be performed automatically as long as the following relation holds:

Final + regulation \geq measured value \geq Final - regulation

If Auto jog function is enabled in Sequence mode, weight is sampled before Auto jog starts.

Request

In Free fall compensation, acquisition of compensation sample is triggered by Over/Under Judge signal. Therefore, if Judging times is set to zero, F159 can not acquire compensation samples, disabling compensation. The user must set larger than zero value to Judging times to use Free fall compensation function.

For further information, see the description in "Judging times", page 62.

Example)	Final	20.000
	FF CPS. regulation value	0.100
	Count Of FF CPS	4
	FF CPS. Coefficient	2/4

Count	Measured value	Error	FF CPS. counter	FF CPS.
0			0	← Power ON
1	20.050	+0.050	1	0.500
2	20.040	+0.040	2	0.500
3	20.070	+0.070	3	0.500
4	20.080	+0.080	4 → 0	0.500
		<u>+0.240/4 = 0.060</u>		
			$0.060 \times 2/4 = 0.030$	→ Corrected value
5	20.020	+0.020	1	0.530
6	20.000	0.000	2	0.530
7	20.010	+0.010	3	0.530
8	20.110	(+0.110)	← ×3	0.530
9	20.010	+0.010	4 → 0	0.530
		<u>+0.040/4 = 0.010</u>		
			$0.010 \times 2/4 = 0.005$	→ Corrected value
10	19.880	(-0.120)	← ×1	0.535
11	19.990	-0.010	1	0.535
12	20.010	+0.010	2	0.535
13	20.000	0.000	3	0.535
14	19.980	0.020	4 → 0	0.535
		<u>-0.020/4 = -0.005</u>		
			$-0.005 \times 2/4 = 0.003$	→ Corrected value
				0.532

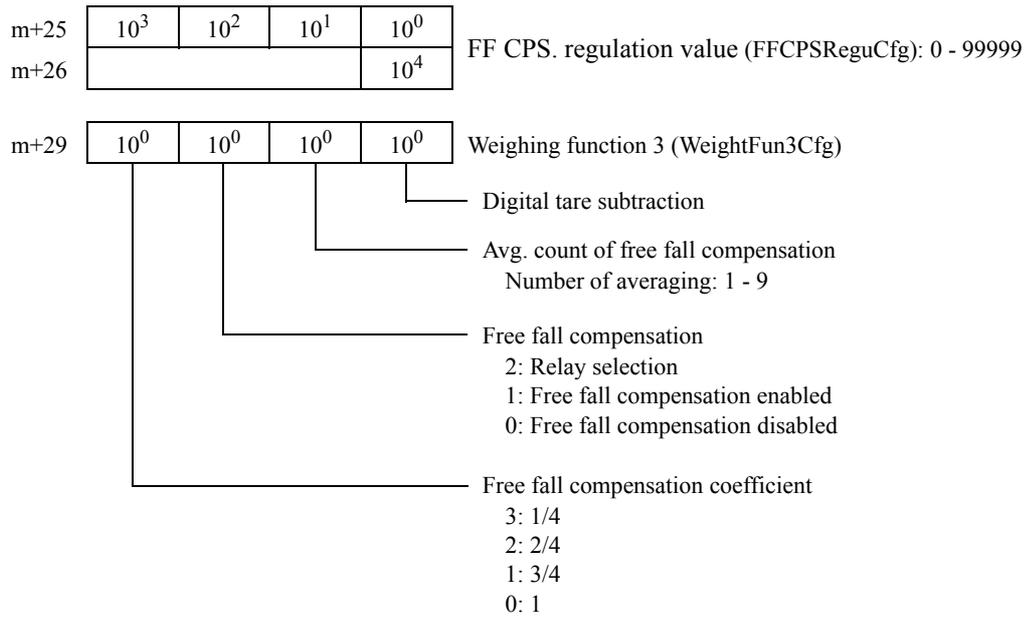
* When set value for FF CPS. is changed, the count setting for Free fall compensation is cleared and, and its counter value is also cleared.



FF CPS. Coefficient calculation

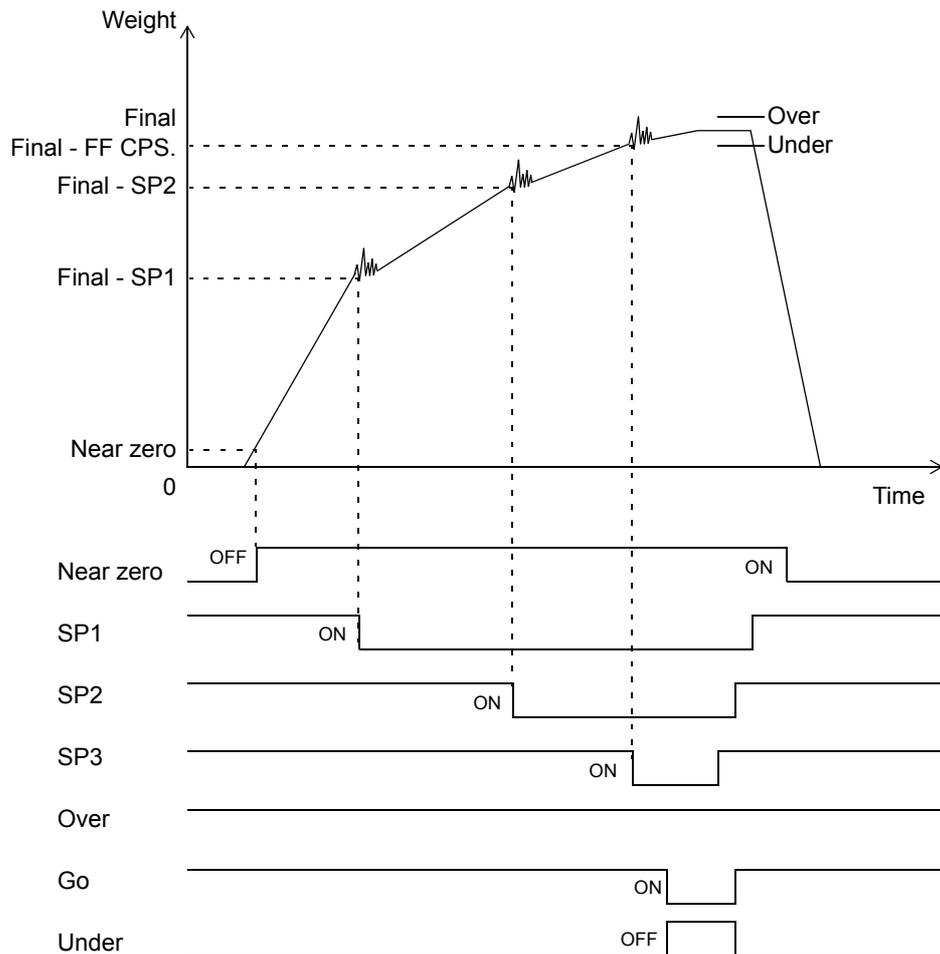
The value for the coefficient can be selected from 1/4, 2/4, 3/4 or 1.

In situation where you can expect fairly consistent measured values, the value 1 is usually sufficient. When measured values fluctuate, selection of 1/4 or 2/4 is recommended for better accuracy.



6-4. Final / Set Point 2 / Set Point 1 / FF CPS. / Over / Under

These parameters are used as target and reference values for Final discharge control.



Parameter settings for Final discharge control

Parameter	Criteria equation
Near zero	Weight <= Near zero
SP1	Weight >= Final - SP1
SP2	Weight >= Final - SP2
SP3	Weight >= Final - FF CPS.
Under	Weight < Final - Under
Over	Weight > Final + Over
Go	Final + Over >= Weight >= Final - Under

m+13	10 ³	10 ²	10 ¹	10 ⁰	Final (FinalCfg): 00000 - 99999
m+14				10 ⁴	
m+8	10 ³	10 ²	10 ¹	10 ⁰	SP2 (SetPoint2Cfg): 00000 - 99999
m+9				10 ⁴	
m+6	10 ³	10 ²	10 ¹	10 ⁰	SP1 (SetPoint1Cfg): 00000 - 99999
m+7				10 ⁴	
m+10	10 ³	10 ²	10 ¹	10 ⁰	FF CPS. (FreeFallCompCfg): 0000 - 9999
m+11		10 ²	10 ¹	10 ⁰	Over (OverCfg): 000 - 999
m+12		10 ²	10 ¹	10 ⁰	Under (UnderCfg): 000 - 999

* If the control does not use SP1 and SP2 signal, the values for these two parameters must be set equal to that of Final.

6-5. Near Zero / Upper Limit / Lower Limit

These parameter settings are used as reference for fixed value final discharge control.

<Conditional equation>

- Near zero: "1" when Weight <= Near zero set value (input range: 0-99999)
- Upper limit: "1" when Weight > Upper Limit set value (input range: 0-99999)
- Lower limit: "1" when Weight < Lower limit set value (input range: 0-99999)

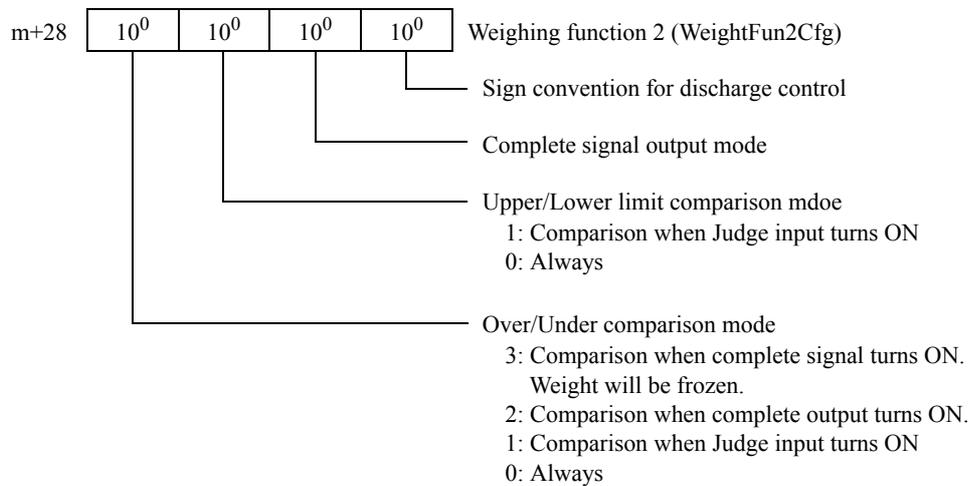
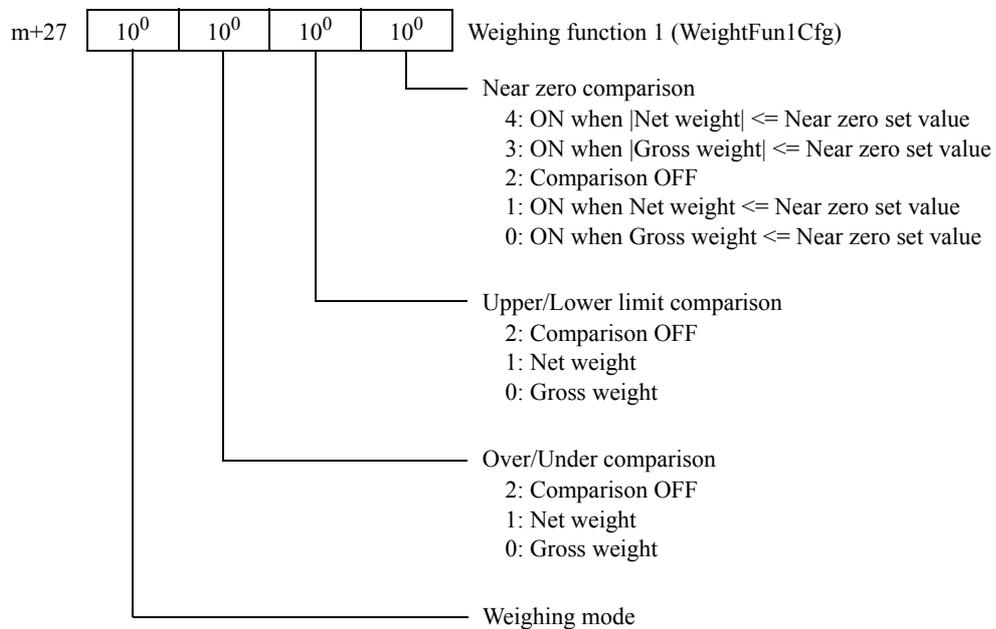
m+4	10 ³	10 ²	10 ¹	10 ⁰	Near zero (NearZeroCfg): 00000 - 99999
m+5				10 ⁴	
m	10 ³	10 ²	10 ¹	10 ⁰	Upper limit (UpperLimitCfg): 00000 - 99999
m+1				10 ⁴	
m+2	10 ³	10 ²	10 ¹	10 ⁰	Lower limit (LowerLimitCfg): 00000 - 99999
m+3				10 ⁴	

6-6. U/L Limit Comparison / U/L Limit Comparison Mode/ Near zero Comparison / Over/Under Comparison / Over/Under Comparison Mode

The user uses these parameters to specify the type of weight (Net/Gross) and timing for comparing Upper/Lower, Near zero, and Over/Under.

Options for each comparison function:

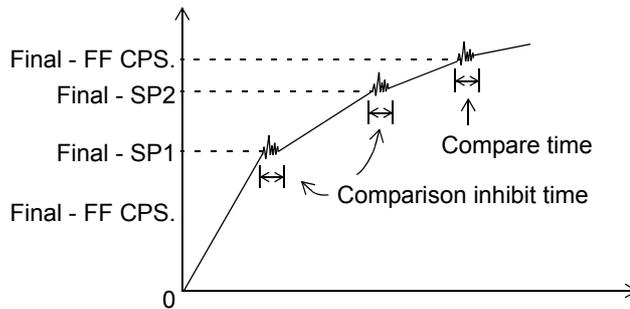
- U/L limit comparison: Gross weight, Net weight or Comparison OFF
- U/L limit comparison mode: Always or Judge input ON
- Near zero comparison: Gross weight, Net weight, Comparison OFF,
|Gross weight|, or |Net weight|
- Over/Under comparison: Gross weight, Net weight, Comparison OFF
- Over/Under comparison mode: Always, Judge input ON, Complete ON, or HOLD



6-7. Complete Signal Output Mode / Complete Output Time / Compare Time / Comparison Inhibit Time

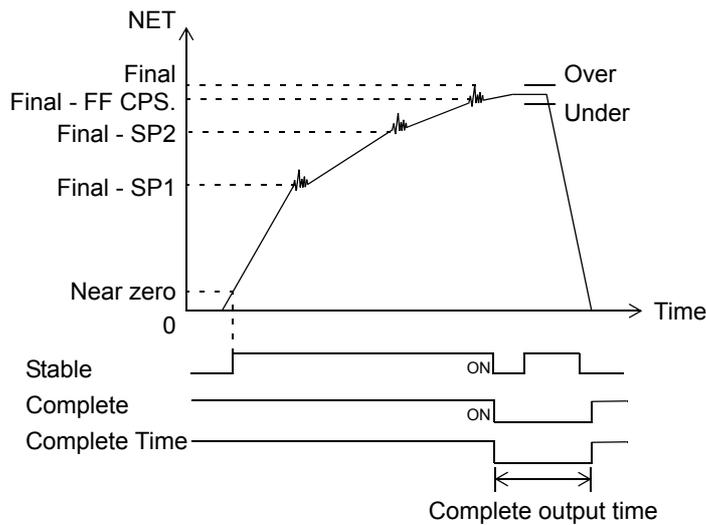
Comparison inhibit time and Compare time

Proper operation of control systems can be adversely affected by mechanical vibration induced by on/off actions of the valve. To avoid this effect, these two parameters inhibit comparison operation for a specific period of time.

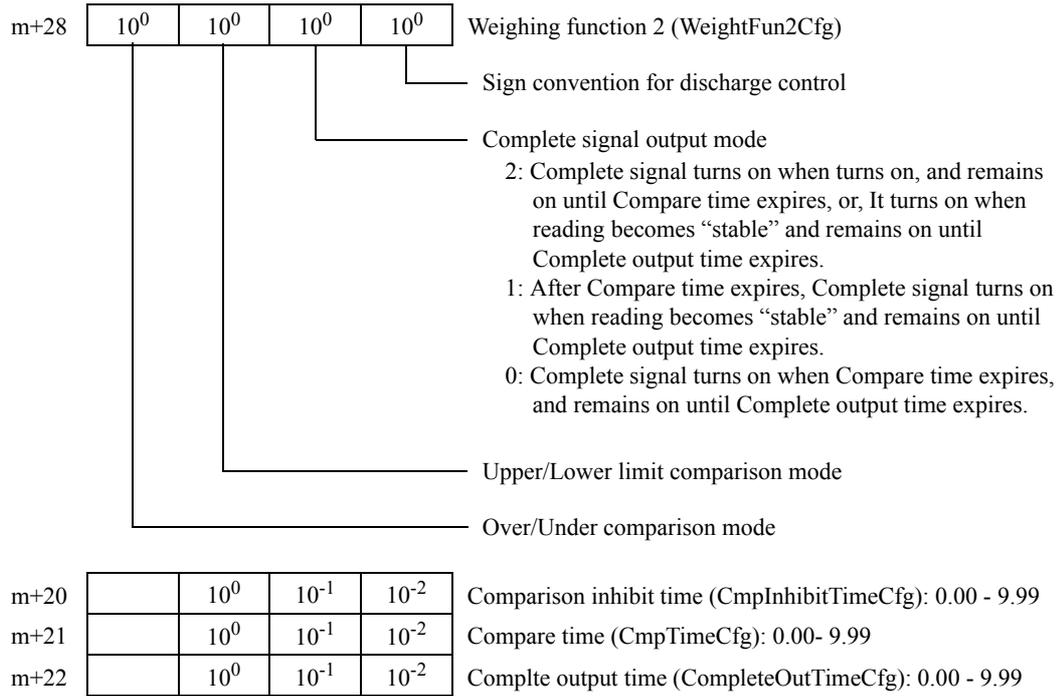


Complete Signal Output Mode and Complete output time

These two parameters define the output timing of Complete signal and its duration.



Complete signal output mode	Compare time/Comp.&Stable/Comp.or Stable
Complete output time	Input range: 0.00 - 9.99
Compare time	Input range: 0.00 - 9.99
Comparison inhibit time	Input range: 0.00 - 9.99



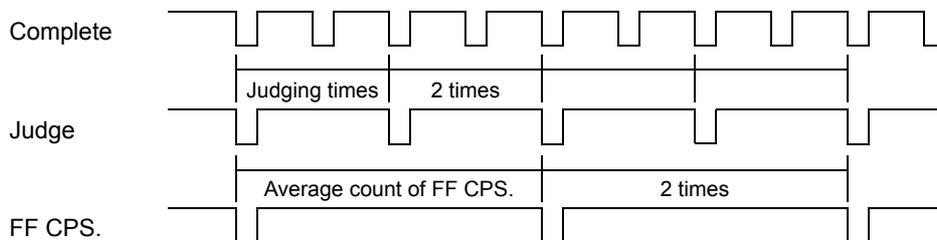
6-8. Judging Times / AZ Times / At Start NZ Confirmation / At Start WV Confirmation / Auto Jog (ON/OFF) / Auto Jog Timer

Judging times

F159 can perform Over/Go/Under comparison when the measuring process is completed (synchronized with Complete signal). This two-digit number (00 - 99) specifies the frequency at which the comparison takes place.

- 00 : comparison disabled
- 01 : every time
- 02 : once in every two outputs
- 03 : once in every three outputs
- ⋮
- 99 : once in every 99 outputs

< Example > Judging times is set to "02"



Request

FF CPS. reads in and stores samples for compensation synchronized with Over/Under comparison signal.

Selecting "00" for Judging times inhibits F159 to collect these sample data, thus disabling Free fall compensation.

Select a non-zero value for Judging times to enable Free fall compensation.

AZ times

This two-digit (00 - 99) number enable/disable zero-clearance of Weight value when the metering process starts. Weight is zero-cleared using Digital Zero (if weight is set to Gross) or Tare Subtraction (if weight is set to Net).

00 : Auto zeroing is disabled

01 : every time

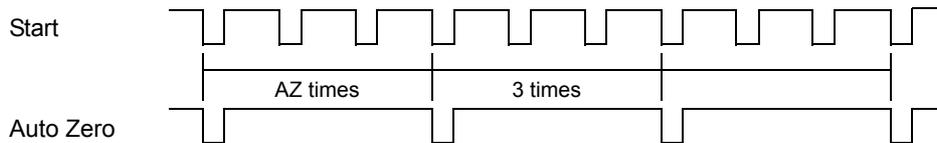
02 : once in every two weighing processes

03 : once in every three weighing processes

⋮

99 : once in every 99 weighing processes

< Example > AZ times is set to "03"



- Auto Zero is executed when the Start signal turns ON.
- If zero alarm is caused by auto zero Zero error bit (ZeroErr: 13th bit of n+7 CH) will be set to "1".
- Disabling Auto Zero "00" does not inhibit Tare subtraction and Digital Zero operation.

At start NZ confirmation

You can enable/disable Near zero check at the start of weighing sequence. The weighing sequence can start if Near zero is ON, and it is inhibited to start if the bit is "0", generating "Sequence Error 4".

For further information on Near zero settings, see Section 6-5. "Near Zero / Upper Limit / Lower Limit", page59.

At start WV confirmation

You can enable/disable the F159 to check if the weight is equal or larger than SP1 point (Final - SP1 set value).

"Sequence Error 5" is generated if the initial weight is equal or larger than SP1 point.

For further information on SP1 settings, see Section 6-4. "Final / Set Point 2 / Set Point 1 / FF CPS. / Over / Under", page58.

Auto jog

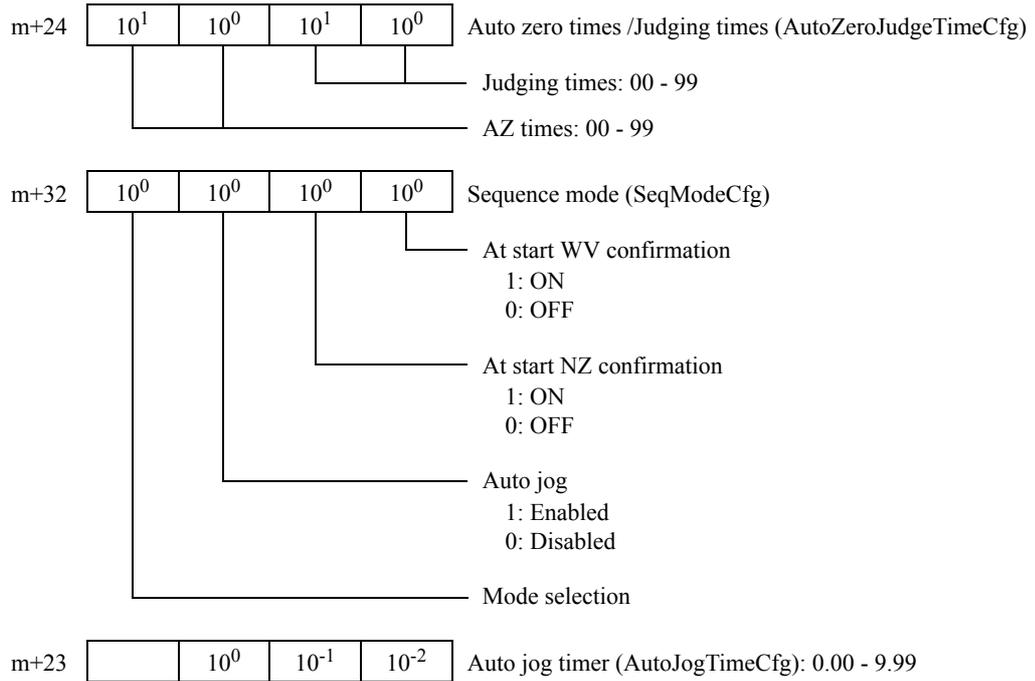
This parameter enable/disable (ON/OFF) the Auto jog function.

Auto jog timer

This parameter specifies the Auto jog timer (allowable range: 0.00 - 9.99)

Auto Jogging is allowed only in the Sequence mode.

If Over/Under check decides that the weight is still short of the desired value (Under), SP3 will turn ON again until Auto jog timer expires.



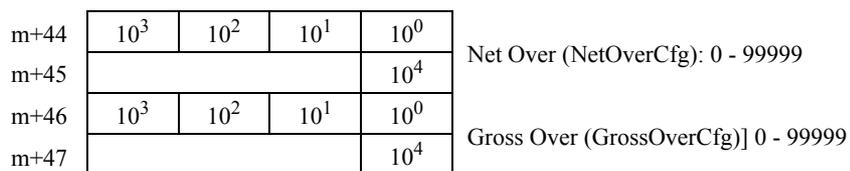
6-9. Net Weight Over / Gross Weight Over

This function is used to generate alarm if Net weight/Gross weight exceeds the user specified limit. Allowable input and output range are as follows:

Net weight Over (input range: 0-99999)

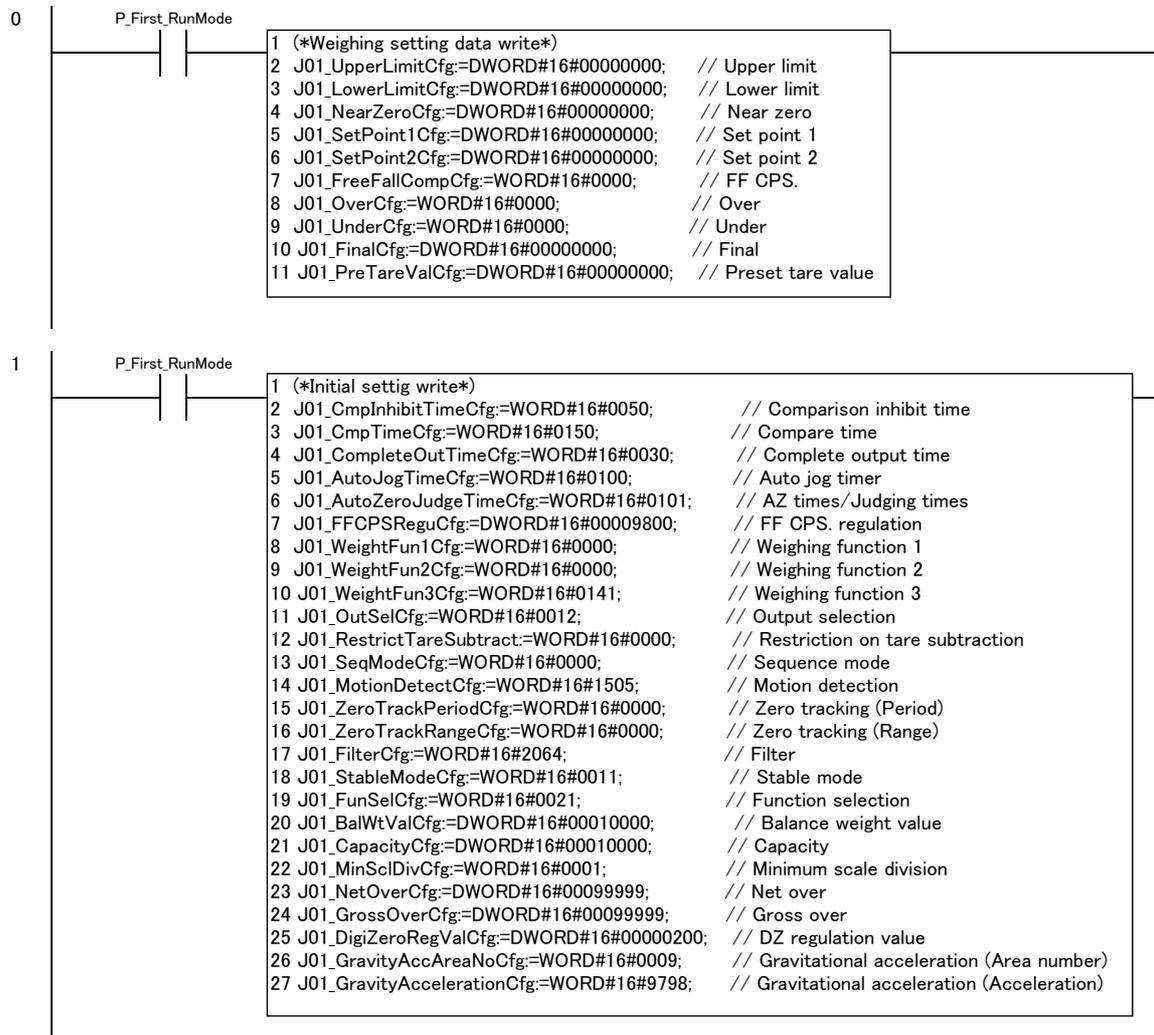
Gross weight Over (input range: 0-99999)

	Conditional equation	Output
Net weight Over	Net weight > Net weight Over set value	OFL1: 10th bit of n+7 CH
Gross weight Over	Gross weight > Gross weight Over set value	OFL3: 12th bit of n+7 CH

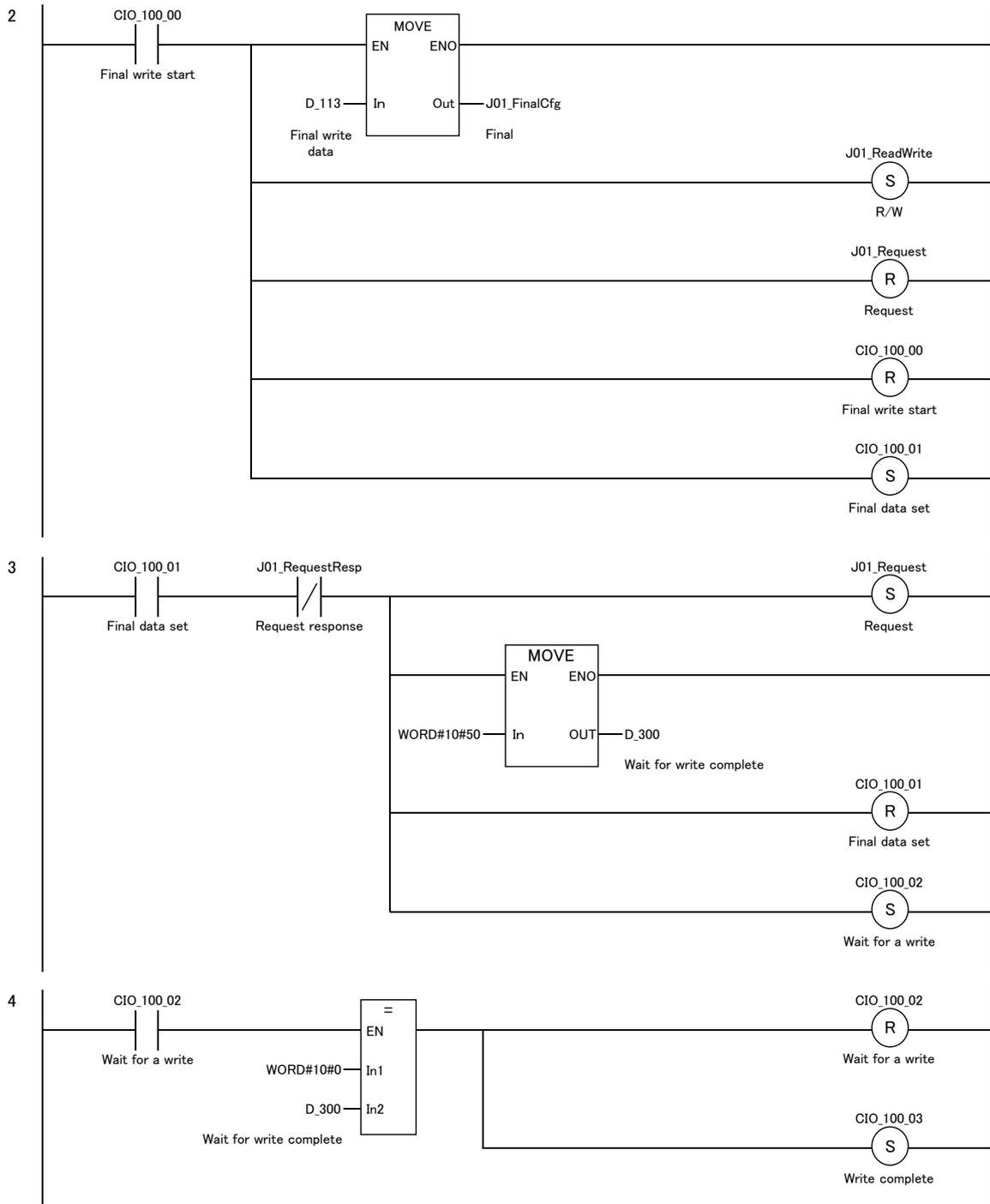


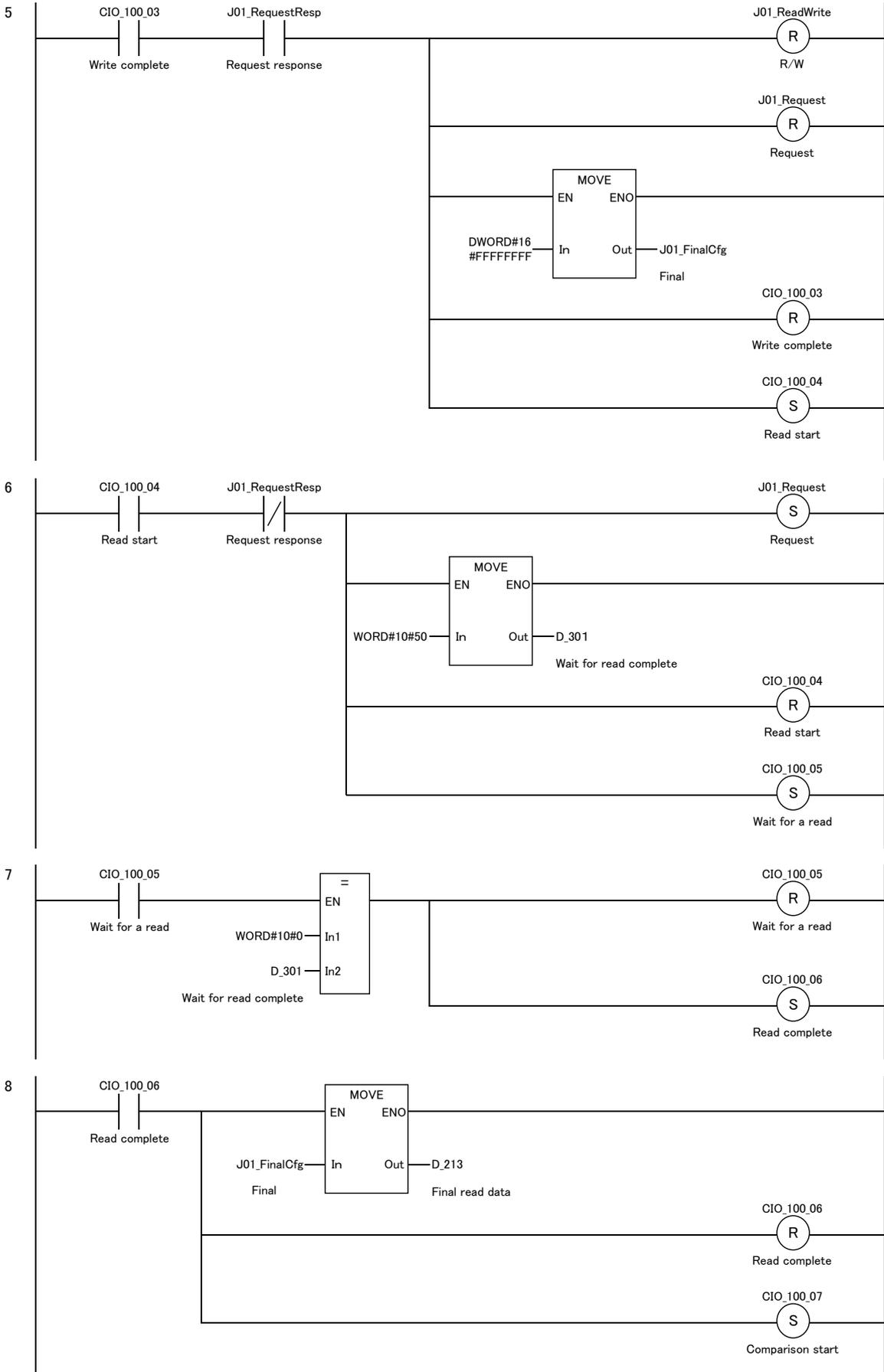
7. LADDER DIAGRAM

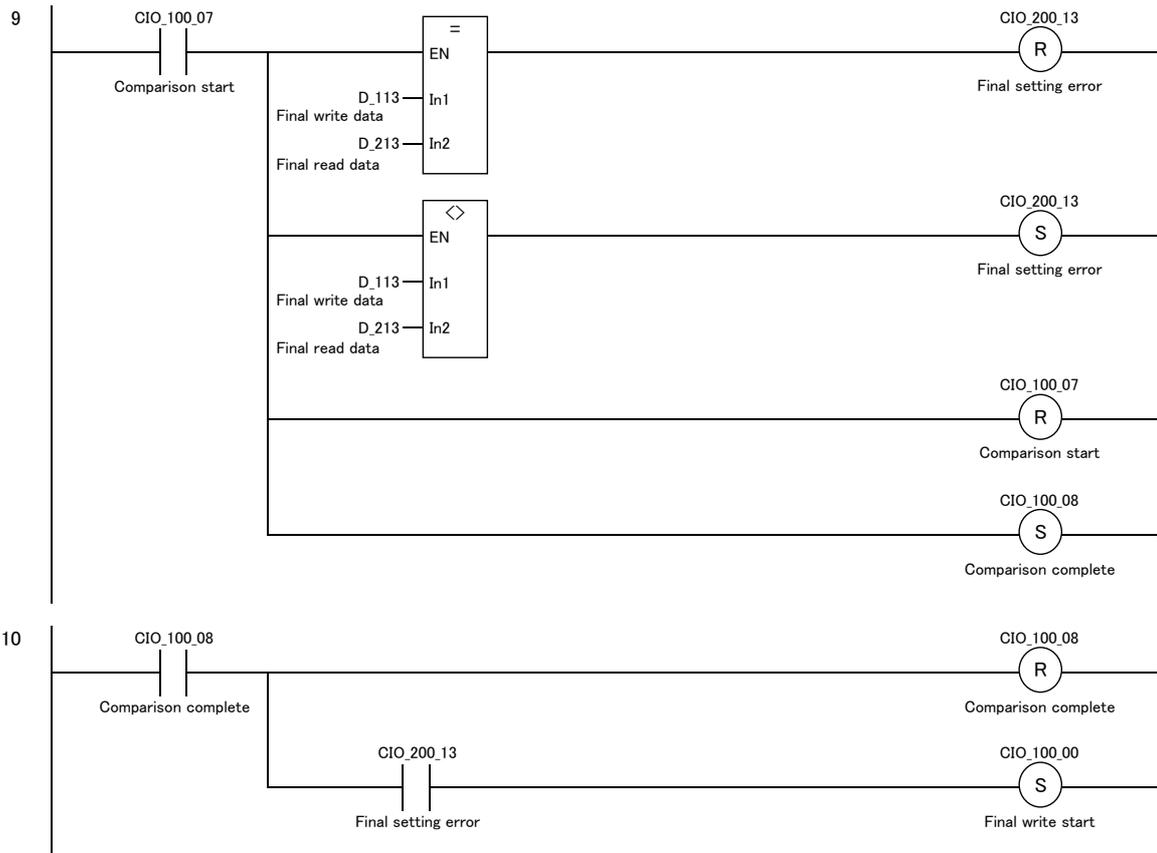
The following is a sample ladder program using a F159 (unit No.0) and NJ series. This program sets initial values to parameters required to carry out weighing process, and writes and reads Final using R/W and request signal.



7.LADDER DIAGRAM







Request

To repeat the scan 50 times, this program uses decrement counters (step 000004 and 000007) for counting “Write complete” and “Read complete”.

To trigger FINS command for exchanging data with CPU unit, F159 sends “Request” bit to CPU. This is required because no flag is available that directly indicates the completion of data exchange by the FINS command. In this method, iteration number of scans can be affected by the time required by other processes: ample time should be allocated to avoid scan number fluctuation.

This ladder diagram is meant to show you the idea how to create your own program, and is not guaranteed to operate properly in all system.

Address Map for the Sample Ladder Diagram

Name	Data Type	Initial Value	Assigned to	Retention	Constant	Network disclosure	Comment	Note
VAR_GLOBAL								
CIO_100_00	BOOL		100.00	None	None	Non-disclosure	Final write start	Used for sequece control of sample ladder
CIO_100_01	BOOL		100.01	None	None	Non-disclosure	Final data set	
CIO_100_02	BOOL		100.02	None	None	Non-disclosure	Wait for a write	
CIO_100_03	BOOL		100.03	None	None	Non-disclosure	Write complete	
CIO_100_04	BOOL		100.04	None	None	Non-disclosure	Read start	
CIO_100_05	BOOL		100.05	None	None	Non-disclosure	Wait for a read	
CIO_100_06	BOOL		100.06	None	None	Non-disclosure	Read complete	
CIO_100_07	BOOL		100.07	None	None	Non-disclosure	Comparison start	
CIO_100_08	BOOL		100.08	None	None	Non-disclosure	Comparison complete	
CIO_200_13	BOOL		200.13	None	None	Non-disclosure	Final setting error	For read/write error detection
J01_Request	BOOL		2001.12	None	None	Non-disclosure	Request	F159 relay area
J01_ReadWrite	BOOL		2001.14	None	None	Non-disclosure	R/W	
J01_RequestResp	BOOL		2009.12	None	None	Non-disclosure	Request response	
D_113	DWORD		D113	None	None	Non-disclosure	Final write data	Write data
D_213	DWORD		D213	None	None	Non-disclosure	Final read data	Read data
D_300	WORD		D300	None	None	Non-disclosure	Wait for write complete	Used as a wait time counter
D_301	WORD		D301	None	None	Non-disclosure	Wait for read complete	
J01_UpperLimitCfg	DWORD		D20000	None	None	Non-disclosure	Upper limit	F159's weighing setting data area
J01_LowerLimitCfg	DWORD		D20002	None	None	Non-disclosure	Lower limit	
J01_NearZeroCfg	DWORD		D20004	None	None	Non-disclosure	Near zero	
J01_SetPoint1Cfg	DWORD		D20006	None	None	Non-disclosure	Set point 1	
J01_SetPoint2Cfg	DWORD		D20008	None	None	Non-disclosure	Set point 2	
J01_FreeFallCompCfg	WORD		D20010	None	None	Non-disclosure	Free fall compensation	
J01_OverCfg	WORD		D20011	None	None	Non-disclosure	Over	
J01_UnderCfg	WORD		D20012	None	None	Non-disclosure	Under	
J01_FinalCfg	DWORD		D20013	None	None	Non-disclosure	Final	
J01_PreTareValCfg	DWORD		D20015	None	None	Non-disclosure	Preset tare value	
J01_CmpInhibitTimeCfg	WORD		D20020	None	None	Non-disclosure	Comparison inhibit time	F159's initial setting data area
J01_CmpTimeCfg	WORD		D20021	None	None	Non-disclosure	Compare time	
J01_CompleteOutTimeCfg	WORD		D20022	None	None	Non-disclosure	Complete output time	
J01_AutoJogTimeCfg	WORD		D20023	None	None	Non-disclosure	Auto jog timer	
J01_AutoZeroJudgeTimeCfg	WORD		D20024	None	None	Non-disclosure	AZ times / Judging times	
J01_FFPSReguCfg	DWORD		D20025	None	None	Non-disclosure	FF CPS. regulation	
J01_WeightFun1Cfg	WORD		D20027	None	None	Non-disclosure	Weighing function 1	
J01_WeightFun2Cfg	WORD		D20028	None	None	Non-disclosure	Weighing function 2	
J01_WeightFun3Cfg	WORD		D20029	None	None	Non-disclosure	Weighing function 3	
J01_OutSelCfg	WORD		D20030	None	None	Non-disclosure	Output selection	
J01_RestrictTareSubtract	WORD		D20031	None	None	Non-disclosure	Restriction on the tare subtraction	
J01_SeqModeCfg	WORD		D20032	None	None	Non-disclosure	Sequence mode	
J01_MotionDetectCfg	WORD		D20033	None	None	Non-disclosure	Motion detection	
J01_ZeroTrackPeriodCfg	WORD		D20034	None	None	Non-disclosure	Zero tracking (Period)	
J01_ZeroTrackRangeCfg	WORD		D20035	None	None	Non-disclosure	Zero tracking (Range)	
J01_FilterCfg	WORD		D20036	None	None	Non-disclosure	Filter	
J01_StableModeCfg	WORD		D20037	None	None	Non-disclosure	Stable mode	
J01_FunSelCfg	WORD		D20038	None	None	Non-disclosure	Function selection	
J01_BalWtValCfg	DWORD		D20039	None	None	Non-disclosure	Balance weight value	
J01_CapacityCfg	DWORD		D20041	None	None	Non-disclosure	Capacity	
J01_MinScIDivCfg	WORD		D20043	None	None	Non-disclosure	Minimum scale division	
J01_NetOverCfg	DWORD		D20044	None	None	Non-disclosure	Net over	
J01_GrossOverCfg	DWORD		D20046	None	None	Non-disclosure	Gross over	
J01_DigiZeroRegValCfg	DWORD		D20048	None	None	Non-disclosure	DZ regulation value	
J01_GravityAccAreaNoCfg	WORD		D20050	None	None	Non-disclosure	Gravitational acceleration (Area Number Input)	
J01_GravityAccelerationCfg	DWORD		D20051	None	None	Non-disclosure	Gravitational acceleration (Acceleration Input)	

8. SETTING VALUES LIST

Weighing Setting Data

DM Area Address	Name	Initial Value	I/O Port Name	Refer to:
m , m+1	Upper limit	00000	UpperLimitCfg	P. 59
m+2 , m+3	Lower limit	00000	LowerLimitCfg	P. 59
m+4 , m+5	Near zero	00000	NearZeroCfg	P. 59
m+6 , m+7	Set point 1	00000	SetPoint1Cfg	P. 58
m+8 , m+9	Set point 2	00000	SetPoint2Cfg	P. 58
m+10	Free fall compensation	0000	FreeFallCompCfg	P. 58
m+11	Over	000	OverCfg	P. 58
m+12	Under	000	UnderCfg	P. 58
m+13 , m+14	Final	00000	FinalCfg	P. 58
m+15 , m+16	Preset tare value	00000	PreTareValCfg	P. 43
m+17 - m+19	Undefined			

m = D20000 + Unit No.×100

Initial Data

DM Area Address	Name	Initial Value	I/O Port Name	Refer to:
m+20	Comparison inhibit time	050	CmpInhibitTimeCfg	P. 61
m+21	Compare time	150	CmpTimeCfg	P. 61
m+22	Complete output time	300	CompleteOutTimeCfg	P. 61
m+23	Auto jog timer	100	AutoJogTimeCfg	P. 62
m+24	AZ times / Judging times	0101	AutoZeroJudgeTimeCfg	P. 62
m+25 , m+26	FF CPS. regulation	09800	FFCPSReguCfg	P. 56
m+27	Weighing function 1	0000	WeightFun1Cfg	P. 25
m+28	Weighing function 2	0000	WeightFun2Cfg	P. 25
m+29	Weighing function 3	0141	WeightFun3Cfg	P. 26
m+30	Output selection	12	OutSelCfg	P. 26
m+31	Restriction on the tare subtraction function	0000	RestrictTareSubtract	P. 26
m+32	Sequence mode	0000	SeqModeCfg	P. 27
m+33	Motion detection	1505	MotionDetectCfg	P. 40
m+34	Zero tracking (Period)	00	ZeroTrackPeriodCfg	P. 41
m+35	Zero tracking (Range)	0000	ZeroTrackRangeCfg	P. 41
m+36	Filter	2064	FilterCfg	P. 39
m+37	Stable mode	11	StableModeCfg	P. 27
m+38	Function selection	21	FunSelCfg	P. 28
m+39 , m+40	Balance weight value	10000	BalWtValCfg	P. 32
m+41 , m+42	Capacity	10000	CapacityCfg	P. 32
m+43	Minimum scale division	001	MinSclDivCfg	P. 32
m+44 , m+45	Net Over	99999	NetOverCfg	P. 64
m+46 , m+47	Gross Over	99999	GrossOverCfg	P. 64
m+48 , m+49	DZ regulation value	00200	DigiZeroRegValCfg	P. 42
m+50	Gravitational acceleration (Area Number Input)	0009	GravityAccAreaNoCfg	P. 33
m+51	Gravitational acceleration (Acceleration Input)	9798	GravityAccelerationCfg	P. 33
m+52 - m+99	Undefined			

m = D20000 + Unit No.×100

9. ERROR CODE

9-1. Error Code and Error Assistance Code

The Error Code contains error related to: Calibration error, Weight error (LOAD, OFL, or Zero Error), and sequence error. In error free state, both of these two registers are set to “0”.

Error Assistance Code indicates the type of error: “1” for calibration errors, “2” for weight errors, and “3” for sequence errors.

Error codes are summarized in the table below.

If multiple of errors occur simultaneously, smaller number of Error Code and Error Assistance Code has the priority.

Calibration Error (Error Assistance Code =1)

Name	Description	Error Code
Calibration Error 1	Zero calibration must be performed again	1
Calibration Error 2	Initial Tare value exceeds the F159's zero adjustable range	2
Calibration Error 3	Initial Tare value is in negative territory	3
Calibration Error 4	Balance weight is larger than Capacity	4
Calibration Error 5	Balance weight is set to zero “00000”	5
Calibration Error 6	Load cell output falls short of the Lower limit of span adjustable range	6
Calibration Error 7	Load cell output is in negative territory	7
Calibration Error 8	Load cell output exceeds the Upper limit of span adjustable range	8
Calibration Error 9	Calibration aborted due to widely fluctuating weight	9

Weight Error (Error Assistance Code =2)

Name	Description	Error Code
EXC ALM	Excitation voltage to the load cell falls below the rated value	1
+LOAD	A/D converter input over-range (to positive direction)	2
-LOAD	A/D converter input over-range (to negative direction)	3
OFL1	Net weight > Net Over set value	4
OFL2	Gross weight > Capacity + 9×(Minimum scale division)	5
OFL3	Gross weight > Gross Over set value	6
Zero Error	Zero error	7

Sequence Error (Error Assistance Code =3)

Name	Description	Error Code
Sequence Error 1	Stop signal had been raised when the system tried to start weighing sequence	1
Sequence Error 2	Stop signal raised while a weighing sequence is underway	2
Sequence Error 3	Auto Zero is activated due to AZ countdown. The system enters into ZALM state	3
Sequence Error 4	Near zero signal was OFF when the system tried to start weighing sequence (depends on system setting)	4
Sequence Error 5	When the system tried to start a weighing sequence, the initial weight was found larger than SP1 (depends on system setting)	5

* However, SP1 = Final - SP1

9-2. Error Description

9-2-1. Calibration Error

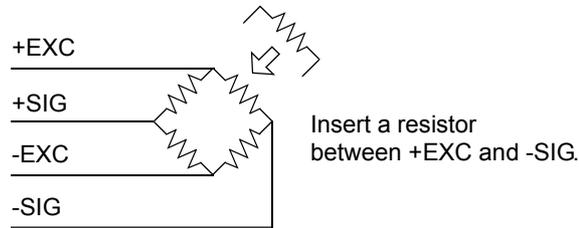
Calibration Error 1

Zero calibration must be performed again. In standard calibration procedures, Zero calibration is performed first, followed by Span calibration. However, if the result of the Span calibration is significantly off the target, F159 displays “Calibration Error 1”. If this happens you must perform Zero calibration. Correctly performed Zero calibration will clear the error message.

Calibration Error 2

Initial dead load exceeds the zero adjustable range of the F159. Check if the cell is loaded with any extra object.

If the **Calibration Error 2** persists while the system is loaded correctly, Zero calibration must be performed again after inserting a resistor between +EXC and -SIG terminals of the load cell for shifting zero point. The relation between input signal shift and resistor values are summarized in the table below.



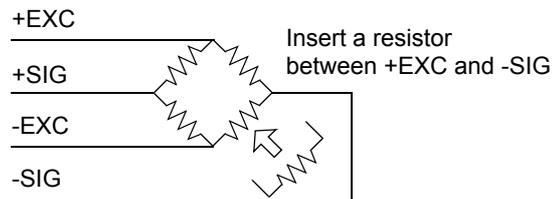
Resistor		Voltage shift equivalent strain	
Calculated	Approximate value	μ -STRAIN	mV/V
875 k Ω	866 k Ω	200	0.1
437 k Ω	442 k Ω	400	0.2
291 k Ω	294 k Ω	600	0.3
219 k Ω	221 k Ω	800	0.4
175 k Ω	174 k Ω	1000	0.5
146 k Ω	147 k Ω	1200	0.6
125 k Ω	124 k Ω	1400	0.7
109 k Ω	110 k Ω	1600	0.8
97 k Ω	97.6 k Ω	1800	0.9
87.3 k Ω	86.6 k Ω	2000	1.0
79.4 k Ω	78.7 k Ω	2200	1.1
72.7 k Ω	73.2 k Ω	2400	1.2
67.1 k Ω	66.5 k Ω	2600	1.3
62.3 k Ω	61.9 k Ω	2800	1.4
58.2 k Ω	57.6 k Ω	3000	1.5
54.5 k Ω	54.9 k Ω	3200	1.6
51.3 k Ω	51.1 k Ω	3400	1.7
48.4 k Ω	48.7 k Ω	3600	1.8
45.9 k Ω	46.4 k Ω	3800	1.9
43.6 k Ω	43.2 k Ω	4000	2.0
41.5 k Ω	41.2 k Ω	4200	2.1
39.6 k Ω	39.2 k Ω	4400	2.2
37.9 k Ω	38.3 k Ω	4600	2.3
36.3 k Ω	36.5 k Ω	4800	2.4
34.8 k Ω	34.8 k Ω	5000	2.5

- The values contained in the table assume single 350Ω load cell configuration.
- Temperature coefficient of the resistor directly affect reading accuracy. Use resistor with temperature coefficient better than 50ppm/ °C (5ppm/ °C class recommended)

Calibration Error 3

Initial dead load overshoots to negative range. Check if the cell is loaded in opposite direction, or +SIG and -SIG of the load cell are connected in reverse order.

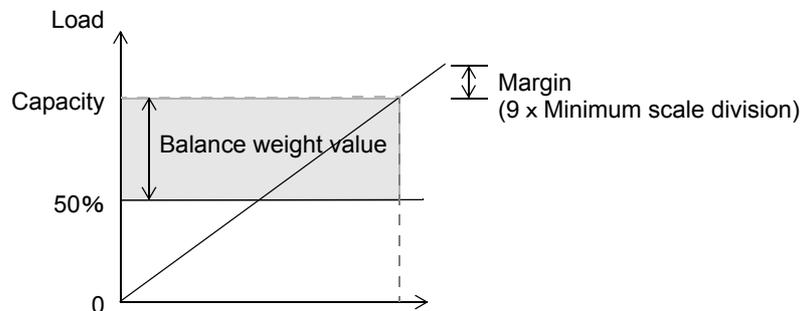
If Calibration Error 3 persists while load direction and cable connections are correct, Zero calibration must be performed again after inserting a resistor between +EXC and -SIG terminals of the load cell for shifting zero point. See the table in the previous section “Calibration Error 2” for determining the resistor to be inserted.



Calibration Error 4

Value set for Balance weight and/or Span calibration is larger than Capacity setting. Modify setting for Balance weight and/or Span calibration and retry Span calibration.

Capacity and Balance weight value



For accurate Span calibration, Balance weight value should be selected between 50%-100% of Capacity.

Calibration Error 5

Balance weight value is preset to “00000”. Select a proper non-zero value.

Calibration Error 6

The load cell output falls short of the F159’s allowable span adjustment range. Check if the load cell is loaded properly, and if its output specification meets F159 requirements. Then, perform Span calibration again.

Calibration Error 7

Load cell output varies in negative range. Check if the cell is loaded in opposite direction, or +SIG and -SIG of the load cell are connected in reverse order. Then, perform Span calibration again.

Calibration Error 8

Load cell output is outside the F159’s allowable span adjustment range. Check if the load cell is properly loaded, and the its rated output falls within the F159’s span adjustable range. Perform Span calibration again. Then, perform Span calibration again.

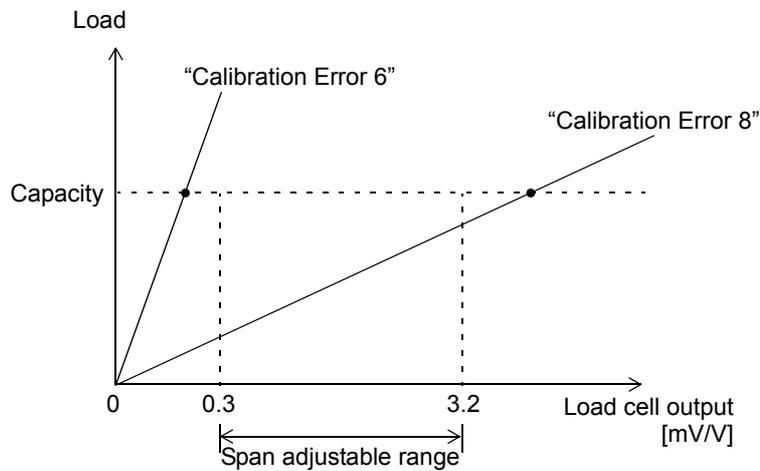
Calibration Error 9

Calibration procedures have not completed because the reading of F159 widely fluctuated. Adjust parameters for stable readings (time, width) and make sure “stable” bit turns on, then perform calibration again.



Span adjustable range for F159 is from 0.3 to 3.2 (mV/V), within which the Span value should fall.

Therefore, if the load cell output for the maximum loadable weight (Capacity) falls short of 0.3 mV/V (Calibration Error 6) or exceeds 3.2 mV/V (Calibration Error 8), the Span calibration fails.



9-2-2. Weight Error

EXC ALM

The load cell excitatio voltage is too low. Check all the cables for proper connection between F159 and the load cell, and if any of the cables are overloaded.

+LOAD (A/D converter scale over)

Magnitude of signal from the load cell exceeds the F159's adjustable range. Check if the load cell output is properly within the range of Span calibration, or if any of the cables are broken. This error can also occur when the terminal block connections are all open.

-LOAD (A/D converter scale under)

Magnitude of signal from the load cell falls below the F159's adjustable range. Check if the load cell output is properly within the range of Span calibration, or if any of the cables are broken. This error can also occur when the terminal block connections are all open.

OFL1 (Net weight > Net over)

Net weight is larger than the set value for Net over. To restore normal weight display, reduce the signal from the load cell until OFL1 bit (10th bit of n+7 CH) turns off, or modify the set value for Net over.

OFL2 (Gross weight > Capacity + 9 scale division)

Gross weight is larger than Capacity + 9 scale division. To restore normal weight display, reduce the signal from the load cell until OFL2 bit (11th bit of n+7 CH) turns off.

OFL3 (Gross weight > Gross over)

Gross weight is larger than the set value for Gross over. To restore normal weight display, reduce the signal from the load cell until OFL3 bit (12th bit of n+7 CH) turns off, or modify the set value for Gross over.

Request

Maximum load (Capacity) is one of the most fundamental parameters for F159 to perform properly as a metering instrument. Modification of Capacity entails re-calibration of the system. Care should be taken to prevent accidental modification of this value when you are correcting OFL2 error.

9-2-3. Sequence Error

Sequence Error 1

This error occurs when you try to start measuring sequence (Start signal turned ON) while Stop signal is still ON. Remove this error by changing stop signal OFF → ON → OFF, then re-start weighing sequence with the stop signal OFF.

Sequence Error 2

Sequence Error 2 occurs when stop signal turns on while a measuring process using sequence control is underway. Change the stop signal from OFF to ON to remove the error.

Sequence Error 3

Sequence error 3 occurs when the system falls into the state of ZALM while it is performing auto zero in using sequence control.

To clear ZALM, remove the cause of zero shift (adherence of foreign object, etc.) and reset Digital Zero.

Change stop signal from OFF to ON to remove the sequence error.

Sequence Error 4

This error occurs when you try to start measuring sequence (Start signal turned ON) while Near zero signal is still OFF "0". (Note that you can select a setting to ignore Near zero when the sequence starts.) First, check the relation between the set value for Near zero and the reference for comparison, and then check the following:

- Sequence started prematurely while material still remains in the metering tank.
- Start turned ON prematurely.
- Material can not be discharged properly, due to valve blockage, etc..

Change stop signal from OFF to ON to remove the sequence error.

Sequence Error 5

This error occurs when you try to start measuring sequence while Set point 1 signal is still ON "1". (Note that you can select a setting to ignore weight when the sequence starts.)

First, check the relation between the set values for SP1 and Final, and then check the following:

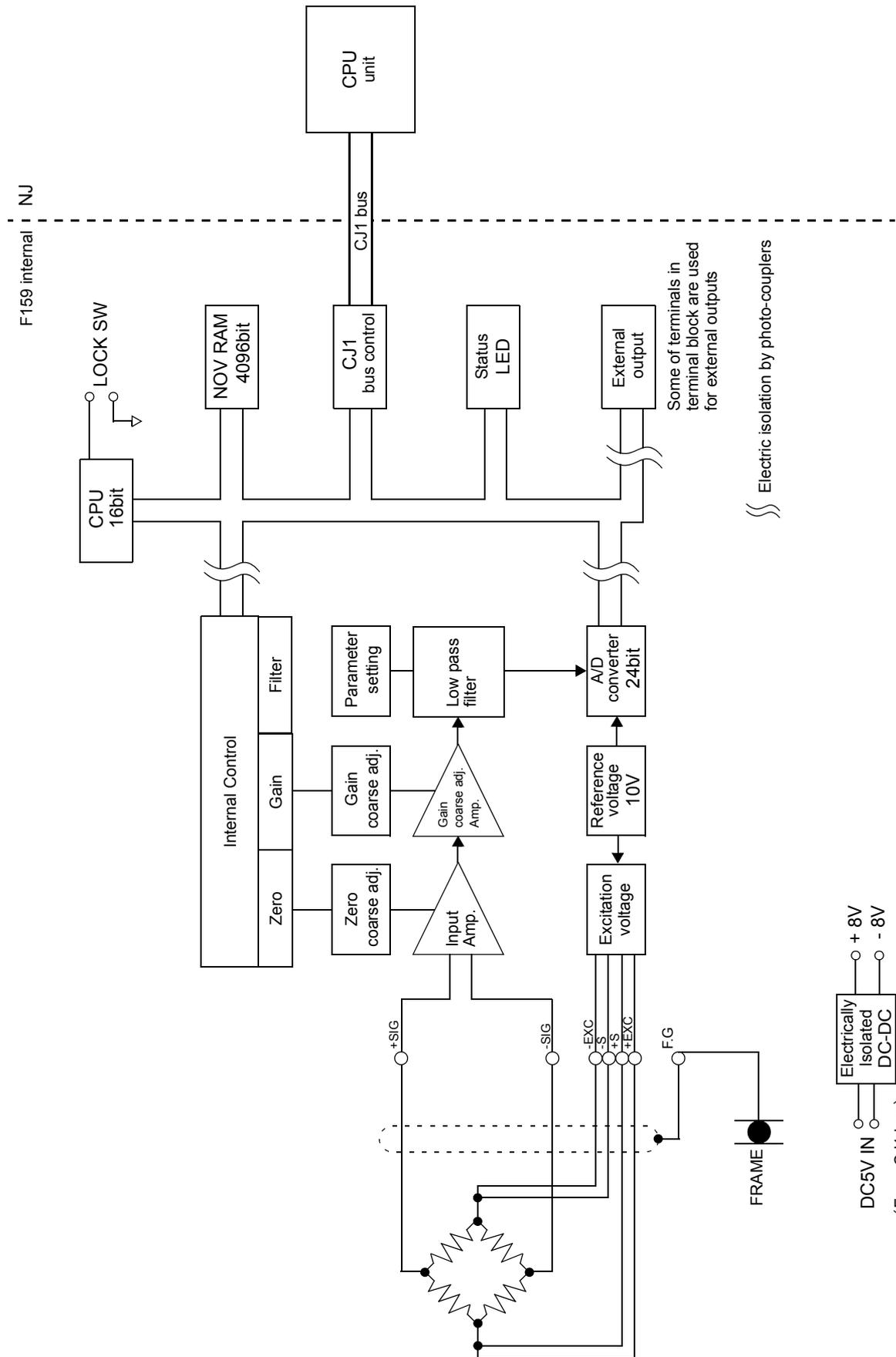
- Sequence started prematurely while material still remains in the metering tank.
- Start turned ON prematurely.
- Material can not be discharged properly, due to valve blockage, etc..

Change stop signal from OFF to ON to remove the sequence error.



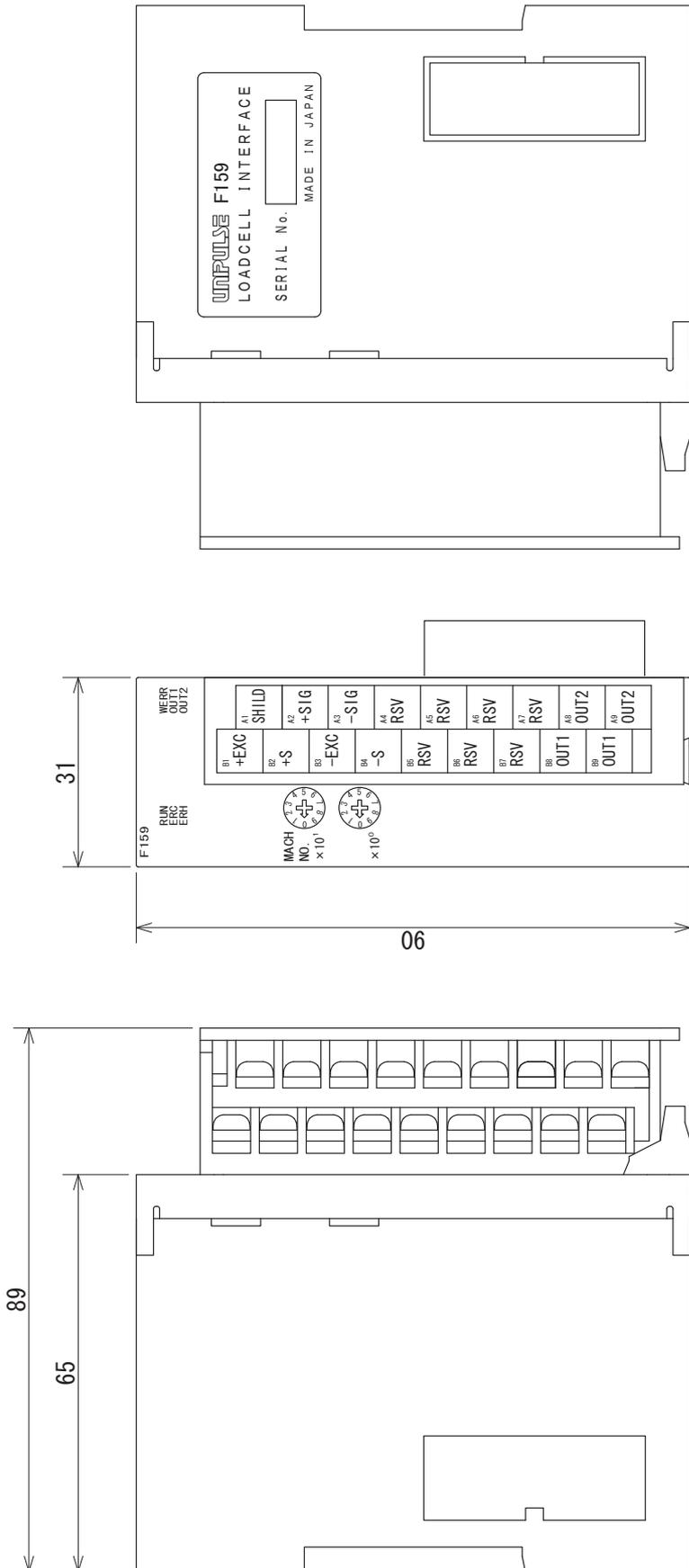
For detailed description of the course of sequence control, see Section 6-2. "Simple Comparison Control and Sequence Control" , page50.

10. BLOCK DIAGRAM



11. DIMENSIONS

Unit: mm

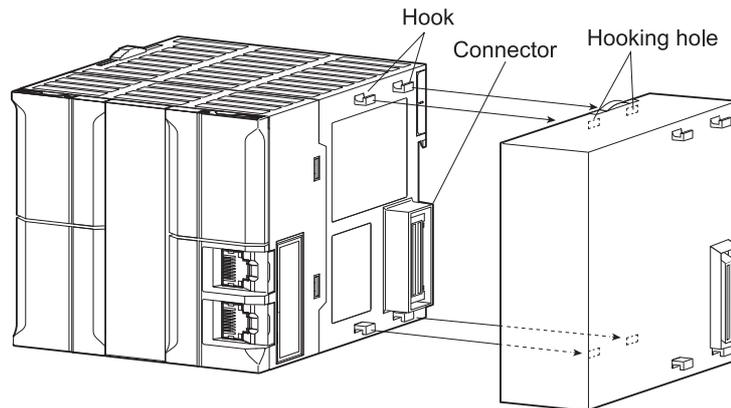


12. INSTALLATION

12-1. Connection between the units (CPU and power supply) of the NJ series and each constituent unit of the CJ series

Multiple of units can be connected by simply engaging connectors and locking the slider. Add an end cover to the unit installed to the right most unit.

1. Engage the connector properly to connect units.

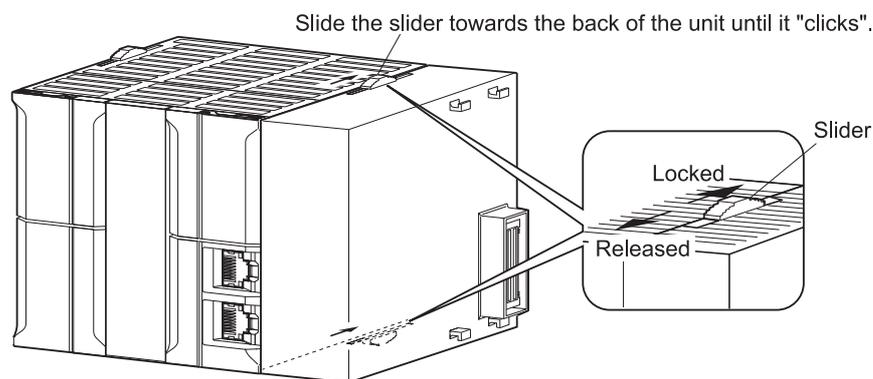


NJ series do not require base unit. Each unit can be connected to each other using the integrated side-mount connector.

⚠ CAUTION

- Never fail to turn off the system before starting system assembly.
- When replacing a unit, remove the assembled unit as a whole before replacing one of them.

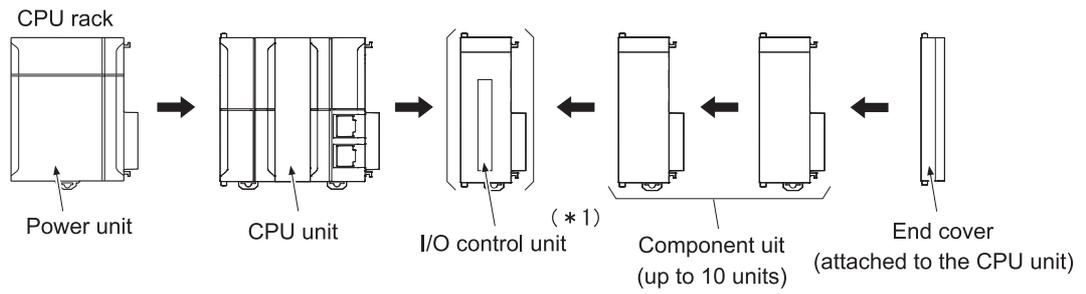
2. Slide the two yellow sliders on the upper and lower end of the unit until they “clicks” to lock securely.



⚠ CAUTION

Lock the unit securely by moving the slider to its full stroke. Insufficient engagement can hinder the system from proper operation.

3. Add an end cover to the right most unit.



*1: Install the I/O control unit immediately to the right of the CPU unit when an extension rack is connected.

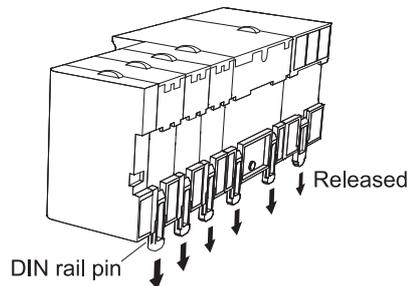
⚠ CAUTION

You must install an end cover to the right most units. Without it, NJ's CPU unit issues "I/O bus error" (Operation Halt Error) and will not start operation ("operation" mode).

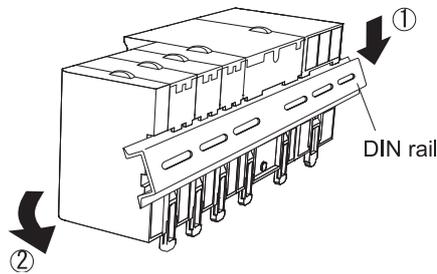
12-2. DIN Rail Installation

NJ series can only be mounted to DIN type rail. It can no be installed using screws.

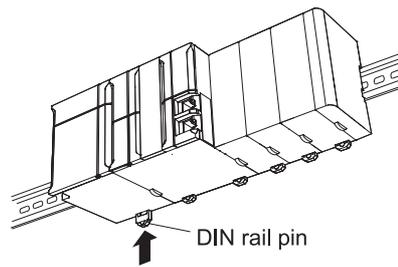
1. Set the DIN rail pins on the rear of the unit to "Released" position.



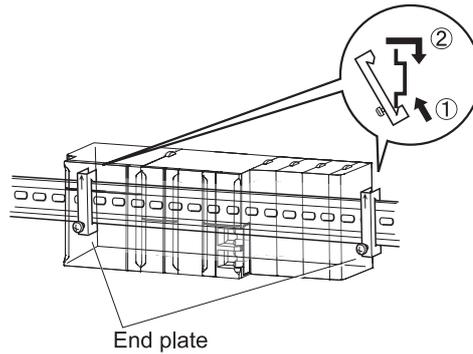
2. Hook the NJ unit's upper protrusions on the DIN rail (①), and engage the entire notch to the rail (②).



3. Lock all the DIN rail pins by pushing upwards.



4. Secure the unit by installing an end plate.



To fix NJ assembly securely, sandwich the assembly using a pair of endplates from both sides. Hook lower notch of the end plate to the lower plate of the rail

(①), and then engage the upper notch, then pull the end plate to lower direction (②). Tighten the screw to fix them securely.

Request

For detailed handling of the NJ series, see the OMRON NJ series Manual "NJ Series Machine Automation Controller Startup Guide (CPU Unit)".

13. SPECIFICATIONS

13-1. Analog Section

Input	6-wire input (+EXC, +S, -S, -EXC, SHIELD, +SIG, -SIG), remote sensing
Load cell source	DC10V \pm 5%, source current max.120 mA (up to four 350 Ω load cells can be connected in parallel)
Zero adjustment	0-2 mV/V Coarse: Digital control using the coarse adjustment circuit Fine: Automatic adjustment using digital calculation
Span adjustment	0.3-3.2 mV/V Coarse: Digital control using the coarse adjustment circuit Fine: Automatic adjustment using digital calculation
Max. sensitivity	0.3 μ V/count
Auracy	Linearity error: <0.01% FS (Typ. 0.005% FS, room temperature) Zero drift: <0.2 μ V/ $^{\circ}$ C RTI (Typ. 0.15 μ V/ $^{\circ}$ C) Gain drift: <15ppm/ $^{\circ}$ C (Typ. 5 ppm/ $^{\circ}$ C)
Analog filter	Bessel type low-pass filter (-12dB/oct) Cut off frequency selectable from 2, 4, 6, 8 Hz
A/D converter	$\Delta\Sigma$ method converter conversion rate: 500 times/sec. resolution: 24 bit (binary)
Display resolution	1/10000 (1/4 scale division enabled) 1/40000 (1/4 scale division disabled)

13-2. Display

Front panel LED

RUN	Turns on when Normal operation.
ERC } ERH }	Turns on when an error in initial settings, CPU related error, and unit error is detected (compliant to NJ specification).
WERR	Turns on when Weight Error status turns ON.
OUT1	OUT1 status turns ON.
OUT2	OUT2 status turns ON.

Terminal layout

+EXC	B1	A1	SHIELD
+S	B2	A2	+SIG
-EXC	B3	A3	-SIG
-S	B4	A4	RSV
RSV	B5	A5	RSV
RSV	B6	A6	RSV
RSV	B7	A7	RSV
OUT1	B8	A8	OUT2
OUT1	B9	A9	OUT2

13-3. Setting

Unit No. rotary switch	Selects a unit number for the high performance I/O unit: 0 - 95
DIP switch	Lock function
Set value	Inported from NJ
Set value storage	Initial values NOV RAM (non-volatile RAM)
Set value protection	Modificatio of set values can be inhibited to procect them from accidental change (LOCK)
Setting item	<ul style="list-style-type: none"> - Upper limit/ Lower limit/ Near zero/ SP1/ SP2/ FF CPS./ Over/ Under/ Final/ Tare - Comparison inhibit time/ Compare time/ Complete output time/ Auto jog timer/ Auto zero times/ Judging times/ FF CPS. regulation/ Weighing function 1 (Weighing mode, Over/Under comparison, Upper/ Lower limit comparison, Near zero comparison)/ Weighing function 2 (Over/Under comparison mode, Upper/Lower limit comparison mode, Complete Signal Output mode, Sign convention for discharge control)/ Weighing function 3 (FF CPS. coefficient, FF CPS., Average count of FF CPS., Digital tare subtraction)/ Output selection (OUT2 selection, OUT1 selection)/ Sequence mode (Mode selection, Auto jog, At start NZ confirmation, At start weight value confirmation)/ Motion detection (period, range)/ Zero tracking (period)/ Zero tracking (range)/ Filter (Analog filter, Digital filter)/ Stable mode (Digital filter 2, Motion detection mode)/ Function selection (Decimal place, 1/4 scale division)/ Balance weight/ Capacity/ Minimum scale division/ Net Over/ Gross Over/ DZ regulation/ Gravitational acceleration (Area number)/ Gravitational acceleration (Acceleration) - Zero calibration/ Span calibration/ Tare subtraction/ Tare subtraction reset/ Digital Zero/ Digital Zero reset

13-4. General Specifications

Power consumption	350Ω load cell: Approx. 300mA (single load cell) - Approx. 700mA (four cells in parallel)
Environment	Temperature: Operational 0 °C - +55 °C Accuracy compensation applicable 0 °C - +40 °C Storage -20 °C - +75 °C Humidity: < 90%RH (non-condensing)
Dimensions	31 (W)×90 (H)×65 (D) mm (protrusions excluded)
Weight	Approx. 150g

14. STATEMENT OF CONFORMATION TO EC DIRECTIVES

Unipulse F159 Weight Module conforms to the EC Directives (based on Council of the European Communities, and is allowed to affix CE mark on it.

* EMC Directives EN61131-2

(EN55011,	EN61000-4-2,	EN61000-4-3,
	EN61000-4-4,	EN61000-4-5,	EN61000-4-6,
	EN61000-4-8,	EN61000-4-11	

The following notice must be observed when you install F159 unit.

1. F159 is an electrical device that are incorporated in machines and manufacturing installations.
 F159 conforms to the related EMC standards so that the devices and machines into which F159 is built can more easily conform to EMC standards.
 The actual F159 has been checked for conformity to EMC standards.
 Whether these standards are satisfied for the actual system, however, must be checked by the customer.
 EMC-related performance will vary depending on the configuration, wiring, and other conditions of the machine or device in which the F159 is installed.
 The customer must, therefore, perform final checks to confirm that the overall machine or device conforms to EMC standards.
2. Use shielded cables for connection with load cell.

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