

Handheld Nutrunner HFC3000 II Instruction Manual



DDK

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Introduction

Thank you for purchasing our Handheld Nutrunner.

This instruction manual describes the procedures for installation, and handling, and actions to be taken in case of any failure.

- ◆ This instruction manual shall be delivered to the end user who operates the equipment.
- ◆ Read all instructions before use, and always keep this instruction manual with the equipment.
- ◆ Items not described in this instruction manual shall be considered “unavailable.”
- ◆ The product specification and appearance described in this instruction manual are subject to change without notice.
- ◆ All rights reserved. Any disclosure, copying, distribution, or use of the information contained herein is strictly prohibited.

For the safety of operator and equipment

- ◆ It is important for you to read all “Safety Precautions” before using the equipment, and understand and observe all instructions and recommendations included in this manual.
- ◆ Read all instructions and recommendations included in this manual, understand the functions and performance of this nutrunner, and use this machine correctly.
- ◆ Wirings and parameter settings shall be conducted by a professional engineer.
- ◆ Indicate the following on all instruction manuals that use this equipment.
 - This equipment is capable of high voltages hazardous to human life.
- ◆ Never conduct a withstand voltage test or megger test on this equipment.

Points to check when unpacking

Please confirm the following when unpacking this equipment.

- ◆ Confirm that you received the correct model that you had ordered.
- ◆ Confirm that there are no missing parts, accessories or tools. (Refer to the system structure specification list.)
- ◆ Check for any damage caused during transportation.

Introduction

Warranty

Warranty Period

The warranty period of this equipment is 1 year from the date of purchase or the date of delivery to the designated place.

Scope of Warranty

If a malfunction occurs in the equipment in the state of correct use in accordance with this instruction manual within the warranty period, repair or replacement shall be performed free of charge. However, accommodations shall be charged accordingly in the following cases, even within the warranty period.

1. If the cause of a malfunction is a condition, environment, handling, etc., falling outside that which is indicated in the instruction manual.
2. If a malfunction is due to a modification or repair performed by the customer.
3. If the cause of a malfunction is an apparatus other than this equipment.
4. If a malfunction is due to use outside the specification ranges of this equipment.
5. If the cause of a malfunction is an act of God or other disaster.

The scope of this warranty is limited to the main body of our equipment and damage induced by a malfunction of this equipment shall be excluded from the warranty.

Safety Precautions

Read all instructions before operating the equipment in order to use this equipment safely and correctly. Prior to use, read this instruction manual carefully and fully understand the equipment functions, safety precautions and instructions.

Safety precautions in this manual are ranked as [Warning] or [Caution].

To prevent danger to the user and other persons as well as property damage, the instructions that must be fully observed are marked with the symbols below.


- ◆ This instruction manual uses the following two symbols according to the degree of damage that may be caused when the instruction is not observed.



This symbol indicates that failure to observe instruction marked with this symbol may result in severe personal injury or death.



This symbol indicates that failure to observe instruction marked with this symbol may result in minor personal injury or material damage.

Even instructions that are marked  may result in severe damage if they are not observed according to conditions. Contents marked with the above symbols are very important instructions. For your safety, follow all instructions marked with the symbols.

- ◆ This instruction manual uses various symbols for instructions that shall be observed.



Warning:
Electrical shock



Warning:
Fire



Caution: Fire



Caution:
Electrical shock



Caution: High
Temperature



Prohibited



**Do not
disassemble**



Required



Ground

Safety Precautions



Warning



Do not remove the motors and gear cases of tools.
The tool output spindle may rotate and cause injury.



Do not repair, disassemble, or modify the equipment.
Failure to observe this instruction may cause injury, electric shock, fire, or malfunction.



Never operate the equipment where it is exposed to water or near corrosive atmosphere and flammable gases. Failure to observe this instruction may cause fire.



Do not touch the connectors while the equipment is turned ON and for a while after the equipment is turned OFF. Failure to observe this instruction may cause an electric shock.



Wiring operation and maintenance work shall be conducted by a professional engineer.
Failure to observe this instruction may cause an electric shock or injury.



Turn OFF the power when conducting wiring operation and maintenance and inspection.
Failure to observe this instruction may cause electric shock and injury.



Never damage the cables, apply excessive strength to cables, or squeeze the cables.
Never use damaged power cables.
Failure to observe this instruction may cause an electric shock or fire.



It takes 15 minutes for capacitor discharging. Do not touch the unit and terminals immediately after power off.



Be sure to conduct type-3 grounding for the FG terminals.
Failure to observe this instruction may cause electric shock.



In case of abnormal odor, noise, or operation error occurs, stop operation immediately and turn OFF the power source.
Failure to observe this instruction may cause injury or fire.

Safety Precautions

Transportation/Storage



Caution



Transport the equipment properly according to its weight.
Failure to observe this instruction may cause injury and malfunction.



The conditions when transporting the equipment by ship are as below.

- ◆ Ambient temperature: $-5^{\circ}\text{C} \sim +55^{\circ}\text{C}$ (Avoid freezing)
- ◆ Ambient humidity: 50% RH or lower (Avoid moisture)
- ◆ Package: Tight seal



Do not hold cables and output spindles when transporting the tools.
Failure to observe this instruction may cause injury or malfunction.



The equipment shall be stored under the following conditions.

- ◆ Ambient temperature: $-5^{\circ}\text{C} \sim +55^{\circ}\text{C}$ (Avoid freezing)
- ◆ Ambient humidity: 90% RH or lower (Avoid moisture)
- ◆ Atmosphere: Indoors (Avoid direct sunlight)
 - No corrosive gases or flammable gases
 - No oil mist, dust, water, salt, iron powder
- ◆ Avoid direct vibration or shocks.

Failure to meet the above conditions may cause earth leakage and malfunction.

Safety Precautions

Installation/Wiring



Caution



Install the controller using the specified screws.
Failure to observe this instruction may cause malfunction.



Use the specified combination of the tool and the controller.
Failure to observe this instruction may cause fire and malfunction.



The power input parts must be provided with safety measures such as breakers and circuit protectors.
Failure to observe this instruction may cause fire and malfunction.



Do not use a tool or a controller that has damages or missing parts.
Failure to observe this instruction may cause fire, injury, and malfunction.



Do not get on the top of equipment or place a heavy object on the top of equipment.
Failure to observe this instruction may cause injury, and malfunction.



Do not subject the equipment to excessive shock or impact.
Failure to observe this instruction may cause malfunction.



Provide proper and firm wiring.
Failure to observe this instruction may cause injury, fault, and malfunction.



Operate the equipment with the specified power supply voltage.
Failure to observe this instruction may cause injury, electric shock, fire, and malfunction.



When operating the equipment at a location such as the following, take sufficient measures to shield the equipment.

- ◆ Location where noise is generated
- ◆ Location where the equipment is subjected to a strong electric field or magnetic field
- ◆ Location a power wire is not laid nearby.

Failure to observe this instruction may cause injury, fault, and malfunction.

Safety Precautions

Operation/Adjustment



Caution



Never operate the equipment with wet hands.
Failure to observe this instruction may cause electric shock.



Use the equipment under the following conditions.

- ◆ Ambient temperature: 0°C~+45°C (Avoid freezing)
- ◆ Ambient humidity: 90% RH or lower (Avoid moisture)
- ◆ Atmosphere: Indoors (Avoid direct sunlight)
 - No corrosive gases or flammable gases
 - No oil mist, dust, water, salt, iron powder
- ◆ Avoid direct vibration or shocks.

Failure to meet these conditions may cause earth leakage and malfunction.



Confirm and adjust all parameters before operation in order to prevent unexpected movement of the equipment.

Failure to observe this instruction may cause an injury, malfunction, or fault.



Never conduct extreme adjustments or setting change that may cause instability of operation.

Failure to observe this instruction may cause an injury, malfunction, or fault.



Do not turn ON and OFF the equipment repeatedly. Failure to observe this instruction may cause a malfunction.



Do not use the equipment at a torque higher than the maximum torque.
Failure to observe this instruction may shorten equipment life or cause breakage due to high temperature caused by overload.



In case any abnormality occurs, remove the cause and ensure safety before resetting and restarting the equipment.
Failure to observe this instruction may cause injury.



It is occurred reaction in sudden rise torque in the following cases.

- Please attach the reaction jig.
- Retightening bolt(nut) which already tighten.
- Loosing bolt(nut) which already tighten.

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Chapter 1 Outline

1-1 How to Use This Instruction Manual

This manual describes the system structure, specifications, handling method, etc., of the Handheld Nutrunner System.

These are described in the following order in this manual:

Chapter	Items	Contents
Chapter 1	Outline	Description of functions and precautions.
Chapter 2	Specifications	General specifications of the Hand System.
Chapter 3	Names of Parts	Names and functions of the respective parts of the Unit and the tools.
Chapter 4	Installation	Installation procedure
Chapter 5	Power Activation and Operational Tests	Items to be checked before power activation and procedures for operational tests.
Chapter 6	Description of Operations	Descriptions of items displayed on the panel and instructions for setting the fastening set values.
Chapter 7	Troubleshooting	Descriptions of abnormal operation indications during operation and corrective actions.
Chapter 8	Options	Optional functions
Chapter 9	Fieldbus	Fieldbus setting and functions
Chapter 10	Warranty and Servicing	Warranty period and servicing system

1-2 Outline of Functions

The Handheld Nutrunner is a flexible fastening tool equipped with a compact, high-performance servomotor developed especially for this product. Like the usual high-performance nutrunner system, it is designed to accommodate various tool models and provide useful functions for fool-proofing, data management, data communication, etc.

★ **Compact Design**

The Unit operates on single-phase 100V ~ 240V, making installation work related to the primary power source easy.

★ **Screw Fastening**

Screw fastening can be performed by the torque method or the angle method. An angle monitor and a torque rate monitoring function are provided as functions for fool-proofing. Also, a fastening counting function is interlocked with line control to prevent neglecting of fastening.

★ **Internal storage of 64 set value types**

Full digitization was pursued to achieve volume reduction.
64 types of fastening set values can be input from the front panel and stored in the Unit.
Also, changing work (parameters) can be performed by external signals.
A backup battery is not used and there is thus no need to worry about problems such as battery run-out, etc. (There is no need to worry about disappearance of the set values and other data).

★ **Data Communication**

An RS-232C interface is incorporated to enable data communication with external devices.
A connector that enables communication with a PC with a dedicated software installed is provided on the bottom. Connectors enabling sending of result data to a PLC or other external device are provided on the bottom.
As an optional function, a D-NET, P-BUS or other fieldbus can be installed.

★ **Motor**

Reduced equipment size and improved protection against dust and oil have been achieved by adoption of a permanent magnet motor.
Also, accommodation of poor-condition environments has been made possible by adoption of a resolver system.

★ **Preamplifier**

Modularized high-precision torque signal amplification and transmission functions and a TOOL-ID function are incorporated in the tools.
The weak signal of the torque transducer is amplified to minimize the effects of electrical noise, etc., on the signal.

★ **Self-Check Function**

Each time a fastening operation starts, a calibration check of the torque transducer is performed to check functions including those of the Unit and the cables to prevent abnormal fastening of bolt nuts, tool breakage, etc.

★ **Abnormal Condition Display**

When an abnormality occurs, the corresponding abnormal state No. is displayed on the front panel.

★ **Fastening Result Record**

Fastening results data are saved in a nonvolatile memory (EEPROM) inside the Unit (approx. 10,000 sets of data). As curve record data, 100 sets of data are stored in the volatile memory (RAM) inside the Unit.

As NG (failure) curve record data, 100 sets of data are stored in the nonvolatile memory (EEPROM). The fastening results data and the NG (failure) curve data are therefore preserved even if the power is turned off. However, once the power is turned off, the curve record data are initialized and the previous data are lost when the power is turned on subsequently. The above data can be read with the User Console software.

●Fastening Result Storage Feature List of HFC3000 System

Function Name		Automatic Save *1		Stored Data	
HFC3000 User Console		Fastening Data	Curve Data	Fastening Data	
Setting Tab		Preferences	Auto Upload	Stored Data	
Storage Content		Stored Data	Curve Data	Stored Data	Abnormals
Storage Location		PC		Each Unit	
Storable Records		-		12000 results	500 results
Setting Item		Yes		No	
JUDGMENT	ACCEPT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	REJECT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	ABNORMAL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	BYPASS	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	STOP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	RESET STOP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
	START OFF	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	

*1 : During the data collection in the Fastening Data screen of AFC3000 User Console, Automatic Save is enabled.

Function Name		Stored Curve Data		CF Card *2	
HFC3000 User Console		Stored Curve Data		-	
Storage Content		Stored Curve Data *3	Stored Reject Curve Data	Stored Data	Curve Data
Storage Location		Each Unit		CF Card	
Storable Records		100 results		-	-
Storage Format		Torque-Angle (540deg)		-	Torque-Angle (180deg)
J U D G M E N T	ACCEPT	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>
	REJECT	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	ABNORMAL	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	BYPASS	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>
	STOP	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	RESET STOP	<input type="radio"/>		<input type="radio"/>	<input type="radio"/>
	START OFF	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

*2 : CF CARD Option and CF CARD are required separately.

*3 : The stored contents (curve data) will be cleared when the control power of the Unit is turned OFF.

1-3 Usage Precautions

To ensure use in the best conditions, please conform to the following instructions.

★ Handling of tool

Each tool is designed to fully withstand vibrations and shocks that may be generated during ordinary fastening operation. However, it cannot bear a strong impact that may occur when the tool is dropped or collides against another tool (there is a possibility of breakage of the tool). Please be very careful in handling the tools.

★ Fastening

Avoid fastening at a torque exceeding the maximum fastening torque of a tool. Also, even when the maximum fastening torque is not exceeded, use the tool within the prescribed duty cycle (ratio of rotating time and downtime).

★ Cable Connection

To supply power to the Unit, use a cable conforming to the specification (dedicated cable). Lock the connector of the tool connection cable securely.

*Ground the Unit without fail. Otherwise, there is danger of fault or electric shock.

The accessory power cable is for use at 125V AC. Exchange the plug if use is to be made at 200V AC. Supply the primary power using wiring of no less than 1.25mm². If the power is supplied using a thin wiring, the power source voltage may drop to 80V AC or less and a Source Voltageply Error may occur.

★ Installation Environment

The following locations can be a cause of fault or malfunction. Avoid such locations or take measures such as installing a forced cooling device, etc.

- ◆ A location exposed to direct sunlight or a location where the ambient temperature falls outside the range of 0°C~45°C.
- ◆ A location where the relative humidity falls outside the range of 20%~90% or a location where the temperature changes rapidly and dew condensation occurs.

The equipment cannot be used at the following locations (if there is a possibility for use at any of the following locations, please contact the manufacturer).

- ◆ A location with a high amount of iron powder or other conductive powder, oil mist, salt, or organic solvent
- ◆ A location with corrosive gas or flammable gas
- ◆ A location where a strong electric field or a strong magnetic field is generated
- ◆ A location where the Unit and the tools are directly subjected to strong vibration or shock

★ Static Electricity

Since the Unit is composed of many electronic components, please be aware of static electricity. Excessive static electricity may occur at dry locations, therefore we recommend the operator to touch grounded metals before operating the front panel operation switches to discharge the static electricity charged inside the human body.

★ Cleaning

Never use thinner or other organic solvent to clean the external surfaces of the Unit or a tool. An organic solvent may melt the surface coating or penetrate inside and cause damage. Lightly wipe off dirt with a cloth dampened with alcohol or warm water.

★ Noise

The Unit is made up of electronic components – therefore, make sure there is no equipment that will generate strong noise in the surroundings. Make sure that the cables that connect the Unit and the tool are not placed inside a duct, etc., together with a power source line or other wiring.



2

Chapter 2 Specifications

2-1 System Specifications

Power Source	Voltage	Single-phase 100V AC~240V AC ±10% (5m cable for 100V AC provided as accessory)
	Frequency	50/60Hz
Installation environment		No vibration must be applied directly to the Unit. Forced-cooling equipment or heating equipment is required when using the Unit outside the following operating range.
Operating Conditions	Ambient temperature	0°C~+45°C (Avoid freezing)
	Ambient humidity	No more than 90%RH (Avoid condensation)
	Operation range	Duty cycle: within 50% (within the prescribed time for one cycle) See "2-1-1 Duty Cycle Calculation."
Storage Conditions	Ambient temperature	-5°C~+55°C (Avoid freezing)
	Ambient humidity	No more than 90%RH (Avoid condensation)
Shipping Conditions	Ambient temperature	-5°C~+55°C (Avoid freezing)
	Ambient humidity	No more than 50%RH (Avoid condensation)
	Packing method	Tight seal
Ambience		Indoors (no direct sunlight), free from corrosive gas, flammable gas, oil mist, dust, and dirt.

2-1-1 Duty Cycle Calculation

The duty cycle for HFC series is calculated as follows.

$$\text{Duty Cycle (\%)} = \text{Rotating time} \div (\text{Rotating time} + \text{Downtime}) \times 100$$

2-1-2 Unit Specifications

Unit model	HFC-B016
Motor model	M50,M80
Power source voltage	Single phase 100~240V AC ±10%
Power source frequency	Both 50/60HZ
Power consumption rating	80W
Maximum momentary current	11.3Ap (at the time of motor max power)
Inrush current	38Ap/AC100V,76Ap/AC200V
Power supply capacity	1.2kVA
Ground fault interrupter (Sensitivity electric current)	△I 30mA Max

2-2 Performance

2-2-1 Fastening Performance

Torque precision	From 1/2 ~ Calibration torque $3\sigma/\bar{X}$: 5% or less From 1/4 ~ 1/2 Calibration torque $3\sigma/\bar{X}$: 6% or less (Precisions in case of in-house standard fastening. *May differ according to work.)
Angle display minimum unit	0.1 degree
Angle internal control unit	0.1 degree
Torque transducer accuracy	±1% of full scale
Torque transducer linearity	±0.5% of full scale
Fastening method	Torque method/Angle method
Torque rate setting	3

List of Tools

Refer to Appendix.

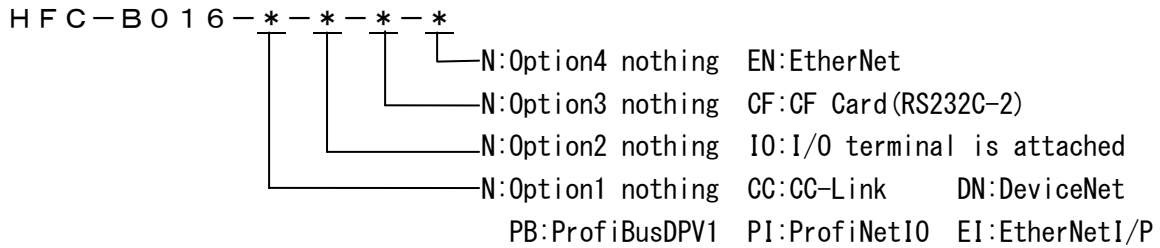
MODEL	MAXIMUM TORQUE [Nm]	MAXIMUM ROTATION SPEED [rpm]	MINIMUM ROTATION SPEED [rpm]
HFT-015M50-A1	15.00	1215	1
HFT-025M80-A1	25.00	1070	1
HFT-060M80-A	60.0	446	1
HFT-080M80-A	80.0	330	1
HFT-130M80-A	130.0	203	1
HFT-015M80-S1	15.00	1600	1
HFT-040M80-A1	40.00	648	1
HFT-040M80-S	40.00	694	1
HFT-015M50-P1	15.00	1190	1
HFT-035M80-P1	35.00	778	1

2-2-2 Unit

CPU: 32-bit RISC

Data communication: Ethernet: 1 port RS232C: 1 port
Fieldbus D-NET, P-BUS, CC-Link, etc. (optional)

Monitor functions: Torque, angle pulse, current

Unit MODEL**2-3 Functions****2-3-1 Main Functions****(1) Fastening Function**

The HAND SYSTEM is capable of the following fastening methods.

1. Torque method: Angle monitor, Torque rate monitor, 1/2/3 step fastening
2. Angle method: Torque monitor, Torque rate monitor, 1/2/3 step fastening

(2) Self-Check Function

When the start lever is gripped (turned ON), the home-position voltage level and CAL voltage level of the torque transducer are automatically checked before fastening. This function is useful for checking the transducer for abnormality and checking the cable for breakage etc.

(3) Bypass Function

When the BYPASS signal is input, the BYPASS signal is output to notify that the Unit is in the BYPASS mode. Starting by the START signal cannot be performed in this mode. If the Unit enters the BYPASS mode during fastening, fastening is stopped immediately.

(4) Abnormal Signal Output Function

When a fastening failure (NG) or a system error occurs, the tool is stopped immediately and a signal corresponding to the problem is output. Also, the fastening failure (NG) details and the abnormal state No. are displayed on the Unit front panel.

(5) Tool Type Checking Function

If, when the Nutrunner is activated, the tool model set at the Unit differs from the model No. of the tool that is actually connected, the Tool Type Error is generated in the power activation process and fastening will not be performed.

The tool ID contents are read in either of the following states.

1. If a tool is connected when the power is activated
2. When the tool is connected

2-3-2 Fastening Method

(1) Torque Method (Angle Monitor)

Fastening is performed up to a preset standard torque.

The fastening operation is performed with the preset torque as the target, and high limit/low limit judgment of the angle value is enabled.

The number of fastenings steps is selectable among 1 step, 2 steps, and 3 steps.

(2) Angle Method (Torque Monitor)

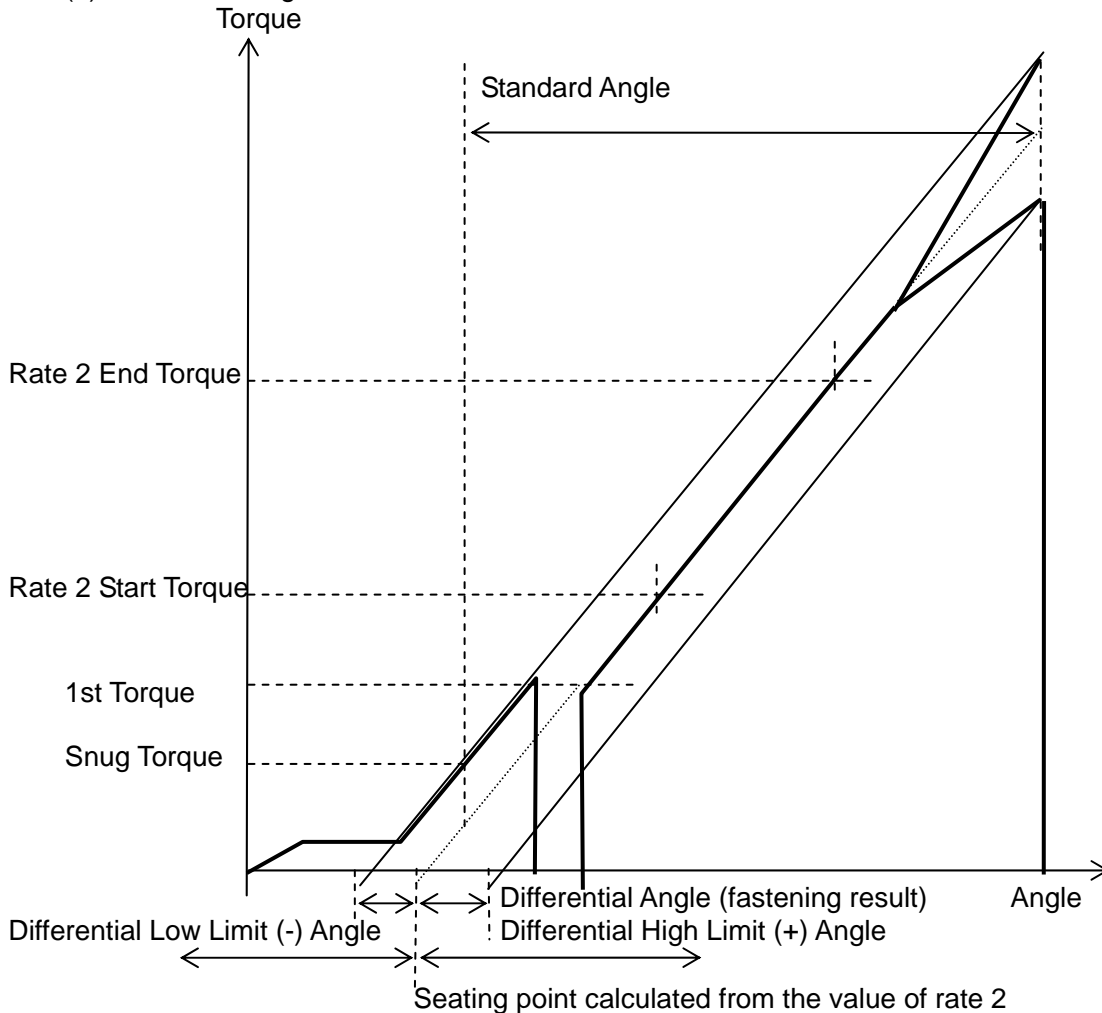
Fastening is performed up to a preset standard angle.

The fastening operation is performed with the preset angle as the target, and high limit/low limit judgment of the torque value is enabled.

Generally when a handheld tool is used, the angular precision may vary according to the state in which the tool is held during fastening. Use in combination with the reaction force receiver jig etc., is recommended.

The number of fastenings steps is selectable among 1 step, 2 steps, and 3 steps.

(3) Differential Angle Check Method



Fastening is performed from the Snug torque (angle measurement start torque) to the standard angle value (or the standard torque value).

After completion of fastening, the seating point is calculated from the value of rate 2.

The differential angle is then calculated from the final torque value and the value of rate 2, and judgment is performed if differential angle check is available.

The rate 2 is calculated from the rate 2 start torque and the rate 2 end torque.



3

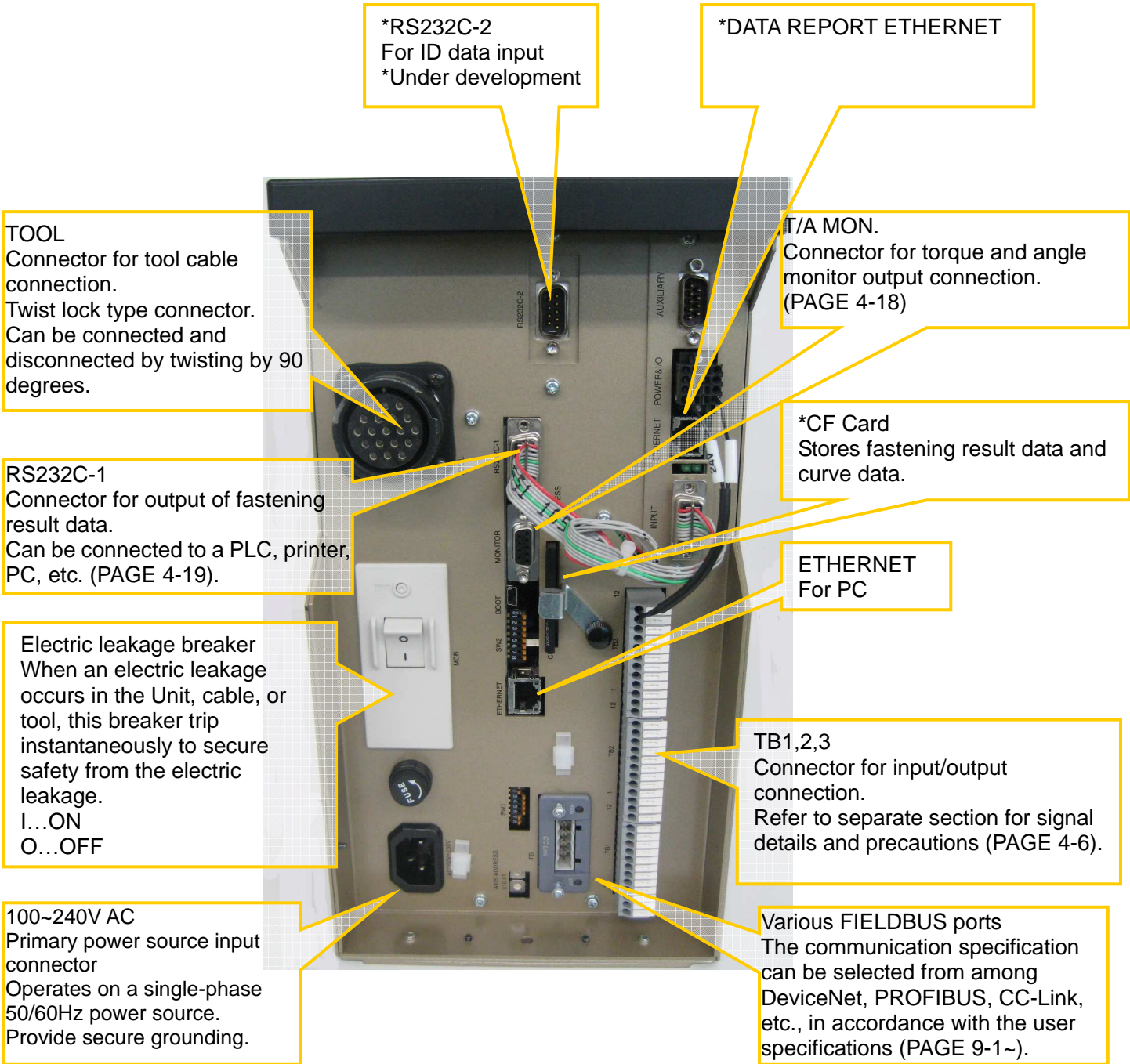
Chapter 3 Part Names

3-1 Controller Unit

3-1-1 Controller Unit Front Panel

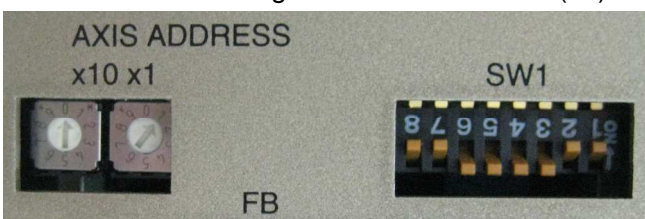


3-1-2 Unit Rear Panel



Note : * FIELDBUS, CF card, RS232C-2 and Data report EtherNet are optional.

Please do not change it AXIS ADDRESS(01)、SW1(1,2,7,8 ON)、SW2(ALL OFF).



3-2 Tools

3-2-1 Angle Tool

Hand-held type fastening tool provided with angle head, planetary gear, torque transducer, servomotor, indicator LEDs, and operating switches.



- ① Starting switch: When the switch is turned ON (by pressing), the tool tip rotates for performing fastening. When the switch is released during fastening (during rotation of the tip), the fastening (rotation) is stopped. For ordinary fastening operation, continue to grip this switch until fastening is completed.
- ② Reversing switch: Switch for switching between normal and reverse rotation operations. This is a ring type normal/reverse changeover switch (*in older models, this is a push type switch). When the reverse rotation mode is set, the judgment LED flashes in orange. When the starting switch is turned ON in this state, the reverse rotation operation is performed. When the starting switch is released during the reverse rotation operation, the operation is stopped.



Caution

*** The torque limit is caused when you loose the bolt already fastened over 5N·m of default setting in the case of the reverse operation and it automatically stops for safety. This can be changed in the setting of fastening parameter. See the PAGE6-33,6-62. If changed, be careful of big torque caused.**

- ③ LED for judgment and status indications (4 LEDs):

When the fastening result is OK, the green LED lights up.

In the case of TOTAL OK, the green LED flashes.

When the fastening result is NG (failure), the red LEDs light up.

In the reverse rotation mode and during initialization upon power activation, the orange LED lights up.

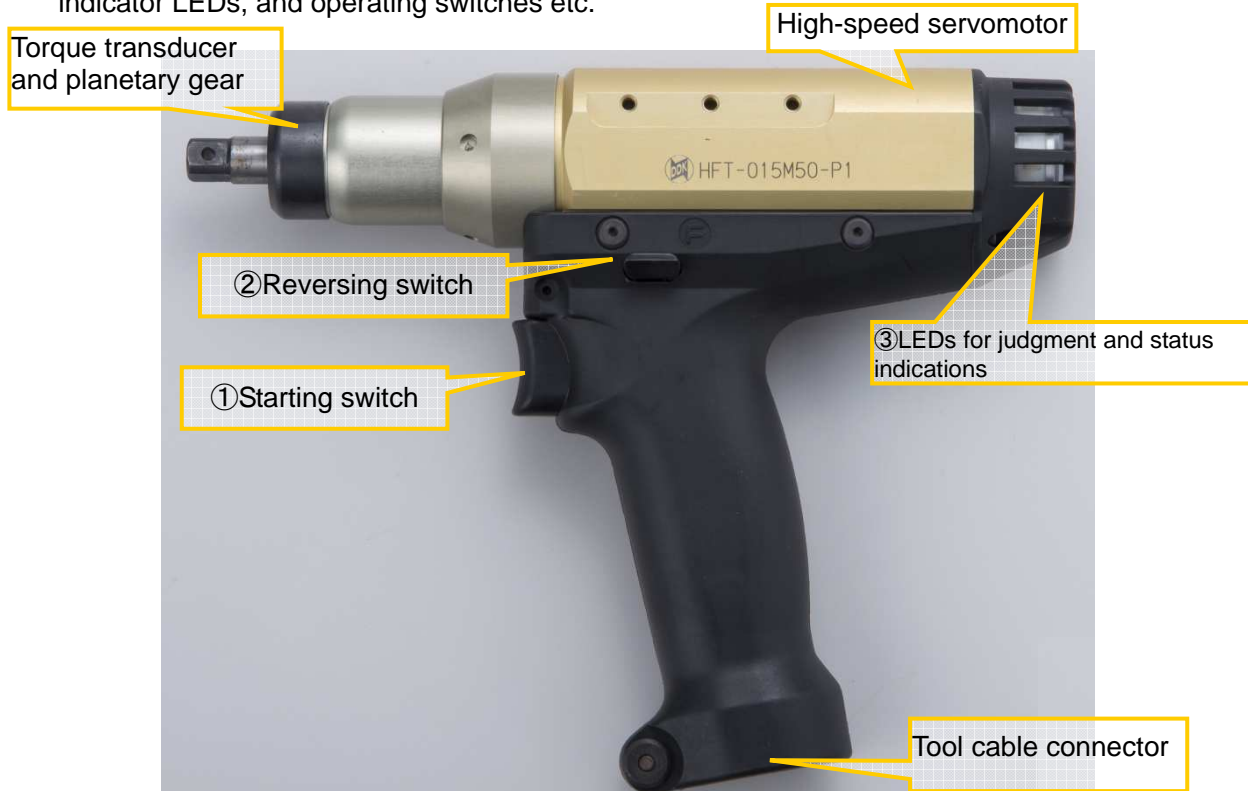


Caution

*** When using the T/D of angle tool and planetary gear part by securing them with a holder, ensure correct selection and attachment of the holder. Some types of holder can cause deformation of the tool case, affecting the accuracy of fastening torque.**

3-2-2 Pistol Tool

Pistol type hand-held type fastening tool provided with planetary gear, torque transducer, servomotor, indicator LEDs, and operating switches etc.



- ① Starting switch: When the switch is turned ON (by pressing), the tool tip rotates for performing fastening.
When the switch is released during fastening (during rotation of the tip), the fastening (rotation) is stopped.
For ordinary fastening operation, continue to grip this switch until fastening is completed.
- ② Reversing switch: Switch for switching between normal and reverse rotation operations.
When the reverse rotation mode is set, the judgment LED flashes in orange.
When the starting switch is turned ON in this state, the reverse rotation operation is performed.
When the starting switch is released during the reverse rotation operation, the operation is stopped.



* The torque limit is caused when you loose the bolt already fastened over 5N·m of default setting in the case of the reverse operation and it automatically stops for safety. This can be changed in the setting of fastening parameter. See the PAGE6-33,6-62. If changed, be careful of big torque caused.

- ③ LED for judgment and status indications (4 LEDs):
When the fastening result is OK, the green LED lights up.
In the case of TOTAL OK, the green LED flashes.
When the fastening result is NG (failure), the red LEDs light up.
In the reverse rotation mode and during initialization upon power activation, the orange LED lights up.



* When using the T/D of pistol tool and planetary gear part by securing them with a holder, ensure correct selection and attachment of the holder. Some types of holder can cause deformation of the tool case, affecting the accuracy of fastening torque.

Memo



4

Chapter 4 Installation

4-1 Installation Procedure

Follow the installation procedures of the Hand System in the order prescribed below.

No	Item	Contents	Page
①	Installation	Mount the Unit with reference to the outer shape.	<u>4-2</u> PAGE 4-2
②	Connection of input power source	Wiring connection by cable provided as accessory to the Unit	<u>4-3</u> PAGE 4-3
③	Connection of tool cable	Connection between unit rear panel (CN1) and tool	<u>4-4</u> PAGE 4-4
④	Connection of external control signal	Connection is made only for the necessary control signals.	<u>4-5</u> PAGE 4-5
⑤	Power activation	Activate the power after checking the wiring and checking the power source voltage.	<u>5-1</u> PAGE 5-1
⑥	Set value input	The torque value, angle value, speed, timer, etc., are set.	<u>Chapter 6</u> PAGE 6-1
⑦	Initial operation check	Perform the initial operation check.	<u>5-2</u> PAGE 5-2

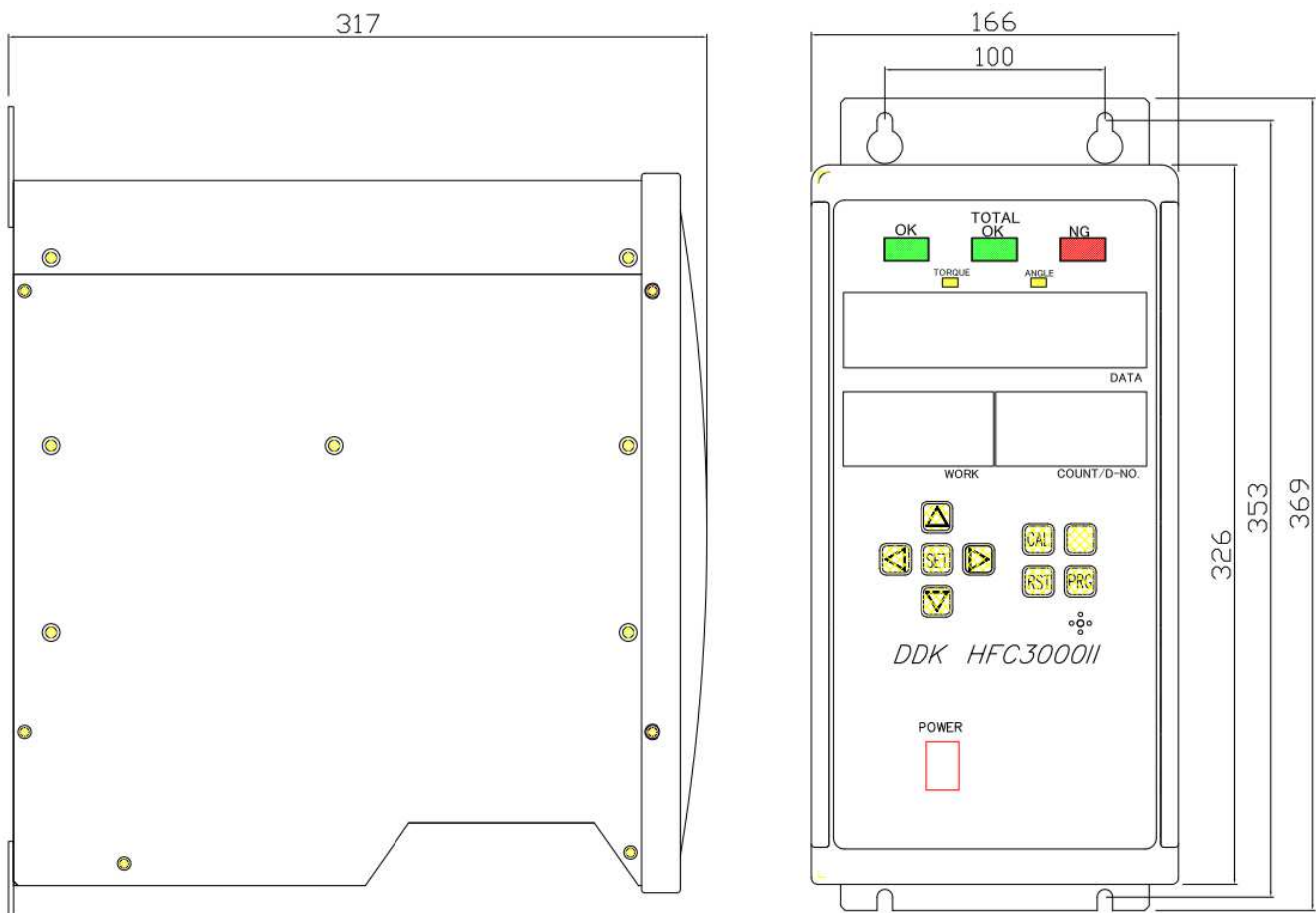
4-2 Unit Outer Shape and Installation Dimensions

Mounting: 4 points (Rear panel) M6 screws: Use screws with a length equivalent to the installation plate thickness +9mm.

Weight: 8.5 kg

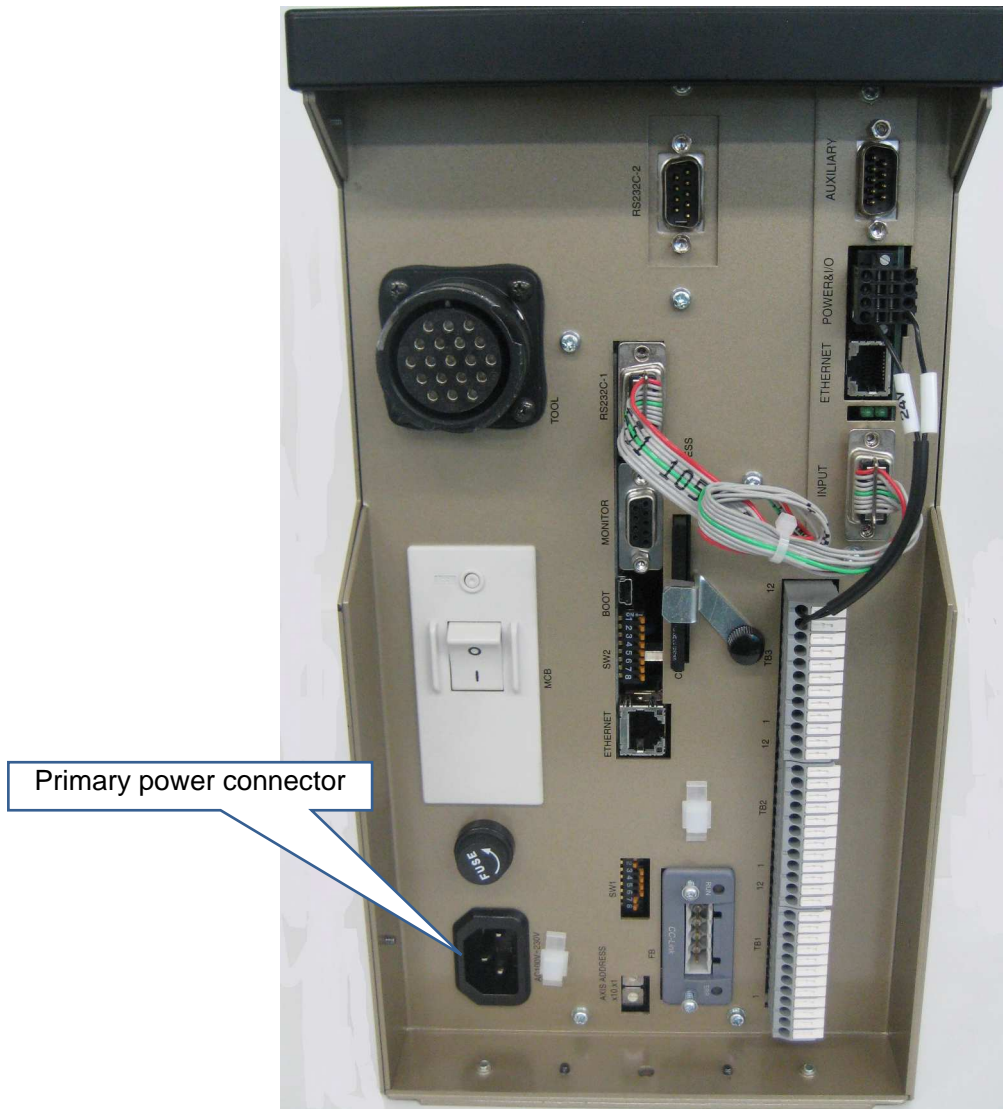
<Mounting Precautions>

- ◆ Do not install the unit at a location that is constantly vibrating.
- ◆ Install the Unit at a location where the temperature, humidity, and other operating environmental conditions are satisfied.
- ◆ Do not use a mounting screw longer than the abovementioned size.



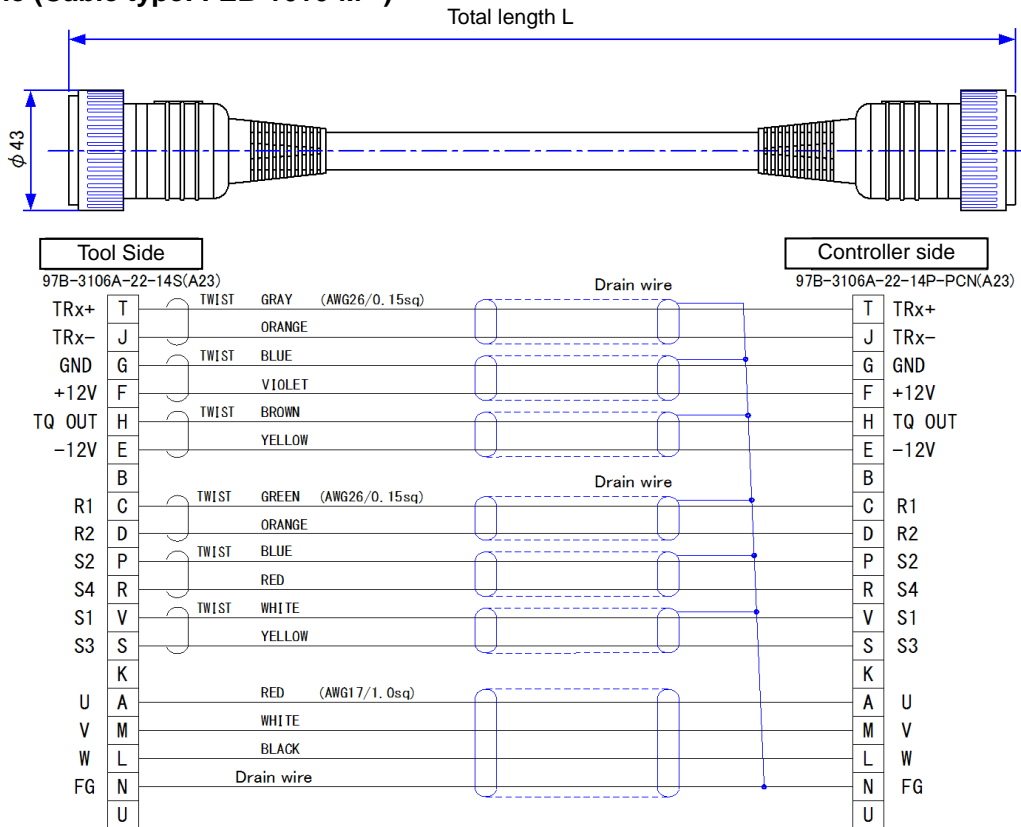
4-3 Input Power Source Connection

Connect the dedicated power cable to the connector at a lower portion of the rear panel of the Unit. A power cable is provided as standard.

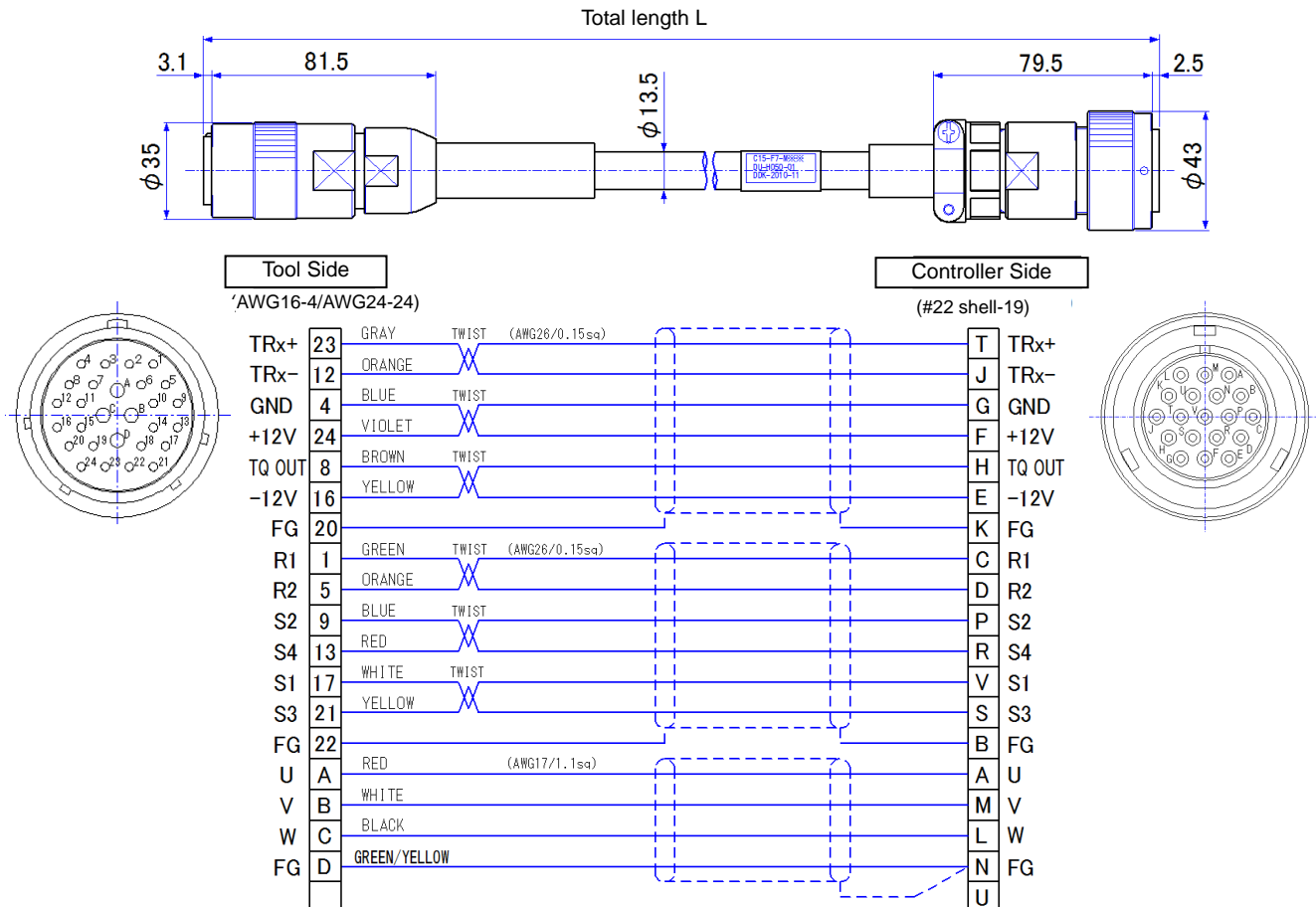


4-4 Tool Cable Specifications

■ Tool Cable (Cable type: FEB-1616-M**)

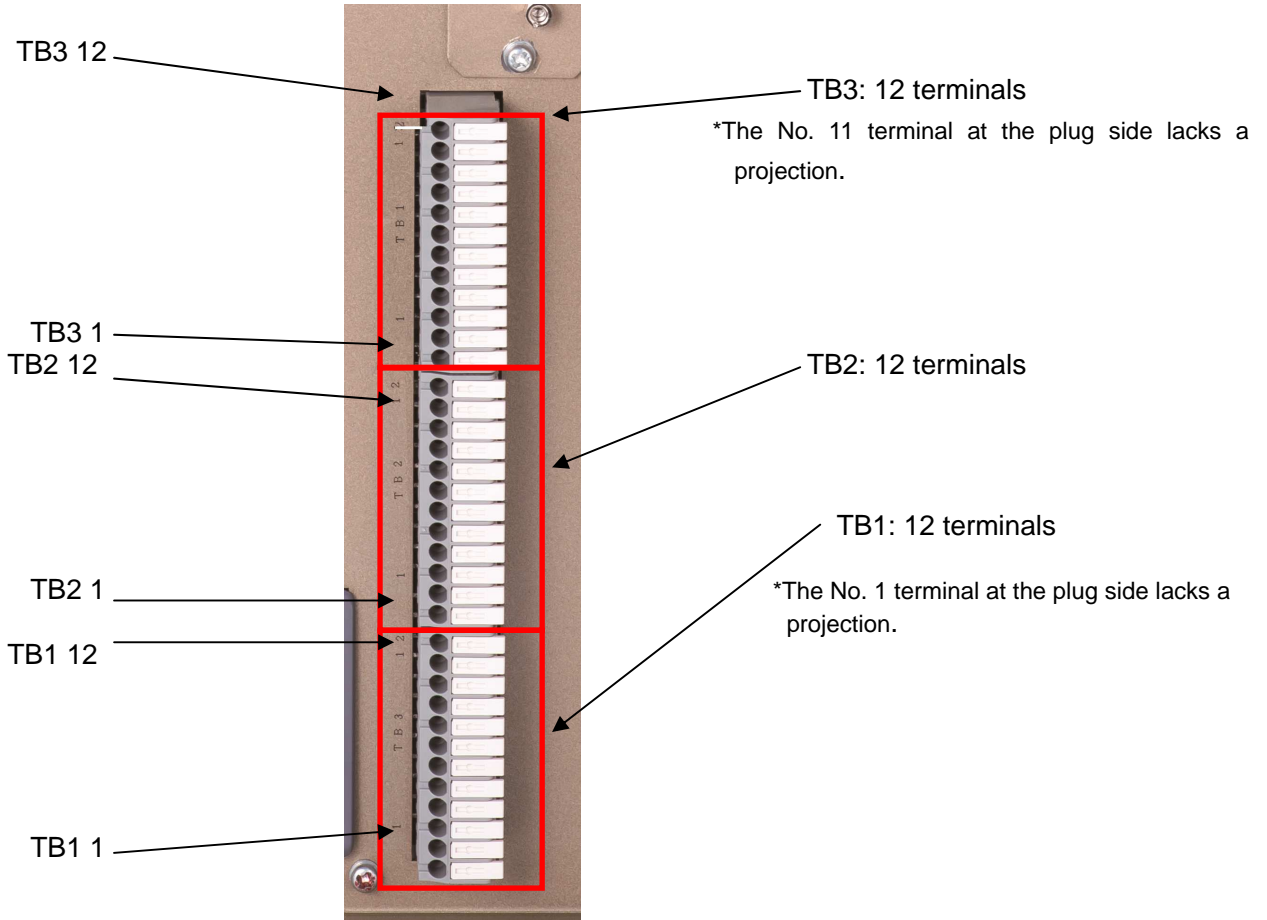


■ Tool Cable (Cable type: C15-F7-M**)



4-5 External Control Signal Connection

DI0 Terminal Block: TB1,2,3



Connector Model: ML-4000-CWSH-12PGY

Manufacturer: SATO PARTS

Rated applicable wire: Solid wire 0.8mm φ (AWG 20), stranded wire 0.5mm² (AWG 20)

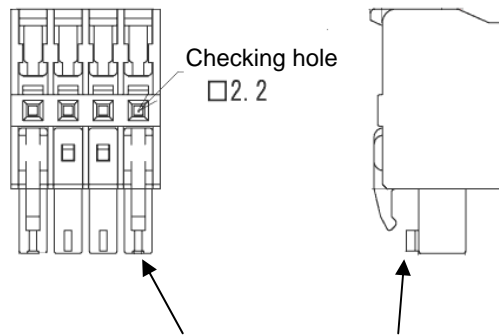
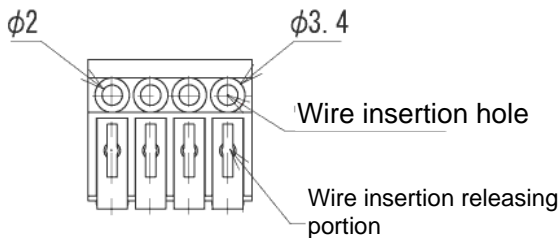
Range of useable wires: Solid wire 0.4mm φ ~ 1.2mm φ (AWG 26 ~ AWG 16)

Stranded wire 0.2mm² to 1.25mm² (AWG 24 ~ AWG 16)

Wire outer diameter 0.18mm φ or more

Standard wire stripping length: 9mm

Note: One wire is connected to one terminal. Do not connect two or more wires to one terminal.



The No. 1 TB1 plug does not have a projection.
The No. 11 TB3 plug does not have a projection.

4-5-1 Unit I/O Signals **[BANK SELECT = OFF]**

Pin No.	Signal	IN/OUT	Description of Function/Usage
TB3-1	IN COMMON	IN	Common input signal (bipolar)
TB3-2,11	+24V	0.5Amax	+24V output When use this power supply, please use a shielding line. Wire it from the noise source apart.
TB3-3,12	GND		
TB1-1	STOP	IN-1(A:NO/ B:NC)	The fastening process is stopped when this signal is set to "OFF." Selection between A contact and B contact is possible. System parameter: SYS.033[xx1xxx] 0: A contact/1: B contact
TB1-2	RESET	IN-2(NO)	The fastening process is stopped and the fastening judgment of the Unit is cleared by inputting "ON." (The ID data are cleared.)
TB1-3	REVERSE	IN-3(NO)	While "ON" is input, the tool rotates in reverse and in accordance with the selected WORK No.
TB1e-4	START	IN-4(NO)	While "ON" is input, the fastening process is started in accordance with the selected WORK No. ("Deadman" specification).
TB1-5	PROGRAM(BYPASS)	IN-5(NO)	The Unit is put in the BYPASS (PROGRAM) mode while "ON" is input.
TB1-6	SELF CHECK DISABLE	IN-6(NO)	When the START signal is set to "ON" while inputting "ON" into this pin, the self-diagnosis of the torque transducer is not performed before the start of the fastening operation (the start of tool rotation can be shortened by approx. 60msec).
TB1-7	WORK SELECT BIT 0	IN-7(NO)	The WORK SELECT BIT 0 ~4 select signals enable selection among parameter Nos. 1 ~ 32 by a combination of the 5 pin Nos.
TB1-8	WORK SELECT BIT 1	IN-8(NO)	
TB1-9	WORK SELECT BIT 2	IN-9(NO)	
TB1-10	WORK SELECT BIT 3	IN-10(NO)	
TB1-11	WORK SELECT BIT 4	IN-11(NO)	
TB1-12	BANK SELECT=[OFF]	IN-12(NO)	Bank select signal (for WORK SELECT return signal)
TB3-4	OUT COMMON	OUT	Common output signal (bipolar)
TB3-5	BATCH OK RESET	IN-13(NO)	Cycle counter (ACCEPT count) reset signal
TB3-6		IN NO	Not connected internally
TB3-7	Fastening Result Data Available	OUT-6(NO)	Output when there are fastening result data in the Unit.
TB3-8	CF CARD FULL	OUT-7(NO)	Output when capacity of the CF card is less than 1%, or CF card is not inserted
TB3-9		IN NO	Not connected internally
TB3-10		IN NO	Not connected internally
TB2-1	REJECT[NG]	OUT-1(NO)	Output when the fastening operation ends with a fastening result falling outside a judgment range.
TB2-2	ACCEPT[OK]	OUT-2(NO)	Output when the fastening operation ends with the fastening results being within the judgment ranges.
TB2-3	ABNORMAL	OUT-3(NO)	Output when an error occurs in the system or during the fastening operation.
TB2-4	READY	OUT-4(NO)	Output when operation is enabled with respect to an input signal from the outside. This signal is also output after the end of fastening, regardless of the judgment.
TB2-5	BUSY	OUT-5(NO)	Output during the fastening process.
TB2-6	BYPASS	OUT-12(NO)	Output when the Unit is in the BYPASS (PROGRAM) mode.
TB2-7	MANREV (RY1-1)	OUT-8(NO)	Turns ON when manually starting the reversed operation. Turns OFF when the next fastening starts or turns OFF at RESET, PROGRAM. (Relay contact-1)
TB2-8	BUZZER (RY2-1)	OUT-9(NO)	Performs interlocking output of REJECT signal ON/OFF to external devices. *However, the key click sound is not output. (Relay contact-2)
TB2-9	BATCH OK (RY3-1) [TOTAL OK]	OUT-10(NO)	Output when the fastening results are OK for the cycle count times of fastening (relay contact-3). Selection between pulse and level outputs is possible. System parameter: SYS.033[xxxx1x] 0: level/1: pulse
TB2-10	RY-COM(RY1,2,3-2)	OUT	Relay contact-1, 2, 3 common
TB2-11	QL OK (RY4-1)	OUT-11(NO)	OK output for QL signal (dry contact) (Relay contact-4)
TB2-12	[OK] (RY4-2)		Selection between pulse and level outputs is possible. System parameter: SYS.033[xxxxx1] 0: level/1: pulse

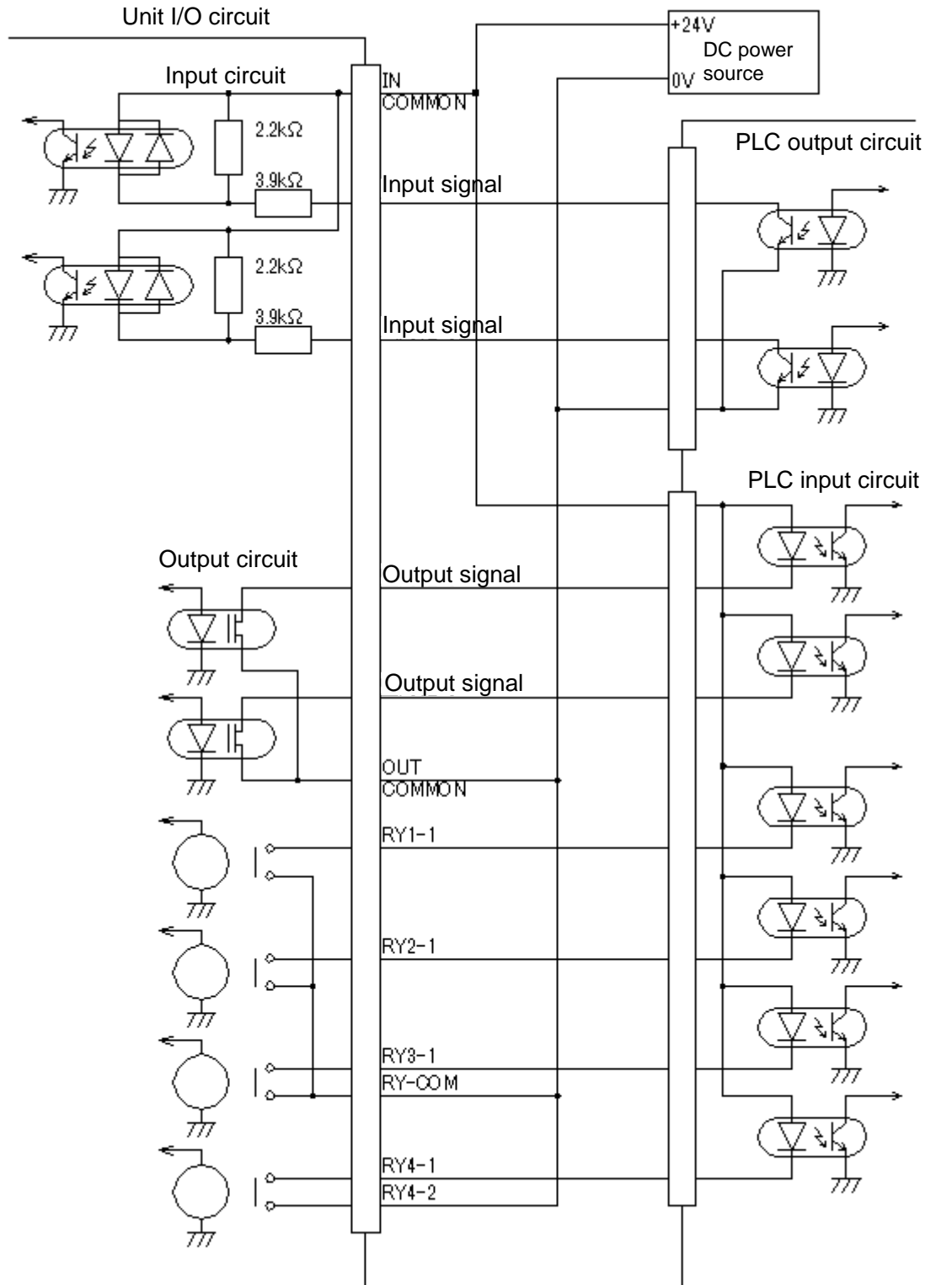
System parameter: SYS.033[xx1xx] 0: 300ms/1: 800ms pulse length

4-5-2 Unit I/O Signals [BANK SELECT = ON]

The following output changes.

Pin No.	Signal	IN/OUT	Description of Function/Usage
TB1-12	BANK SELECT=[ON]	IN-12(NO)	Bank select signal (for WORK SELECT return signal)
TB3-7	WORK OUTPUT BIT 2	OUT-6(NO)	When BANK SELECT=[ON], return output of the select signals of WORK SELECT BITS 2 and 3 is performed. ^{Note 1)}
TB3-8	WORK OUTPUT BIT 3	OUT-7(NO)	
TB2-1	WORK OUTPUT BIT 5	OUT-1(NO)	[ON] is output when any of 33 WORK to 64 WORK is selected.
TB2-2	NONE	OUT-2(NO)	[OFF] is output at all times.
TB2-3	NONE	OUT-3(NO)	
TB2-4	WORK OUTPUT BIT 0	OUT-4(NO)	When BANK SELECT=[ON], return output of the select signals of WORK SELECT BITS 0, 1, and 4 is performed. ^{Note 1)}
TB2-5	WORK OUTPUT BIT 1	OUT-5(NO)	
TB2-6	WORK OUTPUT BIT 4	OUT-12(NO)	

4-5-3 Input and Output Circuit Specifications and Recommended Connection Circuit



*The above diagram shows an NPN type connection example.



Caution

• The I/O hardware accommodates both positive and negative polarities and both NPN (sink · - common) type and PNP (source · + common) type connection may be used.

4-5-4 Description of I/O Signals

+24V, GND: SERVICE POWER SUPPLY

PIN No.: TB3-2,3,11,12

Do not supply power to the [+24V] and [GND] terminals (24V DC service power supply) on the Unit. Doing so may cause damage to the product. Do not use it more than **0.5A**. When use the service power supply; the thing using the shield cable. Wire it from the power lines of other apparatuses apart. Attach a clamp filter to the power supply line. (example ZCAT2032-0930:TDK)

[Input Signals]

STOP: EMERGENCY STOP SIGNAL

PIN No.: TB1-1

While this signal is input in the "ON" state, the Unit is put in the STOP state.
In the STOP state, the output signals are cleared and the fastening operation cannot be started.
When the STOP state is entered during the fastening operation, although the fastening operation will be stopped, the fastening result data immediately prior to stoppage will be held.
For the "ON" state of this signal, an A contact or a B contact can be selected by the system option 1 [033].
When the A contact is selected, the signal is "OFF" in the open contact state and "ON" in the closed contact state.

RESET: RESET SIGNAL

PIN No.: TB1-2

When this signal is input in the "ON" state, the display data and the output signals of the Unit are cleared. Also, when the "ON" RESET signal is input during the fastening operation, the fastening operation is stopped.

REVERSE: TOOL REVERSING SIGNAL

PIN No.: TB1-3

While this signal is input in the "ON" state, the tool rotates in reverse.
To ensure reverse rotation of the tool, set this signal to "ON" after the READY signal is set to "ON."

START: FASTENING START SIGNAL

PIN No.: TB1-4

By this signal, the WORK SELECT 0 to 2 signals and the SELF CHECK signal are read and fastening is started.
The rotation operation is stopped when this signal is set to "OFF."
After the start of fastening, the Unit is put in the BUSY (fastening) state.
In the following states, the READY output signal is set to "OFF" and the START signal will not be accepted.
"During stoppage, during reverse rotation of the tool, during reset, in the BYPASS mode, and in an abnormal state."
When a signal corresponding to any of the above is input, the judgment signal and the previous fastening data are reset.

BYPASS: BYPASS SIGNAL

PIN No.: TB1-5

While this signal is "ON," the Unit is put in the PROGRAM mode, the BYPASS signal is output, and fastening cannot be started.
If the BYPASS mode is entered during fastening, the fastening process is stopped.

SELF CHECK: TORQUE TRANSDUCER AUTOMATIC CHECK SIGNAL

PIN No.: TB1-6

If this signal is "OFF" (or unconnected) when the START signal is input, the home-position voltage level and the CAL voltage level of the torque transducer are automatically checked before the fastening process.
If the automatic check of the transducer is not required, fastening without the self-check can be performed by setting this signal to "ON" when the START signal is input.

BATCH OK RESET: BATCH COUNTER RESET SIGNAL

PIN No.: TB3-5

When a change of WORK has been selected at the terminal block, the current cycle count value is cleared by input of this reset signal.

When a change of WORK has been selected at the Unit indicator panel, the current cycle count value is cleared by input of this reset signal. Or, after performing fastening for the set number of times, the cycle count value is cleared automatically at the start of the next fastening process.

BANK SELECT: OUTPUT SIGNAL BANK SELECT SIGNAL

PIN No.: TB1-12

The contents of the eight output signals are changed by switching ON/OFF the BANK SELECT signal.

UNUSED

PIN No.: TB3-6, 9, 10

These are unused.

WORK SELECT 0 ~ 4: Work Select Signals

PIN No.: TB1-7 ~ 11

A Work No. among 32 types can be selected by a combination of the signals WORK SELECT 0 ~ WORK SELECT 4 (selection from among 64 types of work is not accommodated).

WORK SELECT 4 PIN No.: TB1-11	WORK SELECT 3 PIN No.: TB1-10	WORK SELECT 2 PIN No. TB1-9	WORK SELECT 1 PIN No.: TB1-8	WORK SELECT 0 PIN No.: TB1-7	WORK No.
OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	1
OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	ON	2
OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	ON	OFF(OPEN)	3
OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	ON	ON	4
OFF(OPEN)	OFF(OPEN)	ON	OFF(OPEN)	OFF(OPEN)	5
OFF(OPEN)	OFF(OPEN)	ON	OFF(OPEN)	ON	6
OFF(OPEN)	OFF(OPEN)	ON	ON	OFF(OPEN)	7
OFF(OPEN)	OFF(OPEN)	ON	ON	ON	8
OFF(OPEN)	ON	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	9
OFF(OPEN)	ON	OFF(OPEN)	OFF(OPEN)	ON	10
OFF(OPEN)	ON	OFF(OPEN)	ON	OFF(OPEN)	11
OFF(OPEN)	ON	OFF(OPEN)	ON	ON	12
OFF(OPEN)	ON	ON	OFF(OPEN)	OFF(OPEN)	13
OFF(OPEN)	ON	ON	OFF(OPEN)	ON	14
OFF(OPEN)	ON	ON	ON	OFF(OPEN)	15
OFF(OPEN)	ON	ON	ON	ON	16
ON	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	17
ON	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	ON	18
ON	OFF(OPEN)	OFF(OPEN)	ON	OFF(OPEN)	19
ON	OFF(OPEN)	OFF(OPEN)	ON	ON	20
ON	OFF(OPEN)	ON	OFF(OPEN)	OFF(OPEN)	21
ON	OFF(OPEN)	ON	OFF(OPEN)	ON	22
ON	OFF(OPEN)	ON	ON	OFF(OPEN)	23
ON	OFF(OPEN)	ON	ON	ON	24
ON	ON	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	25
ON	ON	OFF(OPEN)	OFF(OPEN)	ON	26
ON	ON	OFF(OPEN)	ON	OFF(OPEN)	27
ON	ON	OFF(OPEN)	ON	ON	28
ON	ON	ON	OFF(OPEN)	OFF(OPEN)	29
ON	ON	ON	OFF(OPEN)	ON	30
ON	ON	ON	ON	OFF(OPEN)	31
ON	ON	ON	ON	ON	32

[Output Signals]

When an output signal is “ON,” the voltage at the corresponding output terminal is at the same level as the output common voltage (0V).

As shown below, the output signal at each terminal takes on one of two meanings in accordance with the combination with the BANK SELECT signal (output bank).

OFF: Same as the input common (HIGH) level or is open.

ON: Connected to 0V.

BANK SELECT	OFF	ON	
TB2-1	REJECT(NG)	WORK SELECT 5	OUT-1
TB2-2	ACCEPT(OK)		OUT-2
TB2-3	ABNORMAL		OUT-3
TB2-4	READY	WORK SELECT 0	OUT-4
TB2-5	BUSY	WORK SELECT 1	OUT-5
TB3-7	RESULT DATA	WORK SELECT 2	OUT-6
TB3-8	CF CARD FULL	WORK SELECT 3	OUT-7
TB2-6	BYPASS	WORK SELECT 4	OUT-12

MANREV / RELAY CONTACT-1 SIGNAL PIN No.: TB2-7 OUT-8
RELAY CONTACT -COM SIGNAL PIN No.: TB2-10

Turns ON by manually starting the reversed operation.

Turns OFF when the next fastening starts, or turns “OFF” at RESET, PROGRAM.

For details, refer to PAGE4-17 [MANREV signal timing chart]

RELAY CONTACT-2 SIGNAL PIN No.: TB2-8 OUT-9
RELAY CONTACT -COM SIGNAL PIN No.: TB2-10

Performs interlocking output of REJECT signal ON/OFF to external devices. (Click sound of the operation switch is not output.)

Turns ON for 0.4 seconds by the BATCH OK signal rise-up.

Turns ON for 0.1 seconds by the QL OK signal rise-up.

RELAY CONTACT-3 SIGNAL PIN No.: TB2-9 OUT-10
RELAY CONTACT -COM SIGNAL PIN No.: TB2-10

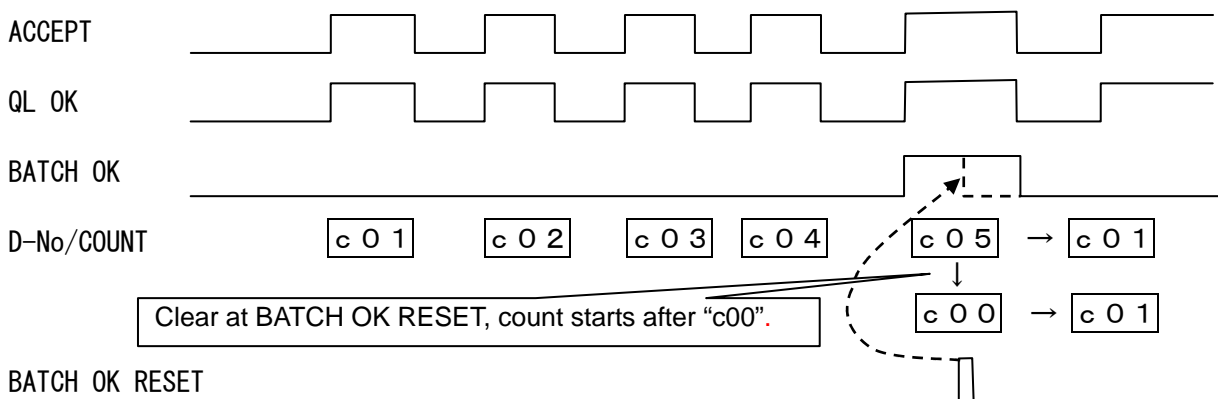
OK is output when the fastening has been performed for the number of times specified by the cycle count.

QL OK RELAY CONTACT-4 SIGNAL PIN No.: TB2-11 OUT-11
QL OK RELAY CONTACT-4 SIGNAL PIN No.: TB2-12 OUT-11

OK output for the QL signal

[QL OK] [BATCH OK] Timing Chart

D-No.540: Cycle count = 5



OUTPUT BANK [OFF]**NG: FASTENING NG (FAILURE) SIGNAL**

PIN No.: TB2-1

OUT-1

The “ON” output is performed when an abnormal exit occurs with a fastening result falling outside a judgment range.

OK: FASTENING OK SIGNAL

PIN No.: TB2-2

OUT-2

The “ON” output is performed when normal exit is accomplished with the fastening results being within the judgment ranges.

ABNORMAL: SYSTEM ERROR/ABNORMAL EXIT

PIN No.: TB2-3

OUT-3

The “ON” output is performed when an error is detected during the system check performed by the Unit or during the fastening process.

When an error occurs, fastening is stopped immediately and the fastening results data are stored.

READY: INPUT ENABLING SIGNAL

PIN No.: TB2-4

OUT-4

The “ON” output is performed when operation fastening, reverse rotation, etc., can be performed by an input signal from the PLC or other external equipment.

The READY signal is “OFF” under the following conditions.

- ⊙ During the initialization process in power activation
- ⊙ During reverse rotation
- ⊙ When the ABNORMAL signal is output
- ⊙ In the BYPASS mode (during settings, in the download mode (during communication), etc.)
- ⊙ In the STOP state
- ⊙ During fastening, reset, or CAL check
- ⊙ Other conditions where operation of the Unit by an external output is disabled

BUSY: SIGNAL DURING FASTENING

PIN No.: TB2-5

OUT-5

The “ON” output is performed when the Unit is performing the fastening process.

Fastening Result Data Available

PIN No.: TB3-7

OUT-6

The “ON” output is performed when fastening result data are present.

CF CARD FULL

PIN No.: TB3-8

OUT-7

The “ON” output is performed when capacity of the CF card is less than 1%, or CF card is not inserted

BYPASS: BYPASS MODE

PIN No.: TB2-6

OUT-12

The “ON” output is performed in the BYPASS mode.

OUTPUT BANK [ON]**UNUSED**

PIN No.: TB2-2, TB2-3

OUT-2~3

These are unused.

WORK OUTPUT 0 ~ 4: WORK SELECTION INPUT CHECK

The input signals, WORK SELECT 0 ~ 4, are returned as they are as the output signals, WORK OUTPUT 0 ~ 4.

These are used to confirm matching with the work selection that is input.

WORK OUTPUT 4 PIN No.: TB2-6	WORK OUTPUT 3 PIN No.: TB3-8	WORK OUTPUT 2 PIN No.: TB3-7	WORK OUTPUT 1 PIN No.: TB2-5	WORK OUTPUT 0 PIN No.: TB2-4	WORK No.
OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	1
OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	ON	2
OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	ON	OFF(OPEN)	3
OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	ON	ON	4
OFF(OPEN)	OFF(OPEN)	ON	OFF(OPEN)	OFF(OPEN)	5
OFF(OPEN)	OFF(OPEN)	ON	OFF(OPEN)	ON	6
OFF(OPEN)	OFF(OPEN)	ON	ON	OFF(OPEN)	7
OFF(OPEN)	OFF(OPEN)	ON	ON	ON	8
OFF(OPEN)	ON	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	9
OFF(OPEN)	ON	OFF(OPEN)	OFF(OPEN)	ON	10
OFF(OPEN)	ON	OFF(OPEN)	ON	OFF(OPEN)	11
OFF(OPEN)	ON	OFF(OPEN)	ON	ON	12
OFF(OPEN)	ON	ON	OFF(OPEN)	OFF(OPEN)	13
OFF(OPEN)	ON	ON	OFF(OPEN)	ON	14
OFF(OPEN)	ON	ON	ON	OFF(OPEN)	15
OFF(OPEN)	ON	ON	ON	ON	16
ON	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	17
ON	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	ON	18
ON	OFF(OPEN)	OFF(OPEN)	ON	OFF(OPEN)	19
ON	OFF(OPEN)	OFF(OPEN)	ON	ON	20
ON	OFF(OPEN)	ON	OFF(OPEN)	OFF(OPEN)	21
ON	OFF(OPEN)	ON	OFF(OPEN)	ON	22
ON	OFF(OPEN)	ON	ON	OFF(OPEN)	23
ON	OFF(OPEN)	ON	ON	ON	24
ON	ON	OFF(OPEN)	OFF(OPEN)	OFF(OPEN)	25
ON	ON	OFF(OPEN)	OFF(OPEN)	ON	26
ON	ON	OFF(OPEN)	ON	OFF(OPEN)	27
ON	ON	OFF(OPEN)	ON	ON	28
ON	ON	ON	OFF(OPEN)	OFF(OPEN)	29
ON	ON	ON	OFF(OPEN)	ON	30
ON	ON	ON	ON	OFF(OPEN)	31
ON	ON	ON	ON	ON	32

WORK OUTPUT 5: WORK SELECTION INPUT CHECK

PIN No.: TB2-1

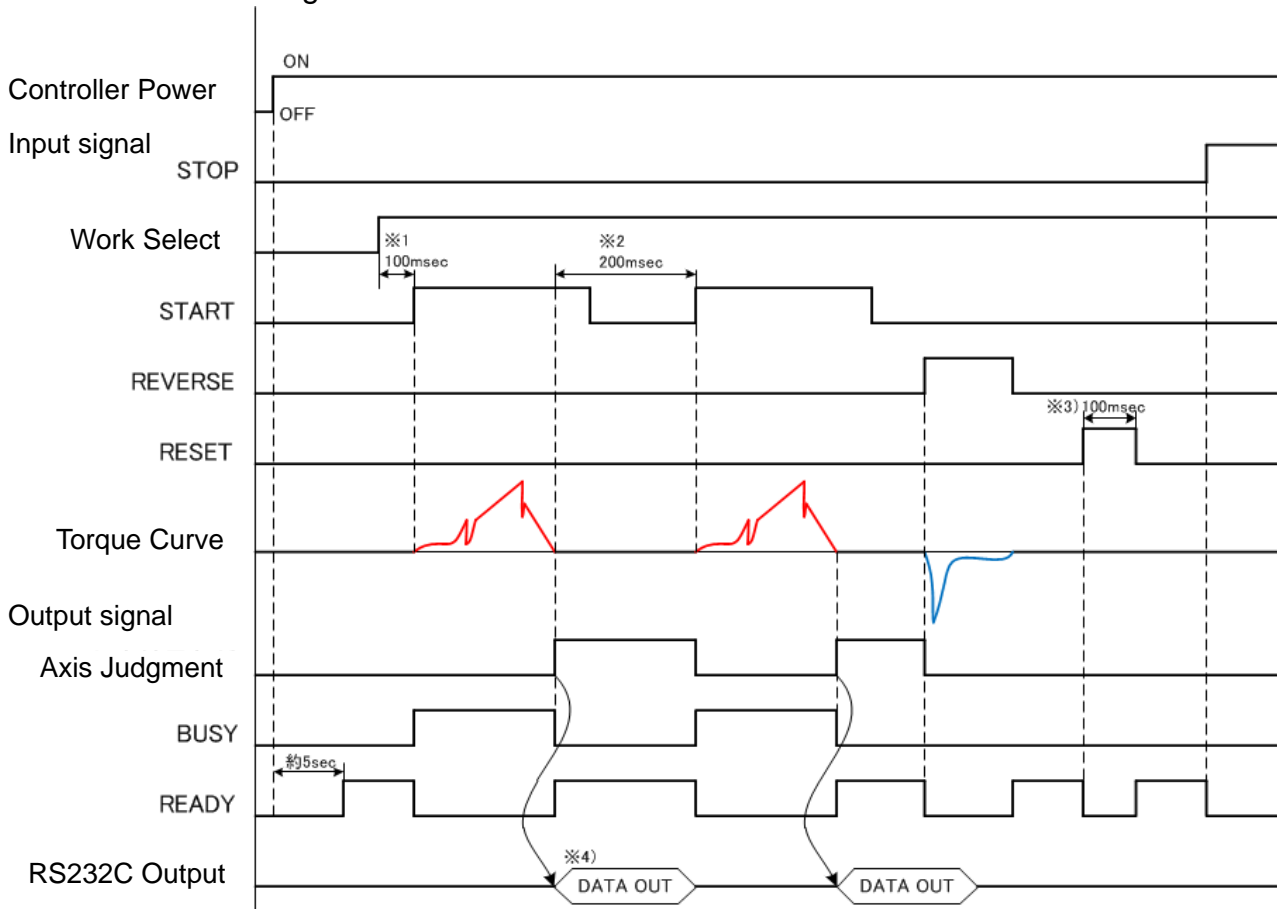
OUT-1

This output signal is set to "ON" while a work among work Nos. 33 ~ 64 is selected.

Although the selection among the work Nos. 33 ~ 64 cannot be made using the [WORK SELECT] input signals, WORK OUTPUT 5 can be used when a selection is made from the operation panel or from a Fieldbus interface.

4-5-5 Input/output signal timing chart

● Basic control signals



***1) WORK SELECT requires a response time of 100 msec or more after the READY signal ON is output until the START signal is input.**

***2) After the fastening operation completes, a waiting time of 200 msec or more is required to input the next START signal. If the START signal is continually input, it may not be accepted.**



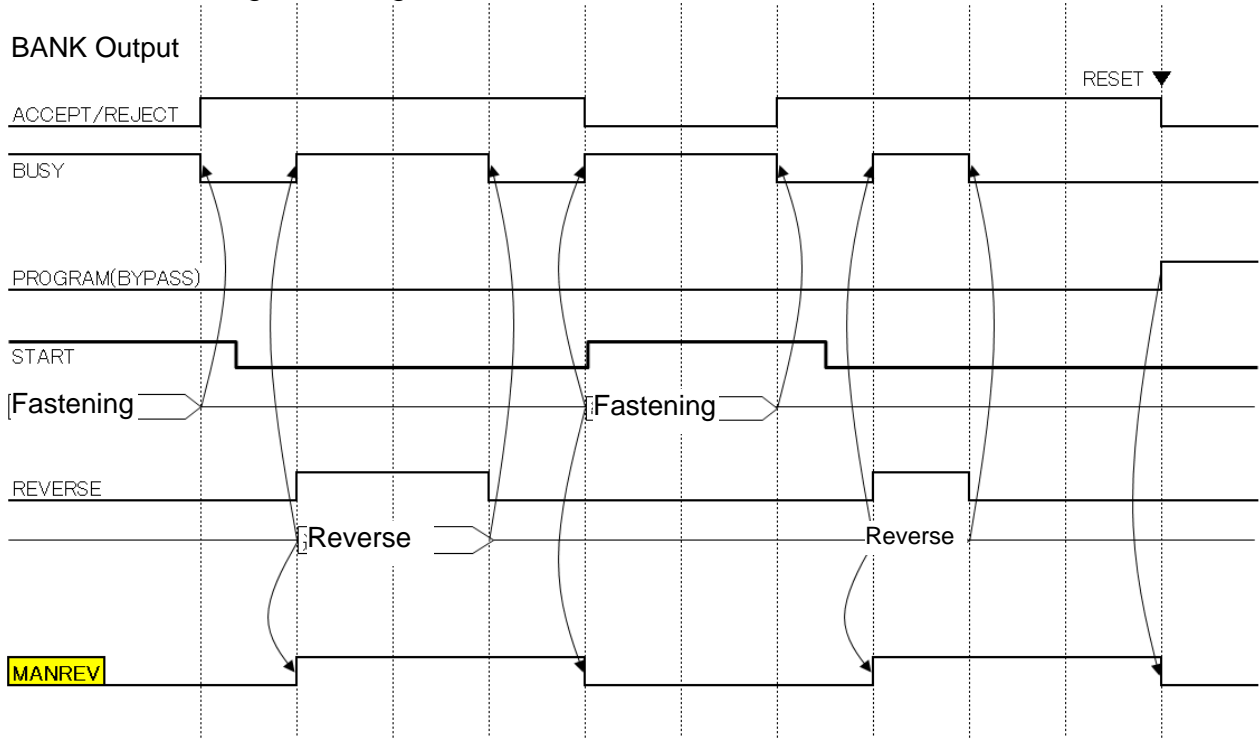
Caution

***3) To input the RESET signal or the STOP signal, input time of 100 msec or more is required. If the signal is continually input, it may not be accepted.**

***4) When the fastening operation completes, the RS 232C data communication output is performed only once for approximately 90 msec.**

To acquire the fastening result data to a PC, start the communication by the START signal input timing (BUSY signal ON).

● MANREV signal timing chart



4-6 External Monitoring Device Signal

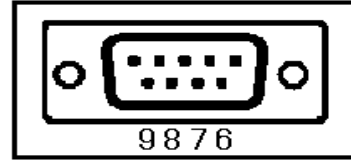
External monitor signals are output from the MONITOR connector on the Unit bottom.

Compatible connector
D-SUB 9-pin plug

Inch thread (#4-40)

MONITOR

5 4 3 2 1



External monitor signal specifications

Pin No.	Signal	IN/OUT	Description
1	EA2	OUT	Disabled
2	EB2	OUT	Disabled
3	ANGLE PULSE	OUT	Angle pulse monitor output
4	ANGLE CW/CCW	OUT	Normal/reverse monitor output
5	GND	-	Monitor signal output GND
6	TD2	OUT	Disabled
7	MON1	OUT	Current monitor output (10V: Unit maximum current)
8	MON2	OUT	Speed monitor output (10V: Tool maximum rotation speed)
9	TORQUE OUT	OUT	Torque analog voltage monitor output

TORQUE OUT: Torque Analog Voltage Signal

With the monitor voltage, the range from the ZERO voltage to the CAL voltage at the calibration torque is expressed by a potential difference of approximately 3.75V. The ZERO voltage is the voltage in the state where the tool is stopped. *The ZERO voltage is not 0V (within a range of -0.1V ~ +0.1V). Also, even among tools of the same model, the ZERO voltage differs according to each tool.

(Example) If the ZERO voltage is -0.03V, the CAL voltage at the calibration torque is +3.72V and the voltage change is $\Delta 3.75V$.

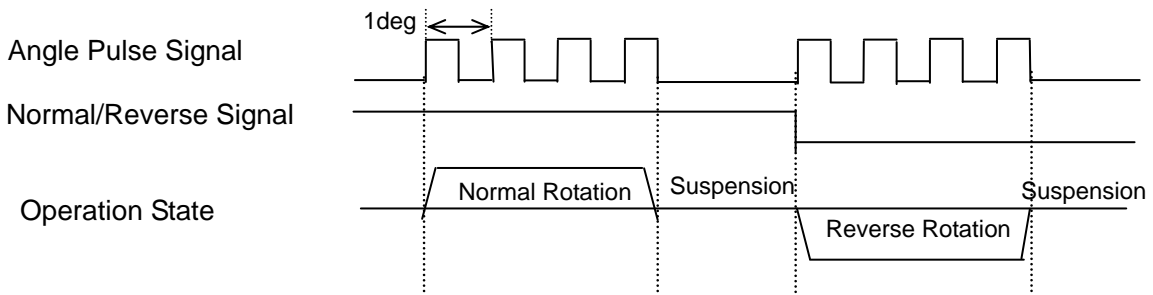
ANGLE PULSE: Angle Pulse Signal (5V TTL signal)

As the angle pulse, 1 pulse is output per 1 degree.

*There is some error with respect to the actual rotation angle (1 rotation of the tip: 358 ~ 362 pulses).

ANGLE CW/CCW: Normal/Reverse Rotation Pulse Signal (5V TTL signal)

A HI signal is output when the motor is rotating in the normal direction and a LOW signal is output when the motor is rotating in reverse.



How to Calibrate the External Monitoring Device

When the CAL switch of the Unit indicator is pressed while “1” is indicated at the D-No. indication part of the indicator in the real time mode, the CAL voltage is output at a potential difference of approximately $\Delta 3.75V$ from TORQUE OUT and, at the same time, the torque value recognized by the Unit is indicated at the upper indication part. Adjust the torque voltage at the external monitoring device so that the same torque value is displayed.

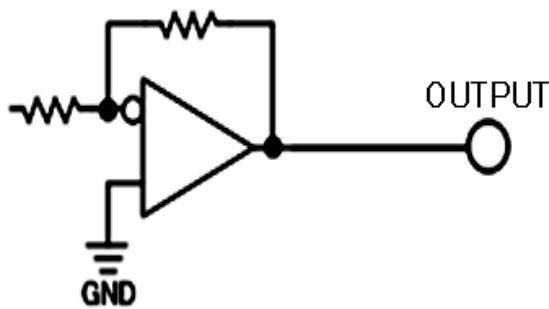
*The ZERO voltage in the no-load state is not 0V. The ZERO voltage value differs according to each Unit and tool and correction at the external monitoring device is thus required.



Output Circuit

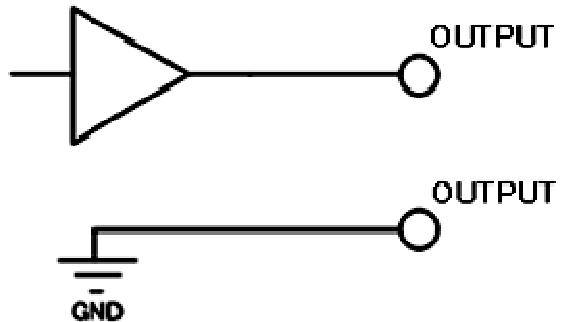
- Torque, Current, Speed Voltage Output Part

Op amp output: 0 ~ $\pm 5V$



- Angle Pulse, Normal/Reverse Output Part

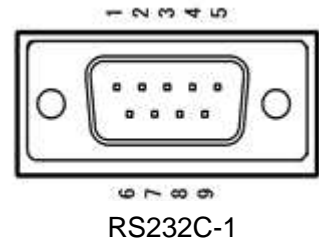
TTL (5V) output



4-7 RS-232C Interface Signal

4-7-1 RS232C Specifications (RS232C-1)

Compatible connector
D-SUB 9-pin socket Inch thread (#4-40)



RS232C Communication Specifications

Synchronization Method	Start-stop synchronization method	Communication Speed	9600bps (fixed)
Communication Mode	Half-duplex system	Data Length/Start Bit/Parity/Stop	8 bits/1 bit/None/2 bits (fixed)

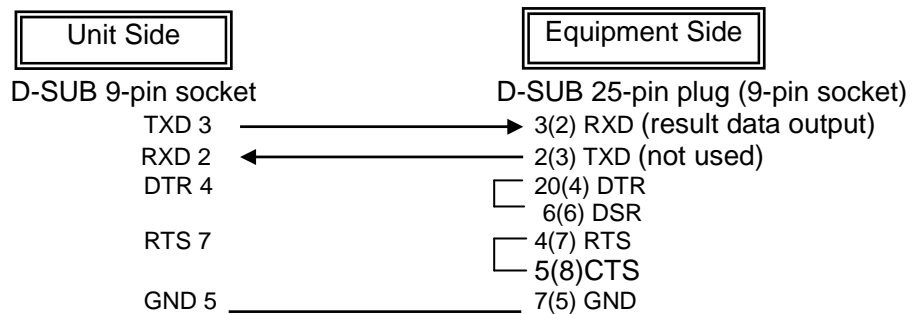
Pin No.	Signal	IN/OUT	Details
1	NC	-	Not used
2	RXD	IN	Not used
3	TXD	OUT	Operation result data output
4	DTR	OUT	Always ON output
5	GND	-	Signal ground
6	NC	-	Not used
7	RTS	OUT	Always ON output
8	NC	-	Not used
9	NC	-	Not used



Caution


• Be sure to clear the PLC receive buffer when the control power of the Unit is activated. Output of garbage data due to the effects of noise, etc., may cause data deviation.

● Connection Diagram



4-7-2 Data Format (RS232C-1)

The fastening result data are output from the RS232C-1 interface at the end of fastening. The data length of the fastening result data in ASCII format is 79 bytes (corresponding to 79 characters) per single fastening operation. The format of the data output per Axis is shown below.

 Caution	<ul style="list-style-type: none"> Be careful because the decimal point differs according to tool model. The output data of each item are indicated in a right-justified manner.
--	--

● Output Data Format (in the case of ASCII format, with torque being indicated to 2 decimal places and the rate is indicated to 3 decimal places)

When the fastening judgment is normal (ACCEPT)

COUNT No. : Incremented by +1 at each fastening (stored even when power is shut down, reset in linkage with erasing of 10,000 records)

ACCEPT COUNT: Counted number of ACCEPT fastening judgments (JDG: Judgment, OCR: Occurrence)

COUNT No.				ACCEPT COUNT		AXIS No.				WORK No.					
30H	30H	30H	31H	30H	31H	30H	31H	20H	20H	30H	31H	20H	20H		
0	0	0	1	0	1	0	1			0	1				
PEAK TORQUE				JDG	OCR		FINAL ANGLE			JDG	OCR				
31H	32H	2EH	33H	34H	20H	20H	20H	20H	31H	32H	33H	20H	20H		
1	2	.	3	4				1	2	3					
FINAL TORQUE				JDG	OCR		RATE1			JDG	OCR				
31H	32H	2EH	33H	34H	20H	20H	20H	30H	2EH	31H	32H	33H	20H	20H	20H
1	2	.	3	4				0	.	1	2	3			
RATE2				JDG	OCR		RATE3			JDG	OCR				
30H	2EH	31H	32H	33H	20H	20H	20H	30H	2EH	31H	32H	33H	20H	20H	20H
0	.	1	2	3				0	.	1	2	3			
1ST TIME				JDG	OCR		2ND TIME			JDG	OCR				
20H	31H	30H	2EH	30H	20H	20H	20H	20H	20H	32H	2EH	30H	20H	20H	20H
1	0	.		0				2	.			0			

77	78	79
JDG	CR	LF
4FH	0DH	0AH

O

TOTAL JUDGMENT
 "O"(4FH): Fastening judgment ACCEPT

[PEAK TORQUE] JUDGMENT
 "H"(48H): HIGH REJECT "L"(4CH): LOW REJECT
 "A"(41H): ABNORMAL "S"(53H): STOP
 "B"(42H): BYPASS "R"(52H): RESET
 "D" (44H): START OFF (Off operation by lever performed during fastening)
 The CAUSE OF REJECT OCR (OCR) is not set in the case of solitary occurrence of "A," "B," "S," "R," or "D."
[FINAL TORQUE], [ANGLE], [RATE], [TIME] JUDGMENT
 "H"(48H): HIGH REJECT "L"(4CH): LOW REJECT

When the fastening judgment is NG (REJECT) (JDG: Judgment, OCR: Occurrence)

COUNT No.				ACCEPT COUNT		AXIS No.				WORK No.					
30H	30H	30H	31H	39H	39H	30H	31H	20H	20H	30H	31H	20H	20H		
0	0	0	1	9	9	0	1			0	1				
PEAK TORQUE					JDG	OCR		FINAL ANGLE				JDG	OCR		
20H	31H	2EH	32H	33H	4CH	20H	20H	20H	20H	35H	30H	4CH	20H		
1	.	2	3	L					5	0	L				
FINAL TORQUE					JDG	OCR	SIGN	RATE1				JDG	OCR	SIGN	
20H	31H	2EH	32H	33H	4CH	20H	20H	30H	2EH	31H	32H	33H	20H	20H	20H
1	.	2	3	L			0	.	1	2	3				
RATE2					JDG	OCR	SIGN	RATE3				JDG	OCR		
30H	2EH	31H	32H	33H	20H	20H	20H	31H	2EH	31H	32H	33H	48H	58H	20H
0	.	1	2	3				1	.	1	2	3	H	X	
1ST TIME					JDG	OCR		2ND TIME				JDG	OCR		
20H	31H	30H	2EH	30H	20H	20H	20H	20H	20H	32H	2EH	30H	20H	20H	20H
1	0	.	0						2	.	0				
JDG	CR	LF													
58H	0DH	0AH													

CAUSE OF REJECT OCR
 "X" (58H): This is set behind the data for which the REJECT judgment was made first.

TOTAL JUDGMENT
 "X"(58H): Fastening judgment REJECT

[PEAK TORQUE] JUDGMENT
 "H"(48H): HIGH REJECT "L"(4CH): LOW REJECT
 "A"(41H): ABNORMAL "S"(53H): STOP
 "B"(42H): BYPASS "R"(52H): RESET
 "D" (44H): START OFF (Off operation by lever performed during fastening)
 The CAUSE OF REJECT OCR (OCR) is not set in the case of solitary occurrence of "A," "B," "S," "R," or "D."

[FINAL TORQUE], [ANGLE], [RATE], [TIME] JUDGMENT
 "H"(48H): HIGH REJECT "L"(4CH): LOW REJECT

4-8 Ethernet Interface

The Ethernet interface is the TCP/IP Ethernet port dedicated to communication with the HFC3000 User Console installed in a PC with Windows®.

A commercially available LAN cable (cross/straight) can be used as the cable.

The following factory settings are set as the TCP/IP settings of the Unit. The settings at the PC side must thus be changed when first connecting to the PC.

IP address	192.168.11.10 (factory setting)
Subnet Mask	255.255.255.0(factory setting)
Default Gateway	192.168.11.1 (factory setting)
Communication Protocol	IEEE 802.3 compliant
Ethernet Standard	100BASE-T
Communication Speed	100Mbps
Cable	Category 5 or higher (category 5 is recommended)
Connector Shape	RJ-45

Memo



5

Chapter 5 Power Activation and Operational Tests

5-1 Items to be Checked Before Power Activation

(1) Check connection between tool and Controller

Connect the cable between the tool and the controller securely.

If there is a movable part in the path of the cable, check whether or not the cable receives stress by actually moving the movable part. If the cable receives stress, change the wiring method.

(2) Check wiring for I/O signals

Connection with the external control equipment must be made at the terminal block on the rear panel of the controller.

(3) Use a dedicated cable for power source.

Check that the earth line is connected without fail.



Caution

There is danger of fault or electric shock.

(4) Check the power source voltage

Check that the input power source voltage of the controller is in a range of single-phase 100V AC ~ 240V AC.

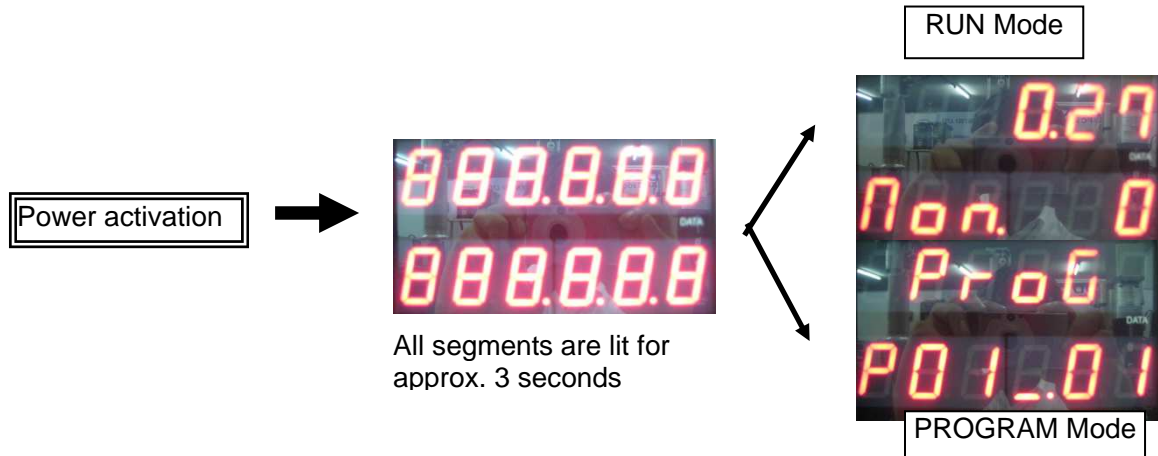
The recommended wiring size for the primary power is no less than 1.25mm². If lowering of the power source voltage occurs due to using a thin wiring, etc., a source voltage error will occur.

Lowering of voltage may occur if a thin wire is used across a long distance.

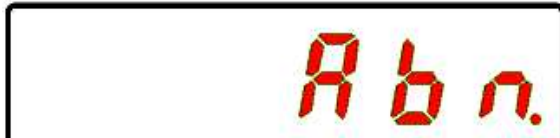
BE SURE TO CONFIRM THE ABOVE ITEMS BEFORE POWER ACTIVATION.

5-2 Items to be Checked When Activating the Equipment

Confirm that the indications on the indicator change as follows when the control power is activated.



If "ABN" is indicated at the upper stage of the indicator when the power is activated, please refer to "Description/Cause of Abnormal State and Recovery Method" to eliminate the cause, ensure safety, and then reactivate the control power.



Also, check the following safety precautions when activating the power.

<Safety Precautions in Reactivating the Power>

If the power is to be reactivated, be sure to wait for a waiting time (recommended: 1 minute) after the power has been turned OFF and then turn ON the power. The following problems may occur if there is no waiting time or if reactivation is performed in a short time.

- An abnormal current may flow to the primary power source circuit without operation of the rush current prevent circuit and the circuit protector which protects the circuit may therefore be put in an interrupted state.
- The Controller power source circuit may detect an error and automatically interrupt the circuit. As a result, the power source circuit will not operate (remains OFF) even when the power is reactivated.

If the power cannot be reactivated, be sure to wait for 5 minutes or more after turning OFF the power and then turn ON the power.

5-3 Input Initial Setting Data

After checking all of the check items of the previous section and activating the power, input the data necessary for performing fastening. Although initial setting data based on the customer's specifications are input at the time of shipment, if the setting data need to be changed, please refer to "Chapter 6 Description of Operations."

5-4 Items to be Checked After Activation

Perform the following checks after activating the power.

(1) Check ZERO Value

Press the RESET switch on the controller and confirm that a value close to zero is indicated as the torque value on the controller. Also confirm that NG LED (red) does not light up at this point.

(2) Check CAL Value

Press the CAL switch on the controller and confirm that NG LED (red) does not light up.

(3) Check Rotation

Press the start switch on the tool to make the tool rotate and confirm that there is no abnormal noise or rotational vibration, etc.

The tool should rotate only when the start switch is pressed and stop when the switch is released.

(4) Check Reverse Rotation

Press the reversing switch on the tool and confirm that the judgment LED flashes.

Then press the start switch. Reverse rotation should be performed while the switch is pressed.

Press the reversing switch again to put the tool in the fastening mode.



6

Chapter 6 Description of Operations

6-1 Changing between RUN and PROGRAM Modes

There are two modes to the Handheld tool - the RUN (operation) and PROGRAM (setting) modes. In the RUN (operation) mode, the fastening operation and the fastening result judgment are indicated. Parameters can be changed in the PROGRAM (setting) mode. Changing between the RUN and PROGRAM modes can be performed by the PLC I/F BYPASS signal or the PRG key switch (long-pressing for 1.5 seconds).



(1) Operation/Check Switches**①CAL key switch: CAL voltage check**

When this switch is pressed, a check of the torque transducer of the tool is performed.

The calibration torque value is indicated at the "DATA" indication part.

If as a result of the check, the value is within the specified ranges, the LED of the tool flashes alternately in green <--> orange.

If as a result of the check, the value falls outside the specified range, the LED of the tool flashes alternately in orange <--> red.

②RST key switch

This is used to reset the Axis Unit.

When this is pressed during fastening, the fastening is interrupted and all output signals are reset.

At the same time, the home position voltage of the torque transducer is indicated.

③PRG key switch: Operation/setting changeover switch

Each time this switch is long-pressed for 1.5 seconds, a mode change between the operation (RUN) and setting (PROGRAM) modes is performed alternately.

(2) Indication LEDs**①OK LED Green [QL OK]**

This lights up when the fastening ends with all results being within the various setting ranges.

When the TOTAL OK LED lights up, this LED is OFF.

②NG LED Red [NG]

This lights up when the fastening ends with a result falling outside any of the various setting ranges.

This lights up when a system error occurs (The abnormality No. is indicated on data indication part).

③TOTAL OK LED Green [TOTAL OK]

This lights up when the results of the fastening operations of the designated number of times (cycle count) are all OK.

④Torque LED Green [TORQUE]

This lights up when the DATA content is a torque value.

⑤Angle LED Green [ANGLE]

This lights up when the DATA content is an angle value.

(3) Switches for Data Indication Operations**①SET key**

This is used to finalize an indication or finalize data.

②Cursor keys [△][▼]

These are used to scroll the indicated data and to change setting data.

These are used to change WORK No. in the operation view mode.

However, these functions cannot be used while an abnormality is occurring.

③Cursor keys [◀][▶]


These are used to change the mode and to move the cursor (flashing indication position).

(4) Tool

This is a pistol type hand-held type fastening tool provided with planetary gear, torque transducer, servomotor, indicator LEDs, and operating switches etc.



- ① Starting switch: When the switch is turned ON (by pressing), the tool tip rotates for performing fastening.
 When started in a half-pressed state, the initial speed is maintained even during free-running.
 However, if the initial time is 0 (seconds), this function is cancelled.
 When the switch is released during fastening (during rotation of the tip), the fastening (rotation) is stopped.
 However, if the switch is released before switching to the 2nd speed, judgment is not performed and therefore fastening results will not be generated.
 For ordinary fastening operation, continue to grip this switch until fastening is completed.
- ② Reversing switch: This switch is for switching between normal and reverse rotation operations.
 When the reverse rotation mode is set, the orange judgment LED flashes rapidly.
 When the starting switch is turned ON in this state, the reverse rotation operation is performed.
 When the starting switch is released during the reverse rotation operation, the operation is stopped.

 Caution	<p>* The torque limit is caused when you loose the bolt already fastened over 5N·m of default setting in the case of the reverse operation and it automatically stops for safety. This can be changed in the setting of fastening parameter. See the PAGE6-33,6-62. If changed, be careful of big torque caused.</p>
--	---

- ③ LED for judgment and status indications (4 LEDs):
 During the fastening operation, all judgment LEDs are OFF.
 If the fastening result is OK, the green judgment LED lights up.
 (In the case of TOTAL OK, the green judgment LED flashes slowly.)
 If the fastening result is NG (failure), the red judgment LED becomes lit (angle-related NG: rapid flashing; torque-related NG: continuously lit up; other NG: slow flashing).
 During initialization upon power activation, the orange judgment LED lights up.
 If as a result of initialization, the tool does not recognize the Unit (communication disconnected), rapid flashing in red is performed.

- ④ CAL Check: This flashes only while the CAL button on the operation panel is being pressed.
 If the result of CAL check is OK: The LED flashes rapidly in orange <--> green.
 If the result of CAL check is NG: The LED flashes rapidly in orange <--> red.

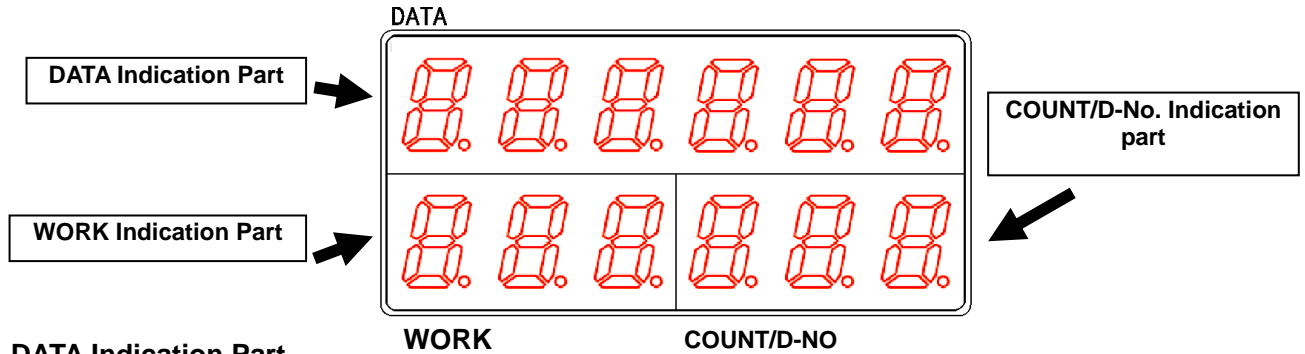
Besides the above, all LEDs are OFF if an error occurs.

* The orange color is made to appear by the green LED and the red LED lighting up simultaneously (when viewed at a close distance, the red and green colors appear separately).

6-2 RUN Mode

When the power is activated (turned ON) and the initial process ends, the operation enabled mode (RUN mode) is entered. In the RUN mode, mainly the fastening results, abnormality status, Axis No., parameters, etc., are indicated.

Data Indication Part (RUN Mode)



DATA Indication Part

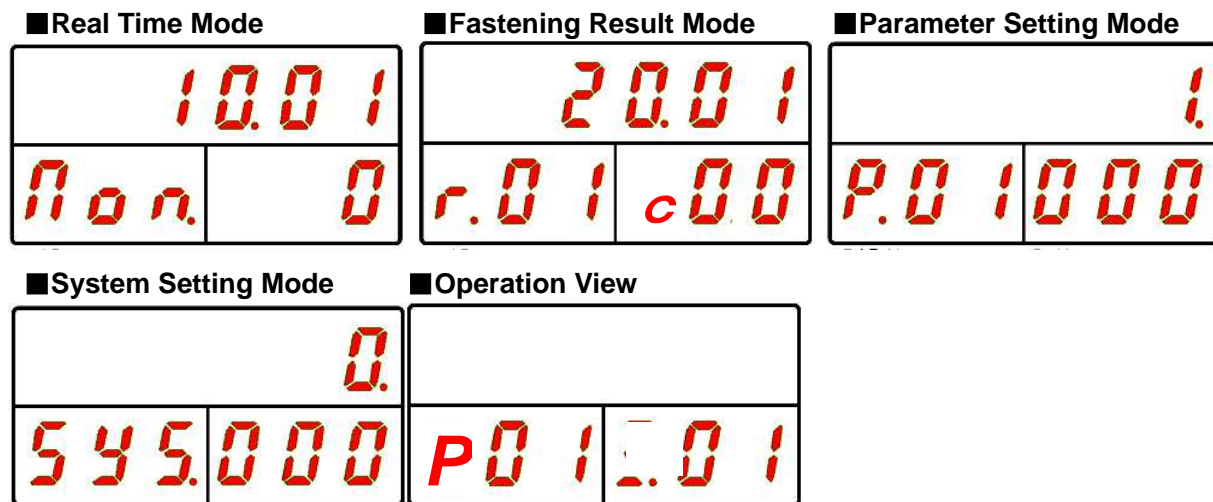
In the real time mode, fastening result mode, and parameter (system) setting mode, the fastening result, set value (parameter), or executed value is indicated here as designated by the COUNT/D-No. indication part.

WORK Indication Part

The WORK No. is indicated here (if sequence operation is disabled, the parameter No. is indicated). When an error occurs, the abnormal state No. is indicated in the operation view.

COUNT/D-No. Indication Part

In the real time mode, fastening result mode, and parameter (system) setting mode, the No. of the data indicated in the DATA indication part is indicated. Also in the operation view, the current speed state is indicated during the fastening operation and the current cycle count value (C##) is indicated when the fastening operation is not started. The abnormal state No. sub code is indicated when an error occurs.

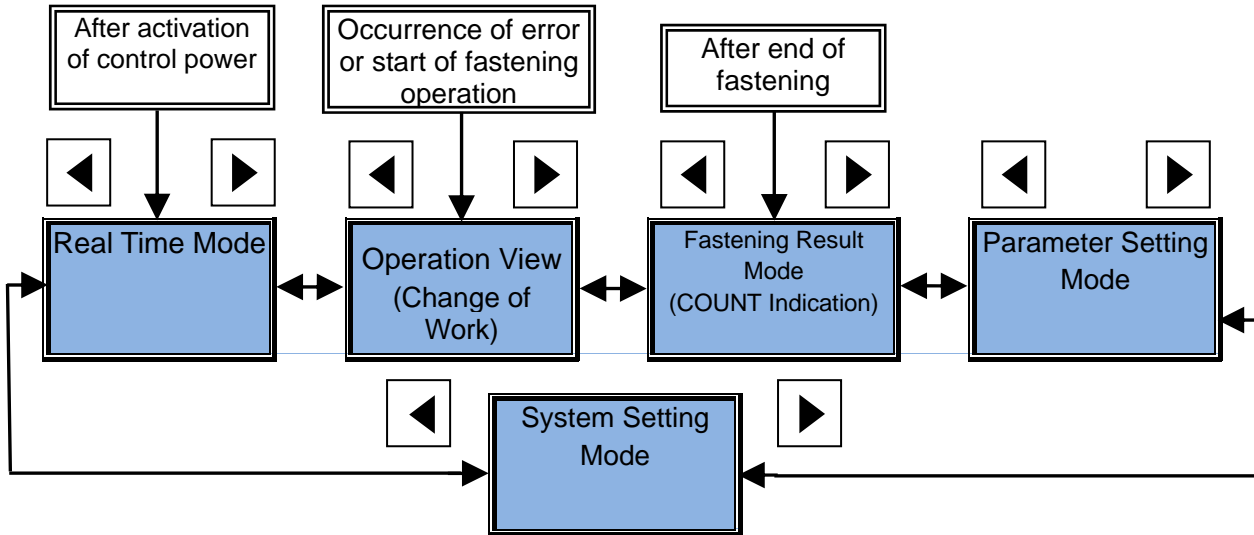


Please refer to the following pages concerning the respective modes in the RUN mode.

6-2-1 Changing Modes in the RUN Mode

In the RUN mode, selection among the five modes can be performed by pressing the [◀] or [▶] switch. Further, in modes other than “Operation View,” the indicated content can be changed by pressing the [▲] or [▼] switch.

Also when fastening starts, the mode changes automatically to “Operation View” and at the end of fastening, the mode changes to the “Fastening Result Mode.” However, changing of indication and changing of the mode by the switches cannot be performed during the fastening operation.



● **Real Time Mode**

The currently executed values are indicated in this mode.

The indicated content is changed with the [▲] or [▼] switch. This mode is indicated immediately after the activation of the control power.

● **Operation View**

The current state of the Unit and the speed state during the fastening operation are indicated in this mode.

The indication changes to the indication during the fastening operation from the start of fastening to the end of fastening.

The operation view is indicated when the state of the Unit is changed, such as when an error occurs, the STOP signal is input in the “OFF” state, the BYPASS signal is input in the “ON” state, etc.

The selected WORK No. is changed with the [▲] or [▼] switch.

However, this function is disabled when work selection by an external I/O is enabled.

● **Fastening Result Mode**

The fastening results are indicated in this mode.

The fastening result content is changed with the [▲] or [▼] switch.

However, when the fastening result D-No. is [00 (PEAK TORQUE)], the COUNT value [c##] is indicated.

The result is indicated automatically after the end of fastening.

● **Parameter Setting Mode**

The fastening parameters are indicated in this mode.

The indicated set value is changed with the [▲] or [▼] switch.

● **System Setting Mode**

The system parameters are indicated in this mode.

The indicated set value is changed with the [▲] or [▼] switch.

6-2-2 Indications in the RUN Mode

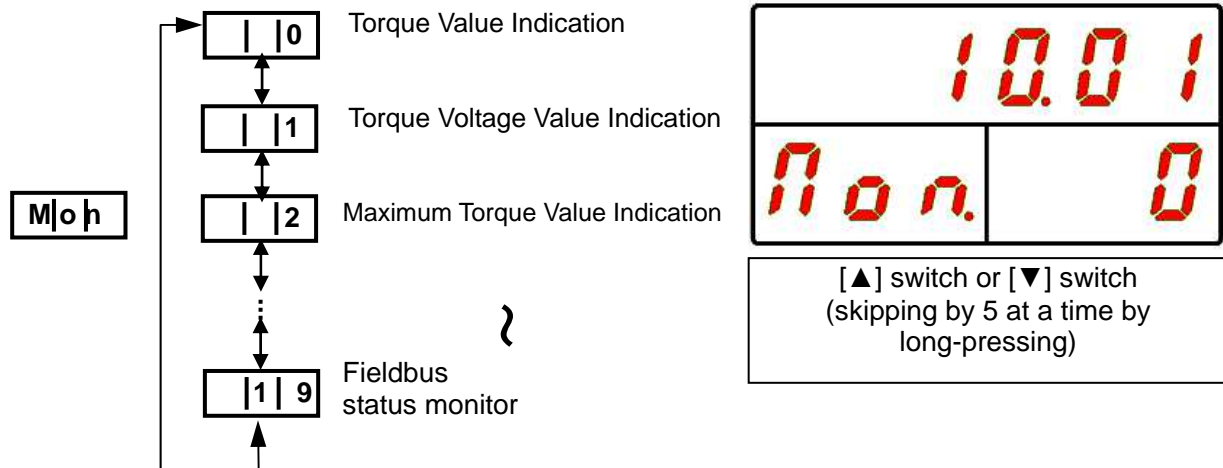
Real time Mode

In the real time mode, [Mon.] is indicated on the WORK Indication Part.

The value in the COUNT/D-No. indication part is incremented or decremented with the [▲] or [▼] switch to change the indicated content.

Also, the value in the COUNT/D-No. indication part can be skipped by 5 at a time by long-pressing the [▲] or [▼] switch.

“WORK” “COUNT/D-NO” “DATA”



Please refer to the “List of Contents Indicated in the Real Time Mode” regarding the respective data contents indicated at the DATA indication part when “COUNT/D-No.” is changed.



Caution

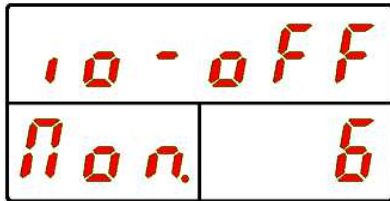
- When the CAL switch or the RESET signal is input in the “ON” state when any of D-Nos. 3 ~ 7 is indicated, the torque will not be indicated at the upper stage of the indicator (the check itself will be executed).
- When the CAL switch or the RESET signal is input in the “ON” state in the real time mode, “CAL” or “RES” will not be indicated in the D-No. indication part.

● List of Contents Indicated in the Real Time Mode

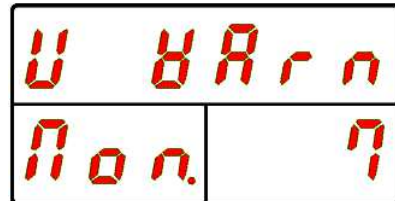
WORK	COUNT/ D-NO	DATA	Units
Mon.	0	[Torque Value Indication] The load that is currently applied to the torque transducer is indicated in real time. When the [CAL] switch is pressed, the torque value converted in terms of the calibration torque is output.	Nm
	1	[Torque Voltage Value Indication] The torque signal voltage that is currently applied to the torque transducer is indicated in real time. When the [CAL] switch is pressed, the torque voltage is output in terms of a potential difference of approximately Δ3.75V.	V
	2	[Maximum Torque Value Indication] (Maximum Torque Value Hold) The peak torque from the point at which the [RESET] switch was pressed last in the real time mode is indicated. Servo lock is performed for 1 minute when the [SET] switch is pressed.	Nm
	3	[Rotating Angle Indication] The angle of rotation from the current position is indicated in real time. When the RESET signal is set to "ON" or when the fastening operation is started by the OFF → ON raising of the START signal, the angle value becomes 0.	deg
	4	[Load Rate] The current motor load rate is indicated in real time. When 100 is exceeded, Abn. 08-10 "Overload Error" is generated.	%
	5	[Current Value] The present current value is indicated in real time.	A
	6	[Simplified I/O Monitor] When SW2: Pin No. 6 at the bottom surface of the Unit is ON, the indication will be as shown in the diagram below (IO-OFF) (external input/output disabling function). Ordinarily, the 12 bits of the standard DIO are monitored and indicated as shown in the diagram below. When the SET button is long-pressed, forced ON output is performed (at 0.5 second intervals) the order of the standard DO (bit 0 ... bit 11 from the left). When [↑], [↓], [→], [←], or [SET] is pressed in the middle of the forced output, the forced output is ended. During the forced output, the fastening operation is blocked. Standard DI monitoring can be performed even during the forced output.	
	7	[ZERO/CAL Voltage Error Warning] If the CAL voltage or ZERO voltage, measured when the control power is activated, when the self-checking is performed at the start of fastening, when the CAL switch of the indicator is pressed, or when the RESET signal is turned "ON," is of an error warning value, the indication (V Warn) shown in the drawing below will be indicated. When the RESET signal is turned "ON" after the warning indication, the [------] is re-indicated.	
	8	[Tool Rotation Speed Monitor] (+: CW/-: CCW) During stoppage: The maximum rotation speed of the connected tool is indicated. During rotation: The connected tool rotation speed converted from the motor feedback speed is indicated.	Rpm
	9	[Tool Response•St1.] (0~255)	Digit
	10	[Tool Response•St2.] (0~15)	Digit
	11	[Tool Response•Ad1.] (0~255) The actual level value of the starting trigger switch is indicated.	Digit
12	[Tool Response•Ad2.] (0~255) The actual level value of the F/R slide switch is indicated.	Digit	

13	[Tool Response•G. Gyrosensor Shake Detection Angle] -2048° ~ +2047°	Deg
14	[Tool Command•Ct1.] (0~255) CAL ON, GYRO RESET, etc.	Digit
15	[Tool Command•Ct2.] (0~255) Angle conversion constant (fixed at 67)	Digit
16	[Tool Command•LEd.] (0~255) LED-related command	Digit
17	[Tool Command•BuZ.] (0~255) Buzzer-related command	Digit
18	[Tool Command•Gan. Gyro Restriction Angle] (0~255)	Deg
19	[Fieldbus•Status Monitor•FbS] Fieldbus connection condition: In the normal state, "4" is indicated. Any other indication indicates an unconnected state (the STOP mode is entered and operation is disabled).	
20	[Angle Head Torque Variation [%]] Displays the current torque variation rate of the angle head after the fastening operation. When the rate exceeds the value set in D-No.541 "[Angle Head Torque Variation]", A.09-10 "Angle Head Torque Variation Abnormal" occurs.	%

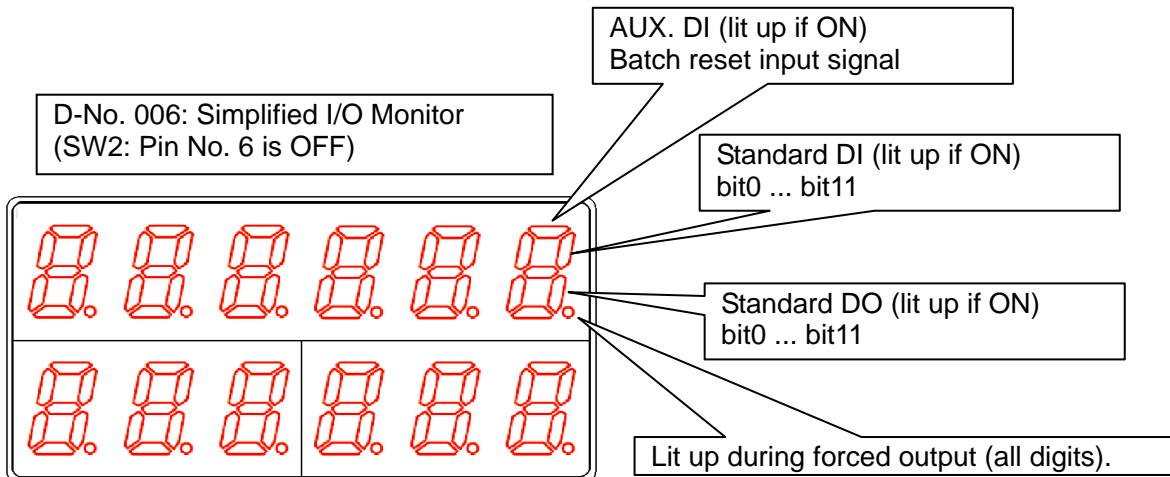
D-No. 006: External I/O Disabling Function
(SW2: Pin No. 6 is ON)



D-No. 7: ZERO/CAL Voltage Error Warning



D-No. 006: Simplified I/O Monitor
(SW2: Pin No. 6 is OFF)



6-2-3 Indications in the RUN Mode

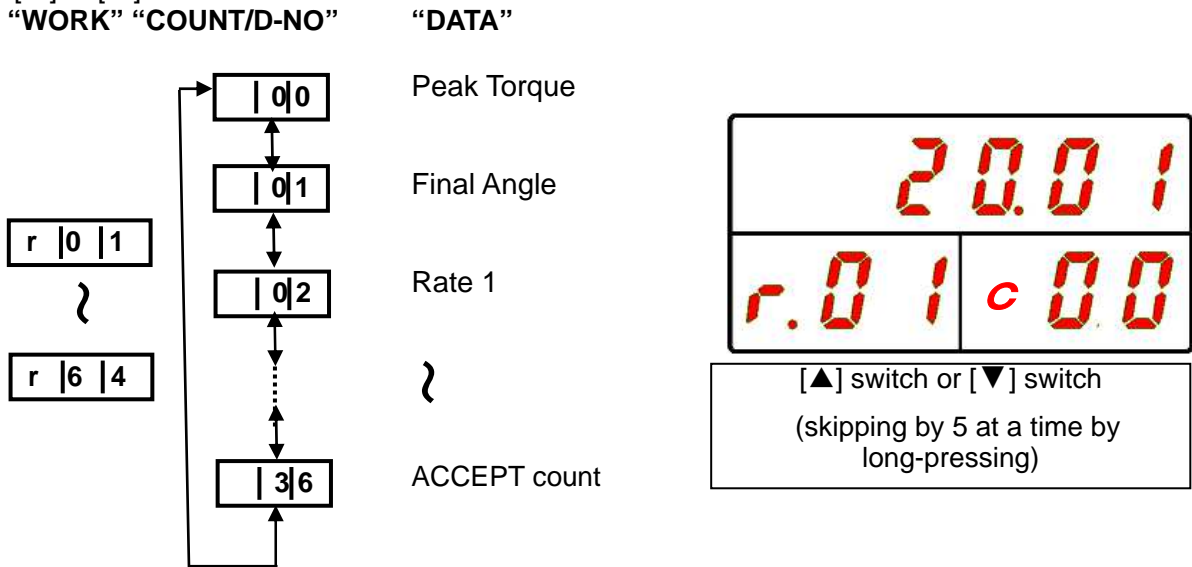
Fastening Result Mode

In the fastening result mode, "r" is indicated at the 100s digit of the WORK indication part and the parameter No. (01 ~ 64) of the fastening operation that was performed is indicated by the 10s and 1s digits.

The value in the COUNT/D-No. indication part is incremented or decremented with the [▲] or [▼] switch to change the indicated content.

* If fastening has not been started, "r00" is indicated.

Also, the value in the COUNT/D-No. indication part can be skipped by 5 at a time by long-pressing the [▲] or [▼] switch.



Please refer to the "List of Contents Indicated in the Real Time Mode" on the next page regarding the respective data contents indicated at the DATA indication part when "COUNT/D-No." is changed.

<p>■Rate 1</p>	<p>■1st NG Item</p>	<p>■Rate 1/2/3 Judgment</p>
<p>■Number of Fastening Steps</p>	<p>■Fastening Method (Torque Method)</p>	<p>■Reverse Flag</p>

Caution The indicated content of the following D-Nos. are not stored in the fastening result record of the Unit.
 D-No. 12 "Fastening Method," D-No. 13 "Number of Fastening Steps,"
 D-No. 14 "Self-Checking Flag," D-No. 15 "Reverse Flag," and
 D-No. 15 "Servo Lock Flag."

●List of Contents Indicated in the Fastening Result Mode

WORK	COUNT /D-NO	DATA	Unit
r01~r64	c##	Peak torque H/L	N•m
	01	Final angle H/L	Deg
	02	Rate 1 H/L	N•m/deg
	03	Rate 2 H/L	N•m/deg
	04	Rate 3 H/L	N•m/deg
	05	1st timeH/L	Sec
	06	2nd time H/L	Sec
	07	Cycle time	Sec
	08	Differential angleH/L	Deg
	09	Axis judgment reject: REJECT (fastening NG (fail)) accept: ACCEPT (fastening OK) abn: Stoppage due to ABNORMAL (error occurrence) signal stop: Stoppage due to STOP (emergency stop) signal reset: System cleared by RESET signal bypass: Stopping due to BYPASS signal st-off: START signal set to OFF during output of BUSY (operating) signal	
	10	1st NG item *The D-No. of the fastening NG (fail) item that occurred first is indicated.	
	11	Rate 1/2/3 judgment H/L	
	12	Fastening method ... trq: torque method, ang: angle method	
	13	Number of fastening steps ... 1 step, 2 steps, 3 steps	
	14	Self-checking flag (SC) ... ON: self-checking performed OFF: self-checking not performed	
	15	Reverse flag (RV) ... ON: reverse rotation performed OFF: reverse rotation not performed	
	16	Servo lock flag (SL) ... ON: servo lock performed OFF: servo lock not performed	
	17	1st peak torque	N•m
	18	2nd peak torque	N•m
	19	Snug torque H	N•m
	20	Final torque H/L	N•m
	21	Rate 1 increment torque (torque from start of rate 1 to end of rate 1)	N•m
	22	Rate 1 increment angle (angle from start of rate 1 to end of rate 1)	Deg
	23	Rate 2 increment torque (torque from start of rate 2 to end of rate 2)	N•m
	24	Rate 2 increment angle (angle from start of rate 2 to end of rate 2)	Deg
	25	Rate 3 increment torque (torque from start of rate 3 to end of rate 3)	N•m
	26	Rate 3 increment angle (angle from start of rate 3 to end of rate 3)	Deg
	27	Peak current H/L (current high/low limit warning indication)	N•m
	28	Rundown revolutions H/L	rev.
	29	Load rate	%
	30	Current value at stopping of fastening	A
	31	----- indication	
	32	Axis cycle count (x1 million) * "--" if less than 1 million cycles	
	33	Axis cycle count (x1)	
	34	Tool cycle count (x1 million) * "--" if less than 1 million cycles	
	35	Tool cycle count (x1)	
36	ACCEPT COUNT *0 to cycle count (0 to 99) This DATA indication is always performed as [c##] for COUNT/D-No. 00.		

NG (failure) result indication is performed for COUNT/D-No. 00 to 10.

6-2-4 Indications in the RUN Mode

Parameter Setting Mode

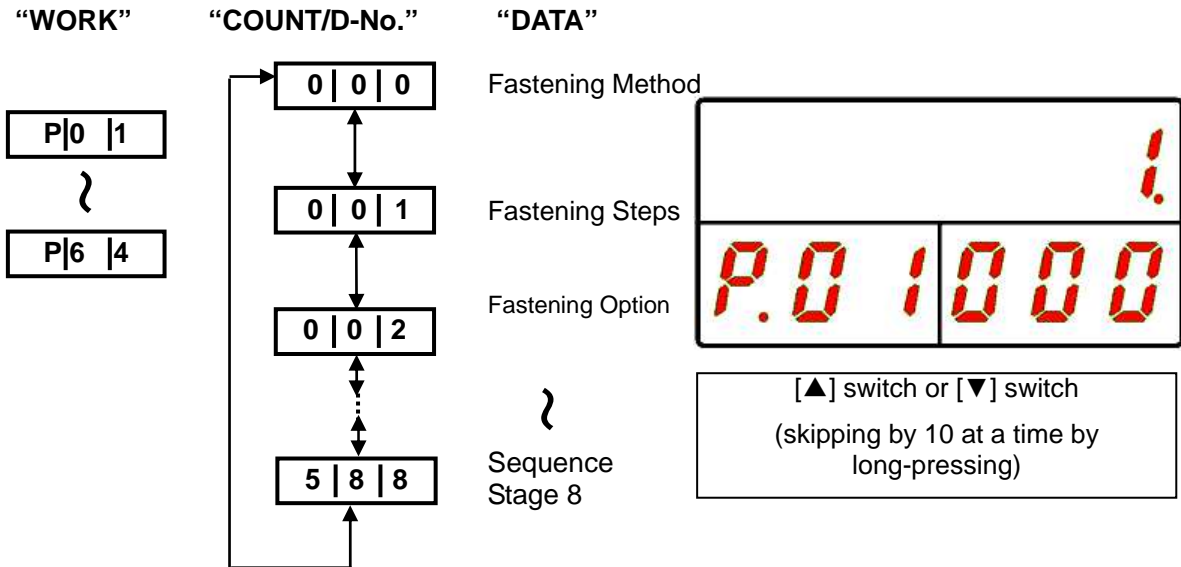
In the parameter setting mode, "P" is indicated at the 100s digit of the WORK indication part and the parameter No. (01 to 64) is indicated by the 10s and 1s digits. The D-No. indication part is changed by pressing the [▲] or [▼] switch and the content of the data No. is indicated accordingly.

When the [▲] switch is pressed when the last data No. of parameter No. is indicated, the value in the WORK indication part is incremented by 1.

Also, when the [▼] switch is pressed when the head data No. of each parameter No. is indicated, the value in the WORK indication part is decremented by 1.

Also, the value in the D-No. indication part can be skipped by 10 at a time by long-pressing the [▲] or [▼] switch.

Please refer to the "List of Parameters" regarding the details of the set values.

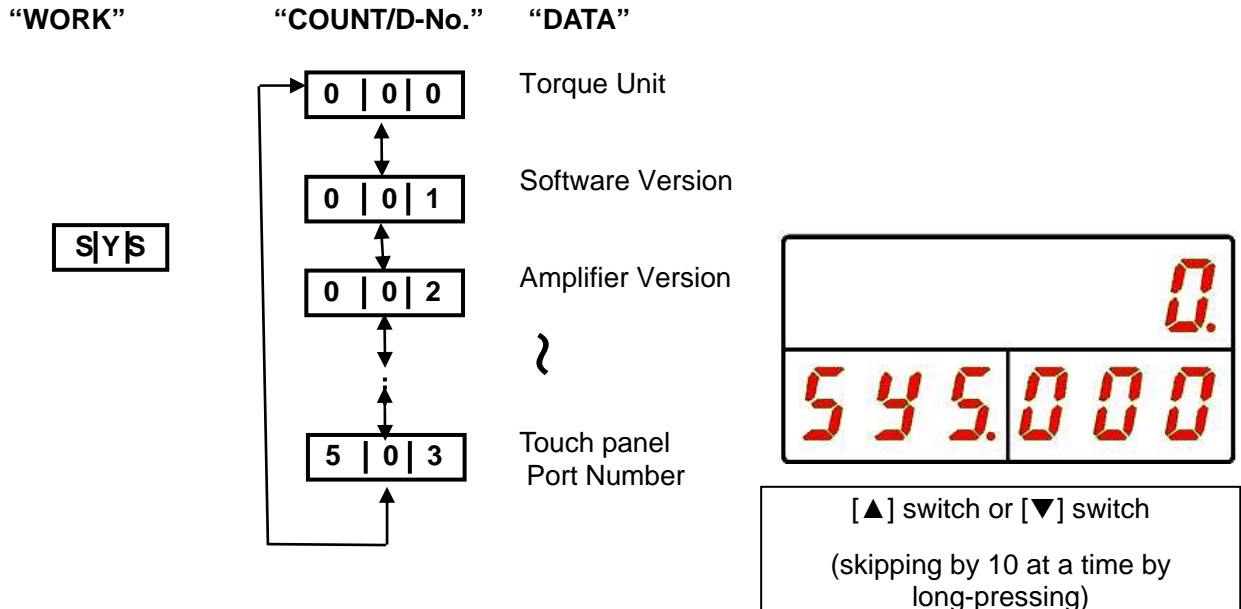


6-2-5 Indications in the RUN Mode System Setting Mode

In the system setting mode, "SYS." is indicated in the WORK indication part.

The D-No. indication part is changed by pressing the [▲] or [▼] switch and the content corresponding to No. is indicated accordingly. The value in the D-No. indication part can be skipped by 10 at a time by long-pressing the [▲] or [▼] switch.

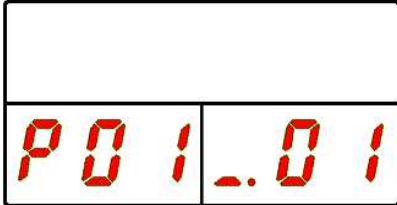
Please refer to the "List of Parameters" regarding the details of the set values.



6-2-6 Indications in the RUN Mode Operation View

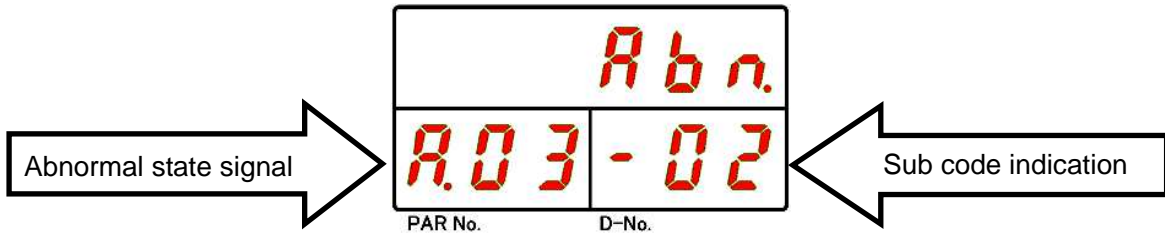
In the operation view, the currently selected work (parameter) No. (01 ~ 64) is indicated in the WORK indication part. The Axis No. of the Unit is indicated by the 10s and 1s digits of the COUNT/D-No. indication part.

■ Ordinary View



When the state of the system is changed due to occurrence of an error or setting of the STOP signal to "OFF," etc., transition to the status indication is performed automatically and the contents indicated in the respective indication parts change accordingly.

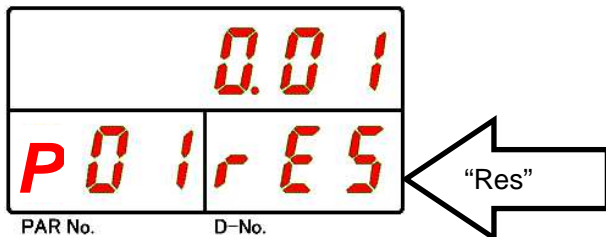
■ When an error occurs (ABNORMAL signal "ON")



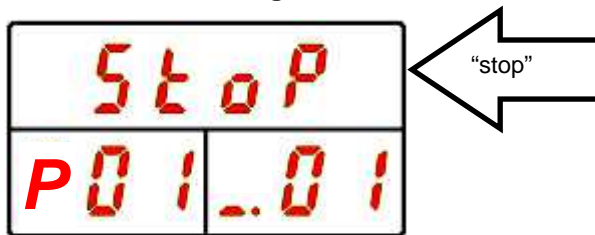
■ When the BYPASS signal is turned "ON"



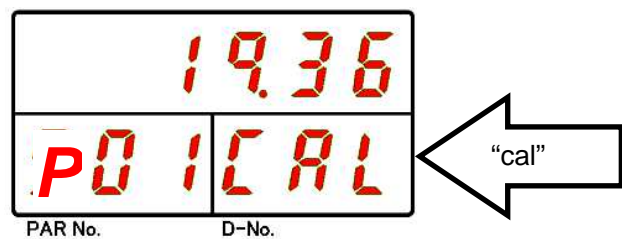
■ When the RESET switch is turned "ON"



■ When the STOP signal is turned "OFF"



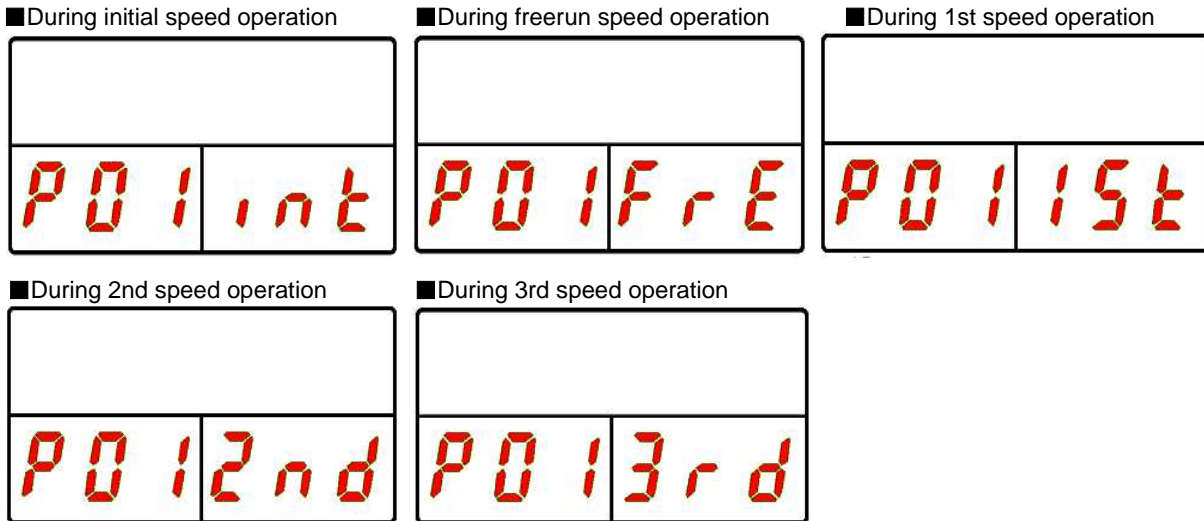
■ When the CAL switch is turned "ON"



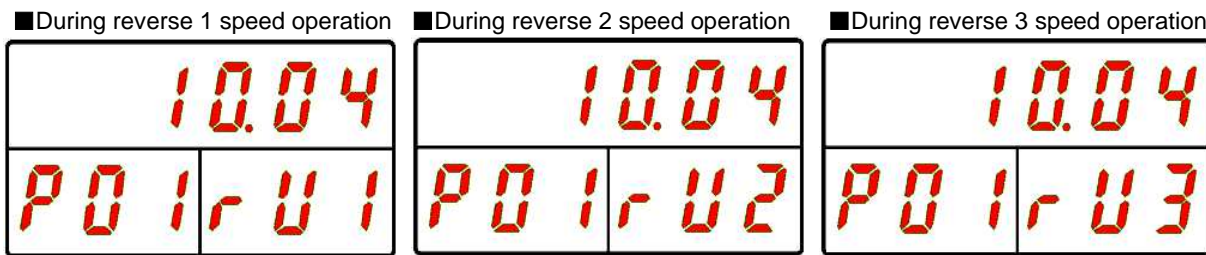
Also, during the fastening operation, the operation speed and the fastening step state are indicated. In the indication during the fastening operation, the parameter No. (01~ 64) that is currently put in operation is indicated in the WORK indication part. The mode cannot be changed in the indication during the fastening operation.

Transition to the fastening result mode is performed automatically after the fastening ends.

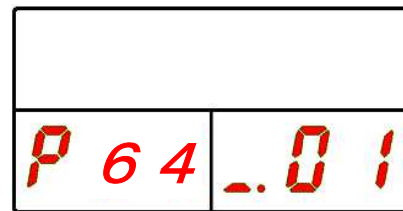
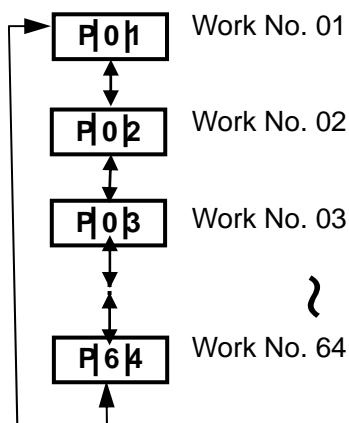
The following are indication examples during a fastening operation of parameter No. 1.



*The indication content of the upper stage of the indicator is maintained during reverse operation.



“WORK”



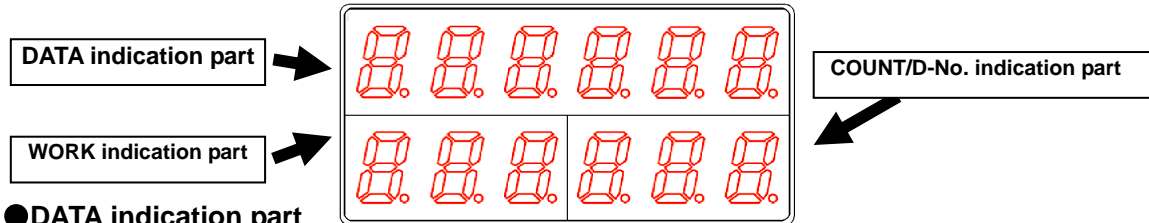
The “WORK” No. is changed with the [▲] switch or the [▼] switch.

***The operation cannot be performed if work selection by external I/O is set.**

6-3 PROGRAM Mode

The parameter settings can be changed in the PROGRAM mode.
The Data No. and parameter of each parameter No. are indicated on the indicator.

Indicator (PROGRAM Mode)



● **DATA indication part**

The set value (parameter) is indicated.

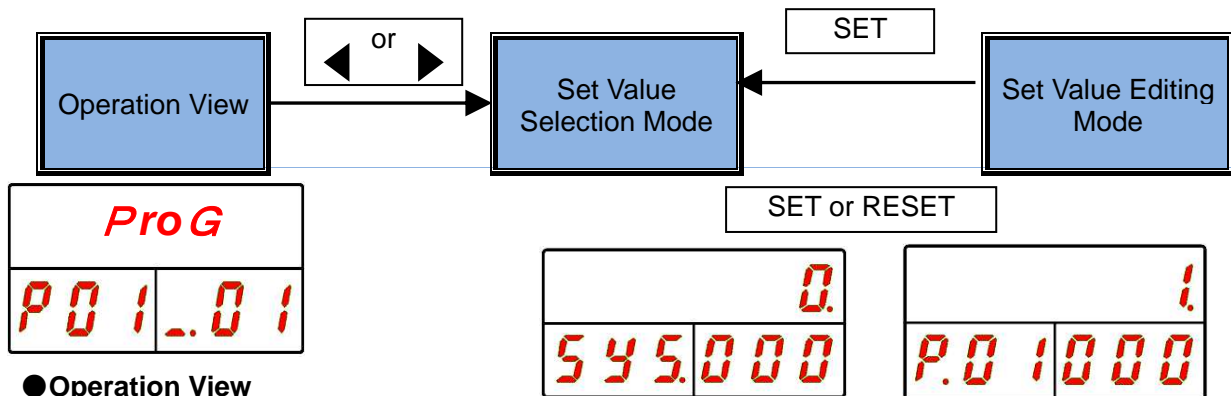
● **WORK indication part**

The fastening parameter No. is indicated.

● **COUNT/D-No. indication part**

The data No. indicated in the DATA indication part is indicated.

6-3-1 Changing Modes in the PROGRAM Mode



● **Operation View**

The current state of the Unit is indicated in this mode.
Indication in this mode is performed immediately after changing from the RUN mode to the PROGRAM mode.

Changing to the set value selection mode is performed by the [◀] and [▶] switches.

However, in the “Parameter Setting Mode” and the “System Setting Mode,” the mode is changed directly to the set value selection mode.

● **Set Value Selection Mode**

A parameter is selected in this mode.

The [◀] and [▶] switches are used to change the position of the cursor.

The [▲] and [▼] switches are used to change the indicated set value.

● **Set Value Editing Mode**

A parameter is set in this mode.

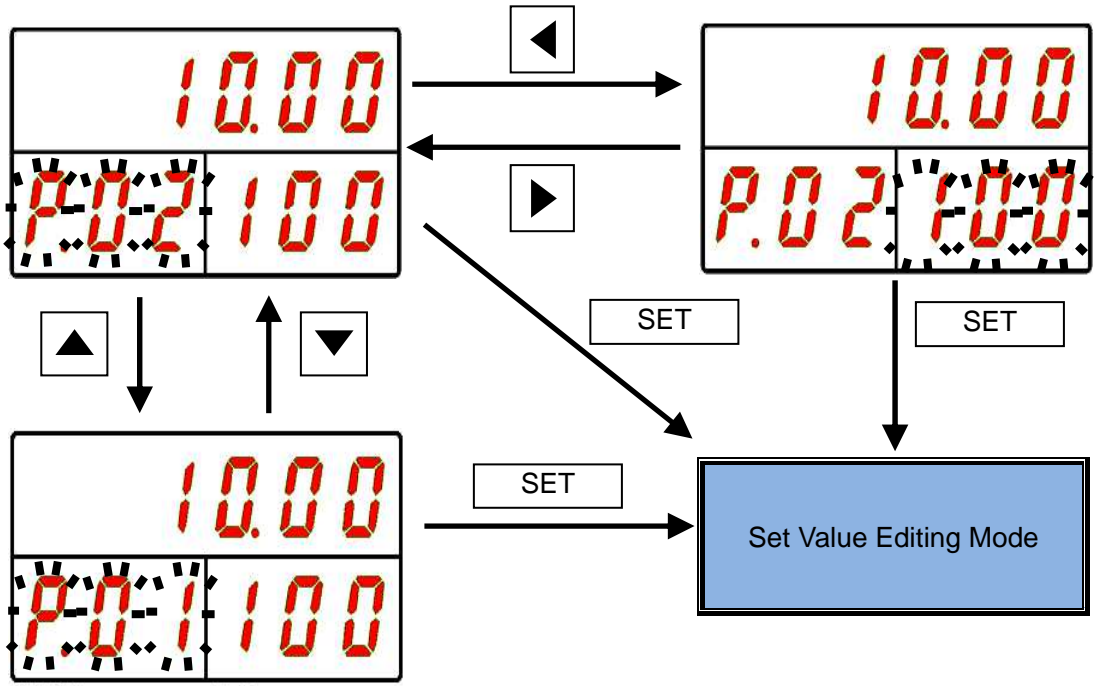
The set value is edited using the [▲] and [▼] switches and set with the “SET” switch.

When the “RESET” switch is pressed, the setting in the process of being changed is discarded and returned to the setting before changing.

6-3-2 Indications in the PROGRAM Mode

Set Value Selection Mode

Immediately after changing to the "Set Value Selection Mode," the cursor (flashing number) is indicated in the WORK indication part when the [◀] switch is pressed and is indicated in the COUNT/D-No. indication part when the [▶] switch is pressed. When the [▲] or [▼] switch is pressed, the numerical value at the cursor position changes by ±1. When the [▶] switch is pressed, the cursor position moves to the COUNT/D-No. indication part. Also, when the [◀] switch is pressed, the cursor position moves to the WORK indication part. When the "SET" switch is pressed, changing to the "Set Value Editing Mode" is performed.



In the set value selection mode, "SYS." is indicated in the WORK indication part in the case of a system parameter and the parameter No. (01 to 64) is indicated in the WORK indication part in the case of a fastening parameter.

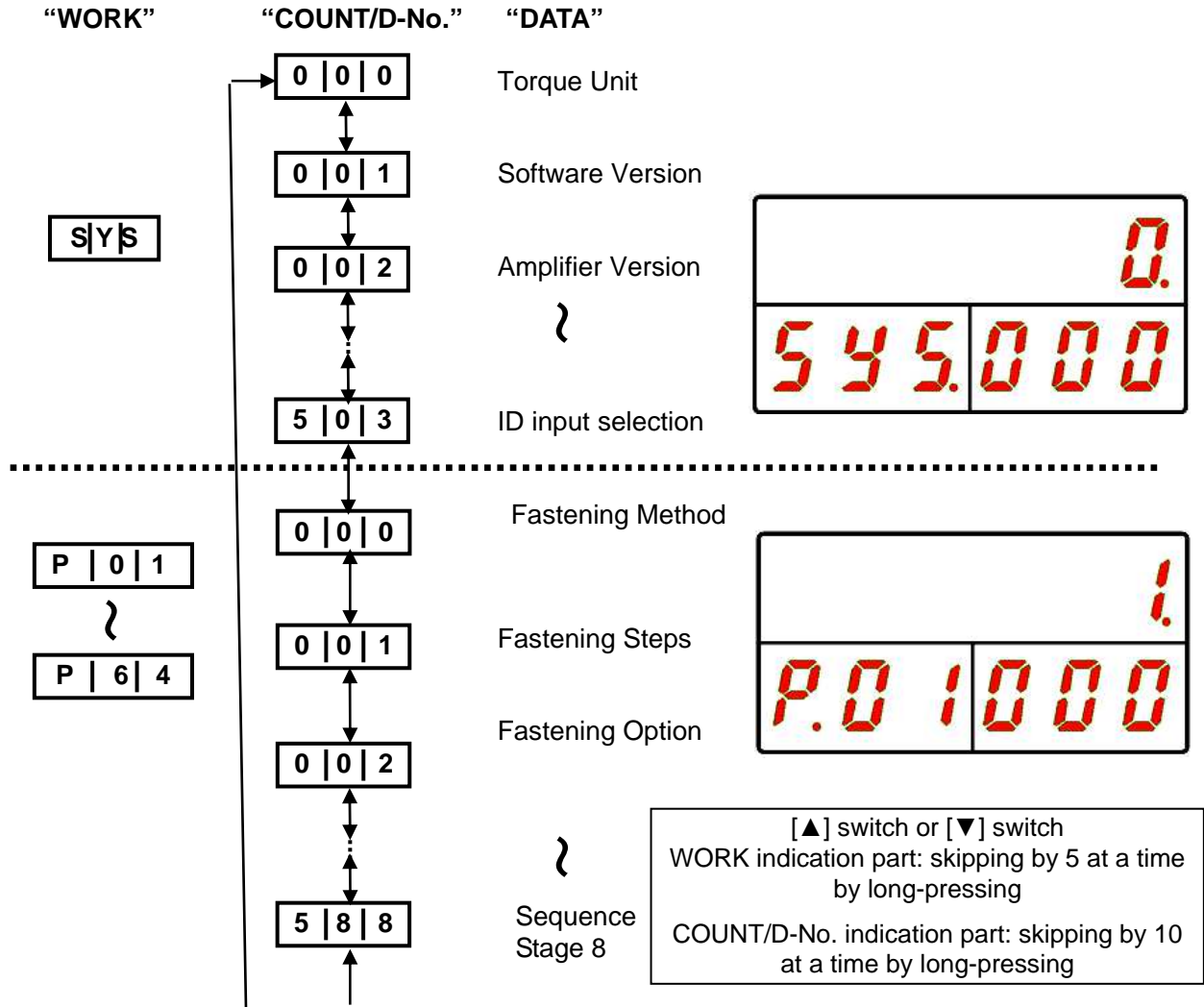
The WORK indication part is changed by pressing the [▶] or [◀] switch and the content of the data No. is indicated accordingly.

When the [▲] switch is pressed when the last data No. of each parameter No. is indicated, the value in the WORK indication part is incremented by 1.

Also, when the [▼] switch is pressed when the head data No. of each parameter No. is indicated, the value in the WORK indication part is decremented by 1.

Also, the current cursor position can be moved by pressing the [▶] or [◀] switch and, by long-pressing the [▲] or [▼] switch, the value in the WORK indication part can be skipped by 5 at a time or the value in the WORK indication part can be skipped by 10 at a time.

Please refer to the "List of Parameters" regarding the details of the set values.

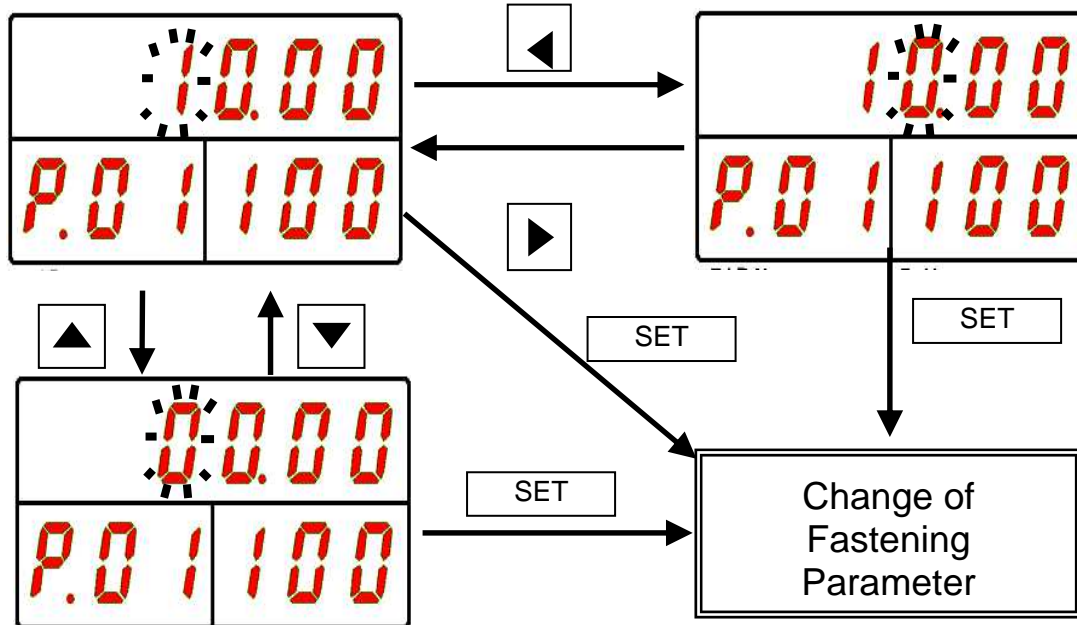


6-3-3 Indications in the PROGRAM Mode

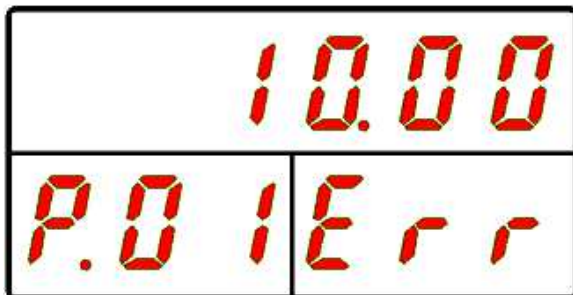
Set Value Editing Mode

Immediately after changing to the "Set Value Editing Mode," the cursor (flashing number) is indicated in the upper stage of the indication part. When the [▲] or [▼] switch is pressed, the numerical value at the cursor position changes by ± 1 .

When the [◀] or [▶] switch is pressed, the digit of the cursor position changes by ± 1 .



When the set value is edited and the [SET] switch is pressed, the set value is changed and changing to the set value selection mode is performed. When the [RESET] switch is pressed in the "Set Value Editing Mode," changing to the set value selection mode is performed without changing the set value. Also, when the changed set value is outside the setting range, the following is indicated and changing to the set value selection mode is performed without changing the set value.

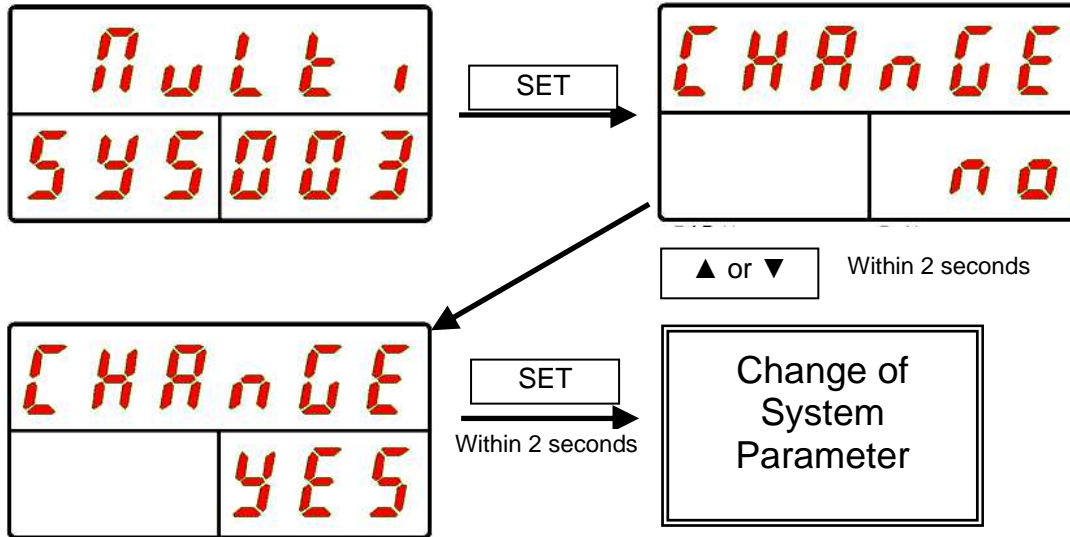


- The changed parameter is effective when the PROGRAM mode switches to the RUN mode, or when the PROGRAM signal changes from ON to OFF.

Turning the power OFF in the PROGRAM mode during the change returns to the parameter before the change.

● System Parameter Setting Method

A parameter with which [SYS] is indicated in the COUNT/D-No. indication part is a system parameter and its set value is changed by editing the set value, then pressing the [SET] switch, thereafter changing the indication of “NO” to “YES” with the [▲] or [▼] switch, and then pressing the [SET] switch again.



*If after pressing the [SET] switch and then changing from “NO” to “YES,” 2 seconds elapses without operating the [▲] or [▼] switch before the [SET] switch is pressed again, changing to the set value selection mode is performed without the set value being changed.



Caution

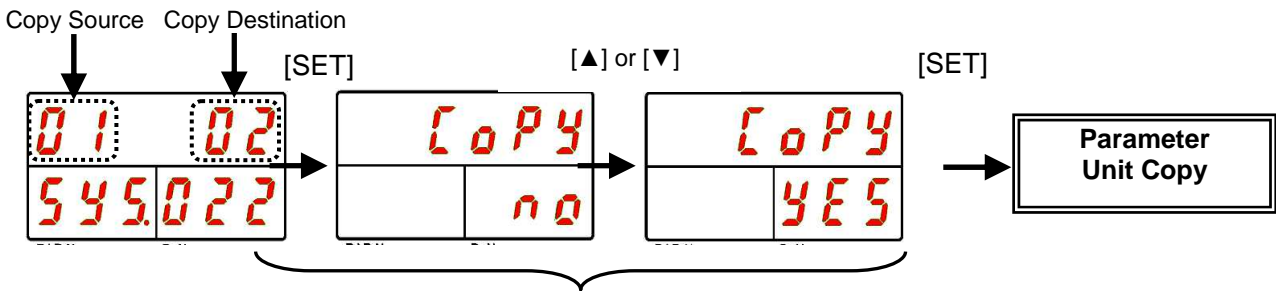
- When changing from the PROGRAM mode to the RUN mode is performed or the BYPASS signal is changed from ON to OFF, the changed parameter is stored in the Unit. When during a setting change, the power is turned OFF in the PROGRAM mode, the setting of the parameter returns to that before the change.
- A portion of the system parameters are made available by reactivating the control power after changing its setting (D-No. 003 System Indication, D-Nos. 011 ~ 016 TCP/IP Setting, etc.).
- When the Unit setup tool No. (PAR No. “SYS,” D-No. “200”) is changed, the fastening parameter set values are subject to initialization and automatic correction.
- Initialization...The calibration torque, the rate 1 ~ 3 high and low limits, the full scale current, the high current limit, and the current limit are subject to initialization.
- Automatic Correction...If the torque, speed, or low current limit set value falls outside the high or low limit value of the tool of the tool No. for which the set value was changed, this set value is subject to automatic correction.

6-4 Copying of Parameters/Erasure of the Fastening Result Record/Formatting of the CF Card

In setting the contents of multiple parameter Nos., a certain parameter No. can be copied to another parameter No. in the set value editing mode. Parameters can be copied by the following operation procedures.

●Procedures for Copying in Parameter Units

1. When the Unit is in the PROGRAM mode, make "CoPY," with "SYS" indicated in the WORK indication part and "022" indicated in the COUNT/D-No. indication part, be indicated and then press "SET."
2. Select the copy source parameter No. as the upper 2 digits of the DATA indication part.
3. Select the copy destination parameter No. as the lower 2 digits of the DATA indication part.
4. Press the SET switch and then press the [▲] or [▼] switch within 2 seconds.
5. After the indication at the DATA indication part changes to "CHANGE YES," press the [SET] switch within 2 seconds.
6. Copying in parameter units is executed.

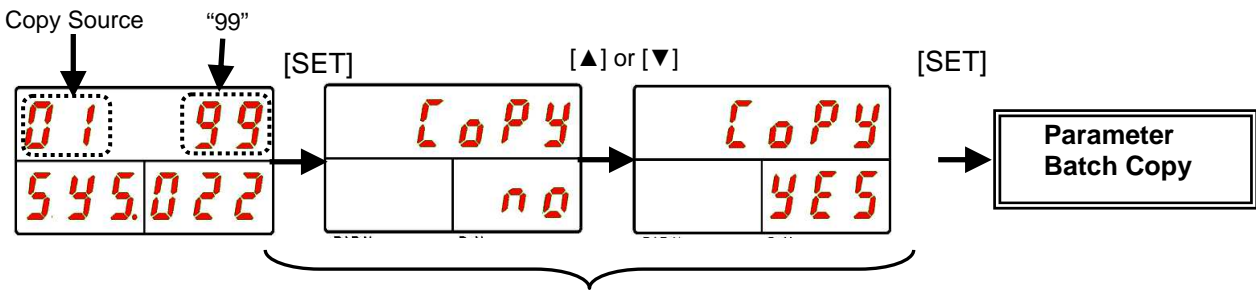


Canceled if operation is not performed within 2 seconds.

●Batch Copying


Example: To copy the contents of parameter 1 into parameters 2 ~ 64

1. When the Unit is in the PROGRAM mode, make "CoPY," with "SYS" indicated in the WORK indication part and "022" indicated in the COUNT/D-No. indication part, be indicated and then press "SET."
2. Select the copy source parameter No. as the upper 2 digits of the DATA indication part.
3. Select "99" as the lower 2 digits of the DATA indication part.
4. Press the SET switch and then press the [▲] or [▼] switch within 2 seconds.
5. After the indication at the DATA indication part changes to "CHANGE YES," press the [SET] switch within 2 seconds.
6. The parameter of the copy source is copied to all parameter in a batch.



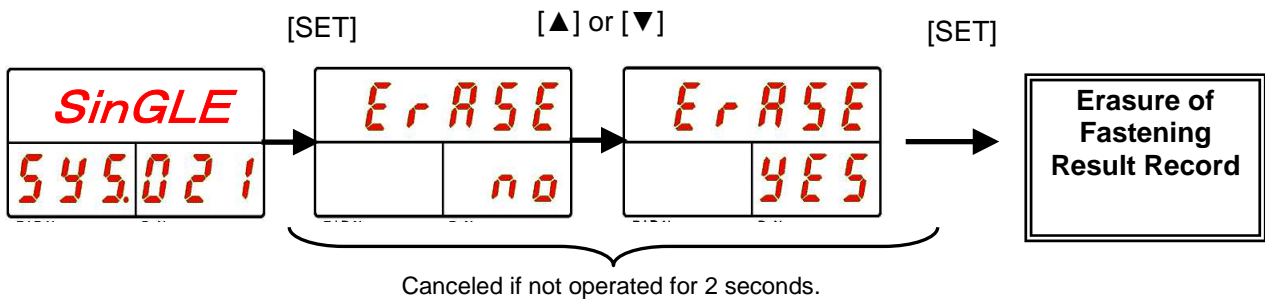
Canceled if operation is not performed within 2 seconds.

Similar operations can be performed from “ErASE,” with “021” indicated in the D-No. indication part, to erase all fastening result record stored in the Unit.

 Caution	• Be careful in executing erasing operation because data cannot be recovered after the fastening result record is erased.
--	--

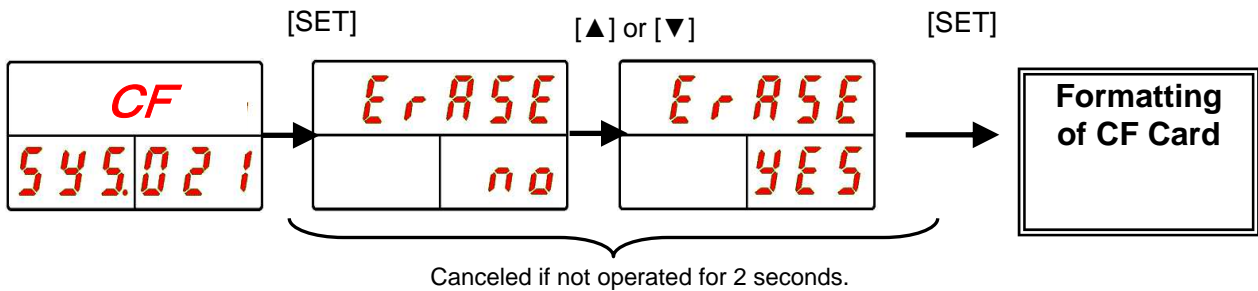
●Fastening Result Record Erasing Operation Procedure

1. When the Unit is in the PROGRAM mode, make “ErASE,” with “SYS” indicated in the WORK indication part and “021” indicated in the COUNT/D-No. indication part, be indicated and then press “SET.”
2. Press the [▲] or [▼] switch to select “SinGLE” and then press “SET.”
3. After the indication at the DATA indication part changes to “ErASE YES,” press the [SET] switch within 2 seconds.
4. When the erasing of the fastening result record is started, “ErASE” in the DATA indication part flashes for a few seconds and the flashing stops when the erasure is completed.



●CF Card Formatting Operation

1. When the Unit is in the PROGRAM mode, make “ErASE,” with “SYS” indicated in the WORK indication part and “021” indicated in the COUNT/D-No. indication part, be indicated and then press “SET.”
2. Press the [▲] or [▼] switch to select “CF” and then press “SET.”
3. After the indication at the DATA indication part changes to “ErASE YES,” press the [SET] switch within 2 seconds.
4. When the formatting of the CF card is started, “ForMAT” in the DATA indication part flashes for a few seconds.



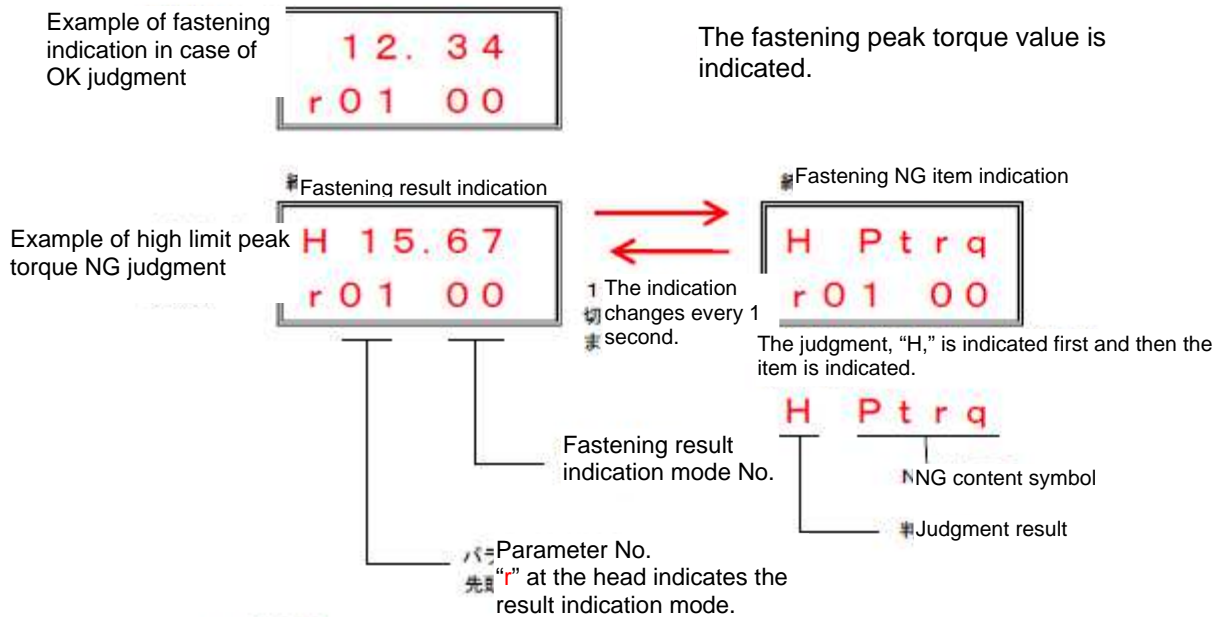
5. If formatting succeeds, “SuccES” is indicated in the DATA indication part for 3 seconds (CF ACCESS lights up in green).
6. If formatting fails, “FAILED” is indicated in the DATA indication part for 3 seconds (CF ACCESS lights up in red).

6-5 Fastening NG (Failure) Result Indications

When a fastening NG occurs, in addition to the NG lamp indication at the upper part of the controller, the item detected as the fastening NG is indicated in the numerical value indication part by the present function.

In the case of fastening to the standard torque, judgments are made in the order: rate high/low limits, differential angle high/low limits, 2ND region fastening high/low limit times, angle high/low limits, peak torque high/low limits, and final torque high/low limits, and the item with which NG is detected first is indicated.

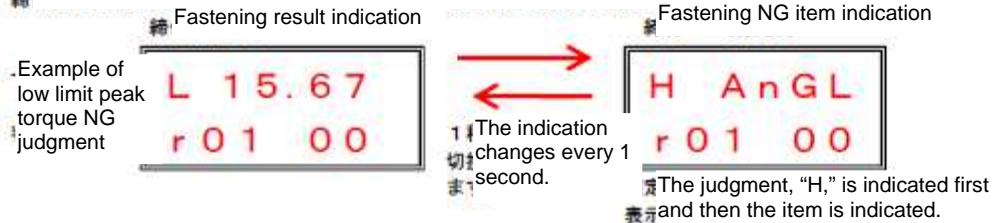
This function is planned to be incorporated as standard. It is planned that the NG result indication operation is performed at all times.



NG content symbols

- P · Ptrq Peak torque
- F · Ftrq Final torque
- S · Strq Snug torque
- s · StC Starting torque inhibit
- S · AnGLFinal angle
- dIFF Differential angle
- A · 1Str Rate 1
- 2 · 2ndr Rate 2
- 1 · 3rdr Rate 3
- 2 · 2ndt 2nd time
- 3 · 1Stt 1st time
- d · turn Rundown revolutions
- 1 · St-off Lever Off
- 2 · Gyro Gyro Stop

If the fastening result indication item is the peak torque indication and the fastening NG item is the angle high limit NG, the indication will be as follows.



Even if the reset, bypass, reverse, or CAL operation is performed, the indication is not canceled (as long as the First-NG result No. exists). When fastening is started, the result is initialized and, in linkage, the alternating indication ends.

6-5-1 Example of Fastening NG item indication

1. Torque High Limit Judgment

1-1



High limit peak torque NG
Cause: Seizing or locking of the screw

1-2



Torque inhibit limit NG
Cause: Work fault, socket fault

2. Angle High Limit Judgment

2-1



High limit angle NG
Cause: Elongation of screw.
During final fastening, fastening was performed while the tool was shaking greatly.
Screw tapping fault.

3. Rate High/Low Limit Judgment

3-1



Low limit Rate1 NG
Cause: Screw thread fault, tapping fault

3-2



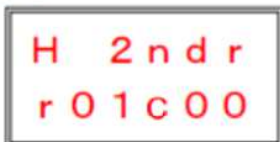
High limit Rate1 NG
Cause: Redundant fastening
Bottom hitting of bolt

3-3



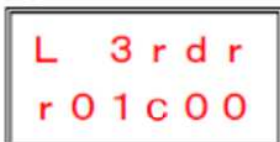
Low limit Rate2 NG
Cause: Abnormality of object of fastening.

3-4



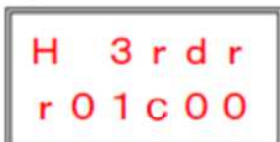
High limit Rate2 NG
Cause: Redundant fastening
Error of object of fastening

3-5



Low limit Rate3 NG
Cause: Elongation of bolt
Error of object of fastening

3-6



High limit Rate3 NG
Cause: Redundant fastening
Seizing of bolt

4. Fastening Time High Limit Judgment

4-1



High limit 1ST time NG

Cause: Tapping fault of object of fastening, bolt thread fault
Detachment of socket

4-2



High limit 2ND time NG

Cause: Elongation of bolt
Cutting of bolt
Detachment of socket

5. Rundown Revolutions High Limit Judgment

5-1



Rundown Revolutions High Limit NG

Cause: Bolt fault
Detachment of socket

6. Others

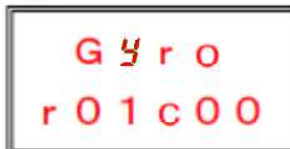
6-1



Start Lever Off NG

Cause: Release the start lever

6-2



Gyro Stop NG

Cause: Gyro swing detection worked safety stop

6-5-2. NG Judgment

Judgments by the high and low limit values of torque, angle, time, and rundown revolutions are performed during the fastening operation or after the end of fastening. The REJECT axis judgment is made if a fastening result falls outside the high or low limit range.

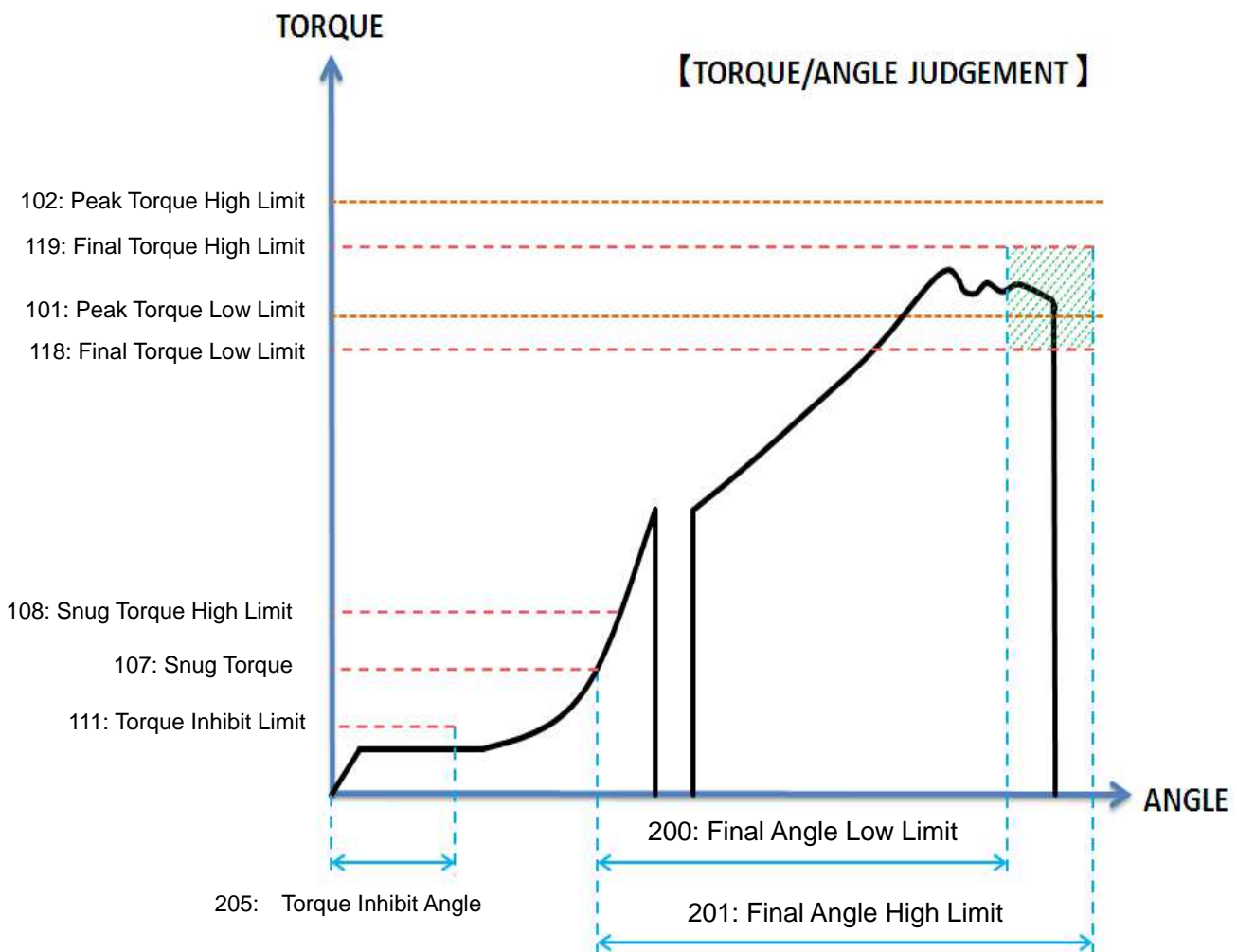
*** High and Low Limit Standard Values for Output Judgment**


The high and low limit values of the HFC3000 System are as follows.

- High limit standard value (REJECT): A value exceeding the high limit standard value
- High limit standard value (ACCEPT): A value that is no more than the high limit standard value
- Low limit standard value (REJECT): A value less than the low limit standard value
- Low limit standard value (ACCEPT): A value that is no less than the high limit standard value

REJECT < Low Limit Standard Value ≤ ACCEPT ≤ High Limit Standard Value < REJECT

Caution Be careful as the output judgment is not performed regardless of the high and low limit set values when the settings of the fastening parameters D-No. 003 "Judge Item 1" and D-No. 004 "Judge Item 2" are 0.

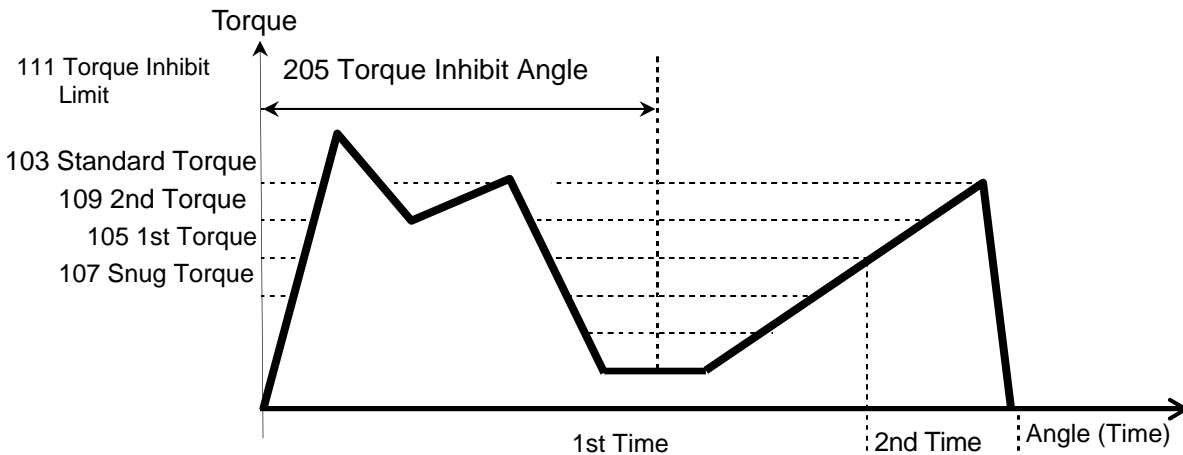



 Caution	The following judgments cannot be made unavailable. •Peak torque check •Final angle check •Timeout check
--	--

●Torque Check [N•m]

- Peak Torque
The high and low limit values of the peak torque in the fastening operation are set. The fastening operation is ended when the peak torque high limit value is exceeded during the fastening operation.
- Final Torque
The high and low limit values of the fastening torque at the point at which the standard angle is attained are set.
- Snug Torque
The high limit value of the Snug torque during Snug torque detection is set.
- Starting Torque Inhibit
The starting torque inhibit high limit value after the start of the fastening operation is set. This can be used for fastening in cases where the starting torque is high. The fastening operation is ended when, during operation within D-No. 205 [Torque Inhibit Angle], the start torque inhibit high limit value is exceeded.

Also, from the start of fastening to the point at which D-No. 205 [Torque Inhibit Angle] is attained, torque-related set values besides the starting torque inhibit high limit are ignored.



 Caution	•When the torque inhibit check is enabled, the following set values are ignored within the start torque inhibit angle from the start of fastening. D-No. 103: Standard Torque, D-No. 104: Ramp Down Start Torque, D-No. 105: 1st Torque, D-No. 107: Snug Torque, D-No. 109: 2nd Torque, D-No. 112: Rate 1 Start Torque, D-No. 113: Rate 1 End Torque, D-No. 114: Rate 2 Start Torque, D-No. 115: Rate 2 End Torque, D-No. 116: Rate 3 Start Torque, and D-No. 117: Rate 3 End Torque.
--	--

● **Angle Check [deg]**

• Final Angle

The high and low limit values of the angle from the point of Snug torque detection to the end are set. The fastening operation is ended when the angle high limit value is exceeded during the fastening operation.

● **Timeout Check [sec]**

• 1st Time

The high and low limit values of time (1st time) from the start of fastening to the detection of the 1st torque or the 1st angle are set.

• 2nd Time

The high and low limit values of time (2nd time) from after the detection of the 1st torque or the 1st angle to the end of fastening are set.

In regard to the 1st time, the fastening operation is ended when the time at which the 1st torque or the 1st angle is detected falls short of the 1st time low limit. Also, with the 1st time and the 2nd time, the fastening operation is ended when the time high limit is exceeded during the fastening operation. Also, when 2 steps or 3 steps is selected as the number of fastening steps, the delay times between fastening steps are not counted as being within the 1st time and the 2nd time.

*The time of the self-checking executed before the start of the fastening operation is not counted as being within the cycle time.


● **Rundown Revolutions Check [rev.]**

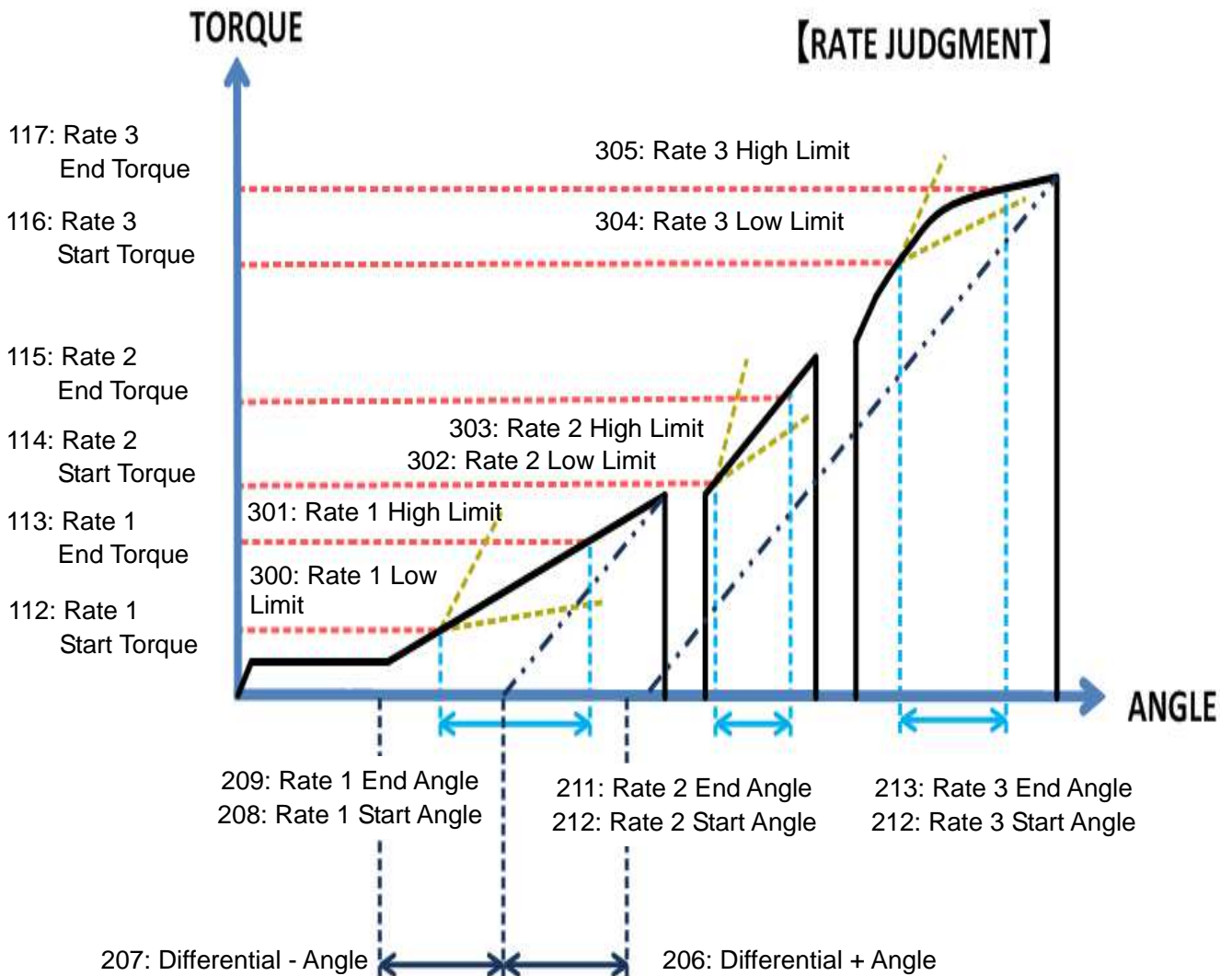
• Rundown revolutions

The high and low limit values of the rundown revolutions from the fastening start point to the fastening end point are set.

●Rate Check

Three rates can be used to monitor the fastening operation during the fastening operation. A rate start torque (angle) and a rate end torque (angle) are set and the torque slope (slope of the torque vs. angle) between the two points at the point at which the rate end torque (angle) is attained is measured to make the judgment. (Example: $25\text{N}\cdot\text{m} \div 100\text{deg} = 0.25\text{N}\cdot\text{m}/\text{deg}$). The fastening operation is ended when the measurement value of each rate falls outside the the high and low limit ranges. The start torque (angle) and end torque (angle) of the respective rates can be set freely without any relation to the order of the rates and the set values of the other rates.

 **[To Customers Using the FUSION Handheld Nutrunner System]**
There are D-Nos. that are changed in name and function. Please perform setting with reference to the correspondence table on the following page.





Caution

- If the rate start torque (angle) cannot be detected during the fastening operation, the rate check will not be performed.
- Under the following conditions, the torque (angle) at the end of fastening is judged as the rate end torque (angle).
 - If the set values are set so that rate start torque (angle) > rate end torque (angle).
 - If the rate end torque (angle) cannot be detected during the fastening operation.
- Whether torque or angle is used as the rate start (end) point is set by the fastening parameter D-No. 005 [Fastening Judgment Output 3].

●FUSION/HFC3000 Fastening Parameter (Rate) Correspondence Table


FUSION Fastening Parameter	HFC3000 Fastening Parameter	Function
17 Threshold Torque	112 Rate 1 Start Torque	The torque value at the start point of measurement of torque rate 1 is set.
15 1st Torque (1st Rate End Torque)	113 Rate 1 End Torque	The torque value at the end point of measurement of torque rate 1 is set.
1E 2nd Rate Start Torque	114 Rate 2 Start Torque	The torque value at the start point of measurement of torque rate 2 is set.
18 CROS Torque (2nd Rate End Torque • 3rd Rate End Torque)	115 Rate 2 End Torque	The torque value at the end point of measurement of torque rate 2 is set.
	116 Rate 3 Start Torque	The torque value at the start point of measurement of torque rate 3 is set.
13 Standard Torque (3rd Rate End Torque)	117 Rate 3 End Torque	The torque value at the end point of measurement of torque rate 3 is set.
	208 Rate 1 Start Angle	The angle value at the start point of measurement of torque rate 1 is set.
23 1st Angle (1st Rate End Angle)	209 Rate 1 End Angle	The angle value at the end point of measurement of torque rate 1 is set.
26 2nd Rate Start Angle	210 Rate 2 Start Angle	The angle value at the start point of measurement of torque rate 2 is set.
24 CROS Angle (2nd Rate End Angle • 3rd Rate Start Angle)	211 Rate 2 End Angle	The angle value at the end point of measurement of torque rate 2 is set.
	212 Rate 3 Start Angle	The angle value at the start point of measurement of torque rate 3 is set.
27 3rd Rate Start Angle		
22 Standard Angle (3rd Rate End Angle)	213 Rate 3 End Angle	The angle value at the end point of measurement of torque rate 3 is set.

Differential Angle Check

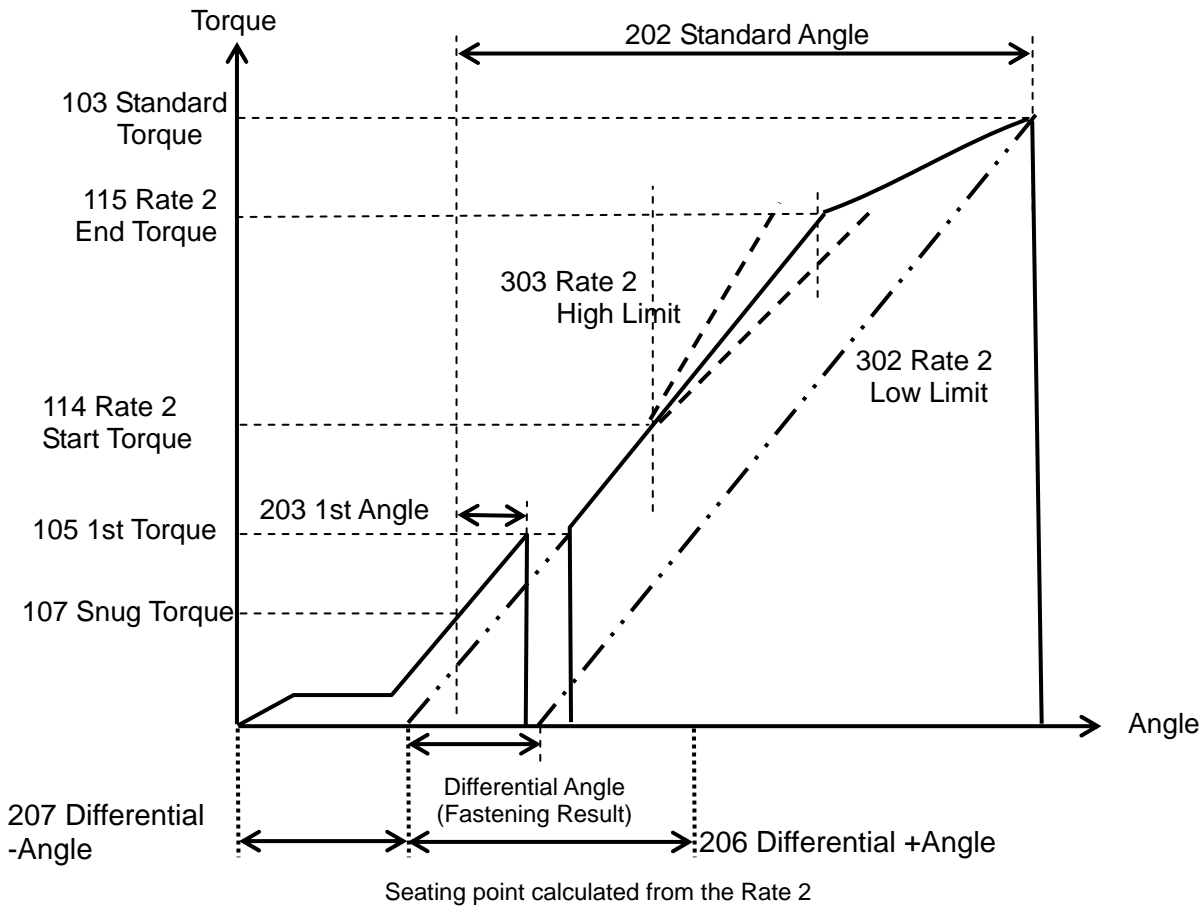
After the end of fastening, the differential angle, which is the difference between the seating point (angle) of the final torque and the seating point (angle) calculated from the rate 2, is measured and judged.


The seating point (angle) calculated from the rate 2 is calculated based on the rate 2 start torque (angle) and the rate 2 end torque (angle).

When the differential angle check is available, it is judged whether or not the calculated differential angle is within ranges based on the seating point (angle) calculated from the value of rate 2 as a reference point.



Caution •The value of the Differential angle of the fastening curve data and the value of the differential angle of the fastening result contain a measurement error of a maximum of 5deg ($\pm 2.5\text{deg}$).





Caution

- If the rate 2 start torque cannot be detected during the fastening operation, the differential angle check will not be performed.
- Under the following conditions, the torque at the end of fastening is judged as the rate 2 end torque.
 - If the set values are set so that rate 2 start torque > rate 2 end torque.
 - If the rate 2 end torque cannot be detected during the fastening operation.

Break away Torque Check

Whether or not the torque value during reverse rotation is within the high limit ranges is judged.

When D-No. 110 [Reverse Torque High Limit] is exceeded, the fastening operation is ended and the abnormal state signal A09-08 "Reverse Torque Error" is generated.

◆Reverse Torque Judgment: [Neglect] ●● Manual reverse rotation by the PLC I/O input signal "REVERSE"

Manual reverse rotation operation by the lever on.

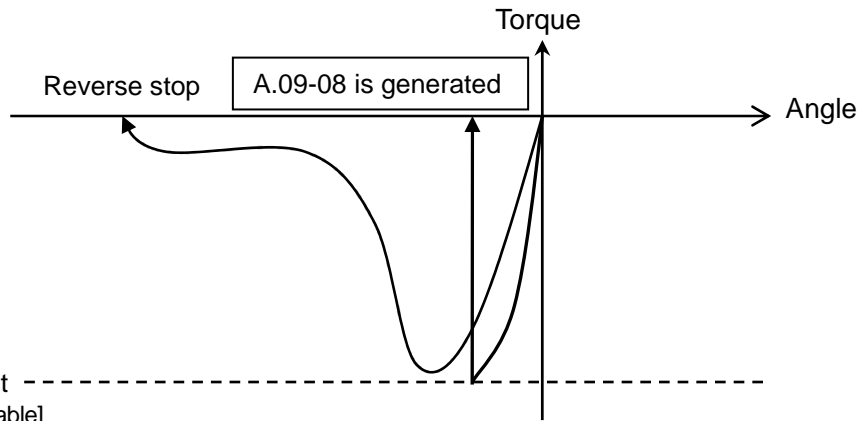
When D-No. 110 [Reverse Torque High Limit] is set "0", The tool stops immediately after starting. In manual reverse rotation operation, the reverse torque judgment is always executed.

◆Reverse Torque Judgment: [Enable] ●● Reverse operation by the fastening option "Reverse After Fastening"


Reverse operation by the fastening option "Reverse Between 1-2 Steps"

Reverse operation by the fastening option "Reverse Between 2-3 Steps"

When D-No. 110 [Reverse Torque High Limit] is set "0" or Reverse Torque Judgment is set "0", Reverse Torque Judgment is ignored.




110: Reverse Torque High Limit
Break away Torque Check: [Enable]

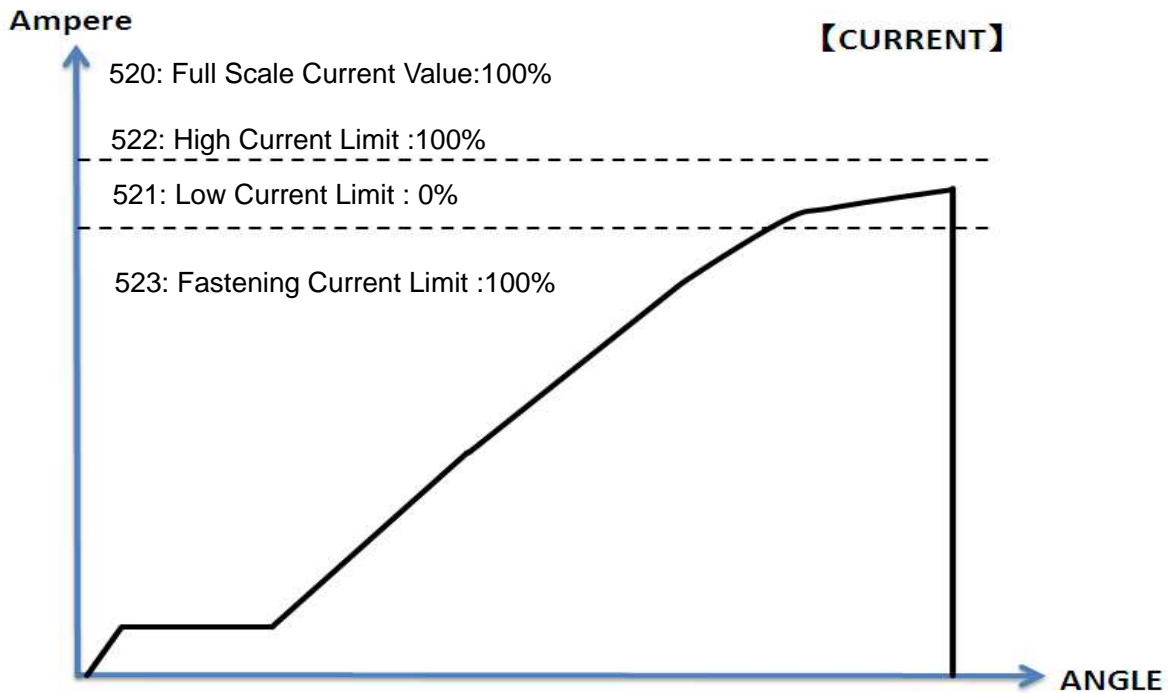
 Caution	<ul style="list-style-type: none"> • D-No. 110 [Reverse Torque High Limit] limit is caused when you loose the bolt already fastened over 5N · m of default setting in the case of the reverse operation and it automatically stops for safety.
---	---

Current Value Warnings

After the end of the fastening operation, it is judged whether or not the peak current value during operation is within the high and low limit ranges. If the peak current value during operation falls below the low current limit or exceeds the high current limit, although the Unit outputs the ACCEPT axis judgment, the PLC layout output signal “Multi: Current Limit Warning,” “Axis: Current Limit Warning,” “Axis: Current Low Warning,” or “Axis: Current High Warning” is turned “ON.”

 Caution	<ul style="list-style-type: none"> ▪ The current value warning judgment cannot be made unavailable. ▪ As the full scale current, a value based on the motor used is set automatically in accordance with the model of the Unit. Do not change this value if there is no special reason to do so.
---	--

Also, the current limit value limits the maximum value of the current during the fastening operation. If a value lower than the full scale current is set, the fastening operation is executed so that the current value does not exceed the value set as the current limit. The current limit value is used to protect the motor during the execution of the torque recovery, which is an after-fastening operation. When the current limit is exceeded, the fastening is stopped and the abnormal state signal A05-01 “Servo Reply Error” is generated.



Fastening Speed and Time

With the HFC3000 Nutrunner System, the speed can be set according to the fastening operation.

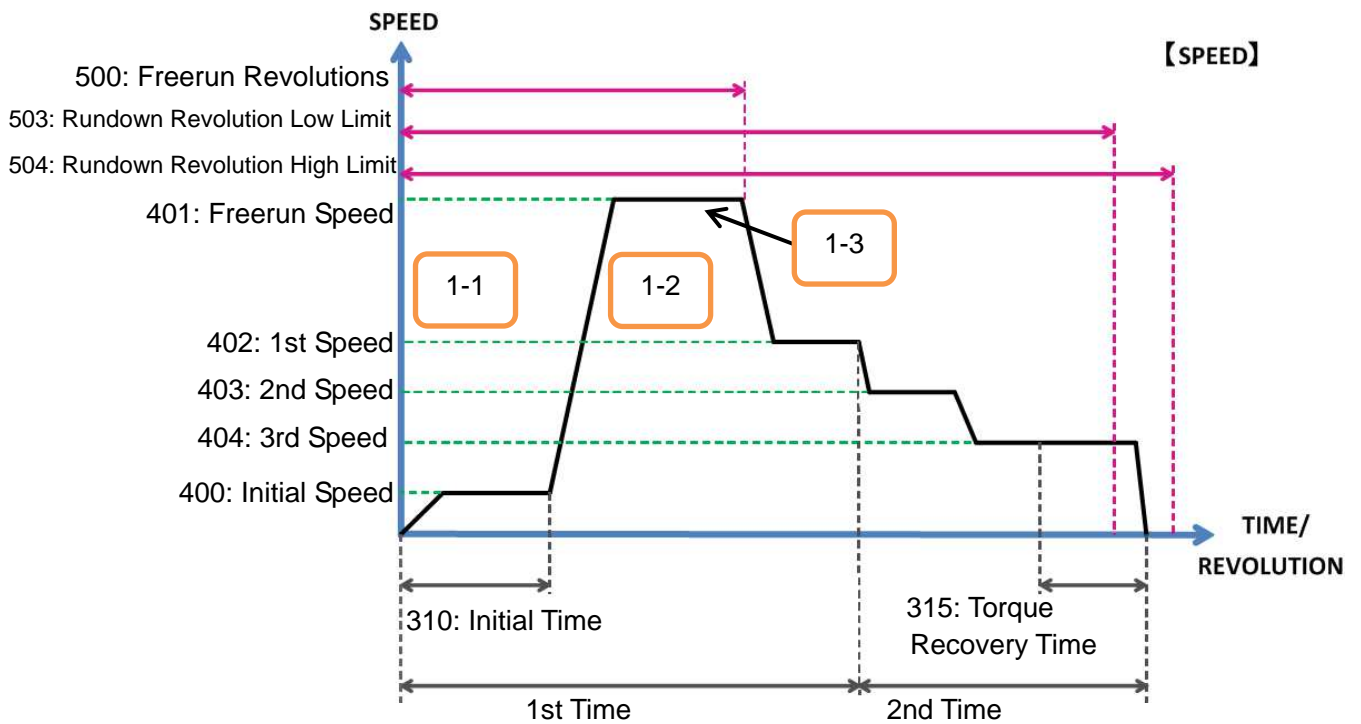
1. Within the set 1st time high limit value, fastening up to the 1st torque or the 1st angle is performed. Also within the 1st time, the following fastening operations are executed.

1-1. Within the time set as the initial time, operation at the initial speed is performed.


The initial time is set to alleviate the shock at the start of fastening and to enable fitting of the bolt and the socket, etc.

1-2. After the end of the initial time, rotation at the freerun speed is performed up to the number of revolutions set as the freerun revolutions. However, if rotation has already been performed for the number of revolutions set as the freerun revolutions during the initial time, the speed is changed from the initial speed to the 1st speed.

1-3. When the ramp down start torque is detected or rotation corresponding to the freerun revolutions has been performed, the speed is changed from the freerun speed to the 1st speed. The operation is continued until the 1st torque or the 1st angle is detected or the 1st time high limit value is reached. The 1st speed is set so that the speed changes to it immediately before the bolt is seated to enable seating to be attained without applying an excessive load to the tool.

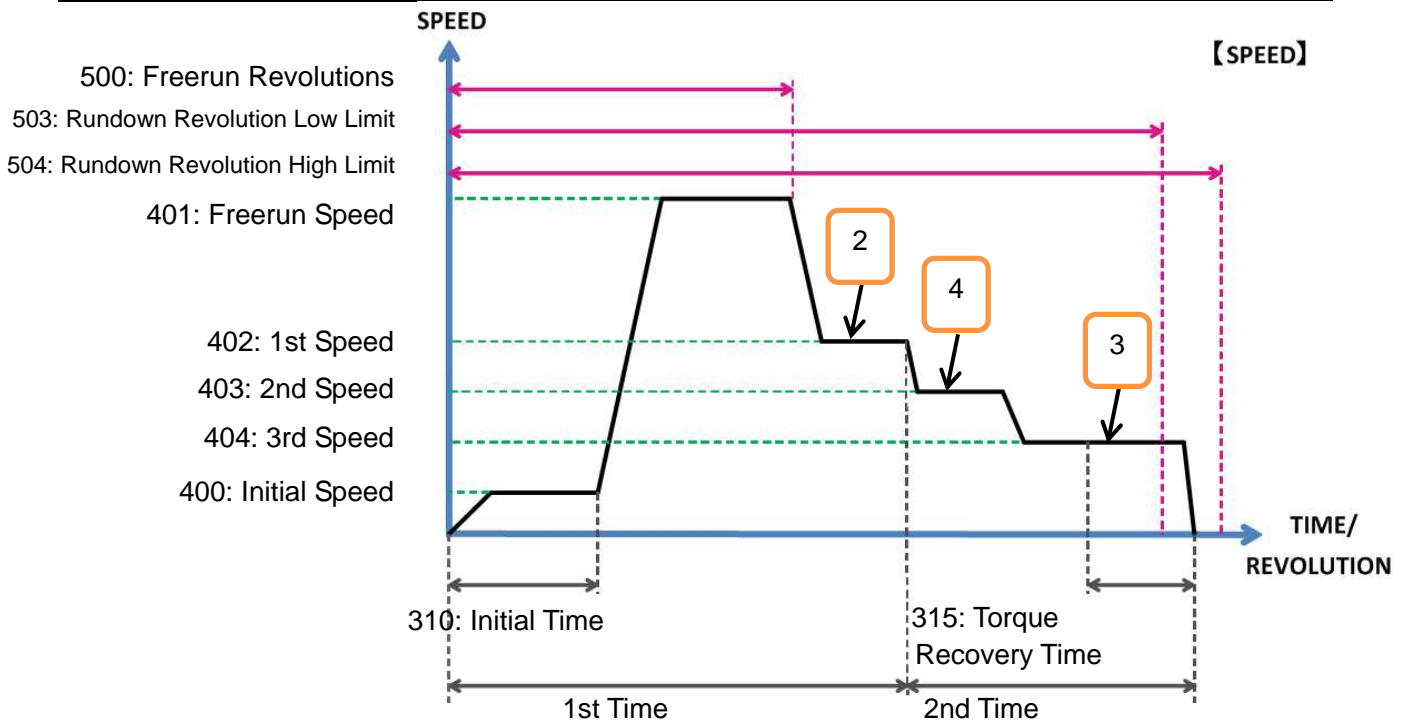


2. When the 1st torque or the 1st angle is detected, the 1st time ends and the 2nd time is started. The 1st torque and the 1st angle are the points of changing from the 1st speed to the 2nd speed and are the points of synchronization of the 2nd step.
3. In the 2nd step, the fastening operation to the standard torque or the standard angle is performed at the 2nd speed until the 2nd time high limit value is reached. If the target value cannot be attained by the 2nd time high limit value, the REJECT fastening result is output.
4. If the 2nd torque or the 2nd angle is detected before the standard torque or the standard angle, the speed is changed from the 2nd speed to the 3rd speed. Also, the 2nd torque and the 2nd angle are the points of synchronization of the 3rd step.

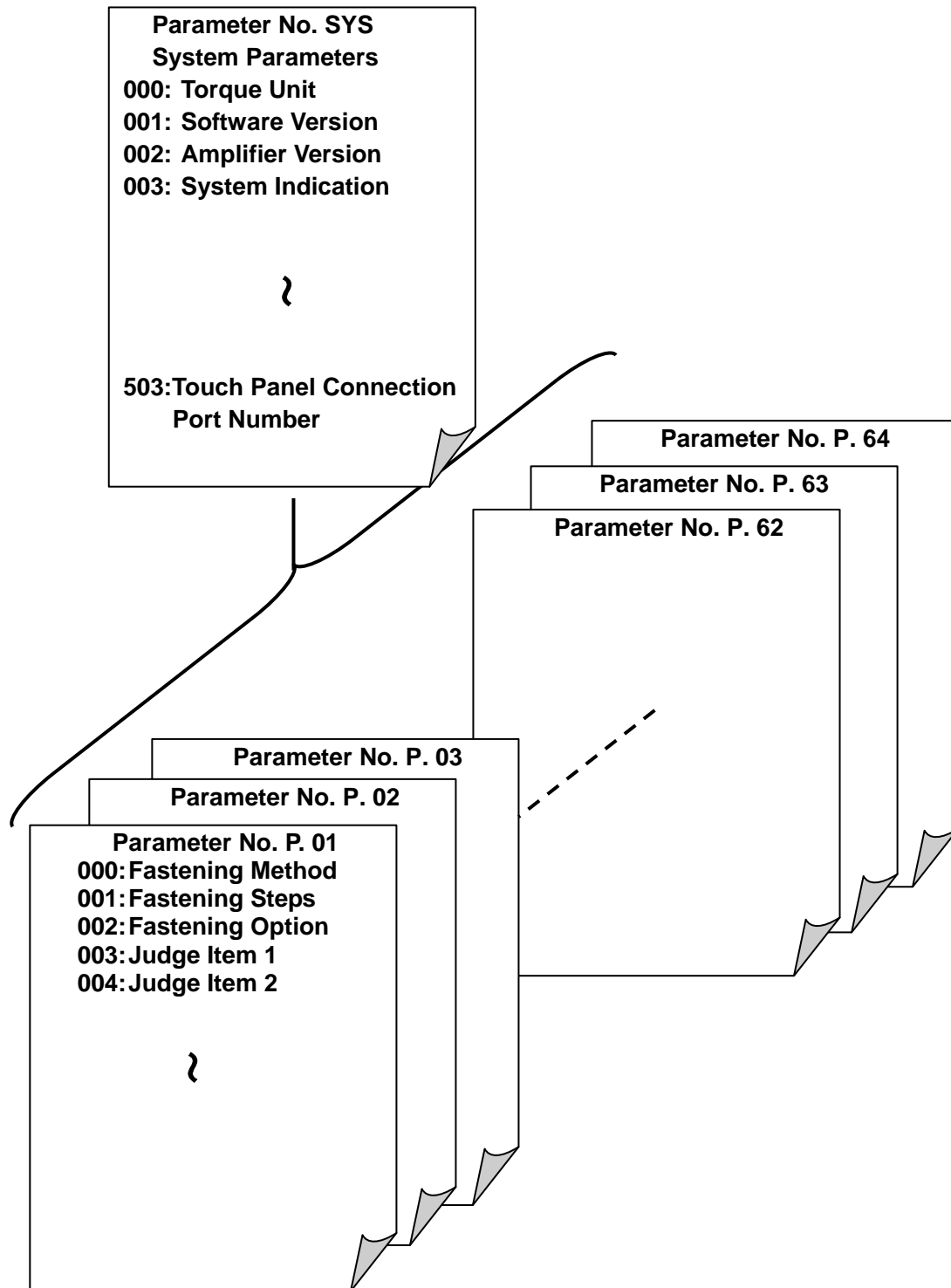


Caution

- If D-No. 109 [2nd Torque] is set to 95 ~ 100% of D-No. 103 [Standard Torque], the fastening speed is automatically set to 3rpm after the detection of the 2nd torque.
- Use of this function is not recommended for fastening a soft joint. The abnormal state signal A.08-10 "Overload Error" may be generated.



6-6 Parameter Structure



System Parameters

<System Parameters> Par No. Indication: SYS

Item	D-No.	Contents	Setting change	Units
Unit Information 1	000	Torque Unit		
	001	Software Version		
	002	Amplifier Version		
	003	System Indication		
	004	Spindle Adapter Gear Ratio	○	
	005	For Adjustment by the Manufacturer		
	006	For Adjustment by the Manufacturer		
	007	Communication Axis Indication		
	008	Axis Cycle Count (×1 million)		
	009	Axis Cycle Count (×1)		
	010	Unit Maximum Current		
	011	IP Address (upper 6 digits): 192.168	○	
	012	IP Address (lower 6 digits): 11.10	○	
	013	Subnet Mask (upper 6 digits): 255.255	○	
	014	Subnet Mask (lower 6 digits): 255.0	○	
	015	Default Gateway (upper 6 digits): 192.168	○	
	016	Default Gateway (lower 6 digits): 11.1	○	
	017	MAC Address (upper 6 digits): 001F98		
	018	MAC Address (lower 6 digits): 001000		
	019	RTC: Year/Month/Day "130725" July 25, 2013	○	
	020	RTC: Time "123456" 12:34 56	○	
	021	Erase Fastening Record/Format CF Card	○	
	022	Parameter Copy	○	
	023	For Adjustment by the Manufacturer		
	024	For Adjustment by the Manufacturer		
	025	For Adjustment by the Manufacturer		
	026	Unit SW1 Setting state		
	027	Unit SW2 Setting state		
	028	For Adjustment by the Manufacturer		
029	For Adjustment by the Manufacturer			
Options	033	System Option 1	○	
	034	System Option 2	○	
	035	System Option 3	○	
	036	Gear head Type	○	
	037	Start Switch Level	○	
	038	Rapid Switch level	○	
	039	CW/CCW Switch Level	○	
	040	For Adjustment by the Manufacturer		
	041	//		Cannot be changed.
	042	//		
	043	//		
	044	//		
	045	//		
	046	//		
	047	//		
	048	//		
	049	//		

Item	D-No.	Contents	Setting change	Units
Connected Tool Settings	100	Connected Tool No.		
	101	Connected Tool Information "015-P1"		
	102	Connected Tool CAL Torque Decimal Point Position		
	103	Connected Tool CAL Torque		Nm
	104	Connected Tool CAL Voltage		V
	105	Connected Tool ZERO Voltage		V
	106	Connected Tool Internal Gear Ratio (×100)		
	107	Connected Tool Serial No. (upper 3 digits)		
	108	Connected Tool Serial No. (lower 4 digits)		
	109	Connected Tool Rotation Direction		
	110	Connected Tool Order No. (upper 2 digits)		
	111	Connected Tool Order No. (lower 5 digits)		
	112	Connected Tool Cycle Count (×1 million)		
	113	Connected Tool Cycle Count (×1)		
114	Connected Tool Maximum Current		A	
Unit Information 2	200	Unit Setting Tool No.	○	
	201	Unit Setup Tool Information "015M50"		
	202	Parameter Setting File Version		
	203	Sequence Setting File Version		
	204	PLC Output Layout Setting File Version		
	205	Fieldbus Setting File Version		
	206	Fieldbus Message Setting File Version		
	207	RS232C Input/Output Setting File Version		
	208	Unit RS232C-1 Communication Speed		bps
	209	Unit RS232C-1 Parity		
	210	Unit RS232C-1 Stop Bit		bit
211	Unit RS232C-1 Word Length		bit	
Option Information1	300	Connected Fieldbus Information		
	301	ANYBUS-CC Version		
	302	Unit Setting Fieldbus Information		
	303	Station No. (Node Address) (1 ~ 64 or 0 ~ 63)		
	304	Communication Speed (0 ~ 4)		
	305	Occupied Stations (1, 2, 3, 4)		
	306	Extended Cyclic Setting (1, 2, 4, 8)		
	307	I/O Setting Byte Length "PLC → MASTER Axis"		
	308	I/O Setting Byte Length "Master Axis → PLC"		
	309	Message Block Byte Length		
	310	Message Setting Byte Length "PLC → MASTER Axis"		
	311	Message Setting Byte Length "Master Axis → PLC"		
	312	IP Address (upper 6 digits)		
	313	IP Address (lower 6 digits)		
	314	Subnet Mask (upper 6 digits)		
	315	Subnet Mask (lower 6 digits)		
	316	Gateway (upper 6 digits)		
317	Gateway (lower 6 digits)			

Item	D-No.	Contents	Setting change	Units
Option Information2	400	CF Card Storage Capacity		%
	401	RS232C-2 Communication Speed		bps
	402	RS232C-2 Parity		
	403	RS232C-2 Stop Bit		bit
	404	RS232C-2 Word Length		bit
	405	Not use		
	406	Not use		
	407	Not use		
	408	Not use		
	409	ID Input Selection		
Touch Panel	500	Touch Panel Connection IP Address (upper 6 digits)	○	
	501	Touch Panel Connection IP Address (lower 6 digits)	○	
	502	Touch Panel Language Select	○	
	503	Touch Panel Connection Port Number	○	

System Parameters (Unit Information 1)

D-No.000 Torque Unit Cannot be changed.

All fastening parameters within the Unit will have the same torque unit.

D-No. 001 Software Version Cannot be changed.

This is the software version of the Unit.

D-No. 002 Amplifier Version Cannot be changed.

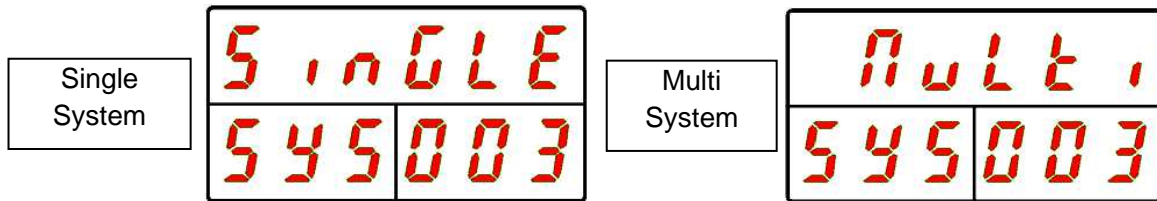
This is the amplifier version.

D-No. 003 System Indication Cannot be changed.

This indicates whether the Unit is a multi system or a single system.

This is also used to change between the multi system and the single system.

The handheld tool operates only in the single system setting.



D-No. 004 External Gear Ratio Setting range: 0.300 ~ 3.000, standard setting: 1.000

When a gear is installed at the top of the tool, the gear ratio with respect to the output shaft of the tool is set here.

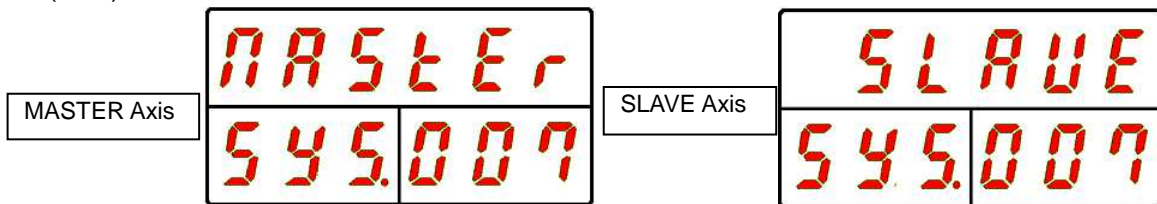
Do not use a value other than 1.000 as long as an external offset gear is not used.

D-No.005 / 006 For adjustment by the manufacturer Cannot be changed.

Not used.

D-No. 007 Communication Axis Indication Cannot be changed.

This indicates whether the Unit is the MASTER Axis for (PC) communication and I/O (PLC) communication or is a SLAVE Axis.



D-No. 008 Axis Cycle Count (x1 million) **D-No. 009 Axis Cycle Count (x1)**

These indicate the count at which the Unit performed the fastening operation.

* When the count is less than 1 million times, [-----] is indicated for D-No. 008.

D-No.010 Unit Maximum Current **Cannot be changed**

This indicates the maximum current value of the Unit.

D-No. 011 IP Address (upper 6 digits) **D-No. 012 IP Address (lower 6 digits)**

Setting range: 0 ~ 255

The IP address is set here.

D-No. 013 Subnet Mask (upper 6 digits) **D-No. 014 Subnet Mask (lower 6 digits)**

Setting range: 0 ~ 255

The subnet mask is set here.

D-No. 015 Default Gateway (upper 6 digits) Setting range: 0 ~ 255**D-No. 016 Default Gateway (lower 6 digits)** Setting range: 0 ~ 255

The default gateway is set here.



Caution

- After being changed, the settings of D-Nos. 011 ~ 016 are made available by reactivation of the control power.
- Please execute the reactivation of the control power after confirming that the “ProG” indication on the upper stage of the indicator changes from being lit up to being unlit after changing the setting.
- If the control power is turned OFF while “ProG” lights up, the parameters may become initialized.

D-No. 017 MAC Address (upper 6 digits) **D-No. 018 MAC Address (lower 6 digits)****Cannot be changed**

The MAC address is indicated.

D-No. 019 RTC: Year/Month/Day Setting range: 13~99 (year), 1~12 (month), 1~31 (day)**D-No. 020 RTC: Time** Setting range: 0 ~ 23 (hours), 0 ~ 59 (minutes), 0 ~ 59 (seconds)

The date and time of the RTC are indicated. The range for the year is 2013 ~ 2099.

* This is not indicated at a SLAVE Axis of the multi system.

D-No. 021 Erase Fastening Record/Format CF Card

Erasure of the fastening result record is executed. Please refer to “Copying of Parameters and Erasure of the Fastening Result Record” regarding the method for erasing the fastening result record. Also, if the Expansion Unit 2 (Model: MFC-CF) is installed, formatting of the CF card can be executed. Please refer to “Formatting the Memory Card” regarding the method for formatting the CF card.

D-No. 022 Parameter Copy

Copying of parameters is performed. Please refer to “Copying of Parameters and Erasure of the Fastening Result Record” regarding the method for copying parameters.

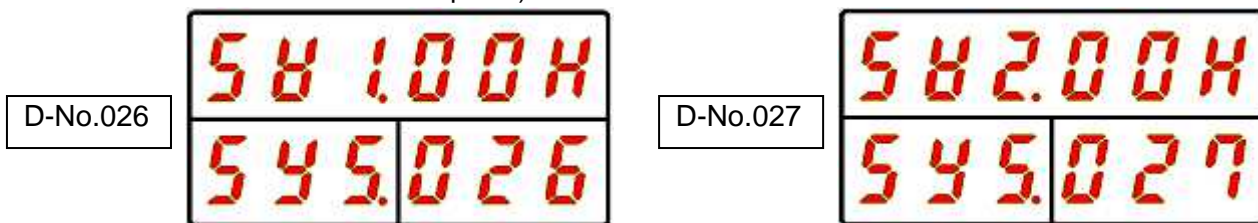
D-No.023,024,025,028,029 For Adjustment by the Manufacturer

Not used.

D-No.026 Unit SW1 Setting State

D-No.027 Unit SW2 Setting State

The setting states of the switch on the Unit inside (the SW1 switch on the Unit front panel and the SW2 switch on the Unit bottom panel) are indicated.



The ON/OFF states of SW No. 1 ~ No. 8 are indicated in 8-bit hexadecimal code in the part in which "00H" is indicated in the drawing above.

SW setting examples	Indication examples
All OFF	00H
Only No. 1 ON	01H
Only No. 2 ON	02H
Only No. 3 ON	04H
Only No. 4 ON	08H
Only No. 5 ON	10H
Only No. 6 ON	20H
Only No. 7 ON	40H
Only No. 8 ON	80H
All ON	FFH

System Parameters (Options)

D-No.033 System Option 1 Standard setting: 000000

Optional functions of the Unit are set here.

*****1: Accept Relay output (0:level/1:pulse)

- Set to "1" if the QL-OK output signal of the standard IO is to be in pulse form.

****1*: Total Accept Relay Output (0:level/1:pulse)

- Set to "1" if the TOTAL-OK output signal of the standard IO is to be in pulse form.

***1**: Accept Relay Output Timing(0:300msec/1:800msec)

- If the pulse method has been selected, select the pulse length here.

1*: Stop input (0: Open Stop/1: Close Stop)

- Set to "1" if the logic of the STOP input signal is to be set to the B contact.

*1****: Self check (0: Startup Time /1: only the first cycle)

- Set to "1" to perform the CAL check at the fastening start only in the first cycle.
Except when a judgment other than the one of the ACCEPT axis is made in the first cycle, the CAL check is performed at the next fastening start, too.

1*****: ID input selection (0:Fieldbus/1:RS232C-3)

- For selecting whether the ID data are to be input as a fieldbus message or input in the RS232C-3 port.

D-No.034 System Option 2 Standard setting: 000000

Optional functions of the Unit are set here.

*****1: WORK change (0: Display panel/1: PLC I/O Signal)

- Set to "1" if the change of WORK is to be performed from the external I/O (the change cannot be performed from both the operation panel and the external I/O)

****1*: Reversing switch (0: Slide/1: Push Button)

- Slide: P type, T type/Pushbutton: A type, S type

***1**: RS232C-1 output (0: PLC/1: Ethernet)

- Not used.

1*: NG result indication (0: enable/1: disable)

- Set to "1" if the NG result indication is not to be performed.

*1****: Fieldbus Function Disable (0:OFF / 1: ON)

- Set to "1" if Fieldbus is to be disabled with Fieldbus being installed.

1*****: WORK change priority (0: Fieldbus/1: standard I/O)

- For selecting between using Fieldbus or the standard I/O when the change of WORK is to be performed by the external I/O.

D-No.035 System Option 3 Standard setting: 000000

An optional function of the Unit is set here.

*****1: Prohibit of Resume after Total Accept Relay (0: OFF./1: ON).

- Set to "1" if restart is to be prohibited when the TOTAL-OK state is entered.

To cancel the prohibition, the RESET, STOP, or BYPASS input signal is set to ON.

The prohibition is not canceled even if batch reset is performed.

1* : CW/CCW Change Select (0:IO input/1: Normal/Reverse switch)

Sets the operation when the IO input signal "START" turns ON by switching the Normal /Reverse changeover switch of the tool to the reverse rotation mode.

- 0: Starts the fastening operation.
- 1: Starts the reverse rotation operation.

D-No.036 Gearhead Option Standard setting: 0, Setting range: 0 ~ 2

0: Standard head/1: Regular tube nut/2: Inverted tube nut

D-No.037 Ordinary Starting Switch Level Standard setting: 10, Setting range: 0 ~ 255

Please set 10.

D-No.038 High-speed Starting Switch Level Standard setting: 40, Setting range: 0 ~ 255

Please set 40.

*Please set 10 for the tool of D type.

D-No.039 Reversing Switch Level Standard setting: 10, Setting range: 0 ~ 255

Please set 10.

D-No.040~049 For Adjustment by the Manufacturer

Not used.

D-No.100 Connected Tool No.

The tool No. corresponding to the tool model is indicated. Please refer to "Tool Models."

D-No.101 Connected Tool Information

The maximum torque and motor capacity of D-No. 100 "Connected Tool No." are indicated.

D-No.102 Tool CAL Torque Decimal Point

The decimal point position of the torque value of D-No. 103 "Tool CAL Torque" is indicated.

D-No.103 Tool CAL Torque [N•m]

The CAL torque of the tool is indicated.

D-No.104 Tool CAL Voltage [V]

The CAL voltage of the tool is indicated.

D-No.105 Tool ZERO Voltage [V]

The ZERO voltage of the tool is indicated.

D-No.106 Tool Internal Gear Ratio (×100)

The value obtained by multiplying the gear ratio of the tool by 100 is indicated.

D-No.107 Tool Serial No. (upper 3 digits)

D-No.108 Tool Serial No. (lower 4 digits)

The serial No. of the tool is indicated.

D-No.109 Tool Rotation Direction

The rotation direction of the tool is indicated. (CW: 0, CCW: 1)

D-No.110 Tool Order No. (upper 2 digits)

D-No.111 Tool Order No. (lower 5 digits)

The order No. of the tool is indicated.

D-No.112 Tool Cycle Count (×1 million)

D-No.113 Tool Cycle Count (×1)

These indicate the number of times (count) of fastening operations performed by the connected tool.

* When the count is less than 1 million times, [-----] is indicated for D-No. 112.

D-No.114 Tool Maximum Current [A]

This indicates the maximum current of the tool.

D-No.200 Unit Setup Tool No. Setting range: Tool No. registered for the model

The Tool No. of the connected tool is set with reference to “Tool Models.” When the unit setup tool No. is changed, initialization and automatic correction of the fastening parameter set values are performed.

D-No.201 Unit Setup Tool Information

The maximum torque and motor capacity of the tool of D-No. 200 “Unit Setup Tool No.” are indicated.

D-No.202 Parameter Setting File Version

The version of the parameter file set in the Unit is indicated.

D-No.203 Sequence Setting File Version

The version of the sequence file set in the Unit is indicated.

D-No.204 PLC Output Layout Setting File Version

The version of the PLC output layout file set in the Unit is indicated.

D-No.205 Fieldbus Setting File Version

The version of the fieldbus file set in the Unit is indicated.

D-No.206 Fieldbus Message Setting File Version

The version of the fieldbus message file set in the Unit is indicated.

D-No.207 RS232C Input/Output Setting File Version

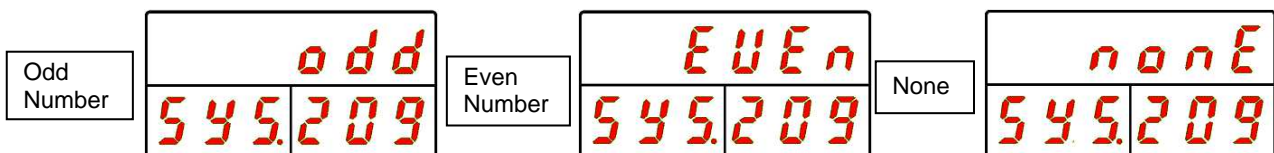
The version of the RS232C input/output file set in the Unit is indicated.

D-No.208 Unit RS232C-1 Communication Speed [bps]

The communication speed of the RS232C-1 interface is indicated.

D-No.209 Unit RS232C-1 Parity

The parity of the RS232C-1 interface is indicated.



D-No.210 Unit RS232C-1 Stop Bit [bit]

The stop bit of the RS232C-1 interface is indicated.

D-No.211 Unit RS232C-1 Data Length [bit]

The data length of the RS232C-1 interface is indicated.

D-No.300 Connected Fieldbus Information

The type of fieldbus installed on the Expansion Unit 1 is indicated.

Expansion Unit 1 Uninstalled (Standard IO)	Std - 10 545.300		
MFC-DT Installed (Expansion IO)	Ext - 10 545.300	MFC-CC Installed (CC-Link)	CC 545.300
MFC-DN Installed (DeviceNet)	d-net 545.300	MFC-PB Installed (PROFIBUS DP-V1)	P-bus 545.300
MFC-PN Installed (PROFINET IO)	P-10 545.300	MFC-EN Installed (EtherNet/IP)	E-IP 545.300

D-No.301 ANYBUS-CC Version (besides standard IO and expansion IO)

The ANYBUS-CC version of the Expansion Unit 1 is indicated.

D-No.302 Unit Setting Fieldbus Information

The type of fieldbus set in the Unit is indicated.

Fieldbus unset	none 545.302		
CC-Link V1	CC-V1 545.302	CC-Link V2	CC-V2 545.302

D-No.303 Station No. (Node Address) (CC-Link, DeviceNet, PROFIBUSDP-V1)

The station No. (node address) of the fieldbus set in the Unit is indicated.

Fieldbus Type		
CC-Link	DeviceNet	PROFIBUSDP-V1
1~64	0~63	0~125

D-No.304 Communication Speed Setting range: 0 ~ 4 (CC-Link, DeviceNet)

The communication speed of the fieldbus set in the Unit is indicated.

Fieldbus Type	System Parameter D-No.304				
	0	1	2	3	4
CC-Link	156kbps	625kbps	2.5Mbps	5Mbps	10Mbps
DeviceNet	125kbps	250kbps	500kbps	-	-

D-No.305 Occupied Stations Setting range: 1 ~ 4 (CC-Link)

The number of occupied stations of the fieldbus set in the Unit is indicated.

D-No.306 Extended Cyclic Setting Setting range: 1, 2, 4, 8 (CC-Link)

The extended cyclic setting of the fieldbus set in the Unit is indicated.

D-No.307 I/O Setting Byte Length “PLC → Master Axis” [byte]

(besides standard IO and expansion IO)

The I/O setting byte length for “PLC → MASTER Axis” of the fieldbus set in the Unit is indicated.

D-No.308 I/O Setting Byte Length “Master Axis → PLC” [byte]

(besides standard IO and expansion IO)

The I/O setting byte length for “MASTER Axis → PLC” of the fieldbus set in the Unit is indicated.

D-No.309 Message Block Byte Length [byte] (besides standard IO and expansion IO)

The message block byte length of the fieldbus set in the Unit is indicated.

Fieldbus type				
CC-Link	DeviceNet	PROFIBUSDP-V1	PROFINET IO	EtherNet/IP
144byte	250 byte	64 byte	250 byte	250 byte

D-No.310 Message Setting Byte Length “PLC → Master Axis” [byte]

(besides standard IO and expansion IO)

The message setting byte length for “PLC → MASTER Axis” of the fieldbus set in the Unit is indicated.

D-No.311 Message Setting Byte Length “Master Axis → PLC” [byte]

(besides standard IO and expansion IO)

The message setting byte length for “MASTER Axis → PLC” of the fieldbus set in the Unit is indicated.

D-No.312 IP Address (upper 6 digits)

D-No.313 IP Address (lower 6 digits)

Setting range: 0 ~ 255 (PROFINET IO, EtherNet/IP)

The IP address of the fieldbus set in the Unit is indicated.

D-No.314 Subnet Mask (upper 6 digits)

D-No.315 Subnet Mask (lower 6 digits)

Setting range: 0 ~ 255 (PROFINET IO, EtherNet/IP)

The subnet mask of the fieldbus set in the Unit is indicated.

D-No.316 Gateway (upper 6 digits)

D-No.317 Gateway (lower 6 digits)

Setting range: 0 ~ 255 (PROFINET IO, EtherNet/IP)

The gateway of the fieldbus set in the Unit is indicated.

D-No.400 CF Card Storage Capacity [%]

The storable capacity of the CF card is indicated.

D-No.401 RS232C-2 Communication Speed [bps]

The communication speed of the RS232C-2 interface is indicated.

D-No.402 RS232C-2 Parity

The parity of the RS232C-2 interface is indicated.

D-No.403 RS232C-2 Stop Bit [bit]

The stop bit of the RS232C-2 interface is indicated.

D-No.404 RS232C-2 Data Length [bit]

The data length of the RS232C-2 interface is indicated.

D-No.405 Not use

D-No.406 Not use

D-No.407 Not use

D-No.408 Not use

D-No.409 ID Input Selection

The selected ID input method is indicated (Fieldbus/RS232C-2).

D-No. 500 IP Address (upper 6 digits)**D-No. 501 IP Address (lower 6 digits)**

Setting range: 0 ~ 255

The IP address of the touch panel connected in the Unit is indicated.

D-No.502 Touch Panel Function / Language Setup

standard setting : 0 Setting range : 0~4

Disabling/enabling of the touch panel function and the language setting are changed.

- If the touch panel is not used

Set "0."

- If the touch panel is used

Set any of "1" ~ "4" in accordance with the language to be used.

D-No.502	0	1	2~4
Setting Details	Touch Panel Function Disable	Language/ Japanese	Language/ English

D-No.503 Port Number

standard setting : 1024 Setting range : 1024~65535

The Port Number of the touch panel connected in the Unit is indicated.



Caution

· After being changed, the settings of D-Nos. 500 ~ 503 are made available by reactivation of the control power.

· Please execute the reactivation of the control power after confirming that the "Prog" indication on the upper stage of the indicator changes from being lit up to being unlit after changing the setting.

· If the control power is turned OFF while "Prog" lights up, the parameters may become initialized.

<Fastening Parameters> * Items in colored cells are skipped by the indicator.

Item	PAR No.	D-No.	Contents	Torque Method	Angle Method
Fastening Settings	P.01~ P.64	000	Fastening Method	0	1
		001	Fastening Steps	○	○
		002	Fastening Option	○	○
		003	Judgment Item 1	○	○
		004	Judgment Item 2	○	○
		005	After Fastening Operation	○	○
		006	Interrupt Operation During Fastening	○	○
Torque [N · m]	P.01~ P.64	100	Calibration Torque	○	○
		101	Peak Torque Low Limit	○	○
		102	Peak Torque High Limit	○	○
		103	Standard Torque	○	
		104	Ramp Down Start Torque	○	○
		105	1st Torque	○	○
		107	Snug Torque	○	○
		108	Snug Torque High Limit	○	○
		109	2nd Torque	○	○
		110	Reverse Torque High Limit	○	○
		111	Torque Inhibit Limit	○	○
		112	Rate 1 Start Torque	○	○
		113	Rate 1 End Torque	○	○
		114	Rate 2 (Differential Angle) Start Torque	○	○
		115	Rate 2 (Differential Angle) End Torque	○	○
		116	Rate 3 Start Torque	○	○
		117	Rate 3 End Torque	○	○
118	Final Torque Low Limit	○	○		
119	Final Torque High Limit	○	○		
120	Option	△	△		
121	1 Pulse Reverse Torque High Limit	○	○		
Angle [deg]	P.01~ P.64	200	Final Angle Low Limit	○	○
		201	Final Angle High Limit	○	○
		202	Standard Angle		○
		203	1st Angle	○	○
		204	2nd Angle	○	○
		205	Torque Inhibit Angle	○	○
		206	Differential + Angle	○	○
		207	Differential – Angle	○	○
		208	Option	△	△
		209	Correction Angle	△	△

△: Unavailable.

Item	PAR No.	D-No.	Contents	Torque Method	Angle Method
Rate [N·m/deg] Time [sec]	P.01~P.64	300	Rate 1 Low Limit	○	○
		301	Rate 1 High Limit	○	○
		302	Rate 2 Low Limit	○	○
		303	Rate 2 High Limit	○	○
		304	Rate 3 Low Limit	○	○
		305	Rate 3 High Limit	○	○
		310	Initial Time	○	○
		311	1st Time Low Limit	○	○
		312	1st Time High Limit	○	○
		313	2nd Time Low Limit	○	○
		314	2nd Time High Limit	○	○
		315	Torque Recovery Time	○	○
		316	1 Pulse Reverse Time	○	○
Speed [rpm]	P.01~P.64	400	Initial Speed	○	○
		401	Freerun Speed	○	○
		402	1st Speed	○	○
		403	2nd Speed	○	○
		404	3rd Speed	○	○
		405	Reverse 1 Speed	○	○
		406	Reverse Speed between 1-2 Step	○	○
		407	Reverse Speed between 2-3 Step	○	○
		408	Ramp Up Time	○	○
		409	FreeRun Ramp Down Time	○	○
410	1 Pulse Reverse Speed	○	○		
Revolution [rev] Current [%]	P.01~P.64	500	Freerun Revolutions	○	○
		501	Reverse Revolutions between 1-2 Step	○	○
		502	Reverse Revolutions between 2-3 Step	○	○
		503	Rundown Revolution Low Limit	○	○
		504	Rundown Revolution High Limit	○	○
		505	Reverse Revolutions before Fastening	○	○
		520	Full Scale Current Value	○	○
		521	Low Current Limit	○	○
		522	High Current Limit	○	○
		523	Fastening Current Limit	○	○

Item	PAR No.	D-No.	Contents	Torque Method	Angle Method
Others	P.01~P.64	540	Number of Accept [times]	○	○
		541	Angle Head Torque Variation Rate[%]	○	○
Time [msec]	P.01~P.64	542	CW Servo Lock Time Between Steps	○	○
		543	CW Wait Time Between Steps	○	○
		544	Ramp Down Time	○	○
		545	Final Ramp Down Time	○	○
		546	Reverse Ramp Up Time	○	○
		547	CCW Wait Time Between Steps	○	○
Pulsing	P.01~P.64	550	Recovery Pulsing Count	○	○
		551	Recovery Pulsing Speed [rpm]	○	○
		552	Pulse Fastening Stop Servo Lock Time [ms]	○	○
		553	Pulse Fastening Wait Time [ms]	○	○
		554	Pulse Fastening Operation Time [ms]	○	○
		555	Pulse Fastening Operation Angle [deg]	○	○
		556	Pulse Fastening Ramp Up Time [ms]	○	○
Gyro	P.01~P.64	560	CW Swing Stop Angle [deg]	○	○
		561	CW Swing Pause Angle [deg]	○	○
		562	CW Swing Pause Servo Lock Time [ms]	○	○
		563	CW Swing Resume Dwell Time [ms]	○	○
		570	CCW Swing Stop Angle [deg]	○	○
		571	CCW Swing Pause Angle [deg]	○	○
		572	CCW Swing Pause Servo Lock Time [ms]	○	○
		573	CCW Swing Resume Dwell Time [ms]	○	○
Sequence	P.01~P.64	580	Sequence Mode	○	○
		581	Sequence Stage 1	○	○
		582	Sequence Stage 2	○	○
		583	Sequence Stage 3	○	○
		584	Sequence Stage 4	○	○
		585	Sequence Stage 5	○	○
		586	Sequence Stage 6	○	○
		587	Sequence Stage 7	○	○
		588	Sequence Stage 8	○	○

Fastening Settings

D-No.000 Fastening Method

Standard setting: 0

The method used for fastening is set.

0: Torque Method, 1: Angle Method

D-No. 001 Fastening Steps

Standard setting: 1

The number of steps used in fastening is set.

1: 1-Step Fastening

- Fastening is performed up to D-No. 103 [Standard Torque] or D-No. 202 [Standard Angle] without stopping in the middle.

2: 2-Step Fastening

- After fastening is started, fastening is stopped temporarily at D-No. 105 [1st Torque] or D-No. 203 [1st Angle]. After the temporary stop, fastening to the set target value is performed (the downtime between steps differs according to the system).

3: 3-Step Fastening

- After fastening is started, fastening is stopped temporarily twice, at D-No. 105 [1st Torque] or D-No. 203 [1st Angle] and at D-No. 109 [2nd Torque] or D-No. 204 [2nd Angle]. After the second temporary stop, fastening to the set target value is performed (the downtime between steps differs according to the system).

D-No. 002 Fastening Option

Standard setting: 010000

The option used in fastening is set.

****1: Reverse Before Fastening (can only be used in the single system)

- Before the start of the fastening operation, reverse rotation at D-No. 405 [Reverse 1 Speed] is executed for D-No. 505 [Reverse Revolutions before Fastening].

****1*: Fastening Direction CCW

- This is a special fastening option for performing a screw loosening operation or for fastening left-hand screws, etc. Normal rotation is performed in the CCW direction (counterclockwise direction) and reverse rotation is performed in the CW direction (clockwise direction).

***1**: Torque Hold Between Steps

- In 2-step fastening, 1/4 the value of the torque at stopping is maintained during the 1st step (1st torque, 1st angle) stopping until the subsequent fastening operation is restarted.
- In 3-step fastening, 1/4 the value of the torque at stopping is maintained during the 1st step (1st torque, 1st angle) stopping and the 2nd step (2nd torque, 2nd angle) stopping until the subsequent fastening operation is restarted.

1*: Disable Stored Curve Data Save

- The curve record is not stored after the end of fastening (the NG (failure) curve record is stored).

*1****: Disable Angle Count Below Snug Torque

- The angle measurement is interrupted while a torque lower than the Snug torque is detected and the angle measurement is restarted when a torque no less than the Snug torque is detected.

* When this is made unavailable, the angle measurement is continued regardless of the value of the torque after detection of the Snug torque.

1***** : Option

- Unavailable



Be careful as the fastening judgment is not performed regardless of the values of the high and low limit set values when the settings of the fastening parameters D-No. 003 “Judgment Item 1” and D-No. 004 “Judgment Item 2” are 0.

D-No. 003 Judgment Item 1 Target setting: 111101

****1: Peak Torque Check **Only the change 0 → 1 is enabled.**

- Whether or not the peak torque during the fastening operation is within the range of the high and low limit values is judged.

****1*: Final Torque Check

- Whether or not the final torque at the end of the fastening operation is within the high and low limit ranges is judged.

***1**: Final Angle Check **Only the change 0 → 1 is enabled.**

- Whether or not the final angle at the end of the fastening operation is within the high and low limit ranges is judged.

The starting point of angle measurement is D-No. 107 [Snug Torque].

1*: Rate 1 Check

- Whether or not the torque slope from D-No. 112 [Rate 1 Start Torque] to D-No. 113 [Rate 1 End Torque] is within the high and low limit ranges when D- No. 113 [Rate 1 End Torque] is attained is judged.

*1****: Rate 2 Check

- Whether or not the torque slope from D-No. 114 [Rate 2 Start Torque] to D-No. 115 [Rate 2 End Torque] is within the high and low limit ranges when D- No. 115 [Rate 2 End Torque] is attained is judged.

1*****: Rate 3 Check

- Whether or not the torque slope from D-No. 116 [Rate 3 Start Torque] to D-No. 117 [Rate 3 End Torque] is within the high and low limit ranges when D- No. 117 [Rate 3 End Torque] is attained is judged.

D-No. 004 Judgment Item 2 Standard setting: 000001

****1: Timeout Check **Only the change 0 → 1 is enabled.**

- Whether or not the fastening time from the start of fastening to D-No. 105 [1st Torque] or D-No. 205 [1st Angle] or from D-No. 105 [1st Torque] or D-No. 205 [1st Angle] to the end of fastening is within the high and low limit ranges is judged respectively.

****1*: Revolution Check

- Whether or not the number of rundown revolutions from the start to end of fastening is within the high and low limit ranges is judged.

***1**: Differential Angle Check

- Whether or not the differential angle, calculated from the rate 2 from D-No.114 [Rate 2 Start Torque] to D-No. 115 [Rate 2 End Torque] and the final torque, is within the high and low limit ranges is judged.

1*: Snug Torque Check

- Whether or not the torque value is within the high limit range is judged when D-No. 107 [Snug Torque] is detected.

*1****: Break Away Torque Check

- Whether or not the torque value is within the high limit range is judged during reverse operation.

1*****: Torque Inhibit Check

- Whether or not the torque value is within the high limit range is judged during operation at D-No. 205 [Torque Inhibit Angle].

D-No.005 After Fastening Operation Standard setting: 000000

****1: 1 Pulse Reverse

- After the end of fastening, the torque is reversed at the D-No. 121 [1 Pulse Reverse Torque High Limit]. The 1 Pulse Reverse is performed at the D-No. 410 [1 Pulse Reverse Speed] for the D-No. 316 [1 Pulse Reverse Time].

****1*: End Slope (priority given to Torque Recovery)

- The reaction force of the tool at the end of fastening is suppressed.
Apply a current limit of 2/3 times the current at the end of fastening.
The current limit is decreased so that 200ms later, it is 0% and fastening is stopped.

****1*: Torque Recovery

- After the target is reached, the standard torque is maintained for the D-No. 315 [Torque Recovery Time]. The fastening speed during execution of the torque recovery is the D-No. 404 [3rd Speed].

***1**: Servo Lock (Hold)

- At the end of operation, the motor is locked to fix the top to prevent rotation of the tool. However, if a backlash occurs in the gear part or socket, etc., rotation is performed within ranges that include the backlash. The servo lock function is also executed when a reverse operation according to the REVERSE signal.
 - The servo lock can be released by turning the PLC I/O input signal "START," "RESET," or "BYPASS" to "ON" or "STOP" to "OFF". It can also be monitored by the fastening result mode D-No. 16 "Servo Lock Flag" of the indicator.

****1*: Recovery Pulse (priority given to Torque Recovery)

- A retightening operation after fastening is performed by pulsing.
Pulsing operation cycles at the D-No. 551 [Recovery Pulsing Speed] are executed for the number of times defined by the D-No. 550 [Recovery Pulsing Count].



【Precautions on the After Fastening Operation】

- "End Slope" and "Recovery Pulse Operation" are not performed when the "Torque Recovery" is effective. Only the "Recovery Pulse Operation" is performed when both "End Slope" and "Recovery Pulse Operation" are effective.

D-No.006 Interrupt Operation During Fastening Standard setting: 000000

*****1: Pulse Fastening Operation

- Set this to ON if fastening by pulsing is to be performed (pulsing is started after detection of 1ST).

****1*: Gyro Setup Enable

- With a P type or T type tool, the pause operation functions are enabled when this is set to ON.

***1**: Angle Head Torque Variation Monitor

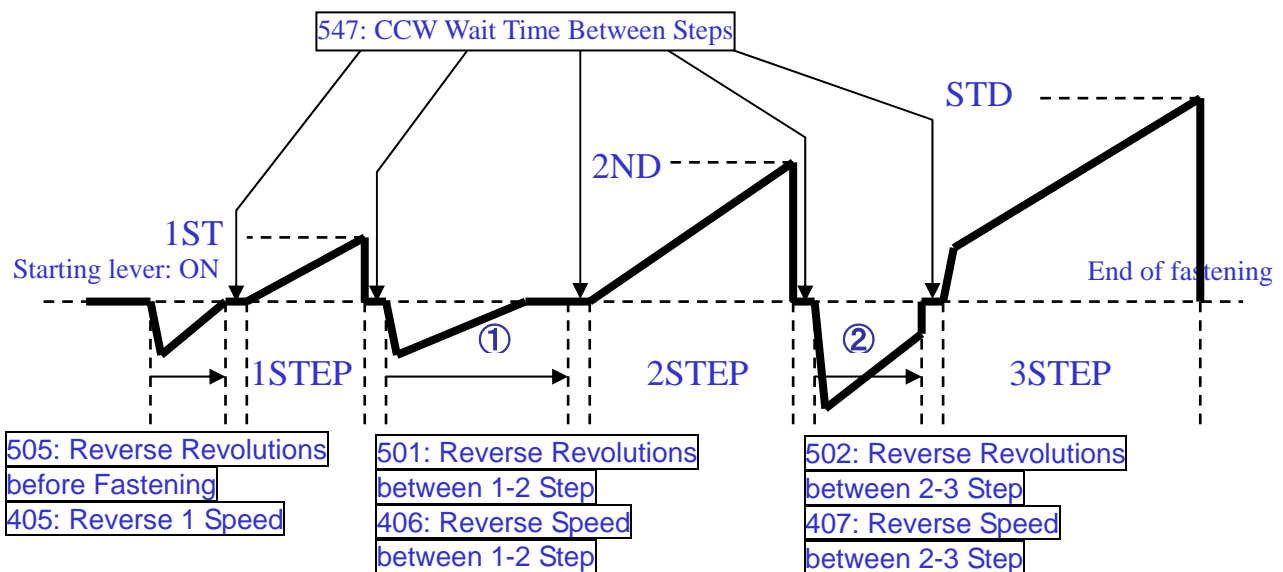
- With an angle head tool, the torque variation is monitored when this is set to ON.

1*: Reverse Between 1-2 Step

- If this is set to ON and there is a 1ST stop, a reverse operation is performed before restarting (① in the diagram below).

*1****: Reverse Between 2-3 Step

- If this is set to ON and there is a 2ND stop, a reverse operation is performed before restarting (② in the diagram below).



Torque

D-No. 100 Calibration Torque [N·m]

Setting range: 70% ~ 120% of the standard calibration torque of the tool

The calibration torque value of the connected tool is set. In a case where a socket or offset gear, with which a load is applied to the tool top, is connected or in a case where, due to the workpiece characteristics, the indicated fastening result value differs from the result obtained by a fastening torque tester, etc., the fastening torque can be corrected by the setting of the calibration torque.

$$\text{Changed calibration torque} = \text{Measured torque (tester result)} \div \text{standard torque} \times \text{Current calibration torque}$$

Example: In the case of:

D-No. 100 [Calibration Torque]	: 294.2N·m	}
D-No. 103 [Standard Torque]	: 200.0N·m	
Measured value (test result)	: 210.0N·m	

$$210.0\text{N}\cdot\text{m} \div 200.0\text{N}\cdot\text{m} \times 294.2\text{N}\cdot\text{m} = 308.9\text{N}\cdot\text{m}$$

And therefore the calibration torque is changed to 308.9N·m.

If the calibration torque is to be changed, calculate the average value from the fastening results data as the measured torque (as a guideline based on a statistical standpoint, use 20 as the sample number of the fastening results data).



When the calibration torque is changed, confirm that other torque-related parameters are lower than the changed calibration torque. The other torque-related parameters must be set to values lower than the maximum torque value of the tool and the calibration torque.

D-No. 101 Peak Torque Low Limit [N·m] Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.1

D-No. 102 Peak Torque High Limit [N·m] Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.3

The low and high limit values of the fastening torque are set.

When the fastening torque exceeds the peak torque high limit or falls below the peak torque low limit, the REJECT axis judgment is made.

D-No. 103 Standard Torque [N·m]

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

The standard torque for fastening is set. This is effective only when D-No. 000 [Fastening Method] is the torque method.

Example: When 10.0 is set, fastening is executed until the torque value becomes 10.0[N·m].

[Caution Regarding Fastening]



Avoid performing fastening at a torque exceeding the maximum fastening torque of a tool.

Also, do not use a tool outside the specified duty cycle (ratio of fastening time and downtime) range, even if the maximum fastening torque is not exceeded.

D-No. 104 Ramp Down Start Torque [N·m]

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

The torque value at which D-No. 401 [Freerun Speed] is switched to D-No. 402 [1st Speed] is set. However, even if the ramp down start torque is not detected, switching to D-No. 402 [1st Speed] is performed when D-No. 500 [Freerun Revolutions] is attained.

D-No. 105 1st Torque [N·m] Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

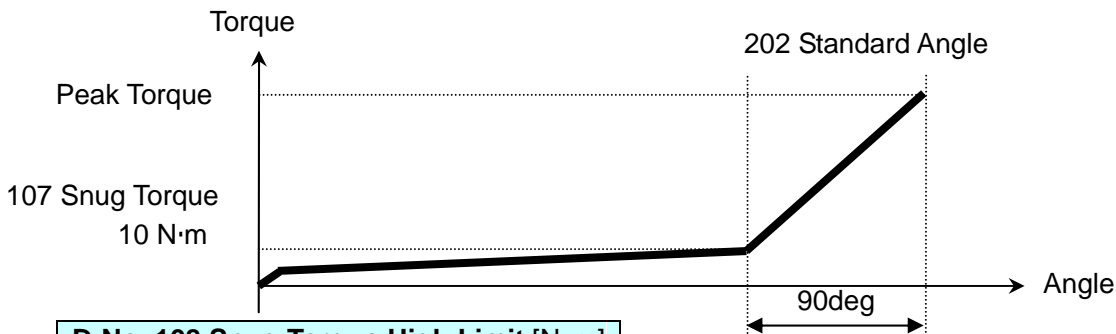
This is the end point of the 1st time from the start of fastening. The torque value at which D-No. 401 [Freerun Speed] or D-No. 402 [1st Speed] is switched to D-No. 402 [2nd Speed] is set. Switching to D-No. 402 [2nd Speed] is also switched at the point at which the 1st torque or D-No. 203 [1st Angle] is detected.

The 1st torque is also the point of synchronization in the 1st step in 2-step fastening and 3-step fastening in the fastening sequence. If the 1st torque is not to be used in the fastening control, input the same value as D-No. 100 [Calibration Torque].

D-No. 107 Snug Torque [N·m] Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

This is the start torque for angle measurement (this is the start point of angle measurement). If D-No. 000 [Fastening Method] is the angle method, this is the start point of fastening. Angle measurement and judgment are started from the Snug torque.

(Example: In case of Snug torque of 10N•m, D-No.202 [Standard Angle] of 90deg)



D-No. 108 Snug Torque High Limit [N·m]

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.1

The high limit value of the start torque for angle measurement is set. If the value of D-No.107 [Snug Torque] exceeds the Snug torque high limit, the REJECT fastening judgment is made.

D-No. 109 2nd Torque [N·m] Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

When the 2nd torque or D-No. 204 [2nd Angle] is detected during operation at D-No. 402 [2nd Speed], switching to D-No. 403 [3rd Speed] is performed. The 2nd torque is also the point of synchronization in the 2nd step in 3-step fastening in the fastening sequence.

If the 2nd torque is not to be used in the fastening control, input the same value as D-No. 100 [Calibration Torque].

D-No. 110 Reverse Torque High Limit [N·m]

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.3

The high limit value of the torque during reverse operation is set. When the reverse torque high limit is exceeded during reverse operation, fastening is stopped and the abnormal state signal A.09-08 "Reverse Torque Error" is generated.

◆Reverse Torque Judgment: [Neglect] ●●

Manual reverse rotation by the PLC I/O input signal "REVERSE"
Reverse rotation operation by the lever on.

◆Reverse Torque Judgment: [Enable] ●●

Reverse operation by the fastening option "Reverse After Fastening"
Reverse operation by the fastening option "Reverse Between 1-2 Steps"
Reverse operation by the fastening option "Reverse Between 2-3 Steps"



· D-No. 110 [Reverse Torque High Limit] limit is caused when you loose the bolt already fastened over 5N·m of default setting in the case of the reverse operation and it automatically stops for safety.

D-No. 111 Torque Inhibit Limit [N·m]

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.3

This is used to perform torque inhibition at the start of fastening. The torque inhibition is executed from the start of fastening until D-No. 205 [Torque Inhibit Angle] is reached. If the starting torque inhibit high limit is exceeded during the torque inhibition, the REJECT fastening judgment is made.

D-No. 112 Rate 1 Start Torque [N·m]**D-No. 113 Rate 1 End Torque [N·m]**

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

The measurement start point and measurement end point of the torque rate 1 are set. The torque slope (slope of torque vs. angle) from the rate 1 start torque to the rate 1 end torque is measured and judged.

D-No. 114 Rate 2 Start Torque [N·m]**D-No. 115 Rate 2 End Torque [N·m]**

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

The measurement start point and measurement end point of the torque rate 2 and the differential angle are set. The torque slope (slope of torque vs. angle) from the rate 2 start torque to the rate 2 end torque is measured and judged.

D-No. 116 Rate 3 Start Torque [N·m]**D-No. 117 Rate 3 End Torque [N·m]**

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

The measurement start point and measurement end point of the torque rate 3 are set. The torque slope (slope of torque vs. angle) from the rate 3 start torque to the rate 3 end torque is measured and judged.

D-No. 118 Final Torque Low Limit [N·m] Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.1

D-No. 119 Final Torque High Limit [N·m] Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.3

The low and high limit values of the torque at the end of fastening are set.

- If D-No. 000 [Fastening Method] is the “Torque Method,” the values of the final torque and the peak torque will be equal - therefore set the same values as D-No. 101 [Peak Torque Low Limit] and D-No. 102 [Peak Torque High Limit]. * Set values that differ only when D-No. 006 [After Fastening Operation]: “Torque Recovery” is used.
- If D-No. 000 [Fastening Method] is the “Angle Method,” set the low and high and limit values of the fastening torque at the point at which the standard angle is reached. If the fastening torque exceeds the final torque high limit or falls below the final torque low limit, the REJECT axis judgment is made.

D-No.120 Option [N·m]

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.0

*Not used

D-No. 121 1 Pulse Reverse Torque High Limit [N·m]

Setting range: 0 ~ D-No. 100 [Calibration Torque] × 1.1

This is the torque used in the D-No. 006 [After Fastening Operation]: “1 Pulse Reverse” operation.

The torque limit value during the operation is set. Normally, set this to be no more than half the standard torque.

Angle

D-No. 200 Final Angle Low Limit [deg]

D-No. 201 Final Angle High Limit [deg]

Setting range: 0 ~ 9999.9

The low and high limit values of the output judgment angle are set. When the fastening angle exceeds the final angle high limit or falls below the final angle low limit, the REJECT axis judgment is made. These are used to detect elongation or seizing of the bolt during fastening.

These are used to detect elongation or seizing of the bolt during fastening.

D-No. 203 1st Angle [deg]

Setting range: 0 ~ 9999.9

This is the end point of the 1st time from the start of fastening. The torque value at which D-No. 401 [Freerun Speed] or D-No. 402 [1st Speed] is switched to D-No. 402 [2nd Speed] is set. Switching to D-No. 402 [2nd Speed] is also performed at the point at which D-No. 105 [1st Torque] or the 1st angle is detected.

The 1st angle is also the point of synchronization in the 1st step in 2-step fastening and 3-step fastening in the fastening sequence. If the 1st angle is not to be used in the fastening control, input a value greater than D-No. 201 [Final Angle High Limit].

D-No. 204 2nd Angle [deg]

Setting range: 0 ~ 9999.9

When D-No. 109 [2nd Torque] or the 2nd angle is detected during operation at D-No. 402 [2nd Speed], switching to D-No. 403 [3rd Speed] is performed.

The 2nd angle is also the point of synchronization in the 2nd step in 3-step fastening in the fastening sequence. If the 2nd angle is not to be used in the fastening control, input a value greater than D-No. 201 [Final Angle High Limit].



Caution

• If 2-step or 3-step fastening is used by the fastening sequence, set a value greater than D-No. 203 [1st Angle] to D-No. 204 [2nd Angle].

D-No. 205 Torque Inhibit Angle [deg]

Setting range: 0 ~ 9999.9

The angle to which the starting torque inhibition is to be performed from the start of fastening is set.

* When the torque inhibit angle is set to "0," the torque inhibit check will not be performed.



Caution

- " Starting Torque Inhibit " does not work with the following settings.
- D-No. 004 [Output Judgment Item 2] : "Torque Inhibit Judgment" "0"
- D-No. 205 [Torque Inhibit Angle] : "0"

D-No. 206 Differential + Angle [deg]

D-No. 207 Differential – Angle [deg]

Setting range: -999.9 ~ 999.9

The high and low limit values for the differential angle check are set. The differential angle difference is judged from the rate 2 and the final torque, regardless of the fastening method. To input a negative value, move the cursor (flashing number) at the DATA indication part to the position of "P" and then press the "▲" or "▼" switch to make "-" be indicated at the cursor position.

D-No.208 Option [deg]

Setting range: 0 ~ 9999.9

*Not used

D-No.209 Correction Angle [deg]

Setting range: -99.9 ~ 99.9

*Not used

Rate

D-No. 300 Rate 1 Low Limit [N·m/deg]

Setting range: - maximum torque rate of tool ~ maximum torque rate of tool

The low limit value of the slope of torque vs. angle between the two points of D-No. 112 [Rate 1 Start Torque] ~ D-No. 113 [Rate 1 End Torque] is set. A judgment is made at the point at which D-No. 113 [Rate 1 End Torque] is attained.

D-No. 301 Rate 1 High Limit [N·m/deg]

Setting range: - maximum torque rate of tool ~ maximum torque rate of tool

The high limit value of the slope of torque vs. angle between the two points of D-No. 112 [Rate 1 Start Torque] ~ D-No. 113 [Rate 1 End Torque] is set. A judgment is made at the point at which D-No. 113 [Rate 1 End Torque] is attained.

D-No. 302 Rate 2 Low Limit [N·m/deg]

Setting range: - maximum torque rate of tool ~ maximum torque rate of tool

The low limit value of the slope of torque vs. angle between the two points of D-No. 114 [Rate 2 Start Torque] ~ D-No. 115 [Rate 2 End Torque] is set. A judgment is made at the point at which D-No. 115 [Rate 2 End Torque] is attained.

D-No. 303 Rate 2 High Limit [N·m/deg]

Setting range: - maximum torque rate of tool ~ maximum torque rate of tool

The high limit value of the slope of torque vs. angle between the two points of D-No. 114 [Rate 2 Start Torque] ~ D-No. 115 [Rate 2 End Torque] is set. A judgment is made at the point at which D-No. 115 [Rate 2 End Torque] is attained.

D-No. 304 Rate 3 Low Limit [N·m/deg]

Setting range: - maximum torque rate of tool ~ maximum torque rate of tool

The low limit value of the slope of torque vs. angle between the two points of D-No. 116 [Rate 3 Start Torque] ~ D-No. 117 [Rate 3 End Torque] is set. A judgment is made at the point at which D-No. 117 [Rate 3 End Torque] is attained.

D-No. 305 Rate 3 High Limit [N·m/deg]

Setting range: - maximum torque rate of tool ~ maximum torque rate of tool

The high limit value of the slope of torque vs. angle between the two points of D-No. 116 [Rate 3 Start Torque] ~ D-No. 117 [Rate 3 End Torque] is set. A judgment is made at the point at which D-No. 117 [Rate 3 End Torque] is attained.

* To input a negative value for any of D-No. 300 ~ D-No. 305, move the cursor (flashing number) at the DATA indication part to the position of "P" and then press the "▲" or "▼" switch to make "-" be indicated at the cursor position.



• The minimum (maximum) torque rate of a tool differs according to the tool model.
Please refer to "Tool Models" regarding the allowed input range.

Time**D-No. 310 Initial Time [sec]** Setting range: 0.0 ~ 999.9

The time for shock relaxation, fitting of the bolt and socket, etc., at the start of fastening is set. Operation at D-No. 400 [Initial Speed] is executed during the initial time or during D-No. 500 [Freerun Revolutions].

Although when "0.0" is set as the initial time, operation is started at D-No. 401 [Freerun Speed], when "0.0" is set as D-No.500 [Freerun Revolutions], operation at the initial speed is executed for the initial time and thereafter, operation at the 1st speed is executed.

D-No. 311 1st Time Low Limit [sec] Setting range: 0.0 ~ 999.9

The value of the low limit of time until D-No. 105 [1st Torque] or D-No. 203 [1st Angle] is attained from the start of fastening is set.If the time of attainment falls short of the 1st time low limit, the REJECT axis judgment is made.

D-No. 312 1st Time High Limit [sec] Setting range: 0.0 ~ 999.9

The value of the high limit of time until D-No. 105 [1st Torque] or D-No. 203 [1st Angle] is attained from the start of fastening is set.If the 1st time high limit is exceeded, the REJECT axis judgment is made.

D-No. 313 2nd Time Low Limit [sec] Setting range: 0.0 ~ 999.9

The value of the low limit of time until D-No. 103 [Standard Torque] or D-No. 202 [Standard Angle] is attained from the attainment of D-No. 105 [1st Torque] or D-No. 203 [1st Angle] is set. If the time of attainment falls short of the 2nd time low limit, the REJECT axis judgment is made.

D-No. 314 2nd Time High Limit [sec] Setting range: 0.0 ~ 999.9

The value of the high limit of time until D-No. 103 [Standard Torque] or D-No. 202 [Standard Angle] is attained from the attainment of D-No. 105 [1st Torque] or D-No. 203 [1st Angle] is set. If the 2nd time high limit is exceeded, the REJECT axis judgment is made.

D-No. 315 Torque Recovery Time [sec] Setting range: 0.0 ~ 5.0

After the standard torque is attained, the standard torque is maintained for the torque recovery time. Fastening equivalent to manual retightening is made possible.

* Normally, set this to 0. Otherwise, the abnormal state signal Abn.08-10 "Overload Error" may be generated.

D-No.316 1 Pulse Reverse Time [sec] Setting range: 0.0 ~ 9.99

This is the time used in D-No. 006 [After Fastening Operation]: "1 Pulse Reverse."

During the 1 Pulse Reverse Time, an operation for preventing the locking of the socket is performed.

D-No. 408 Ramp Up Time [sec] Setting range: 0.1 ~ 5.0, standard setting: 0.5

The time constant for acceleration from zero speed to attainment of the maximum rotation speed of a tool in the fastening operation is set. The ramp up time is used in the following cases.

- From the start of fastening by the raising ("OFF" → "ON") of the PLC I/O input signal "START" to attainment of D-No. 400 "Initial Speed" or D-No. 401 "Freerun Speed."

D-No.409 Ramp Down Time [sec] Setting range: 0.0 ~ 5.0, standard setting: 0.5

The time constant for deceleration from the maximum rotation speed of a tool to attainment of zero speed upon attainment of D-No. 500 [Freerun Revolutions] in the fastening operation is set.

Deceleration time (Freerun Revolutions) is used also for the downtime during manual reversing.

Speed



Caution

• The minimum tool rotation speed and the maximum tool rotation speed differ according to the tool model.

Please refer to “Tool Models” regarding the allowed input range.

D-No. 400 Initial Speed [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

The speed for impact relaxation, fitting of the bolt and socket, etc., at the start of fastening is set. Operation at the initial speed is executed during D-No. 310 [Initial Time].

D-No. 401 Freerun Speed [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

The speed for high-speed rotation after the end of D-No. 310 [Initial Time] is set. Rotation at the freerun speed is performed for D-No. 500 [Freerun Revolutions] or until D-No. 310 [Slowdown Start Torque] is attained.

D-No. 402 1st Speed [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

The speed for operation between the operations at D-No. 401 [Freerun Speed] and D-No. 403 [2nd Speed] is set. Rotation at the 1st speed is performed from the detection of D-No. 104 [Ramp Down Start Torque] to the detection of D-No. 105 [1st Torque] or from the detection of D-No. 104 [Ramp Down Start Torque] to the detection of D-No. 203 [1st Angle].

* If D-No. 105 [1st Torque] or D-No. 203 [1st Angle] is attained during the operation at D-No. 401 [Freerun Speed], the 1st speed is not used and switching to D-No. 403 [2nd Speed] is performed.

D-No. 403 2nd Speed [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

The speed from the 2nd step onward is set. This is the speed after detection of D-No. 105 [1st Torque] or D-No. 203 [1st Angle].

* The slower the 2nd speed, the better the fastening accuracy.

D-No. 404 3rd Speed [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

The speed from the 3rd step onward is set. This is the speed after detection of D-No. 106 [2nd Torque] or D-No. 204 [2nd Angle].

* The slower the 3rd speed, the better the fastening accuracy. Also, if the 3rd speed is not to be used, set the same value as D-No. 403 [2nd Speed].

D-No.405 Reverse 1 Speed [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

The speed during reverse operation is set.

This is the reverse speed at which rotation is performed while the REV. switch of the indicator is pressed.

This is also the speed used in D-No. 002 [Fastening Option]: "Reverse before Fastening."

D-No.406 Reverse Speed between 1-2 Step [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

The speed during reverse operation is set.

This is the speed used in D-No. 006 [Fastening Interrupt Operation]: "Reverse Between 1-2 Steps ON."

D-No.407 Reverse Speed between 2-3 Step [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

The speed during reverse operation is set.

This is the speed used in D-No. 006 [Fastening Interrupt Operation]: "Reverse Between 2-3 Steps ON."

D-No.410 1 Pulse Reverse Speed [rpm]

Setting range: Minimum tool rotation speed to maximum tool rotation speed

This is the speed used in D-No. 005 [After Fastening Operation]: "1 Pulse Reverse."

Revolutions/Current

D-No. 500 Freerun Revolutions [rev.] Setting range: 0 ~ 99.9

The number of revolutions, from the start of fastening, at which switching to D-No. 402 [1st Speed] is performed is set. However, even if the freerun revolutions are not reached, switching to D-No. 402 [1st Speed] is performed when D-No. 104 [Ramp Down Start Torque] is detected. If "0.0" is set as D-No. 500 [Freerun Revolutions], operation at the 1st speed is executed after operation at the initial speed has been performed for D-No. 310 [Initial Time].

D-No. 501 Reverse Revolutions between 1-2 Step [rev.] Setting range: 0 ~ 99.9

This is the number of revolutions used in D-No. 006 [Fastening Interrupt Operation]: "Reverse Between 1-2 Steps ON."

D-No. 502 Reverse Revolutions between 2-3 Step [rev.] Setting range: 0 ~ 99.9

This is the number of revolutions used in D-No. 006 [Fastening Interrupt Operation]: "Reverse Between 2-3 Steps ON."

D-No. 503 Rundown Revolution Low Limit [rev.] **D-No. 504 Rundown Revolution High Limit [rev.]**

Setting range: 0 ~ 99.9

The low and high limit values of the number of revolutions from the start of fastening to the end of fastening are set.

If the number of revolutions at the end of fastening exceeds the rundown revolution high limit or falls below the rundown revolution low limit, the REJECT axis judgment is made.

D-No.505 Reverse Revolutions before Fastening [rpm] Setting range: 0 ~ 99.9

This is the number of revolutions used in [Fastening Option]: "Reverse before Fastening."

D-No.520 Full Scale Current Value [%] **D-No.521 Low Current Limit [%]**

D-No.522 High Current Limit [%] **D-No.523 Fastening Current Limit [%]**

Setting range: 0 ~ 100

Warning is displayed by a user console. It is not displayed the warning to a controller.

Time

D-No.540 Number of Accept [times] Setting range: 0~99

This designates the number of times of fastening and when fastening OK is issued for the number of times designated by the cycle count, the batch OK is output.

D-No.541 Angle Head Torque Variation Rate [%] Initial value: 0, Setting range: 0~100

When reaching the Standard Torque and the monitored curve variation of the torque curve shows the percentage (%) of torque variation exceeding the angle head torque variation [%], the angle head error occurs as the abnormal signal A.09-10 "Angle head torque variation abnormal".

*The torque variation check can only be performed with the angle head type (-A) tool.

D-No.542 Pause-Between-Steps Servo Lock Time [msec] Initial value: 5

Setting range: 0~200

The servo lock time when the fastening is stopped temporarily as a pause between steps is set. This is used when 2-step fastening or 3-step fastening is performed.

D-No.543 Pause-Between-Steps Restart Time [msec] Initial value: 15

Setting range: 0~200

The time until rotation is started again after the fastening has been stopped temporarily as a pause between steps is set.

When the set time is increased, the fastening time is increased correspondingly.

This is used when 2-step fastening or 3-step fastening is performed.

D-No.544 Ramp Down Time 0~200ms (Initial value: 0)

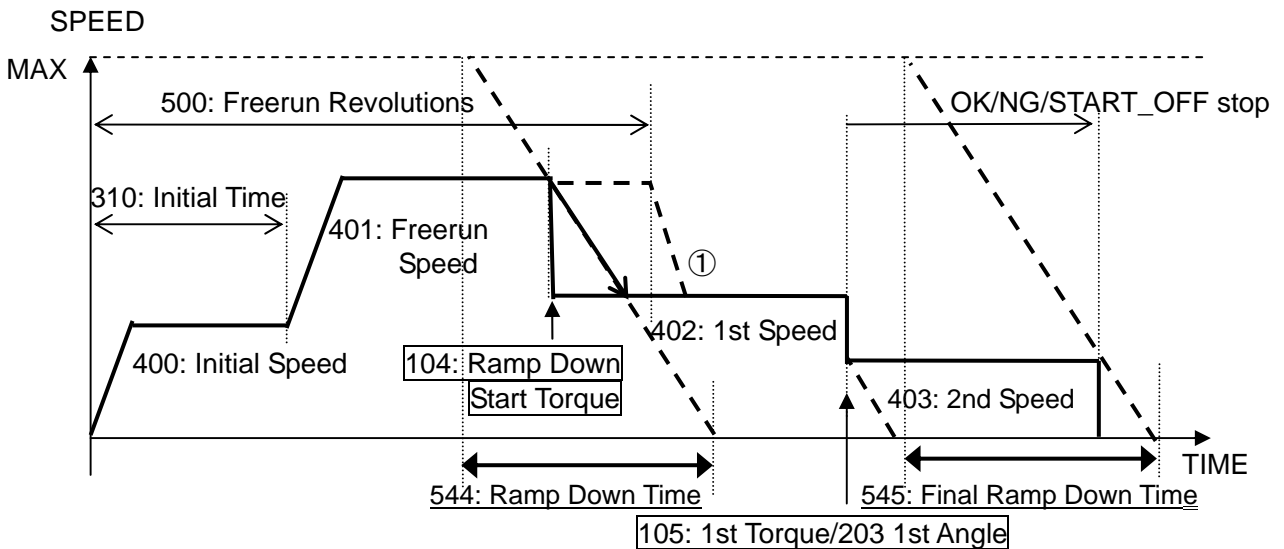
D-No.545 Final Ramp Down Time 0~200ms (Initial value: 0)

Damage to the tool that occurs during deceleration is alleviated by the slope stop function.

Ramp Down Time ••• Freerun speed → Attainment of ramp down start torque → SD ramp down → 1st speed

However when the front panel SW1-3 is turned on (rapid deceleration operation), the ramp down time is set to 16msec

Final Ramp Down Time ••• Ordinary stop (OK/NG/START_OFF)



① Freerun speed → Attainment of freerun revolutions → 409: Slowdown Time (0.1~5.0sec) → 1st speed

D-No.546 Reverse Ramp Up Time [msec] Setting range: 100~5000, Standard setting: 500

The time constant for acceleration from zero speed to the maximum rotation speed of the tool in reverse rotation operation is set. The reverse ramp up time is used in the following cases.

- Manual reverse by raising (“OFF”→“ON”) of the PLC I/O input signal “REVERSE.”
- This is the reverse ramp up time used in D-No. 002 [Fastening Option]: “Reverse before Fastening.”
- This is the reverse ramp up time used in D-No. 006 [Fastening Interrupt Operation]: “Reverse Between 1-2 Steps ON.”
- This is the reverse ramp up time used in D-No. 006 [Fastening Interrupt Operation]: “Reverse Between 2-3 Steps ON.”

D-No.547 CCW Wait Time Between Steps [msec]

Setting range: 0~500, Standard setting: 200

This is the waiting time during which operation is stopped when normal rotation changes to reverse rotation and vice versa when fastening is interrupted by a reverse rotation operation.

- This is the reverse wait time used in D-No. 002 [Fastening Option]: “Reverse before Fastening.”
- This is the reverse wait time used in D-No. 006 [Fastening Interrupt Operation]: “Reverse Between 1-2 Steps ON.”
- This is the reverse wait time used in D-No. 006 [Fastening Interrupt Operation]: “Reverse Between 2-3 Steps ON.”

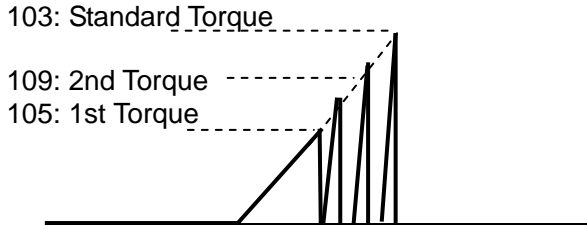
Pulsing

D-No.006 Interrupt Operation During Fastening : Pulse Fastening Operation ON

Set value: xxxxx1

By setting "1" for Pulse Fastening Operation ON as Data No. 006 Fastening Interrupt Operation, the pulse fastening operation is performed from after the detection of the 1st torque (D-No. 105) to the attainment of the standard torque (D-No. 103).

Operation speed: 1st torque ~ 2nd torque/2nd speed (D-No. 403)
 2nd torque ~ standard torque/3rd speed (D-No. 404)



D-No.005 After Fastening Operation: Recovery Pulse ON

Set value: xxxx1x

D-No.550 Recovery Pulsing Count [times]

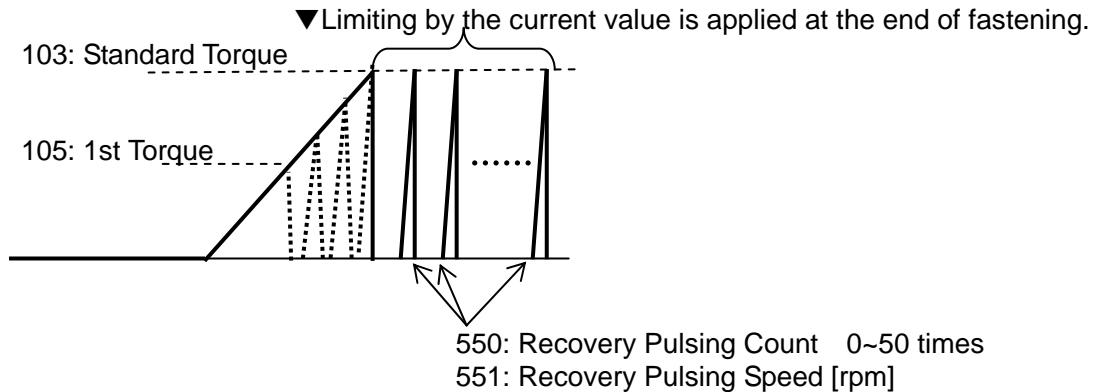
Setting range: 0~50

D-No.551 Recovery Pulsing Speed [rpm]

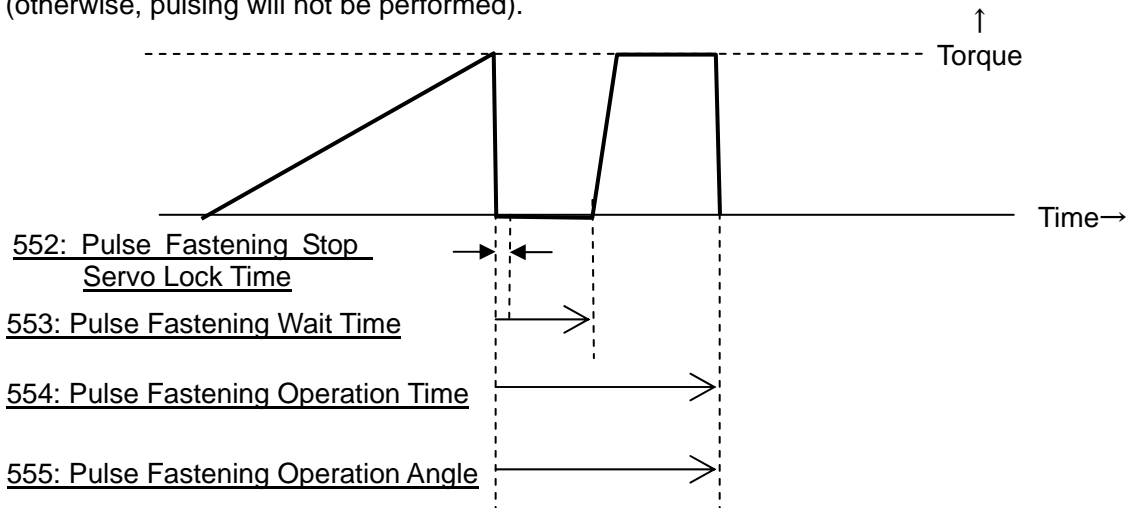
Setting range: within tool speed range

By setting "1" for Recovery Pulse Operation ON as Data No. 005 After Fastening Operation, refastening is performed for the number of times defined by the recovery pulsing count (D-No. 550) after fastening to the standard torque (D-No. 103).

Operation speed: Recovery pulsing speed (D-No. 551)



During recovery pulsing, the parameters for pulse fastening operation are used.
 (Caution) Be sure to set the parameters so that Pulsing Cycle Time > Pause Time
 (otherwise, pulsing will not be performed).



D-No.552 Pulse Fastening Stop Servo Lock Time [msec] Initial value: 5, Setting range: 0~200

Immediately after the fastening is paused, a servo lock is applied for the set amount of time to relax the stop shock.

D-No.553 Pulse Fastening Wait Time [msec] Initial value: 15, Setting range: 0~200

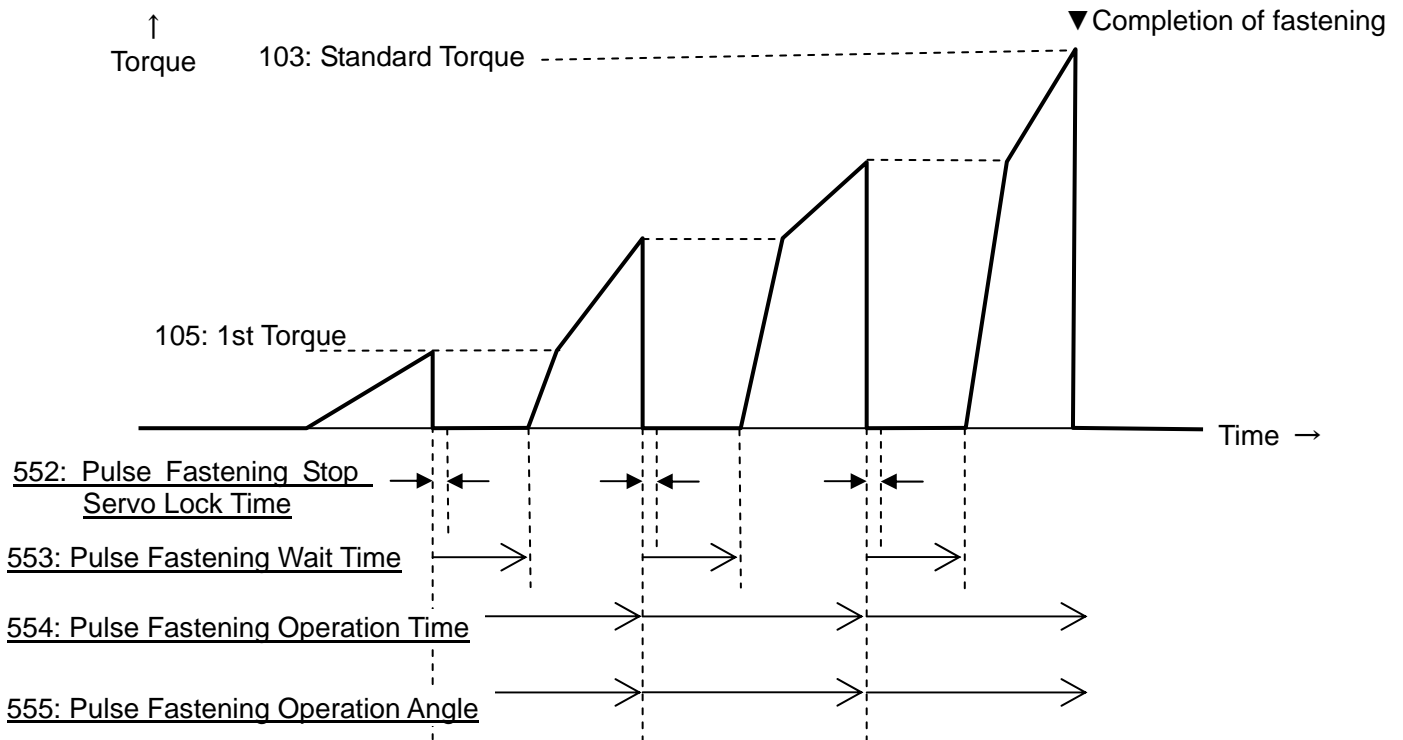
The time until rotation is started again from the point at which fastening is paused is set. When the set time is increased, the fastening time is increased correspondingly.

D-No.554 Pulse Fastening Operation Time [msec] Initial value: 30, Setting range: 0~200

Time required to restart the rotating until the next stop position is set, starting from the previous pause position. The fastening operation pauses only when the torque value at the previous pause is reached after the elapse of the Pulsing Cycle Time. A cycle means the operation time set at the operation time or the fastening up to the set operation angle. Set the operation time greater than the Wait time, otherwise the fastening process cannot be completed.

D-No.555 Pulse Fastening Operation Angle [deg] Initial value: 5, Setting range: 0~200

Angle required to restart the rotating until the next stop position is set, starting from the previous pause position. The fastening operation is paused only when the torque value at the previous pause is reached and the Pulsing Cycle Angle has been detected. Fastening temporarily stops either when it reaches the Pulsing Cycle Time or the Pulsing Cycle Angle.

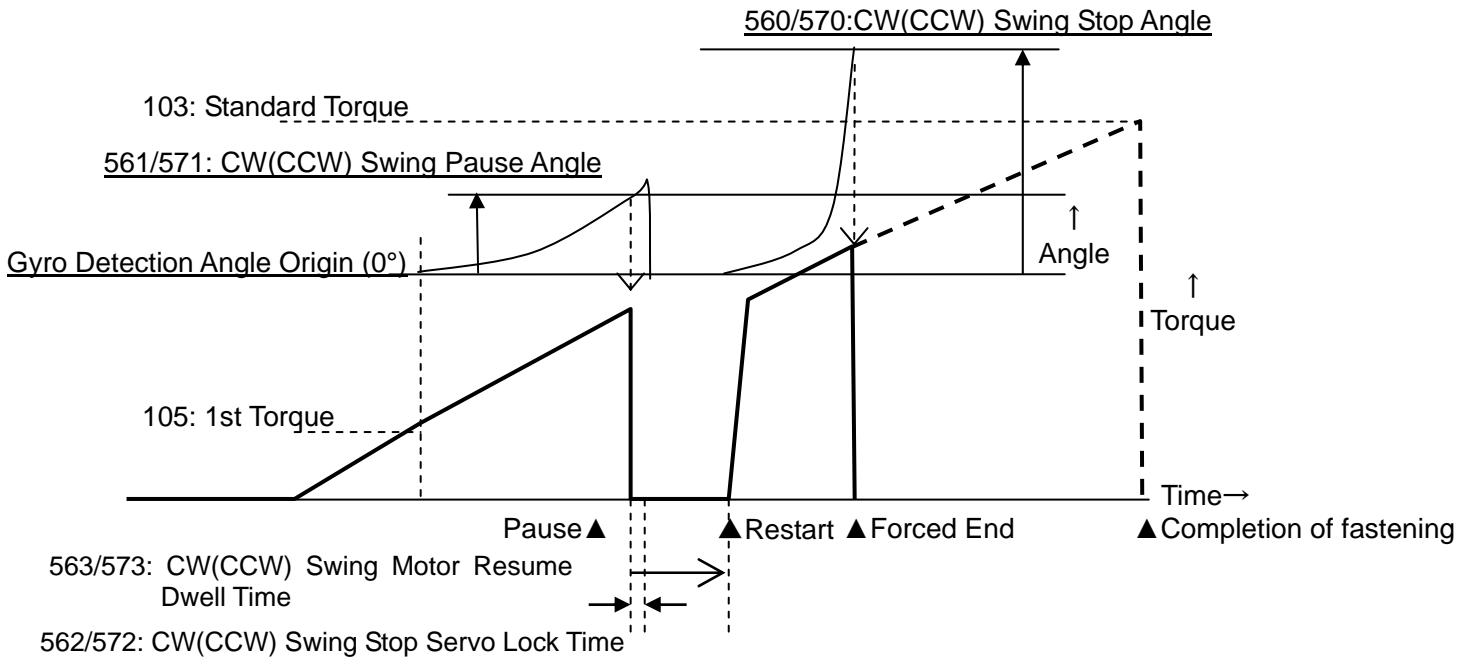


Gyro

D-No.006 Interrupt Operation During Fastening : Gyro Setup Enable ON Set value: xxxx1x

By setting "1" for Gyro Settings Available ON as data No. 006 Interrupt Operation During Fastening, a gyro pause operation is performed from after the detection of the 1st torque (D-No. 105) to the attainment of the standard torque (D-No. 103).

* This setting is available for a P (pistol) type or a T type tool (gyrosensor-incorporated type).



D-No.560 CW Swing Stop Angle [deg] Initial value: 30

D-No.570 CCW Swing Stop Angle [deg] Initial value: 30

Setting range: 0~200

The upper limit angle of tool shaking by a reaction force, at which the operation is to be ended forcibly, is set (always monitored).

When the angle of shaking of the tool exceeds this set value, the fastening operation is stopped (START OFF judgment).

D-No.561 CW Swing Pause Angle [deg] Initial value: 3

D-No.571 CCW Swing Pause Angle [deg] Initial value: 3

Setting range: 0~200

The angle of tool shaking by a reaction force, at which the operation is to be paused, is set.

When the angle of shaking of the tool exceeds this set value, the fastening operation is paused. After the pause, rotation is started again after the elapse of the pause time set as Data No. 563 or 573.

When the operation is paused, the detected angle value from the gyrosensor is reset to 0 degrees.

D-No.562 CW Swing Stop Servo Lock Time [msec] Initial value: 5

D-No.572 CCW Swing Stop Servo Lock Time [msec] Initial value: 5

Setting range: 0~200

When the tool is shaken and the fastening is paused, a servo lock is applied for the set amount of time to relax the stop shock.

D-No.563 CW Swing Motor Resume Dwell Time [msec] Initial value: 15

D-No.573 CCW Swing Motor Resume Dwell Time [msec] Initial value: 15

Setting range: 0~200

The time until rotation is started again from the point at which fastening is paused is set.

Ordinarily, this is set to be longer than the Servo Lock Time (however, use is possible even if Servo Lock Time > Gyro Pause Restart Time).

When the set time is increased, the fastening time is increased correspondingly.

Sequence Operation

Besides the standard fastening procedures of Parameter 1 ~ 64, two types of sequence operation modes, which are available for accommodating applications requiring a complex process, are provided. 64 types of fastening parameters can be used to program up to 8 stages.

Batch sequence: Multiple parameter settings are used and at each stage, an operation, each requiring a separate start signal, is repeated for the number of times designated by “Count.”

Continuous sequence: Up to 8 stages of operation with multiple parameter settings are executed successively. A single start signal must be sustained and held until the required sequences are completed.

The designation of a Sequence Operation Mode besides “0: Standard Operation” shall be handled as a sequence setting with Work Select No.=Parameter No.

[Precautions on the Sequence Operation Mode]



Caution

- Input the start signal via the external IO or the start lever of the tool.
 - Maintain the start signal for the sequence operation. (Deadman circuit)
 - The sequence operation immediately stops with any NG during it.
 - The OK signal outputs only when the sequence operation normally completes.
 - Results of each stage are saved. (Result history, Waveform history, CF card)
 - Waveform data is saved as a continuous data, except when free-run occurs.
- *For continuous sequence, the waveform data for each stage (except for at the end of fastening) cannot be read or saved via the HFC3000 user console.
(Only the torque-angle waveform (540deg fixed) is saved in the waveform history or the CF card.)
- Axis cycle count is incremented at the final stage.

D-No.580 Sequence Mode

- 0: Standard operation (sequence unavailable)
- 1: Batch sequence
- 2: Automatic Function 1 (REJECT is not output when the lever is switched off in the middle)
- 3: Automatic Function 2 (REJECT is output when the lever is switched off in the middle)

D-No.581 Sequence Stage 1 [Parameter No./ Count / Dwell Time]

D-No.582 Sequence Stage 2 [Parameter No./ Count / Dwell Time]

D-No.583 Sequence Stage 3 [Parameter No./ Count / Dwell Time]

D-No.584 Sequence Stage 4 [Parameter No./ Count / Dwell Time]

D-No.585 Sequence Stage 5 [Parameter No./ Count / Dwell Time]

D-No.586 Sequence Stage 6 [Parameter No./ Count / Dwell Time]

D-No.587 Sequence Stage 7 [Parameter No./ Count / Dwell Time]

D-No.588 Sequence Stage 8 [Parameter No./ Count / Dwell Time]

Setting ranges: 0~64(*D-No.581:1~64) /0~99 (times)/0~99 [x0.1 second]

Initial value: 000000 (*D-No.581:XX0000, XX=Parameter No.)

Precautions on setting [D-No.581 [Sequence Operation Stage 1]]



Caution

- Under the following settings: 1. Batch sequence, 2. Continual sequence 1, or 3. Continual sequence 2, setting “0” as a parameter No. causes the abnormal signal A. 09-02 “Missing Parameter Setting” to occur after the start signal is set to ON.


[1: Batch Sequence]

The parameter No. and count are set for the operation at each stage (the intermission time is not used).

If the setting is [02. 05. □□], after the fastening operation using parameter 2 is counted 5 times, the next stage is entered (a fastening operation is counted only when the ACCEPT judgment is made).

If "0" is set as the parameter No. for the stages 2-8, the one prior stage becomes the sequence end position.

When a batch reset signal is provided from the outside, a return to stage 1 is performed.


 Caution	[Precautions on the setting for the batch sequence] • If "0" is set as the count at each stage, the fastening operation is once counted with the set parameter No. and the operation moves to the next stage.
--	--

[2, 3: Continuous Sequence]

As the continuous sequence setting, [Parameter No./Intermission Time × 0.1 second] are set (the count is not used).

If the setting is [02. □□. 05], after the fastening operation using parameter 2 is performed, waiting for 0.5 seconds is performed and then the next stage is entered (the start lever must be kept pressed; the sequence is interrupted when the start lever returns).

If "0" is set as the parameter No. for the stages 2-8, the one prior stage becomes the sequence end position and the judgment of the stage at which fastening was performed last is output.

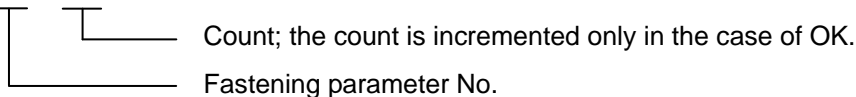
[Precautions on the result display of D-No.581[Sequence Operation Stage 1]]	
 Caution	- 2, 3: When using the continuous sequence, the fastening result parameter: [Axis Cycle Count] uses the same count unless the following conditions are satisfied: • Sequence operation is completed • Sequence operation is aborted and terminated

<Program Examples1>

Batch Sequence:

Six digits of data, which designate the parameter No. and the count required for entering the next stage, are used in each stage. Incrementing of the count is not performed unless the fastening result is OK.

0 2 . 0 4 . 0 0



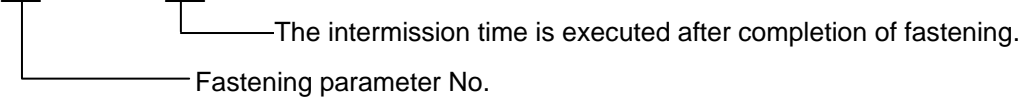
Stage	Data No.	Data	Operation
	580	1: Batch	The batch sequence is executed.
1	581	01.03.00	Fastening by parameter 1 is performed 3 times.
2	582	02.04.00	Fastening by parameter 2 is performed 4 times.
3	583	07.01.00	Fastening by parameter 7 is performed 1 time.
4	584	00.00.00	The batch sequence is ended.
5	585	00.00.00	
6	586	00.00.00	
7	587	00.00.00	
8	588	00.00.00	

<Program Examples2>

Automatic Function:

For each stage, six digits of data are used to designate the parameter No. and the intermission time.

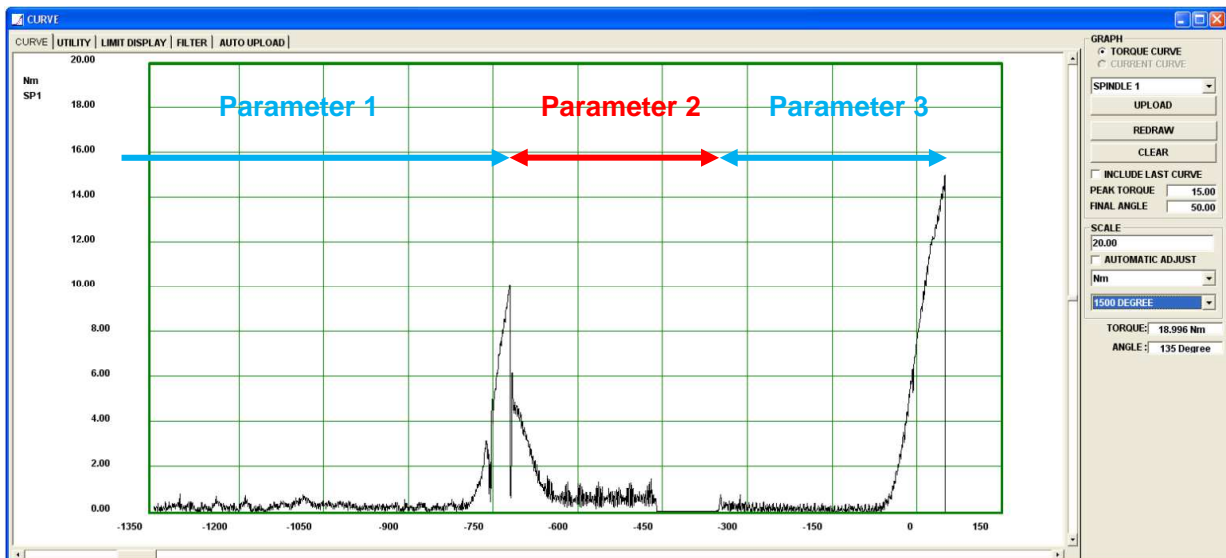
01.00.05



Stage	Data No.	Data	Operation
	580	2(3): Continuous	The continuous sequence is executed.
1	581	01.00.05	Fastening by parameter 1 is performed and followed by an intermission of 0.5 seconds.
2	582	02.00.03	Fastening by parameter 2 is performed and followed by an intermission of 0.3 seconds.
3	583	03.00.00	Fastening by parameter 3 is performed and judgment is made (the intermission time is ignored).
4	584	00.00.00	The continuous sequence is ended.
5	585	00.00.00	
6	586	00.00.00	
7	587	00.00.00	
8	588	00.00.00	
Parameter No.		Operation	
1		Fastening 10Nm	
2		Loosening operation (angle method, CCW -360 degrees)	
3		Fastening 15Nm	

*2: In the Continuous 1 mode, if when the lever is set to off in the middle to interrupt the sequence, an NG (failure) judgment is not made, the sequence is ended without judgment (the fastening results are not generated).

3: In the Continuous 2 mode, when the lever is set to off in the middle to interrupt the sequence, the sequence is ended with an NG judgment.



Memo



7

Chapter 7 Troubleshooting

7-1 Abnormal State Display

When an error occurs in the tool or the Unit, the abnormal state No. is indicated in the WORK part and the sub code is indicated in the COUNT/D-No. part of the indicator.



Abnormal State No. PAR No. Indication	Abnormal Type
A.01	Torque Transducer Error
A.03	TOOL ID Error
A.04	System Memory Error
A.05	Servo Reply Error
A.06	Servo Type Error
A.08	Servo Amplifier Error
A.09	Setting Data Error

7-2 Abnormality Details/Causes and Recovery Methods



• When an abnormality occurs, remove the cause and ensure safety before restarting operation.

Caution If a critical error occurs in the Unit, the abnormal state number is not indicated and the [CONTROL POWER LED] of the Unit lights up in red. Please contact us in this case.

Please contact us if the abnormal state signal cannot be canceled by the corresponding recovery method or if there is a possibility of breakage or fault of the cable, tool, or Unit.

A.01: Torque Transducer Error

Indication	Description/Cause	Recovery Method
A.01-01	Zero Master Error An error occurred in the ZERO voltage check of the torque transducer upon supply of control power.	<ol style="list-style-type: none"> 1. Inspect the tool cable. 2. Ensure that the tool is installed firmly. 3. Confirm the origin level, and CAL voltage. 4. Inspect the driving load of the end tool (bracket, etc.) of the tool. 5. Confirm the core of the workpiece of the tool. 6. Turn the control power OFF and then turn ON the power again after waiting for at least 5 minutes. 7. Breakage or malfunction of the tool cable or the tool may have occurred. 8. Replace the tool. <p>* If the socket is locked and generating torque when "A.01-03: ZERO Check Error" occurred, perform reverse operation to loosen the socket or leave the socket alone for a while and wait until the socket becomes loose.</p>
A.01-02	Cal Master Error An error occurred in the CAL voltage check of the torque transducer upon supply of control power.	
A.01-03	Zero Check Error An abnormality occurred in the ZERO voltage check of the torque transducer at the start of fastening.	
A.01-04	Cal Check Error An error occurred in the CAL voltage check of the torque transducer at the start of fastening with the self-check being enabled.	
A.01-05	Cal Judgment Error An error occurred in the CAL voltage check of the torque transducer at the start of fastening with the self-check being disabled.	
A.01-06	Stared with Zero Error The fastening operation was started when an error occurred in the ZERO voltage check of the torque transducer upon supply of control power.	
A.01-07	Started with Cal Error The fastening operation was started when an error occurred in the CAL voltage check of the torque transducer upon supply of control power.	

A.03: TOOL ID Error

Indication	Description/Cause	Recovery Method
A.03-01	ID Data Error There is an error in the ID data in the preamplifier.	1. Inspect the tool cable. 2. Breaking or malfunction of the tool cable or the tool may have occurred.
A.03-02	Tool Type Error The system parameters D-No. 100 "Connected Tool No." and D-No. 200 "Unit Setup Tool No." differ.	1. Set D-No. 200 to the same value as the Tool No. D-No. 100 of the system parameters (SYS). 2. Breaking or malfunction of the tool cable or the tool may have occurred.
A.03-03	Tool Not Connected The tool is not connected.	1. Inspect the tool cable. 2. Breaking or malfunction of the tool cable or the tool may have occurred.
A.03-04	Tool Communication Error An error occurred in the communication between the tool preamplifier and the Unit.	

A.04: System Memory Error

Indication	Description/Cause	Recovery Method
A.04-01	FlashROM Write Error An error occurred during writing into the FlashROM of the Unit.	1. Turn the control power OFF and then turn ON the power again after waiting for at least 5 minutes. 2. Breaking or malfunction of the Unit may have occurred.
A.04-02	FlashROM Read Error An error occurred during reading from the FlashROM of the Unit.	
A.04-03	Amplifier FlashROM Error An error occurred during reading from or writing into the FlashROM of the amplifier.	
A.04-04	Stored Data Write Error An error occurred during writing data to be stored in the SDRAM.	
A.04-05	Stored Data Read Error An error occurred during reading data stored in the SDRAM.	

A.04: System Memory Error (contd.)

Indication	Description/Cause	Recovery Method
A.04-06	RTC Write Error Writing of settings into the RTC failed.	<ol style="list-style-type: none"> 1. Turn the control power OFF and then turn ON the power again after waiting for at least 5 minutes. 2. Breaking or malfunction of the Unit may have occurred.
A.04-07	RTC Read Error Reading of settings from the RTC failed.	

A.05: Servo Reply Error

Indication	Description/Cause	Recovery Method
A.05-01	Servo Reply Error The position pulse from the resolver that indicates the operation of the tool has not changed. Or, there is no response to the amplifier side speed command.	<ol style="list-style-type: none"> 1. Inspect the tool cable and the tool. 2. If a spare cable is available, replace the cable. 3. Replace the tool 4. Breaking or malfunction of the tool cable or the tool may have occurred. 5. D-No. 523 "Fastening Current Limit" is set to 0%.

A.06: Servo Type Error

Indication	Description/Cause	Recovery Method
A.06-01	Servo Type Mismatch Error The motor type and the servo type do not match.	<ol style="list-style-type: none"> 1. Set D-No. 200 to the same value as the Tool No. D-No. 100 of the system parameters (SYS). 2. Breaking or malfunction of the tool cable or the Unit may have occurred.

A.08: Servo Amplifier Error

Indication	Description/Cause	Recovery Method
A.08-01	<p>Over Heated Error The servo drive circuit does not function normally due to overheating of the Unit.</p>	<ol style="list-style-type: none"> 1. Ensure that the ambient temperature is 0 ~ 45°C. 2. Ensure that the duty cycle conforms to the specified range. 3. Turn the control power OFF and then turn ON the power again after waiting for at least 5 minutes.
A.08-02	<p>Watchdog Timer Error The watchdog timer function of the Unit is not operating correctly.</p>	<p>Breaking or malfunction of the Unit may have occurred.</p>
A.08-04	<p>Over current Error An overcurrent has occurred in the Unit.</p>	<ol style="list-style-type: none"> 1. Confirm the speed set values. 2. Inspect the tool cable. 3. Breaking or malfunction of the tool cable or the Unit may have occurred.
A.08-05	<p>Over voltage Error An overvoltage has occurred in the Unit.</p>	<ol style="list-style-type: none"> 1. Confirm the speed set values. 2. Ensure that the power source voltage of the control power source is 200 ~ 230V AC. 3. Breaking or malfunction of the Unit may have occurred.
A.08-06	<p>Source Voltage Error 1. The internal power source circuit of the Unit does not function correctly. 2. The power source voltage is not within the specified ranges.</p>	<ol style="list-style-type: none"> 1. Check the control power wirings. 2. These may occur when an instantaneous power failure occurs. Check the power source capacity.
A.08-07	<p>Control Power Interrupt Error The power source voltage of the control power source is 18V ~ 17V.</p>	

A.08: Servo Amplifier Error (contd.)

Indication	Description/Cause	Recovery Method
A.08-08	Over Speed Error The Unit cannot control the rotation of the motor.	<ol style="list-style-type: none"> 1. Inspect the tool cable. 2. Breaking or malfunction of the tool cable or the tool may have occurred.
A.08-10	Over load Error The motor load rate exceeded 100%.	<ol style="list-style-type: none"> 1. Check the workpiece. 2. Ensure that the duty cycle is within the specified ranges. 3. Increase the set value of D-No. 402 "1st Speed" and D-No. 403 "2nd Speed" to shorten the cycle time. 4. Increase the settings of D-No. 104 "Ramp Down Start Torque" and D-No. 109 "2nd Torque." 5. Make the interval to the next operation longer.
A.08-11	Resolver Error The Unit cannot recognize the resolver.	<ol style="list-style-type: none"> 1. Inspect the tool cable. 2. Breaking or malfunction of the tool cable or the tool may have occurred.
A.08-12	System Error An error has occurred in the Unit.	Breaking or malfunction of the Unit may have occurred.
A.08-14	Motor Parameter Error There is an error in the internal parameters of the Unit.	
A.08-15	System Error An error has occurred in the Unit.	
A.08-16	Drive Power Error The drive power source is not connected or the drive power was turned OFF during the fastening operation.	<ol style="list-style-type: none"> 1. Inspect the drive power cable. 2. Ensure that the power source voltage of the drive power source is 200 ~ 230V AC. 3. This may occur when an instantaneous power failure occurs. Check the power source capacity.
A.08-17	System Error An error has occurred in the Unit.	Breakage or malfunction of the Unit may have occurred.
A.08-20	Current Sensor Error An error has occurred in the Unit.	Breakage or malfunction of the Unit may have occurred.

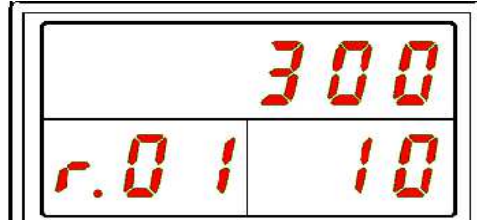
A.09: Setting Data Error

Indication	Description/Cause	Recovery Method
<p>A.09-02</p>	<p>Missing Parameter Setting A parameter operation set value is not set.</p>	<p>If a set value is set to 0 or outside the setting range, set a correct value. [A. 09-02] 102: Peak Torque High Limit=0 312: 1st Time High Limit=0 314: 2nd Time High Limit=0 100: Calibration Torque=0 202: Angle Method & Standard Angle=0 103: Torque Method & Standard Torque=0 581: At Sequence Operation Mode & Sequence Stage1 = 000000 SYS-036 = 1 & Fastening Direction CCW SYS-036 = 2 & Fastening Direction CW</p>
<p>A.09-08</p>	<p>Reverse Torque Error The torque value exceeded D-No. 110 "Reverse Torque High Limit" during the reverse operation.</p>	<ol style="list-style-type: none"> 1. Confirm the driving load during reverse rotation. 2. Ensure that stress is not applied to the output shaft of the tool. 3. Breaking or malfunction of the tool or the Unit may have occurred. 4. Factory setting is 5N·m. Please increase the value of D-No.110.
<p>A.09-09</p>	<p>Axis Number Set Value Error The axis No. of the controller is not set to 01.</p>	<p>After the power to the controller to OFF, Rotary bottom of AXIS ADDRESS Please refer to the switch to 01</p>
<p>A.09-10</p>	<p>Angle Head Torque Variation Abnormal The torque variation of the angle head exceeded D-No. 541 "Angle Head Torque Variation Rate."</p>	<ol style="list-style-type: none"> 1. The angle head part of the tool may be degraded. The angle head part must be replaced. 2. Even if the tool is normal, this abnormality may occur if fastening according to a fastening curve that varies in torque is performed. In this case, change the setting of D-No. 541 to "0%" or "100%." 3. Change the setting of D-No.006:xxx1xx to "Unavailable " xxx0xx.

7-3. Axis Judgment: Checking the Contents of the REJECT

When a value falling outside the high and low limit range (falling below the low limit value) of a fastening parameter is detected during a fastening operation, the REJECT axis judgment is made and the NG LED of the Unit lights up in red.

Also, the reason for stopping of fastening that was detected first can be confirmed from the indicator.



●Confirmation of the Fastening Parameter

Procedure 1. After the end of fastening, “r.**” is indicated at the WORK indication part of Unit indicator as shown in the drawing above, with the numeral indicated at “**” being the parameter No. of the last parameter used for operation (the parameter No. will not be renewed unless a fastening operation is performed).

●Confirmation of Reason for Stopping of Fastening

Procedure 1. After the end of fastening, operate the “▲” and “▼” switches to select COUNT/D-No.: “09.”
The reason for stopping of the Unit is indicated at the upper part of the indicator.

Procedure 2. If “REJECT” is indicated, the D-No. of the parameter set value for which stopping occurred first is indicated at the COUNT/D-No. indication part “10” as shown in the drawing above.
Also, for each item for which a fastening NG (failure) is detected, “H/L” is indicated at the top digit of the upper stage of the indicator.

7-4. Ethernet Communication

If Ethernet communication of the User Console cannot be performed with the PC being used, please refer to the following troubleshooting table and take the necessary measures.

Item	Countermeasures/Check Details	PAGE
Is there an error in the TCP/IP setting procedures?	Check the TCP/IP setup procedures.	PAGE 4-21
Is there any problem with the PC communication cable?	<ul style="list-style-type: none"> · If the PC and the Unit are to be connected without a hub, use a cross cable. · If connection is to be made via a hub, use a straight cable. · Select a LAN cable of category 5e or higher. 	PAGE 4-21
Is network connection enabled in the PC to be used for Ethernet communication?	<ul style="list-style-type: none"> · Set up the PC to enable network connection or prepare another PC. 	-
Confirm by command prompt functions	<ul style="list-style-type: none"> · The PC's Ethernet setting can be confirmed by command prompt functions. 	Next page

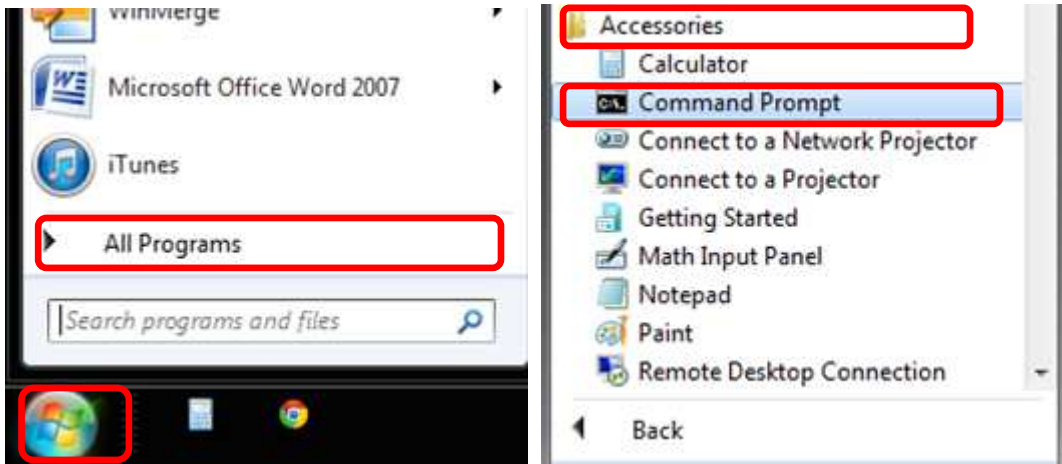
If data are not output correctly even though there are no problems in communication, please refer to the following table and take the necessary measures.

Item	Countermeasures/Check Details	PAGE
Data are not output at all.	<ul style="list-style-type: none"> · Confirm that the protocol by which output is to be performed is set. 	Next page
A portion of the data is not output.	<ul style="list-style-type: none"> · The fastening results will not be output if an erroneous Unit axis No. is set. Check the sequence setup again and set the correct Unit axis No. 	

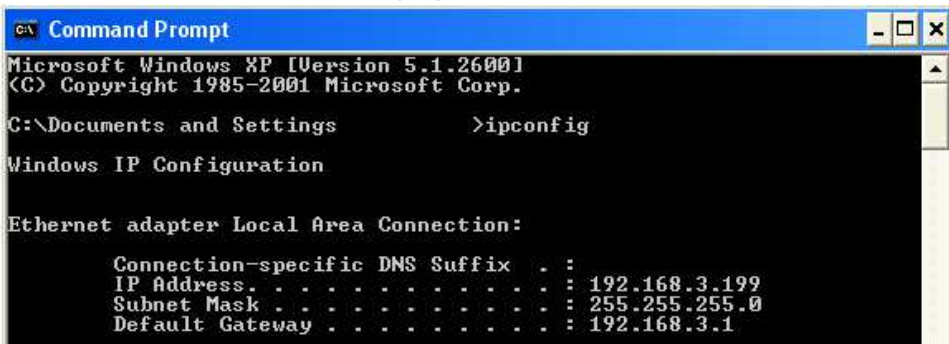
● Method for Confirming Using Command Prompt Functions (Windows 7)

Procedure 1. Connect the Unit and the PC with the PC communication cable.

Procedure 2. In the Windows Start menu, click “All Programs” → “Accessories” → “Command Prompt.”



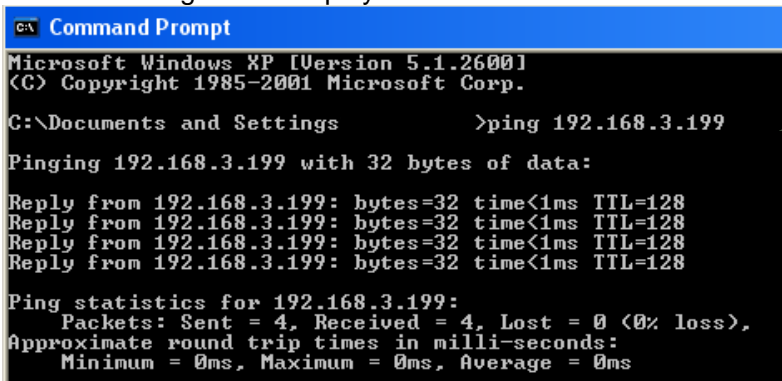
Procedure 3. When the command prompt screen appears, enter “ipconfig” and then press the Enter key. The current PC settings are displayed. If the displayed settings are not correct, set the PC’s setting again.



Procedure 4. If a normal response is made as in the screen above and yet connection with the HFC3000 User Console fails, make the command prompt screen appear again and then enter “ping 192.168.3.199” or “ping 192.168.3.198.”

* Enter the IP address of the Unit and the PC after ping.

The following will be displayed if normal communication between the Unit and the PC is enabled.



In the case of normal communication

7-5. RTC

The HFC3000 Unit is equipped with an RTC (real time clock) for holding date and time data.

- Model ANG-RTC
- Backup power source Backup by electric double layer capacitor
- Backup duration in power OFF state Approx. 1000 hours
- Power ON time needed for full charging of clock unit 1 hour

With a spare Unit, etc., be careful because the time setting inside a Unit will be cleared if the control power of the Unit is not turned on for 2 months or more.

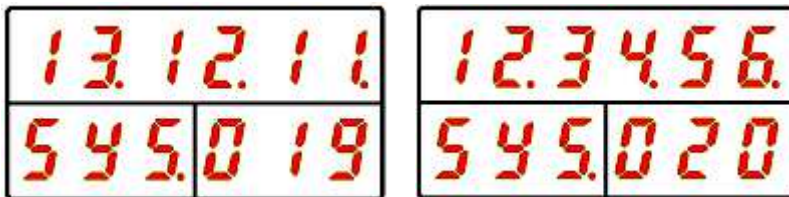
Please perform time adjustment periodically because the clock loses time at a rate of approximately 10 minutes a month.

Caution

● Procedures for Changing the Date/Time of a Unit (Indicator)

1. Long-press the PROGRAM switch of the Unit.
2. Operate the arrow switches to make “SYS” be indicated at the Work No. indication part and “019” or “20” (“RTC: Year/Month/Day (Time)”) be indicated at the COUNT/D-No. indication part and then press the [SET] switch.
3. After transition to the set value editing mode, operate the arrow switches to change to the desired date or time (“▲”, “▼”: for incrementing/decrementing the value; “◀”, “▶”: for moving the cursor).
4. Press the [SET] switch, and within 2 seconds, press the “▲” or “▼” switch to change “NO” to “YES,” and then press the [SET] switch again.
5. Long-press the PROGRAM switch of the Unit.

2



4



* Besides the method of setting from the indicator, synchronization with the date/time of the PC can be performed from the “Date/Time Setting” window of the HFC3000 User Console.



8

Chapter 8 Options

8-1 CompactFlash (CF) Card

Fastening results and fastening curves can be stored as files in a CompactFlash (CF) card (hereinafter, "memory card"). The stored data can be confirmed later by reading with a PC.



Caution

- If an unused memory card or a memory card used in another device is to be used, be sure to use it after formatting it.

● Operation-Confirmed Memory Cards

Please select a memory card of 32GB or less with reference to the following table.

Series	Manufacturer	Model
UltraCompactFlash	SanDisk	SDCFHG-004G-J95
Platinum II	Lexar	LCF8GBBCJP200
CF115	I-O DATA	CF115-1G

● List of Number of Storable Data Sets According to Capacity

- Storage data format: Fastening results + Fastening curve (180 degrees: torque vs. angle)

Storage Capacity	Number of Stored Data Sets
4GB	approx. 900 thousand sets
8GB	approx. 1.8 million sets
16GB	approx. 3.4 million sets
32GB	approx. 7.0 million sets

[Precautions Concerning Memory Card Usage]

- Be careful as the data stored in a memory card may be erased under the following conditions.
 - ◆ When a user handles a memory card incorrectly.
 - ◆ When a memory card is used or stored in an environment with static electricity or electrical noise.
 - ◆ When a memory card is not used for a long period of time.




Caution

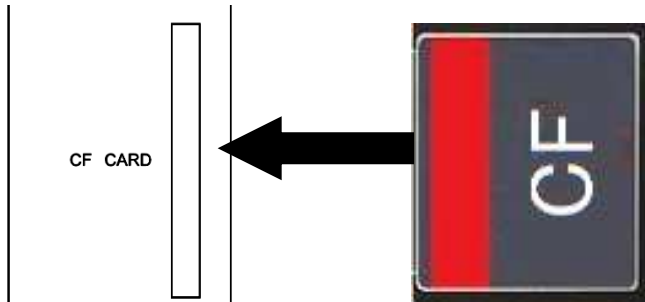
- A memory card has a limited lifetime and the stored data may become unreadable if the card is not used for a long period of time. Be sure to back up the necessary data in a PC, etc., periodically.
- Avoid use and storage in a location with sudden temperature change, a location where condensation occurs, or a location exposed to direct sunlight.
- Do not bend or apply a strong shocks to the memory card. Also, do not wet the memory card with water or place it in a location of high temperature.


Storing Data in the Memory Card

1. Insert the memory card in the memory card slot (CF CARD) in the state where the power of the Unit is OFF.

 **Caution**


- When the control power of the Unit is turned ON with the memory card installed in the slot, it takes more than the regular time for the Unit to become operable because a file storage folder is generated in the memory card.



 **Caution**

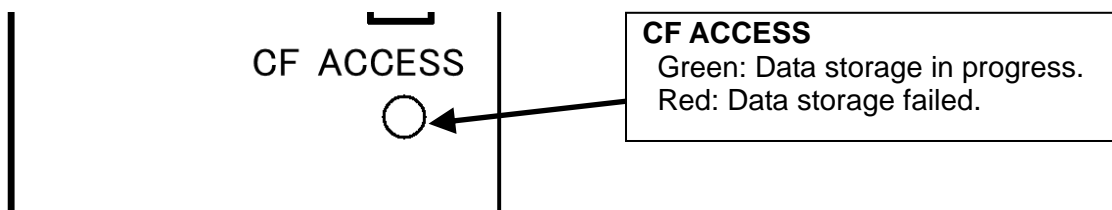
- Insert vertically the memory card slowly and with its top surface at the left side. Although arrangements are made so that a card cannot be inserted in the opposite orientation, a malfunction of the Unit or the card may occur if the card is pressed in forcibly.
- Be sure to set the memory card when the Unit is not performing a fastening operation.

2. Data storage is executed after the fastening operation is ended in the state where the memory card is set.

 **Caution**

- Do not extract the card from the slot or turn OFF the control power of the Unit while storage into the memory card is in progress. Otherwise, the stored data or the memory card may become damaged.

3. When data are being stored in the memory card, the CF ACCESS LED is lit up in green. If storage in the memory card fails, the CF ACCESS LED lights up in red.



Flow of Data Storage

The fastening results and the fastening curves are stored in the memory card. The fastening results are stored according to date in the TSV format and can be displayed in Microsoft® Excel®.

In regard to the fastening curves, the torque vs. angle (180deg) curve of each axis is stored in the “nrad” format, which is dedicated for use with the HFC3000 User Console.

The fastening curve displayed on the “Curve Monitor” of the HFC3000 User Console can be stored in the TSV format.

Please refer to “Wave Monitor” of the <<HFC3000 User Console Instruction Manual>> concerning the display of the curve.

● Storage of Fastening Curves

Fastening curves are stored in the automatically-generated folder “CURVE.”

Inside the “CURVE” folder, folders, each with a name expressing the year and month, such as “201309,” are generated automatically, and a folder is automatically generated in the manner of “201310,” “201311,” “201312,” etc., at each turn of the month or year.

Inside the “201309” folder, folders, each with a name expressing the year, month, and day, such as “20130901,” are generated automatically, and a folder is automatically generated in the manner of “20130902,” “20130903,” “20130904,” etc., as the date changes.

Inside the “20130901” folder, folders, each with its name being the time of the fastening curve that is saved first, are generated automatically in the manner of “123456~,” “123616~,” etc.

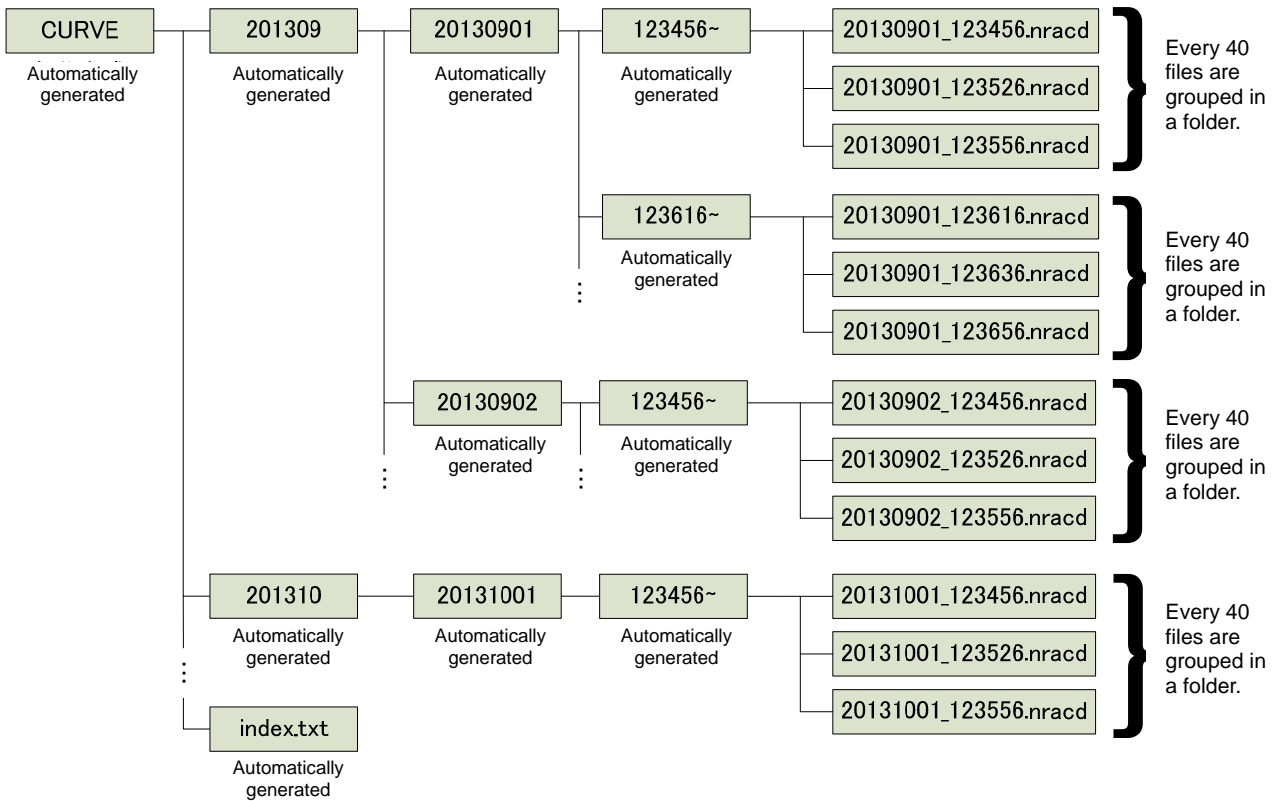
Inside the “123456~” folder, the following file is stored at the end of the fastening operation.

CURVE¥YYYYMM¥YYYYMMDD¥hhmmss~¥YYYYMMDD_hhmmss.nracd (nracd format)

Year/Month
Year/Month/Day
Hour/Minute/Second
Year/Month/Day
Hour/Minute/Second

30 sets of fastening curves are stored in each file. When 30 sets of fastening curves have been stored, the next file is generated automatically inside the “20130901” folder.

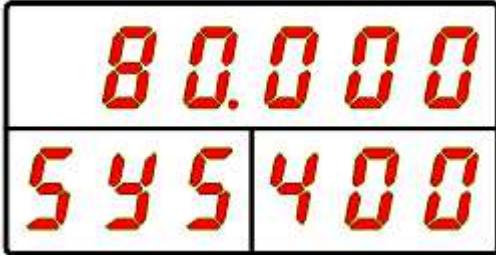
Also, besides the fastening curves, “index.txt” for folder identification is generated inside “CURVE.” The contents of index.txt are erased each time a folder is generated automatically.




When the remaining capacity of the memory card falls to no more than 1%, the CF ACCESS LED lights up in orange. The storable capacity of the memory card can be checked from the indicator.

● Procedures for Confirming the Storable Capacity of the Memory Card

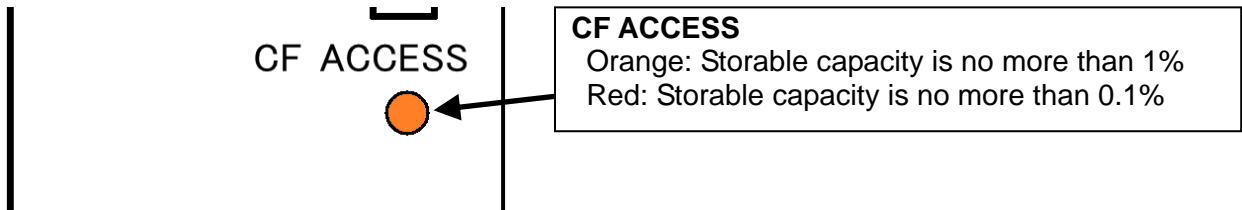
1. Put the Unit in a state in which starting by external control will not be performed and then perform the following in the state where the I/O output signal: READY is "ON."
2. Use the "◀" and "▶" switches of the Unit indicator to make the System Setting Mode be indicated.
3. Use the "▲" and "▼" switches of the Unit to make "400" be indicated at the COUNT/D-No. indication part.



4. The value indicated at the upper stage of the indicator is the storable capacity (units: %) of the memory card.



Caution ▪ When the storable capacity of the memory card falls to no more than 0.1%, storage into the memory card is discontinued to prevent mismatch of the stored contents of the fastening results and the fastening curves (the CF ACCESS LED lights up in red).



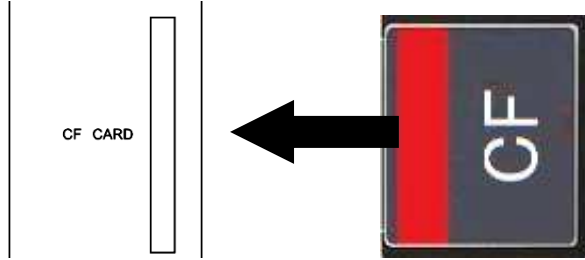
Formatting the Memory Card

All data stored in the memory card can be erased by an operation from the indicator.

 **Do not extract the memory card during formatting of the memory card. The card may become damaged and become incapable of use.**
Caution

● Memory Card Formatting Procedure

Procedure 1. Insert the memory card in the memory card slot (CF CARD) of the Unit in the state where the power of the Unit is OFF.



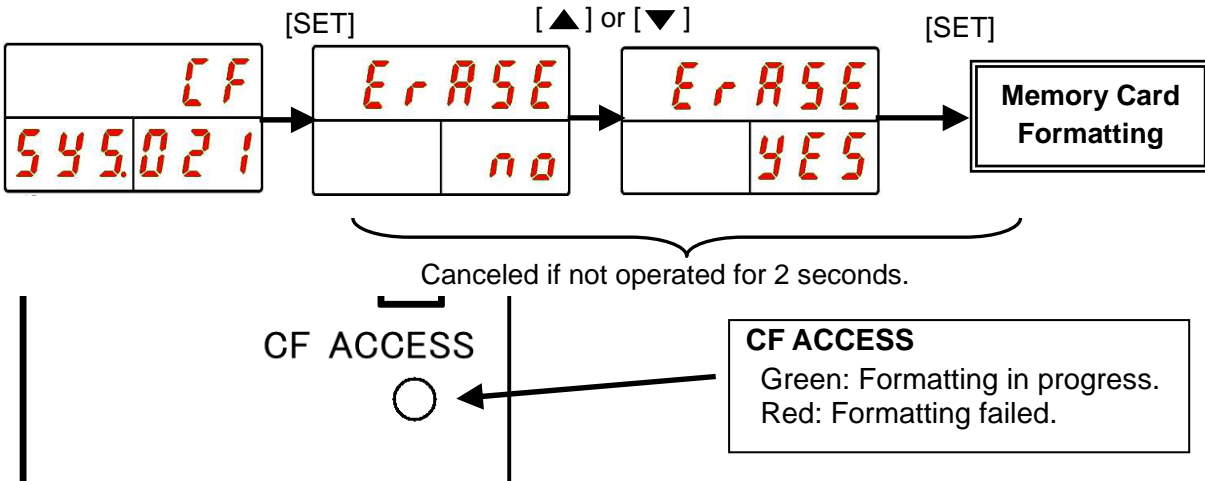
Procedure 2. Operate the arrow switches to make “SYS” be indicated at the WORK indication part and “021” (for “Erase Record”) be indicated at the COUNT/D-No. indication part.

Procedure 3. Long-press the PROGRAM switch on the Unit Front Panel. Set the PLC I/O input signal “BYPASS” to “ON” to put the Unit in the BYPASS mode and then press the [SET] switch.

Procedure 4. Press the “▲” or “▼” switches to select “CF” as the type of data to be erased at the upper stage of the indicator and then press the [SET] switch.

Procedure 5. Within 2 seconds, press the “▲” and “▼” switches to change “Erase NO” to “Erase YES” and within 2 seconds thereafter, press the [SET] switch.

Procedure 6. When the formatting is started, “Erase” at the upper stage of indicator flashes and the lighting of the ACCESS LED in green is started. If the formatting fails, the ACCESS LED lights up in red.



8-2 Expansion RS232C Interface

ID data can be input via the expansion RS232C interface.

The ID data that have been input are added to the curve and fastening result data and output as result data or to the fieldbus message, etc.

Pin No.	Signal	IN/OUT	Contents
1	N.C.	-	Not used
2	RxD	IN	ID data input
3	TxD	OUT	Not used
4	DTR	OUT	Always ON output
5	GND	-	Signal ground
6	N.C.	-	Not used
7	RTS	OUT	Always ON output
8	N.C.	-	Not used
9	N.C.	-	Not used



Caution

• The RS232C-2 port is for input of ID data only.

Set SYS. 033: 1XXXXX ID Input Selection to “RS232C-2.”

The factory settings of the RS232C-2 ports of the Expansion Unit 2 are as shown below. The respective set values can be confirmed with D-No. “401” ~ “404” of the System Setting Mode (PAR No. indication part: “SYS”) (the settings cannot be changed).

● Factory Set Values (System Parameters)

D-No.401 “RS232C-2: Communication Speed”	38400bps
D-No.402 “RS232C-2: Parity”	None
D-No.403 “RS232C-2: Stop bit”	2 bits
D-No. 404 “RS232C-2: Data Length”	8 bits

● Expansion RS232C Specifications

Synchronization Method	Start-stop synchronization method	Communication Speed	9600bps/19200bps/38400bps
Communication Mode	Half-duplex system	Start Bit	1 bit
Data length	7 bits/8 bits	Stop Bit	1 bit/2bits
Error control	None	Parity	odd/even/none

Memo



9

Chapter 9 External Interface

9-1 Common specifications

9-1-1 Fieldbus I/O signal specifications

① HFC3000 [PLC → HFC3000]Input signal specification

The input signal becomes the fixed layout.

No.	Bit	Signal Name	Connection	Contents	
IN No.01	0bit	0bit	Not USE	NO	Always off.
	1bit	1bit	Not USE	NO	Always off.
	2bit	2bit	Not USE	NO	Always off.
	3bit	3bit	Not USE	NO	Always off.
	4bit	4bit	BANK	NO	Fieldbus message bank reshuffling BIT. In the case of CC-Link the output top position of the message Can change it.
	5bit	5bit	Not USE	NO	Always off.
	6bit	6bit	RESET	NO	Resets to the initial condition (Clear ID data)
IN No.02	7bit	7bit	Not USE	NO	Always off.
	8bit	0bit	Not USE	NO	Always off.
	9bit	1bit	Not USE	NO	Always off.
	10bit	2bit	Not USE	NO	Always off.
	11bit	3bit	Not USE	NO	Always off.
	12bit	4bit	Work Select Bit0	NO	Select fastening pattern. Select the Parameter No.1~64 at Work Select 0~5.
	13bit	5bit	Work Select Bit1	NO	
14bit	6bit	Work Select Bit2	NO		
15bit	7bit	Work Select Bit3	NO		
IN No.03	0bit	0bit	STOP	NO	Emergency stop
	1bit	1bit	RESET	NO	Resets to the initial condition (Clear ID data)
	2bit	2bit	REVERSE	NO	Spindle will reverse(CCW) while active
	3bit	3bit	START	NO	Starts fastening cycle
	4bit	4bit	PROGRAM	NO	Bypass the unit
	5bit	5bit	SELF CHECK OFF	NO	Disables self-check function
	6bit	6bit	Not USE	NO	Always off.
IN No.04	7bit	7bit	Not USE	NO	Always off.
	8bit	0bit	Not USE	NO	Always off.
	9bit	1bit	Not USE	NO	Always off.
	10bit	2bit	Not USE	NO	Always off.
	11bit	3bit	Work Select Bit5	NO	Work Select 5.
	12bit	4bit	BATCH OK RESET	NO	Batch resets to the initial condition
	13bit	5bit	Work Select Bit4	NO	Work Select 4.
	14bit	6bit	Not USE	NO	Always off.
	15bit	7bit	Not USE	NO	Always off.

② HFC3000 [HFC3000→PLC]OUT signal specification

The output signal becomes the fixed layout.

No.	Bit	Signal Name	Connection	Contents	
OUT No.01	0bit	0bit	END	NO	Outputs when N/R operation ends.
	1bit	1bit	ACCEPT	NO	Outputs when fastening result OK.
	2bit	2bit	REJECT	NO	Outputs when fastening result NG.
	3bit	3bit	MANREV	NO	Turned on when Start a reversal by manual operation. The next clamping starts or is off in RESET,PROGRAM.
	4bit	4bit	BANK	NO	The lapel output of fieldbus message bank reshuffling BIT.
	5bit	5bit	Job Cycle Accept	NO	Outputs when Job Cycle Accept
	6bit	6bit	Fastening Result Data Available	NO	While fastening result data exist, output it.
OUT No.02	7bit	7bit	CF CARD FULL	NO	In the case of non-insertion, a CF card is turned on again, and the remainder capacity of the CF card outputs 1% lower than.
	8bit	0bit	Work Select Bit4	NO	Outputs echo of work select.
	9bit	1bit	Work Select Bit5	NO	Outputs echo of work select.
	10bit	2bit	Time 1 Reject	NO	
	11bit	3bit	Time 2 Reject	NO	
	12bit	4bit	Work Select Bit0	NO	Outputs echo of work select. Parameter No.
	13bit	5bit	Work Select Bit1	NO	
14bit	6bit	Work Select Bit2	NO		
OUT No.03	15bit	7bit	Work Select Bit3	NO	
	0bit	0bit	REJECT(NG)	NO	Outputs when fastening result NG.
	1bit	1bit	ACCEPT(OK)	NO	Outputs when fastening result OK.
	2bit	2bit	ABNORMAL	NO	Outputs when system abnormality occurs.
	3bit	3bit	READY	NO	Outputs when system ready condition.
	4bit	4bit	BUSY	NO	Outputs during fastening or reverse operation.
	5bit	5bit	TQ HI REJECT	NO	
OUT No.04	6bit	6bit	SNUG HI REJECT	NO	
	7bit	7bit	TQ LO REJECT	NO	
	8bit	0bit	PROGRAM	NO	Outputs when program mode status.
	8bit	0bit	ANG HI REJECT	NO	
			DIFF HI REJECT	NO	
	9bit	1bit	ANG LO REJECT	NO	
			DIFF LOW REJECT	NO	
10bit	2bit	RATE1 HI REJECT	NO		
11bit	3bit	RATE 1 LO REJECT	NO		
12bit	4bit	RATE 2 HI REJECT	NO		
13bit	5bit	RATE 2 LO REJECT	NO		
14bit	6bit	RATE 3 HI REJECT	NO		
15bit	7bit	RATE 3 LO REJECT	NO		

9-1-2 Message Output Format (Handheld Tool Output → PLC Input)

ASCII Code :182 bytes fixed

Data Format in BANK : OFF

COUNT No. : Incremented by +1 at each fastening

ACCEPT COUNT: Counted number of ACCEPT fastening judgments

(JDG: Judgment, OCR: Occurrence)

Date (Year: Lower 2 digits)								TIME								COUNT No.				ACCEPT COUNT	
31H	32H	2FH	30H	34H	2FH	31H	38H	31H	32H	3AH	33H	34H	3AH	35H	36H	30H	30H	30H	31H	30H	31H
1	2	/	0	4	/	1	8	1	2	:	3	4	:	5	6	0	0	0	1	0	1

Axis No.		Parametr No.		PEAK TORQUE				JDG	OCR	FINAL TORQUE				JDG	OCR	
30H	31H	30H	31H	31H	32H	2EH	33H	20H	20H	20H	31H	32H	2EH	33H	20H	20H
0	1	0	1	1	2	.	3	4			1	2	.	3	4	

1ST PEAK TORQUE				2ND PEAK TORQUE				FINAL ANGLE				JDG	OCR
31H	32H	2EH	33H	31H	32H	2EH	33H	31H	32H	33H	20H	20H	
1	2	.	3	4	1	2	.	3	4		1	2	3

SIGN	DIFFERENTIAL ANGLE				JDG	OCR	SIGN	RATE 1				JDG	OCR		
2DH	20H	20H	31H	33H	20H	20H	20H	20H	30H	2EH	31H	32H	33H	20H	20H
-			1	0				0	.	1	2	3			

SIGN
 " " (20H) : + data
 "- " (2DH) : - data

SIGN	RATE 2				JDG	OCR	SIGN	RATE 3				JDG	OCR		
20H	30H	2EH	31H	32H	33H	20H	20H	20H	30H	2EH	31H	32H	33H	20H	20H
	0	.	1	2	3			0	.	1	2	3			

BANK [ON] TOP

1ST TIME				JDG	OCR	2ND TIME				JDG	OCR		
20H	31H	30H	2EH	30H	20H	20H	20H	20H	32H	2EH	30H	20H	20H
	1	0	.	0					2	.	0		

CYCLE TIME				PEAK TORQUE CURRNT				PEAK TORQUE ANGLE				1ST RATE INC TOEQUE								
20H	20H	33H	2EH	31H	20H	31H	37H	2EH	31H	20H	20H	20H	32H	30H	20H	20H	31H	2EH	32H	20H
		3	.	1	1	7	.	1				2	0			1	.	2		

RATE1 INC ANGLE				RATE2 INC TOEQUE				RATE2 INC ANGLE								
20H	20H	20H	20H	33H	20H	20H	20H	38H	2EH	39H	20H	20H	20H	31H	37H	20H
				3				8	.	9				1	7	

RATE3 INC TOEQUE				RATE3 INC ANGLE				RUNDOWN REVO.						
20H	20H	30H	2EH	30H	20H	20H	20H	20H	30H	20H	20H	33H	2EH	35H
		0	.	0					0			3	.	5

CALIBRATION VOLT				SIGN	ZERO VOLT		SNUG DETECTION TORQUE				JDG				
32H	20H	31H	31H	20H	32H	36H	31H	20H	32H	2EH	33H	34H	20H	4FH	20H
2	5	1	1		2	6	1	2	.	3	4		0		

JDG
 "O" (4FH) : ACCEPT

Data Format in BANK : ON

(JDG: Judgment, OCR: Occurrence)

BANK

[OFF] 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110
 [ON] 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1ST TIME					JDG	OCR	2ND TIME					JDG	OCR	
20H	31H	30H	2EH	30H	20H	20H	20H	20H	32H	2EH	30H	48H	58H	20H
	1	0	.	0					2	.	0	H	X	

REJECT Outbreak factor
 "X" (58H) :
 There is it behind the data
 which REJECT produced first.

[OFF] 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132
 [ON] 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38

CYCLE TIME					PEAK TORQUE CURRNT					PEAK TORQUE ANGLE					RATE1 INC TOEQUE						
20H	20H	33H	2EH	31H	20H	31H	37H	2EH	31H	20H	20H	20H	32H	30H	20H	20H	20H	31H	2EH	32H	20H
		3	.	1		1	7	.	1				2	0				1	.	2	

[OFF] 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150
 [ON] 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56

RATE1 INC ANGLE					RATE2 INC TOEQUE					RATE2 INC ANGLE							
20H	20H	20H	20H	33H	20H	20H	20H	38H	2EH	39H	20H	20H	20H	20H	31H	37H	20H
				3				8	.	9					1	7	

[OFF] 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166
 [ON] 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72

RATE3 INC TOEQUE					RATE3 INC ANGLE					RUNDOWN REVO.				
20H	20H	30H	2EH	30H	20H	20H	20H	20H	30H	20H	20H	33H	2EH	35H
		0	.	0					0			3	.	5

[OFF] 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182
 [ON] 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88

CALIBRATION VOLT				SIGN	ZERO VOLT			SNUG DETECTION TORQUE					JDG		
32H	20H	31H	31H	20H	32H	36H	31H	20H	32H	2EH	33H	34H	20H	58H	20H
2	5	1	1		2	6	1		2	.	3	4		X	

[PEAK TORQUE] JDG

"H" (48H) : Hight REJECT "L" (4CH) : Low REJECT
 "A" (41H) : Abnormal "S" (53H) : STOP
 "R" (52H) : RESET "B" (42H) : PROGRAM
 "D" (44H) : START OFF (Before turning off a start lever)
 ※ "A", "B", "D", "R", "S" does not gain the REJECT outbreak factor
 alone.

[FINAL TORQUE], [ANGLE], [RATE], [TIME] JDG

"H" (48H) : Hight REJECT "L" (4CH) : Low REJECT

JDG

"X" (58H) : REJECT

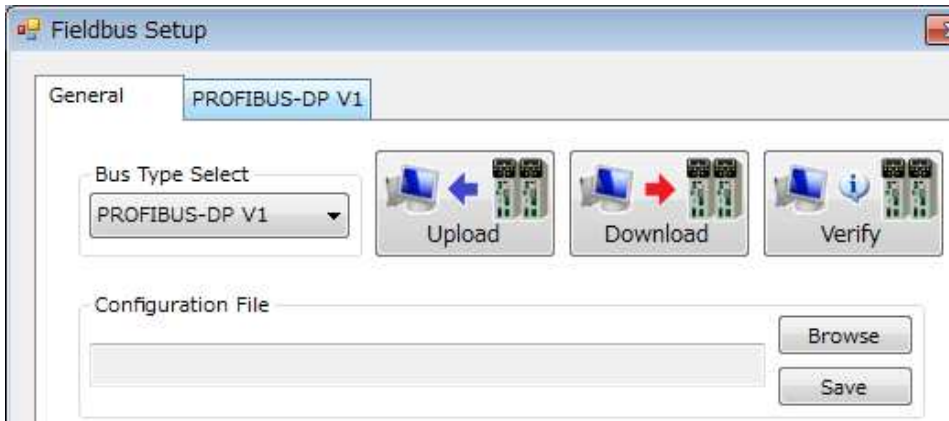
[OFF] 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200
 [ON] 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 200


00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	00H	...	00H
																				...	

9-1-3 Fieldbus Setup

The fieldbus settings are set in the “Fieldbus Setup” menu of the HFC3000 User Console. The following setting window is displayed when “OPTION” → “Fieldbus Setup” is selected at the menu bar.

In the bus select/communication window, selection of the fieldbus type, uploading, downloading, and verification of fieldbus settings with respect to the Unit, and browsing and saving of fieldbus settings with respect to the PC can be performed.





Caution

- The standard set values are set as the factory settings in the Unit. Do not change the settings unless there is a special reason.
- Be sure to perform backup before changing the fieldbus settings of the Unit.
- When executed "Browse" if the file version of "HFC3000 UserConsole" and "A fieldbus configuration file" is different, A warning window is displayed.

●Bus Type Select: The type of bus is selected from the list. Also, when “Upload” is executed, the bus type is judged and reflected in the selection part.

●Configuration File

- Browse: A fieldbus configuration file (*.nrfcf) is read from the PC.
- Save: A fieldbus configuration file (*.nrfcf) is saved in the PC.

●Upload: The Fieldbus Setup is read from the HFC3000 for PC communication and I/O (PLC) control. Also, if the “File version check” checkbox of “Upload/Download” is checked, the file version check is executed.

●Download: The Fieldbus Setup is written into the HFC3000 for PC communication and I/O (PLC) control. Also, if the “File version check” checkbox of “Upload/Download” is checked, the file version check is executed.

*Please refer to “Upload/Download” in the 《HFC3000 User Console Instruction Manual》 regarding the “File Version Check.”

●Verify: The Fieldbus Setup of the HFC3000 for PC communication and I/O (PLC) control and the Fieldbus Setup in the UserConsole are compared.

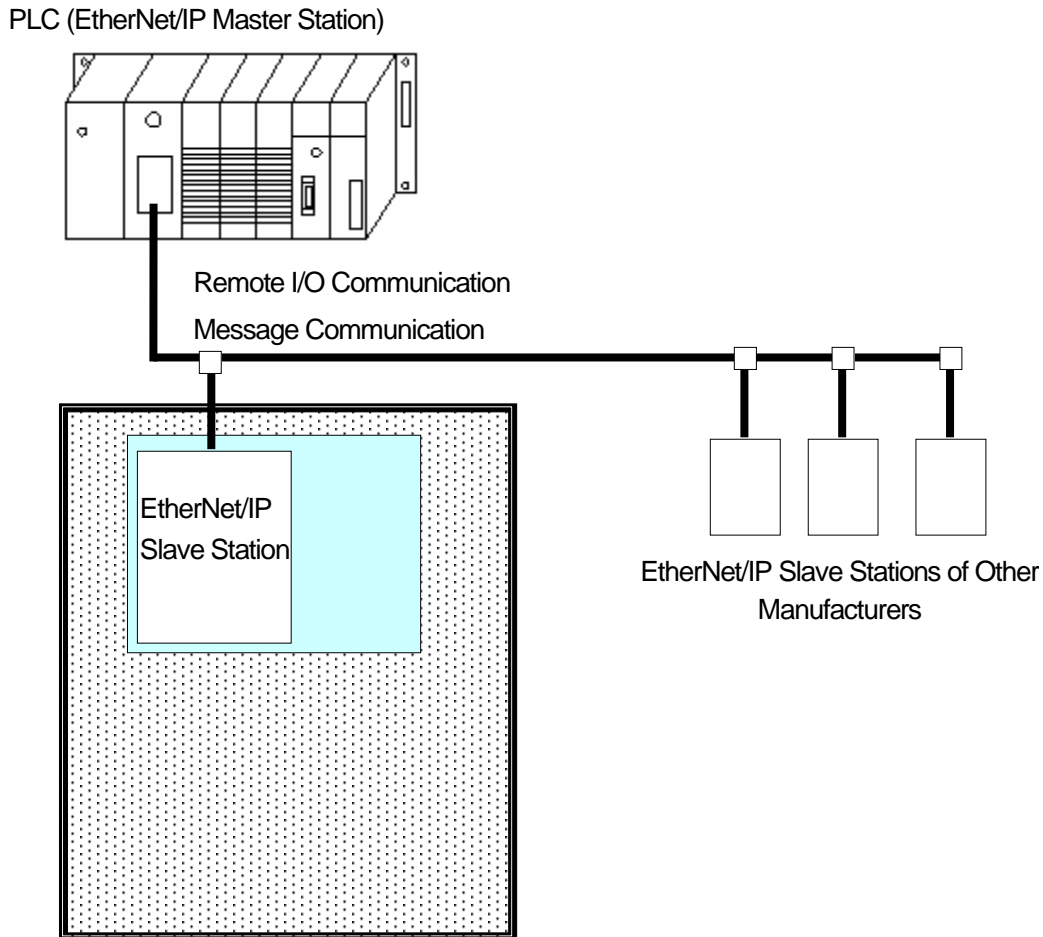
9-2. EtherNet/IP

The HFC3000 EtherNet/IP System conforms to the open field network EtherNet/IP. Control of tools and transactions of message information are executed by EtherNet/IP Explicit message communication.

Due to conformance with the open field network EtherNet/IP System, connections with EtherNet/IP devices (master/slave) of other manufacturers are enabled.

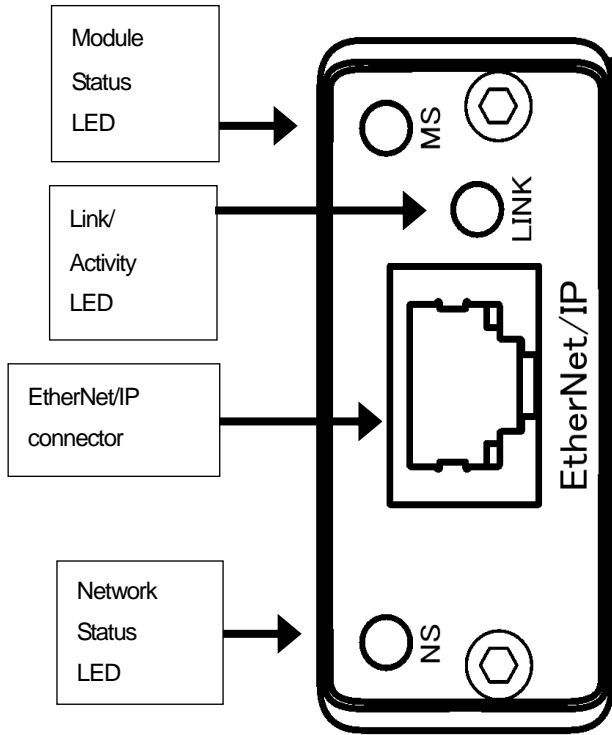
Also, remote I/O communication and message communication can be executed at the same time.

9-2-1. System Structure



HFC3000 EtherNet/IP System

9-2-2 Hardware Setting



●EDS File

An EDS file is an information file related to the communication specifications of EtherNet/IP-compatible device and a separate, individual file exists for each device. The EDS file is necessary for using the EtherNet/IP configuration software to connect the MFC-EN and the PLC.

The EDS file is included in the installation CD for the HFC3000 User Console. Please refer to the instruction manual for the EtherNet/IP configuration software concerning the appropriate method for using the EDS file.

●Module Pin Configuration

No.	Signal	Description
1	TD+	Send data +
2	TD-	Send data -
3	RD+	Receive data +
4	-	Not used
5	-	Not used
6	RD-	Receive data -
7	-	Not used
8	-	Not used

* The cable is not included with the equipment. Please prepare a LAN cable of Category 5e or higher on your own.

▪ **Be sure to connect the cable with all power turned OFF.**

●List of LED Indications

The module LEDs indicate the states of the nodes of the HFC3000 EtherNet/IP System and the network state.

LED		Color	State		Details
A	Network Status LED	OFF	Off	Offline	Offline or power is not supplied.
		Green	Lit up	Online	Communicating normally.
			Flash	Communication not established	Although online, connection is not established.
		Red	Lit up	Error	A critical error has occurred./ Redundant IP address.
			Flash	Connection timeout	A connection timeout has occurred once or more.
		B	Module Status LED	OFF	Off
Green	Lit up			Online	Normal state
	Flash			Communication not established	Due to incomplete configuration or connection failure, the device must be re-recognized.
Red	Lit up			Error	A critical error has occurred.
	Flash			Error	A recoverable error has occurred.
C	Link Activity LED			OFF	Off
		Green	Lit up	Not communicating	Ethernet link is established but communication is not performed.
			Flash	Communicating	Ethernet link is established and communication is in progress.

9-2-3 I/O Signal Specifications

	I/O Input/Output		Message Input/Output	
	AXIS to PLC	PLC to AXIS	AXIS to PLC	PLC to AXIS
Maximum Setting	32 bytes (256 bits)	8 bytes (64 bits)	4096 bytes	32bytes
Standard Setting	16 bytes (128 bits)	8 bytes (64 bits)	200 bytes	32bytes

9-2-4 Fieldbus Setting

Please refer to [S0140165 HFC3000 Omron PLC EtherNet/IP Connection Guide](#).

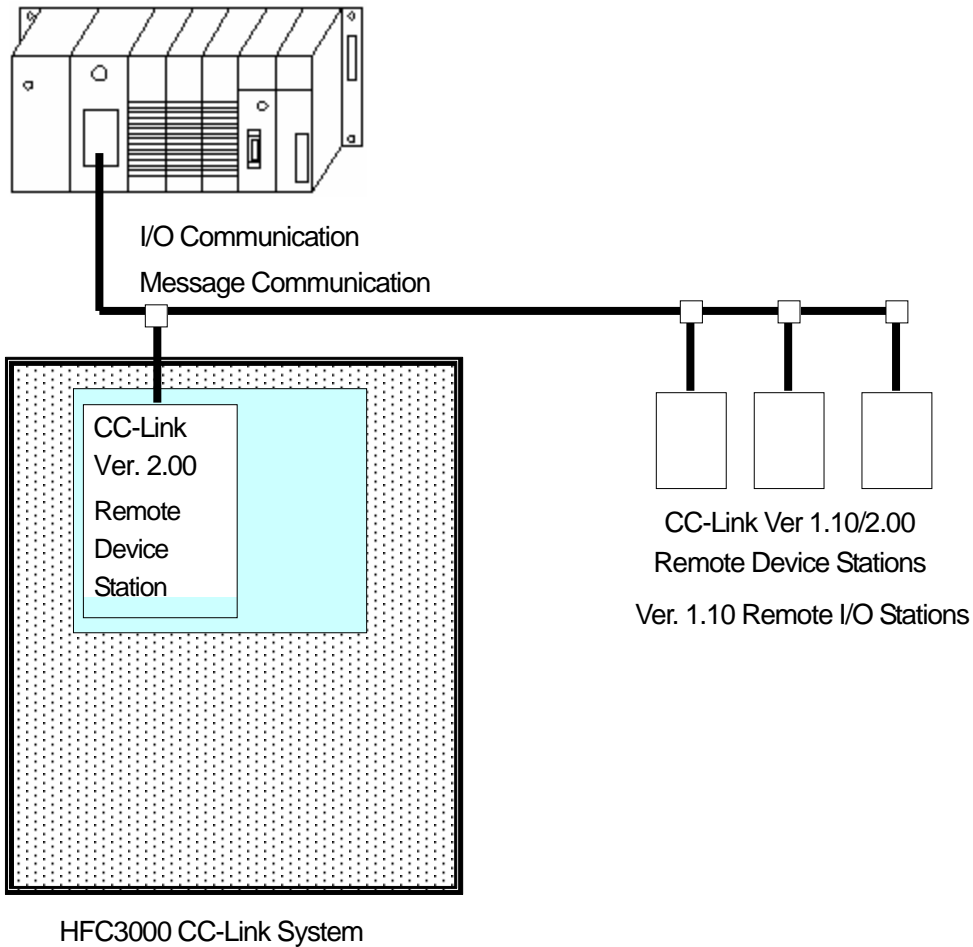
9-3. CC-Link

The HFC3000 CC-Link System conforms to the open field network CC-Link Ver 2.00. Control of tools and transaction of message information are executed by communication.

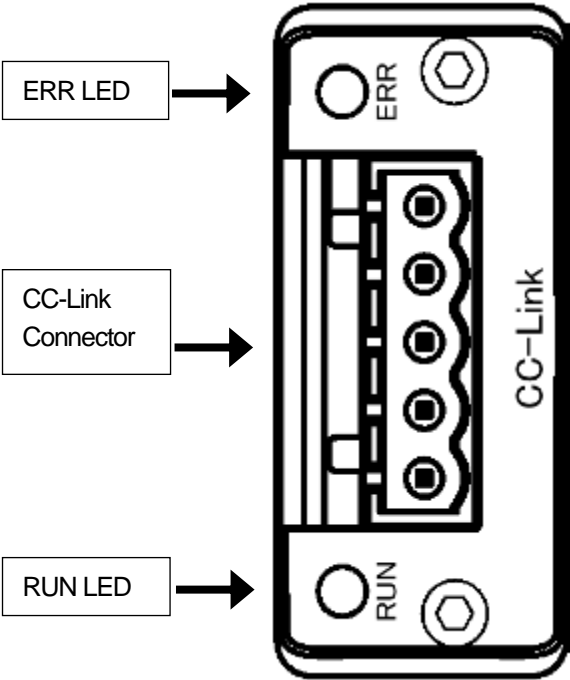
Due to conformance to the open field network CC-Link Ver 2.00 System, connections with a CC-Link Ver 2.0 master station, Ver 1.10/2.00 remote device stations, and Ver 1.10 remote I/O stations are enabled. Also, I/O communication and message communication can be executed at the same time.

9-3-1 System Structure

PLC (CC-Link Ver 2.00 Master Station)

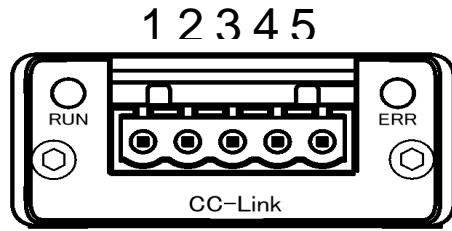


9-3-2 Description of the hardware



● Module Pin Configuration

No.	Signal	Wire Color	Description
1	DA	Black	Sending side
2	DB	Blue	Receiving side
3	DG	-	Signal ground
4	SLD	White	Shield
5	FG	Red	Ground



Manufacturer: Phoenix Contact
 Type: Connector plug
 Model: MSTB 2.5/5-ST-5.08 AU M
 Applicable wire size: AWG 14 ~ 23 or 0.25mm² ~ 2.5mm²
 * The connector is provided with the equipment.
 Please prepare the cable on your own.



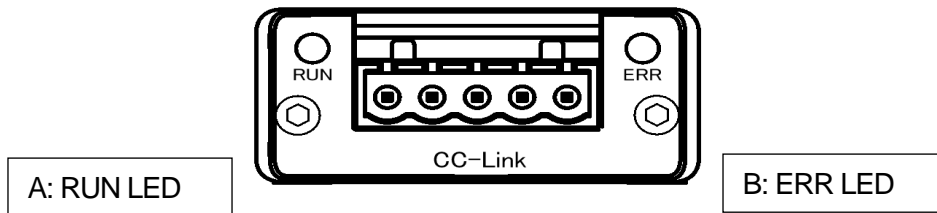
The cable wiring method is the same as that for the control power. Please refer to “Control Power Wiring Procedures” of “Input Power Source Connection” on PAGE 3-4 of the <<AFC3000 AC Servo Nutrunner Instruction Manual>>.

However, the compatible wire size and recommended rod terminals (ferrules) are as follows.

- Compatible wire size ··· AWG 23 ~ 14 (0.25mm² ~ 2.5mm²)
- Recommended rod terminals (ferrules)
 ··· Model: AI 2,5-6 WH (Phoenix Contact)

Be sure to connect the cable with all power being OFF.

Also, the module LEDs indicate the states of the nodes of the AFC3000 CC-Link System and the network state.



● List of LED Indications

LED	Color	State	Details	
A	RUN LED	OFF	Off Offline Power is not supplied or connection is unestablished.	
		Green	Lit up Online Communicating normally.	
		Red	Lit up Error A critical error has occurred.	
B	ERR LED	OFF	Off Offline Power is not supplied.	
		Red	Lit up	Error A critical error has occurred.
			Flickering	CRC error A cyclic redundancy check (CRC) error has occurred.
		Flash	Minor error Station No. or baud rate setting is changed after power on.	

9-3-3 I/O Signal Specifications

	I/O Input/Output		Message Input/Output	
	AXIS to PLC	PLC to AXIS	AXIS to PLC	PLC to AXIS
Maximum Setting	110 bytes (880 points)	110 bytes (880 points)	88 words	87 words
Standard Setting	78 bytes (624 points)	78 bytes (624 points)	88 words	87 words

<Area per Station · 1 Time Setting>

* PLC CC-Link V1.10 Master Station ▼

Type	1 Station Occupied		2 Stations Occupied		3 Stations Occupied		4 Stations Occupied	
	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points
RX	32 points ^{*1}	16 points	64 points ^{*1}	48 points	96 points ^{*1}	80 points	128 points ^{*1}	112 points
RY		16 points		48 points		80 points		112 points
RWw	4 words		8 words		12 words		16 words	
RWr ^{*2}	3 words		7 words		11 words		15 words	

<Area per Station · 2 Times Setting>

Type	1 Station Occupied		2 Stations Occupied		3 Stations Occupied		4 Stations Occupied	
	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points
RX	32 points ^{*1}	16 points	96 points ^{*1}	80 points	160 points ^{*1}	144 points	224 points ^{*1}	208 points
RY		16 points		80 points		144 points		208 points
RWw	8 words		16 words		24 words		32 words	
RWr ^{*2}	7 words		15 words		23 words		31 words	

<Area per Station · 4 Times Setting>

Type	1 Station Occupied		2 Stations Occupied		3 Stations Occupied		4 Stations Occupied	
	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points
RX	64 points ^{*1}	48 points	192 points ^{*1}	176 points	320 points ^{*1}	304 points	448 points ^{*1}	432 points
RY		48 points		176 points		304 points		432 points
RWw	16 words		32 words		48 words		64 words	
RWr ^{*2}	15 words		31 words		47 words		63 words	

<Area per Station · 8 Times Setting>

* Standard Setting ▼

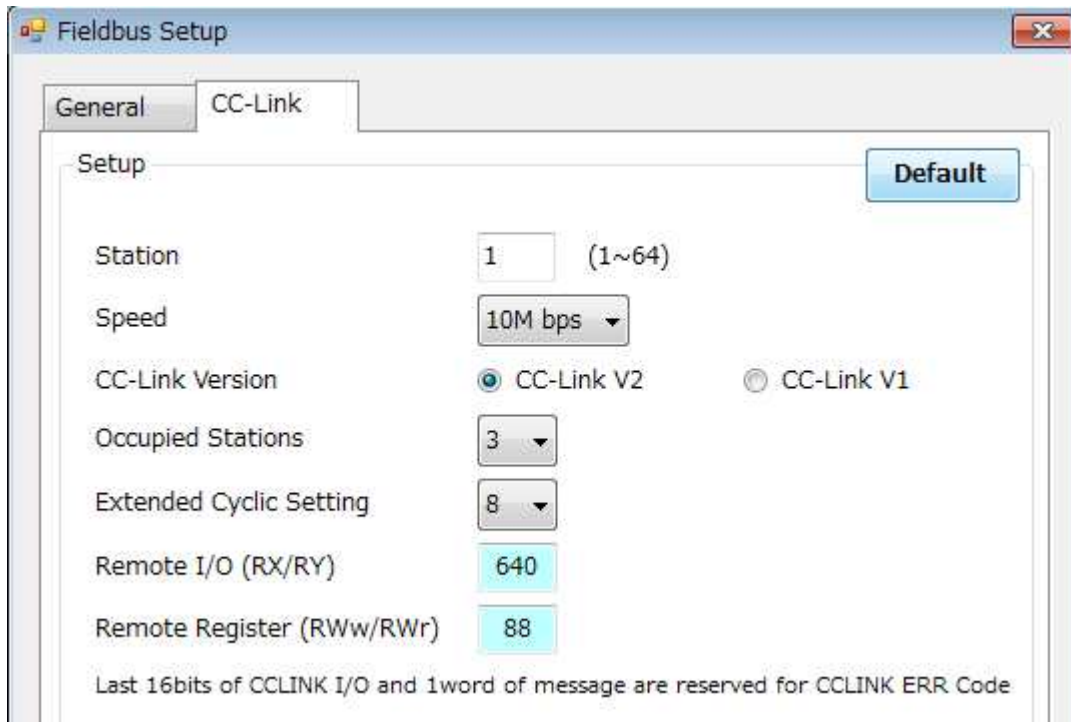
Type	1 Station Occupied		2 Stations Occupied		3 Stations Occupied		4 Stations Occupied	
	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points	Number of Occupied Points	Number of Available Points
RX	128 points ^{*1}	112 points	384 points ^{*1}	368 points	640 points ^{*1}	624 points	896 points ^{*1}	880 points
RY		112 points		368 points		624 points		880 points
RWw	32 words		64 words		88 words ^{*3}		72 words ^{*3}	
RWr ^{*2}	31 words		63 words		87 words ^{*3}		71 words ^{*3}	

*1: 16 of the occupied points are used by the system area and the number of available points is decreased accordingly.

*2: With RWr, 1 word is used for the error code and the area thereof is therefore 1 word less than that of RWw.

*3: The message input/output setting is restricted to a maximum of 256 bytes that is the total of the remote input/output (RX/RY) and the remote registers (RWw/RWr) (640 points + 88 words, 896 points + 72 words).

In the CC-Link tab, setting of the Anybus-CompactCom CC-Link is performed. The station No., the communication speed, the number of occupied stations, the extended cyclic setting, and the CC-Link version can be changed.



- Default (the settings are set to the factory settings)
 - Station: 1
 - Speed: 10M bps
 - Occupied Stations: 3 stations(CC-Link V2), 4 stations (CC-Link V1)
 - Extended Cyclic Setting: 8 times (CC-Link V2), 1 time (CC-Link V1)

* Message Block Bytes is fixed at 176 bytes.

● **Station**

Setting range: 1 ~ 64

● **Speed**

Setting range: 156kbps, 625kbps, 2.5Mbps, 5Mbps, 10Mbps

● **CC-Link Version**

Setting range: CC-Link V2, CC-Link V1

● **Occupied Stations**

Setting range: 1 station, 2 stations, 3 stations, 4 stations (* fixed at 4 stations with CC-Link V1)

● **Extended Cyclic Setting**

Setting range: 1 time, 2 times, 4 times, 8 times (* fixed at 1 time with CC-Link V1)

● **Remote I/O (RX/RX)**

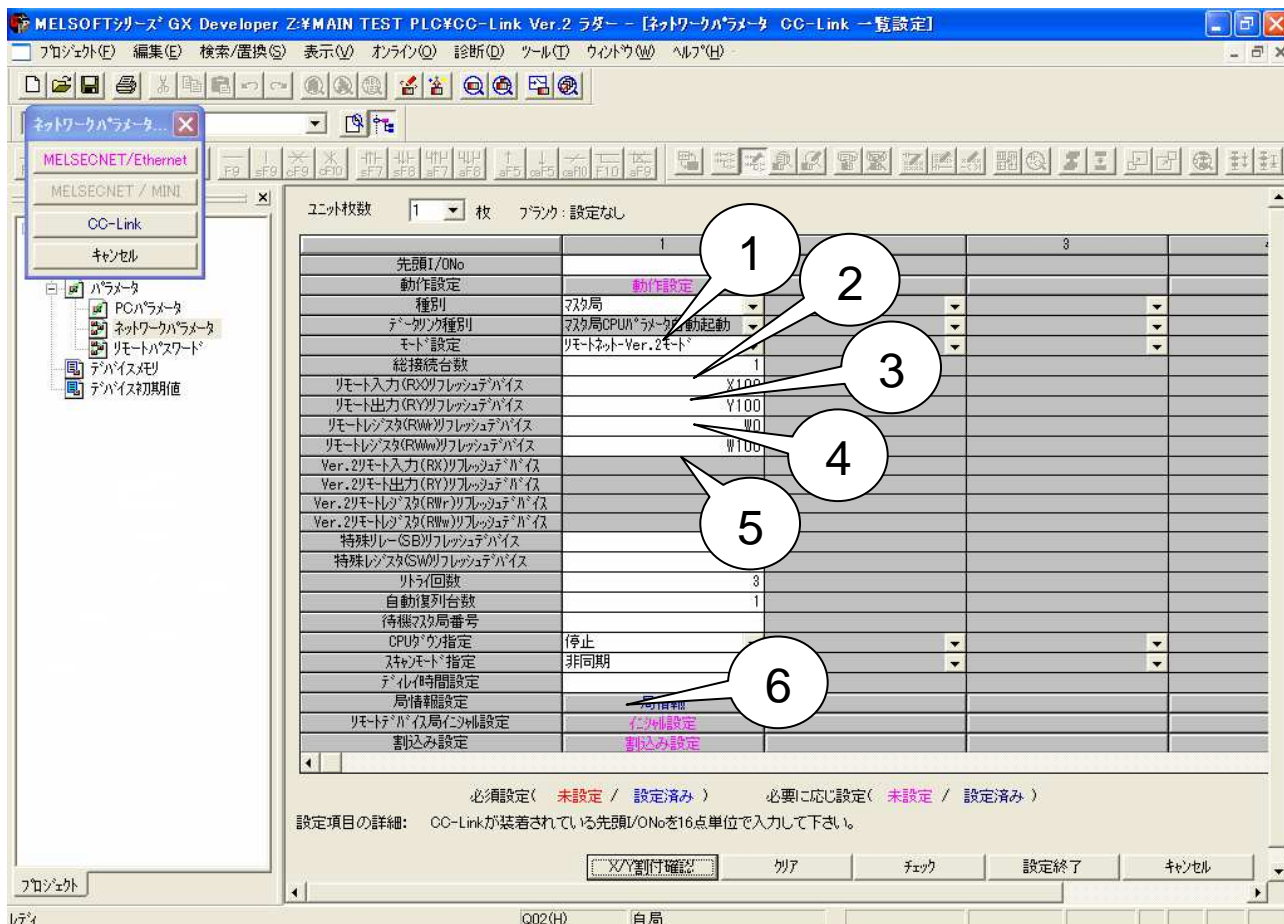
● **Remote Register (RWw/RWr)**

This can be set in accordance with the combination of the extended cyclic setting and the number of occupied stations.

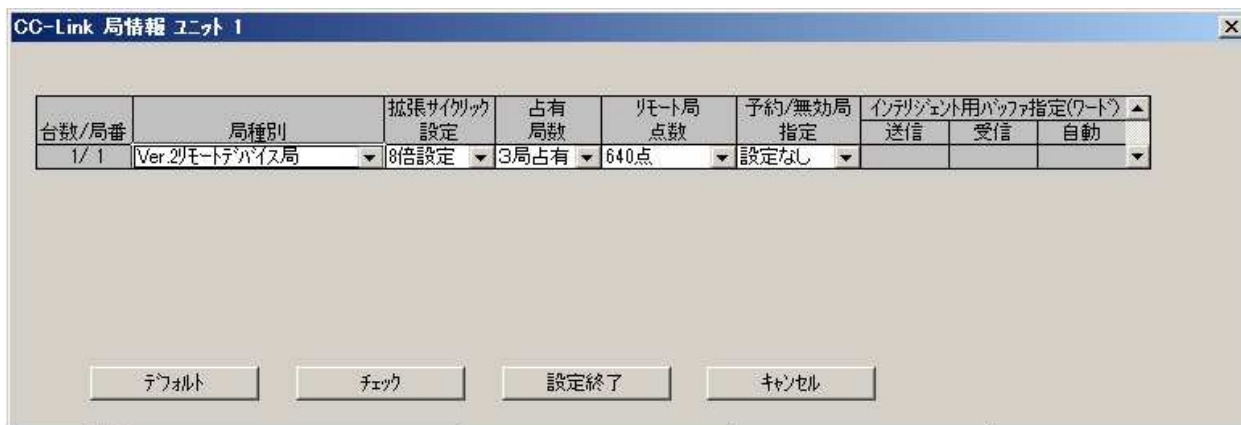
MELSEC-Q Series Parameter Setting

Startup GX Developer → Prepare PC Series QCPU (Q mode) Project →

Parameter → Network Parameter → Set List of CC-Link



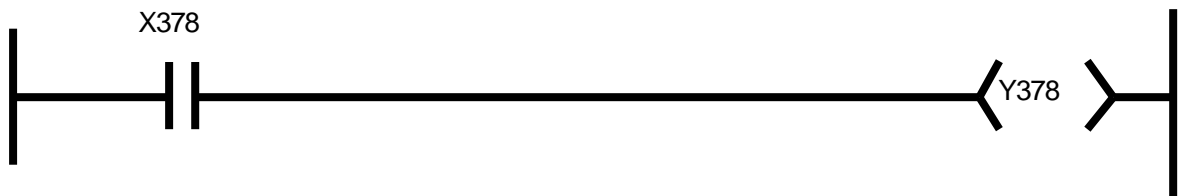
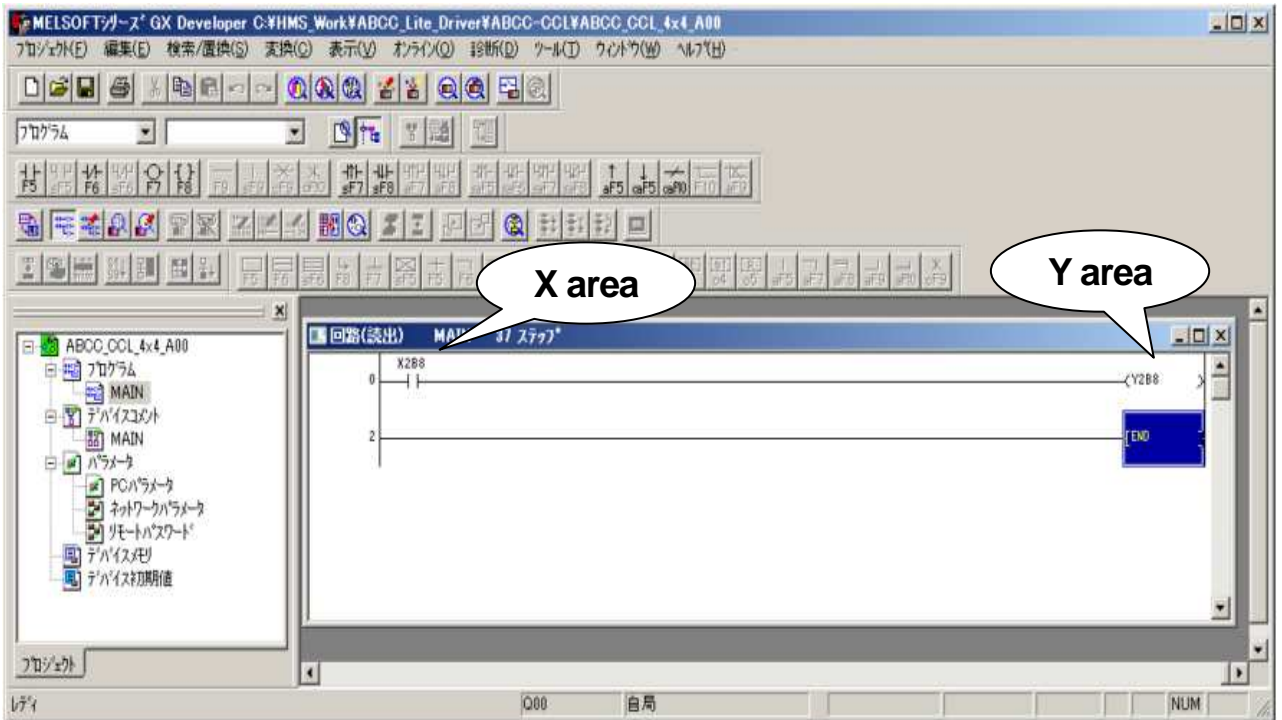
1. Select “Remote Net (Ver. 2 Mode)” at Mode Select.
2. Set the All Connect Count (3) for number of connected Remote Device stations
3. Set the refresh device Remote Input (X100) / Output (Y100) at “Remote Output (RX / RY).”
4. Set the refresh device Remote Register read (D1000) at “Remote Register (RWr).”
5. Set the refresh device Remote Register write (D4000) at “Remote Register (RWw).”
- * The allocated set values differ according to the station No. of the Controller used.
6. Set the station information at Station Information Setting (the picture below shows an example forreference).



◆Enabling the CC-Link connection to the PLC

In addition, it is necessary for even the PLC side to implement a handshake about the system area. In a ladder program, explain a method of the setting about three stations 8 times.

When 632 (278h) bit eyes (Initial Data Processing Request) of the system area (X domain) are turned on as a program of the PLC in the case of three stations 8 times setting, set it so that 632 (278h) bit eyes (Initial Data Processing Complete) of the system area (Y domain) become ON. Actually, appoint (100h +278h) like the chart below as X domain and Y domain for 378h because allocate it as a domain of X and Y from 100h.



● Location of Handshaking Bits According to Size Configuration

Cyclic Cycles Setting	1 Occupied Station	2 Occupied Station	3 Occupied Station	4 Occupied Station
1	24th bits / 18h	56th bits / 38h	88th bits / 58h	120th bits / 78h
2	24th bits / 18h	88th bits / 58h	152th bits / 98h	216th bits / D8h
4	56th bits / 38h	184th bits / B8h	312th bits / 138h	440th bits / 1B8h
8	120th bits / 78h	376th bits / 178h	632th bits / 278h	888th bits / 378h

(Location of “Initial Data Processing Request” and “Initial Data Processing Complete” Bits)

“h” = hexadecimal

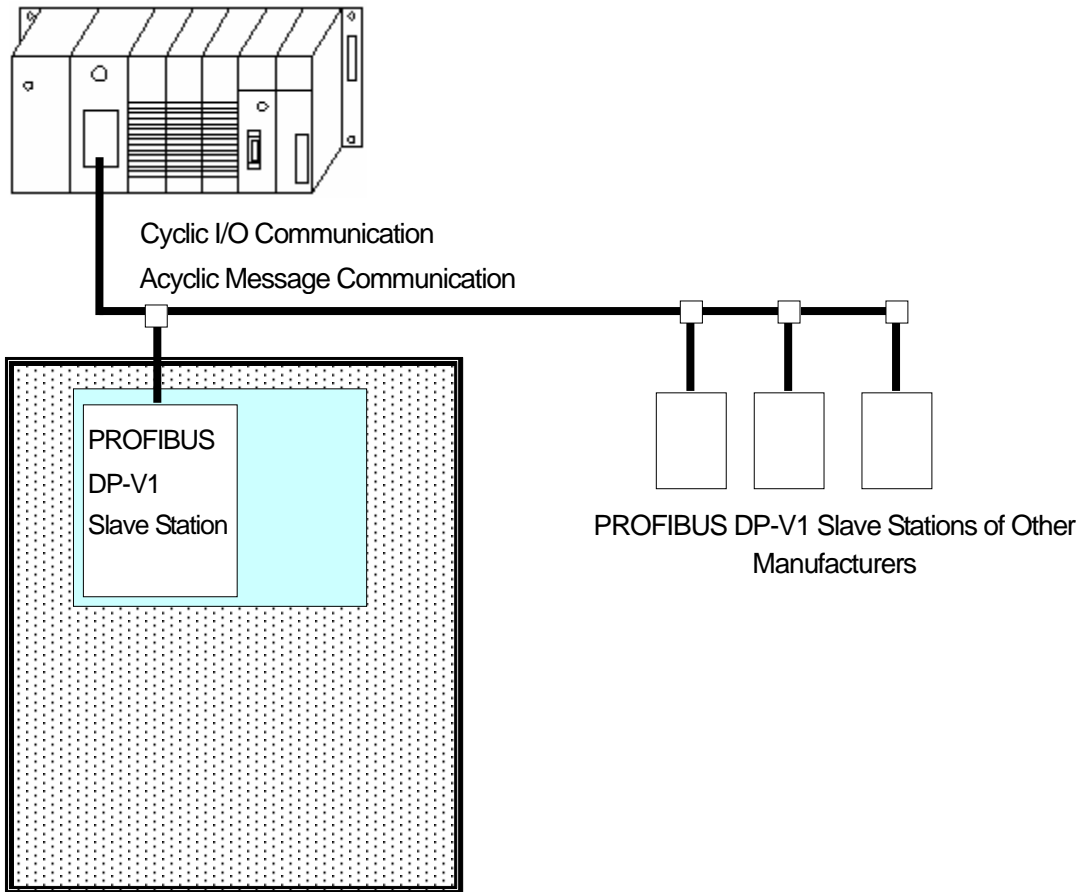
9-4 PROFIBUS DP-V1

The HFC3000 PROFIBUS DP-V1 System conforms to the open field network PROFIBUS DP-V1. Control of tools and transaction of message information are executed by cyclic I/O communication and acyclic message communication. Due to conformance to the open field network PROFIBUS DP-V1 system, connections with PROFIBUS DP-V1 devices (master/slave) of other manufacturers are enabled.

Also, cyclic I/O communication and acyclic message communication can be executed at the same time.

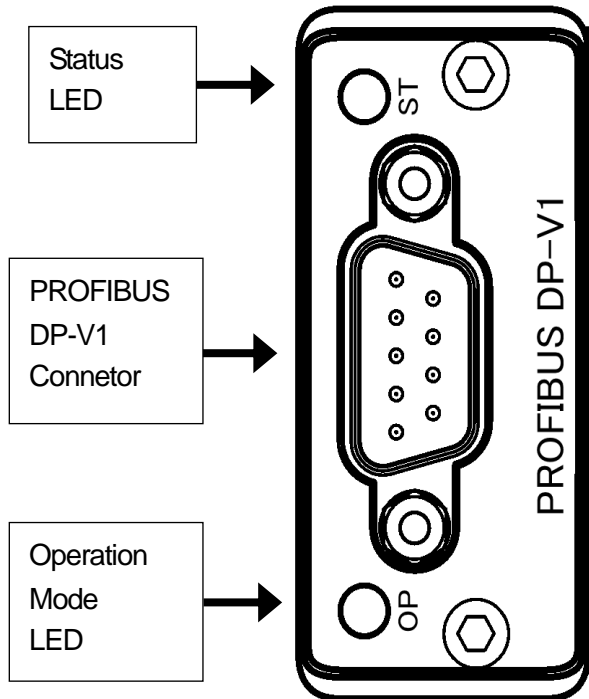
9-4-1 System Structure

PLC (PROFIBUS DP-V1 Master Station)



HFC3000 PROFIBUS DP-V1 System

9-4-3 Description of the Hardware

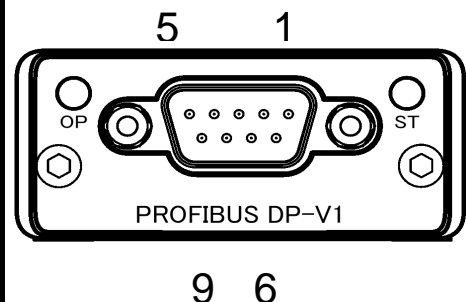


● GSD File

A GSD file is an information file related to the communication specifications of PROFIBUS DP-V1-compatible device and a separate, individual file exists for each device. The GSD file is necessary for using the PROFIBUS DP-V1 configuration software to connect the HFC3000 and the PLC. The GSD file is included in the installation CD for the HFC3000 User Console.

● Module Pin Configuration

No.	Signal	Description
1	-	Connection prohibited
2	-	Connection prohibited
3	RxD/TxD-P	Data sending/receiving + (B line · P side)
4	CNTR-P	RTS
5	DGND	Communication power (ground side)
6	VP+5	Communication power (+5V side)
7	-	Connection prohibited
8	RxD/TxD-N	Data sending/receiving - (A line · N side)
9	-	Connection prohibited



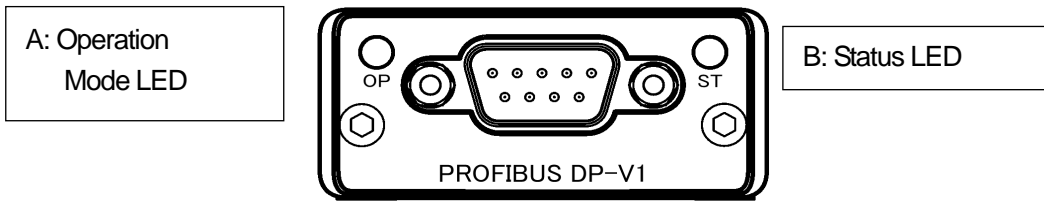
* The connector (D-SUB 9-pin plug) at the cable side and the cable are not provided with the equipment.

Please prepare these on your own.

· Be sure to connect the cable with all power being OFF.

● List of LED Indications

The module LEDs indicate the states of the nodes of the HFC3000 PROFIBUS DP-V1 System and the network state.



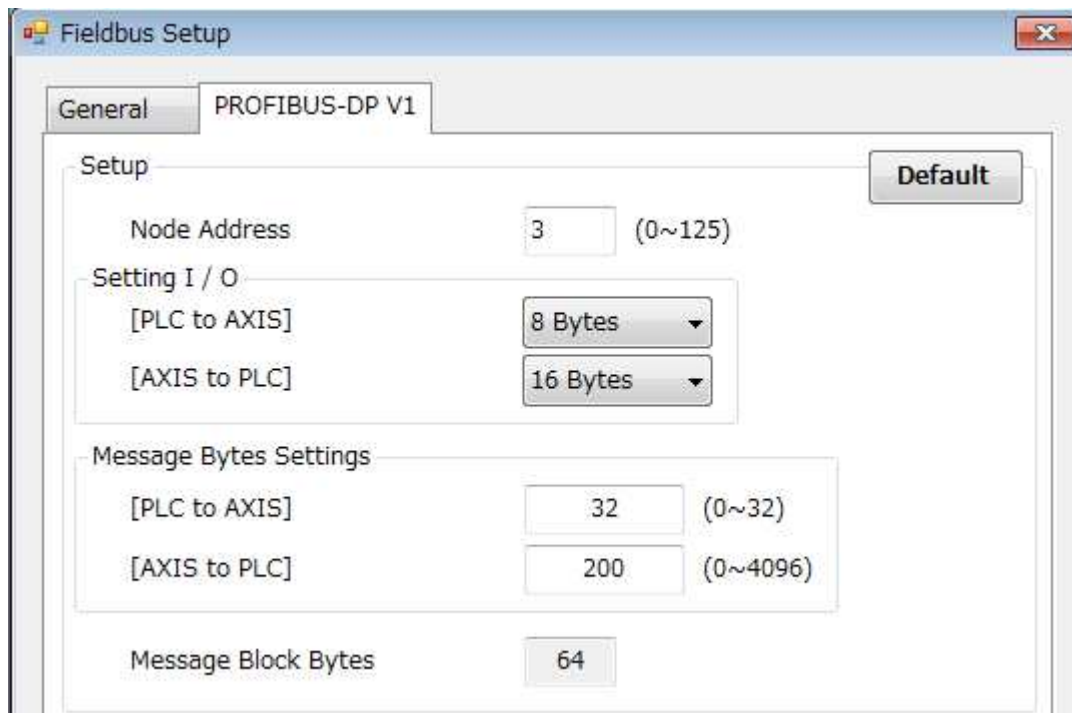
LED		Color	State		Details
A	Operation Mode LED	OFF	Off	Offline	Offline or power is not supplied.
		Green	Lit up	Online	Data communication in progress.
			Flash	Online	Clearing data.
		Red	Flash 1	Parameter error	There is an error in the parameter setting.
Flash 2	Configuration error		An error has occurred in the Profibus configuration (setting).		
B	Status LED	OFF	Off	Power OFF Uninitialized	Power is not supplied. Network is being initialized. Module is being set up.
		Green	Lit up	Normal operation	The module has transitioned from the initial state.
			Flash 1	Diagnosis event	The diagnosis event is being executed.
		Red	Lit up	Exceptional error	A crucial error has occurred.

9-4-4 I/O Signal Specifications

	I/O Input/Output		Message Input/Output	
	AXIS to PLC	PLC to AXIS	AXIS to PLC	PLC to AXIS
Maximum Setting	32 bytes (256 points)	32 bytes (256 points)	4096 bytes	32bytes
Standard Setting	8 bytes (64 points)	16 bytes (128 points)	200bytes	32 bytes

9-4-5 Fieldbus Setup

In the PROFIBUS DP-V1 tab, setting of the Anybus-CompactCom PROFIBUS DP-V1 is performed. The node address, the I/O settings, and the message settings can be changed.



●Default (the settings are set to the factory settings)

- Node Address: 3
- Setting I/O [PLC to Axis]: 8bytes[64bits]
- Setting I/O [Axis to PLC]: 16bytes[128bits]
- Message Bytes Settings[PLC to Axis]: 32bytes
- Message Bytes Settings [Axis to PLC]: 200bytes

* Message Block Bytes is fixed at 64 bytes.

●Node Address

Setting range: 0 ~ 125

●Setting I/O

- [PLC to Axis]
 - Setting range: 2bytes [16bits] ~ 8bytes [64bits]
- [Axis to PLC]
 - Setting range: 2bytes [16bits] ~ 32bytes [256bits]

● **Message Bytes Settings**

- [PLC to Axis]
Setting range: 0byte ~ 32bytes
- [Axis to PLC]
Setting range: 0byte ~ 4096bytes

9-5 DeviceNet

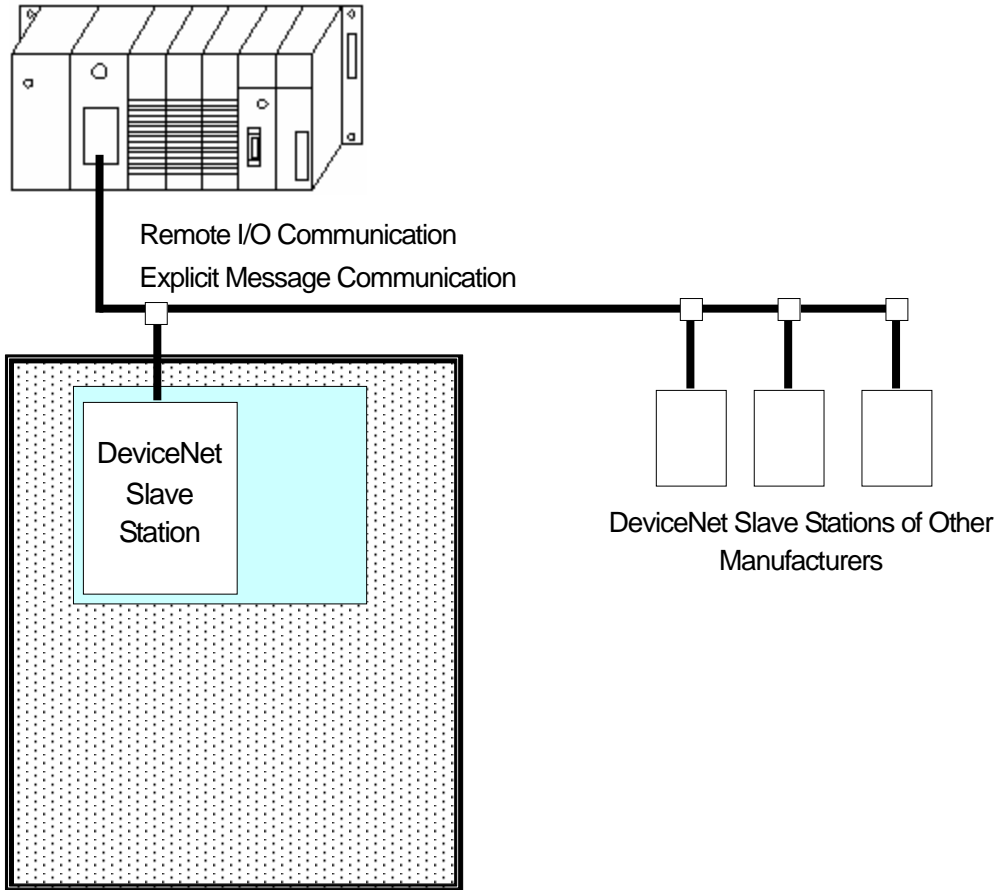
The HFC3000 Device Net System conforms to the open field network Device Net. Control of tools and transaction of message information are executed by Device Net Explicit message communication.

Due to conformance to the open field network Device Net System, connections with Device Net devices (master/slave) of other manufacturers are enabled.

Also, remote I/O communication and Explicit message communication can be executed at the same time.

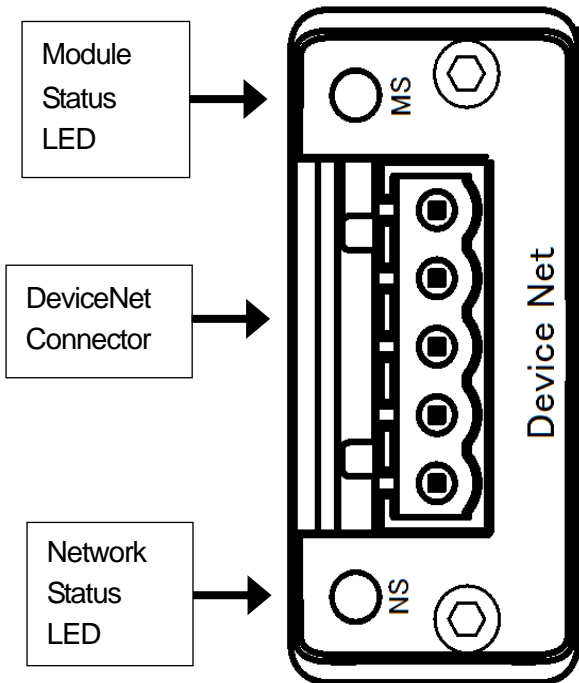
9-5-1 System Structure

PLC (DeviceNet Master Station)



HFC3000 DeviceNet System

9-5-2 Description of the Hardware



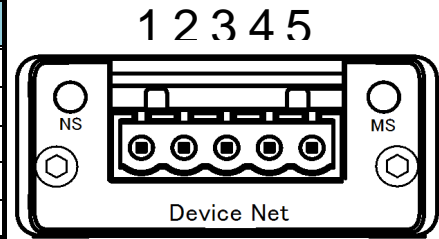
● EDS File

An EDS file is an information file related to the communication specifications of Device Net-compatible device and a separate, individual file exists for each device. The EDS file is necessary for using the Device Net configuration software to connect the MFC-DN and the PLC.

The EDS file is included in the installation CD for the AFC3000 User Console. Please refer to the instruction manual for the Device Net configuration software concerning the appropriate method for using the EDS file.

● Module Pin Configuration

No.	Signal	Wire Color	Description
1	V-	Black	Power cable - side
2	CAL L	Blue	Communication data Low side
3	SHUELD	-	Shield
4	CAL H	White	Communication data High
5	V+	Red	Power cable + side




Manufacturer: Phoenix Contact
 Type: Connector plug
 Model: MSTB 2.5/5-ST-5.08 AU M
 Applicable wire size: AWG 14 ~ 23 or 0.25mm² ~ 2.5mm²
 * The connector is provided with the equipment.
 Please prepare the cable on your own.



However, the compatible wire size and recommended rod terminals (ferrules) are as follows.

- Compatible wire size ... AWG 23 ~ 14 (0.25mm² ~ 2.5mm²)
- Recommended rod terminals (ferrules) ... Model: AI 2,5-6 WH (Phoenix Contact)



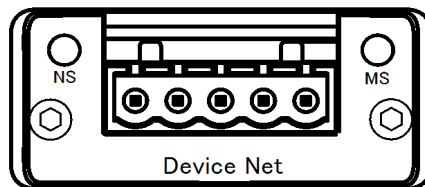
• **Be sure to connect the cable with all power being OFF.**

Caution

● List of LED Indications

The module LEDs indicate the states of the nodes of the AFC3000 Device Net System and the network state.

A : Network
Status LED



B : Module
Status LED

LED	Color	State	Details	
A	Network Status LED	OFF	Off Offline Offline or power is not supplied.	
		Green	Lit up	Online Communicating normally.
			Flash	Connection unestablished Although online, connection is unestablished.
		Red	Lit up	Error A critical error has occurred.
			Flash	Connection timeout A connection timeout has occurred once or more.
Red/Green	Lit up	Repeated Test mode		
B	Module Status LED	OFF	Off Power OFF Power is not supplied.	
		Green	Lit up	Online Normal state
			Flash	Connection unestablished Due to incomplete configuration or connection failure, the device must be re-recognized.
		Red	Lit up	Error A critical error has occurred.
			Flash	Error A recoverable error has occurred.
Red/Green	Lit up	Repeated Test mode		

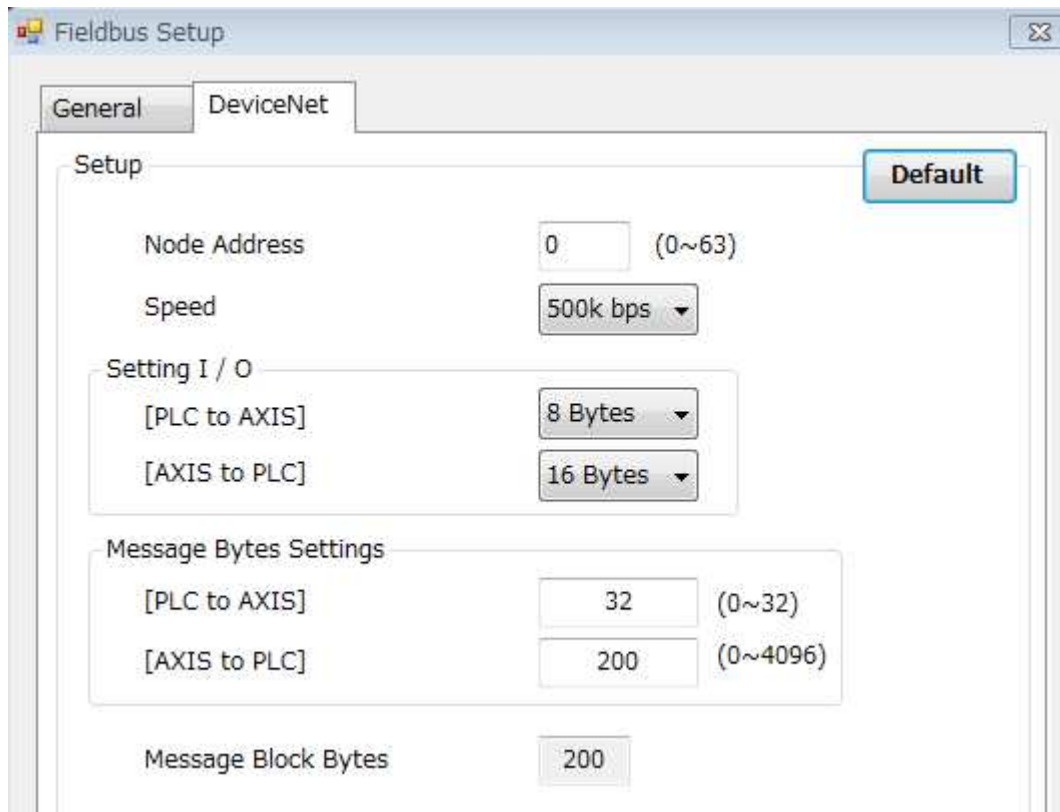
9-5-3 I/O Signal Specifications

	I/O Input/Output		Message Input/Output	
	AXIS to PLC	PLC to AXIS	AXIS to PLC	PLC to AXIS
Maximum Setting	32 bytes (256 points)	8 bytes (64 points)	4096 bytes	32 bytes
Standard Setting	16 bytes (128 points)	8 bytes (64 points)	200 bytes	32 bytes

9-5-4 Fieldbus Setup

In the Device Net window, setting of the Anybus-CompactCom Device Net is performed.

The communication speed, the node address, the I/O settings, and the message settings can be changed.



● **Default** (the settings are set to the factory settings)

- Node Address: 0 · Speed: 500k bps
- Setting I/O [PLC to Axis]: 8bytes[64bits]
- Setting I/O [Axis to PLC]: 16bytes[128bits]
- Message Bytes Settings[PLC to Axis]: 32bytes
- Message Bytes Settings [Axis to PLC]: 200bytes

* **Message Block Bytes is fixed at 200 bytes.**

● **Node Address**

Setting range: 0 ~ 63

● **Speed**

Setting range: 156kbps, 250kbps, 500kbps

● **Setting I/O**

· [PLC to Axis]

Setting range: 2bytes [16bits] ~ 8bytes[64bits]

· [Axis to PLC]

Setting range: 2bytes [16bits] ~ 32bytes[256bits]

● **Message Bytes Settings**

· [PLC to Axis]

Setting range: 0byte ~ 32bytes

· [Axis to PLC]

Setting range: 0byte ~ 4096bytes

9-6 PROFINET IO

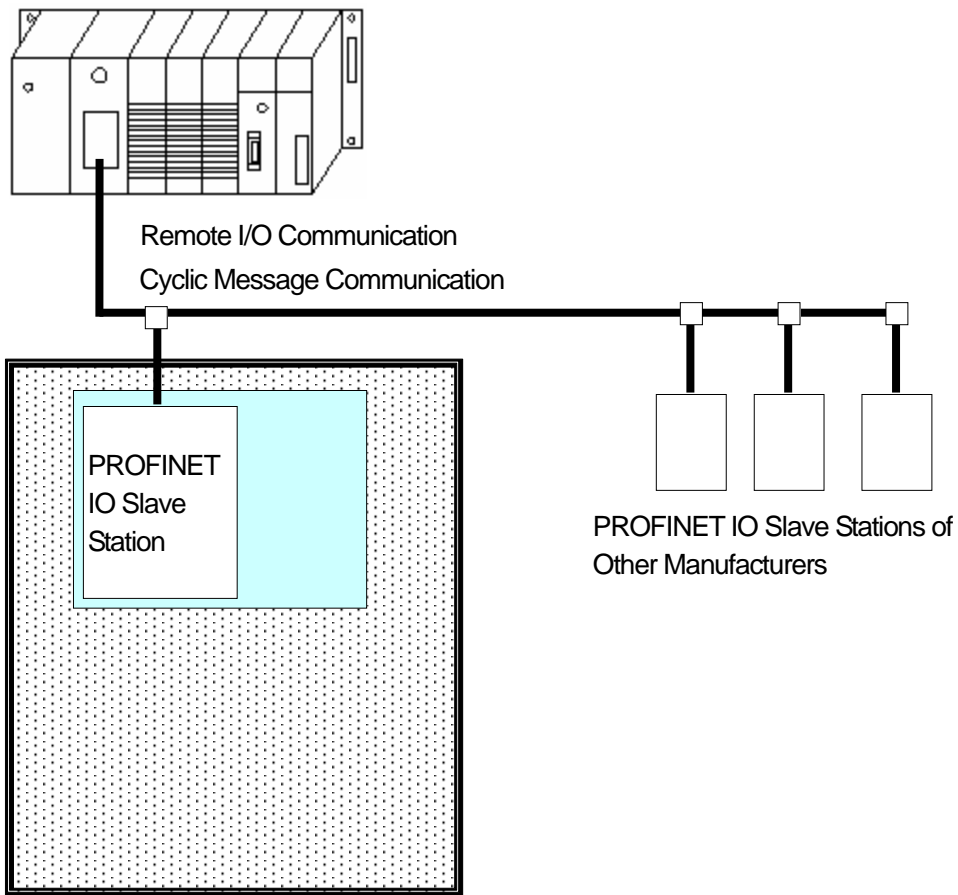
The HFC3000 PROFINET IO System conforms to the open field network PROFINET IO. Control of tools and transaction of message information are executed by cyclic message communication.

Due to conformance to the open field network PROFINET IO System, connections with PROFINET IO devices (master/slave) of other manufacturers are enabled.

Also, remote I/O communication and cyclic RECODE DATA communication can be executed at the same time.

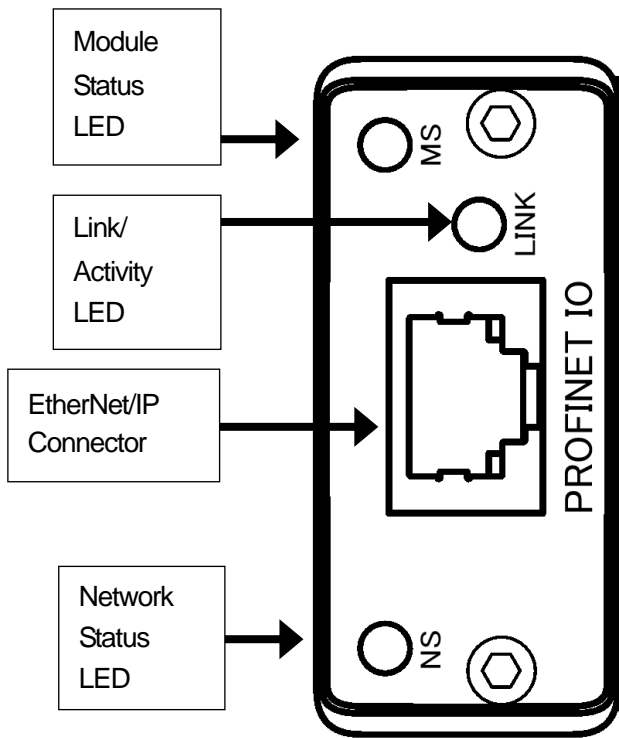
9-6-1 System Structure

PLC (PROFINET IO Master Station)



HFC3000 PROFINET IO System

9-6-2 Description of the Hardware



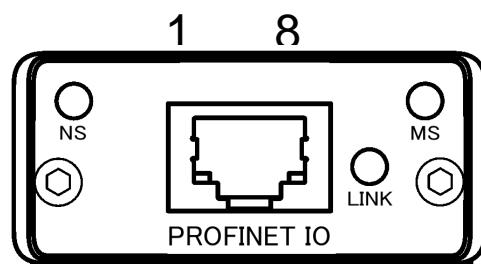
● GSDML File

A GSDML file is an information file related to the communication specifications of PROFINET IO-compatible device and a separate, individual file exists for each device. The GSDML file is necessary for using the PROFINET IO configuration software to connect the MFC-PN and the PLC.

The GSDML file is included in the installation CD for the HFC3000 User Console. Please refer to the instruction manual for the PROFINET IO configuration software concerning the appropriate method for using the GSDML file.

● Module Pin Configuration

No.	Signal	Description
1	TD+	Send data +
2	TD-	Send data -
3	RD+	Receive data +
4	-	Not used.
5	-	Not used.
6	RD-	Receive data -
7	-	Not used.
8	-	Not used.



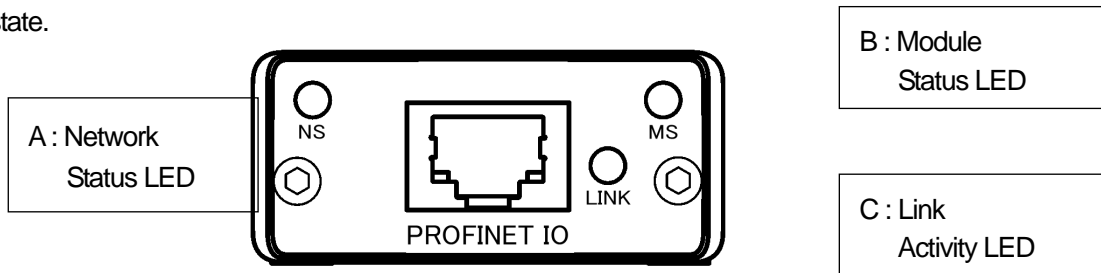
* The cable is not provided with the equipment. Please prepare a LAN cable of Category 5e or higher on your own. equipment. Please prepare these on your own.



· **Be sure to connect the cable with all power being OFF.**

● List of LED Indications

The module LEDs indicate the states of the nodes of the HFC3000 PROFINET IO System and the network state.



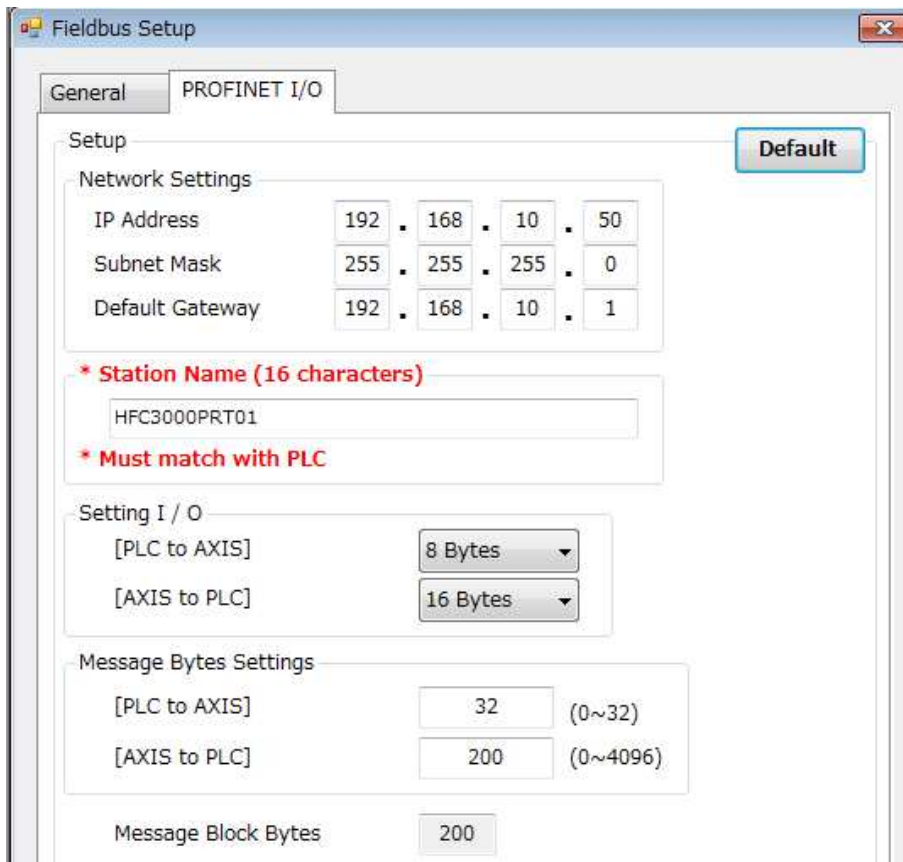
LED	Color	State		Details	
A	Network Status LED	Off	Off	Offline	Offline or power is not supplied.
		Green	Lit up	Online	Communicating normally.
			Flash	Communication unestablished	Although online, connection is unestablished.
		Red	Lit up	Error	A critical error has occurred. / Redundant IP address.
			Flash	Connection timeout	A connection timeout has occurred once or more.
		B	Module Status LED	Off	Off
Green	Lit up			Online	Normal state
	Flash			Communication unestablished	Due to incomplete configuration or connection failure, the device must be re-recognized.
Red	Lit up			Error	A critical error has occurred.
	Flash			Error	A recoverable error has occurred.
C	Link Activity LED			Off	Off
		Green	Lit up	Not communicating	ETHERNET link is established but communication is not performed.
			Flash	Communicating	ETHERNET link is established and communication is in progress.

19-6-3 I/O Signal Specifications

	I/O Input/Output		Message Input/Output	
	AXIS to PLC	PLC to AXIS	AXIS to PLC	PLC to AXIS
Maximum Setting	32 bytes (256 points)	8 bytes (64 points)	4096 bytes	32 bytes
Standard Setting	16 bytes (128 points)	8bytes (64 points)	200 bytes	32 bytes

9-6-4 Fieldbus Setup

In the PROFINET I/O tab, setting of the Anybus-CompactCom PROFINET IO is performed. The network settings, the station name, the I/O settings, and the message settings can be changed.



● **Default** (the settings are set to the factory settings)

- Network Settings
 - IP Address: 192.168.10.50
 - Subnet Mask: 255.255.255.0
 - Default Gateway: 192.168.10.1
- Station Name: HFC3000PRT01
- Setting I/O [PLC to Axis]: 8bytes[64bits]
- Setting I/O [Axis to PLC]: 16bytes[128bits]
- Message Bytes Settings [PLC to Axis]: 32bytes
- Message Bytes Settings [Axis to PLC]: 200bytes

* **Message Block Bytes is fixed at 250 bytes.**

● **Network Settings**

- IP Address: 0.0.0.0 ~ 255.255.255.255
- Subnet Mask: 0.0.0.0 ~ 255.255.255.255
- Default Gateway: 0.0.0.0 ~ 255.255.255.255

● **Station Name**

Setting range: ASCII characters (half-width alphanumeric characters· 16 characters at max.)
 Please make sure that the name is the same as the name registered at the PLC side.
 If the names are not the same, network connection with the PLC side cannot be established.

● **Setting I/O**

- [PLC to Axis]

Setting range: 2bytes[16bits] ~ 8bytes[64bits]

- [Axis to PLC]

Setting range: 2bytes[16bits] ~ 32bytes[256bits]

● **Message Bytes Settings**

- [PLC to Axis]

Setting range: 0byte ~ 32bytes

- [Axis to PLC]

Setting range: 0byte ~ 4096bytes

Chapter 10 Warranty and Servicing

10-1. Warranty

The period and scope of warranty of this equipment shall be as described below.

10-1-1. Warranty Period

The warranty period of this equipment is 1 year from the date of purchase or the date of delivery to the designated place or within 10 million fastening cycle counts.

10-1-2. Scope of Warranty

If a malfunction occurs in the equipment in the state of correct use in accordance with this instruction manual within the warranty period, repair or replacement shall be performed free of charge. However, accommodations shall be charged accordingly in the following cases, even within the warranty period.

1. If the cause of a malfunction is a condition, environment, handling, etc., outside that which is indicated in the instruction manual.
2. If a malfunction is due to a modification or repair performed by the customer.
3. If the cause of a malfunction is an apparatus other than this equipment.
4. If a malfunction is due to use outside the specification range of this equipment.
5. If the cause of a malfunction is fire, earthquake, storm or flood damage, brine damage, or other disaster or act of God.
6. If the cause of a malfunction is dropping after purchase or delivery to the designated place or damage due to transport.
7. If the cause of a malfunction is entry of water, oil, piece of metal, or other foreign matter.

This scope of this warranty is limited to the main body of our equipment and damage induced by a malfunction of this equipment shall be excluded from the warranty.

10-1-3. Maintenance

Please perform periodic inspections to use the HFC3000 in the best condition.

●Check List

- Ensure that there is no abnormal heat generation by the Unit and Tool.
- Ensure that there is no abnormal noise or vibration when the tool rotates.
- Ensure that there is no adhesion of dust or foreign matter on the tool.
- Ensure that the cable has no flaws that may cause disconnection.
- Ensure there is no adhesion of dust, foreign matter, or oil on the cable.
- Ensure that the cable is not generating heat and that the cable sheath is free of deformation due to
- Ensure that there is no adhesion of dust, foreign matter, or oil on the Unit.
- Ensure that Unit is fixed firmly. Check the mounting screws for play and loosening.

●Torque Management

Please perform the periodic torque accuracy inspection and calibration inspection once a year for accurate torque management.

Our Manufacturing/Quality Control Group is executing the Calibration for Torque sensor and periodic inspection.

Please consult our company.

10-2. Servicing System

[Concerning Export]

- This equipment includes items that correspond to being strategic goods (or services) regulated under the Foreign Exchange Law and the Foreign Trade Control Law. Therefore, if this equipment is to be exported, an export license (or service permission) in accordance with these laws must be acquired from the Ministry of Economy, Trade and Industry and the license must be submitted to customs.
- Please be sure to contact us if this equipment is to be exported.

Memo

Appendix List of Tool Models

◆Please use the following forms of tool model and AXIS Unit type when order

HFT — M —

For tools besides those indicated in the table, please contact us.

Tool No.	Tool Model	Maximum Torque [N·m]	Maximum Rotation Speed [rpm]	Minimum Rotation Speed [rpm]	Maximum Rate [N·m/deg]	Unit
4	HFT-015M50-A	15.00	1090	1	99.999	HFC-B024
6	HFT-015M80-S	15.00	1895	1	99.999	HFC-B024
5	HFT-025M80-A	35.00	1218	1	99.999	HFC-B024
12	HFT-040M80-A	40.00	735	1	99.999	HFC-B024
13	HFT-015M50-A1	15.00	1215	1	99.999	HFC-B024
15	HFT-025M80-A1	25.00	1070	1	99.999	HFC-B024
16	HFT-040M80-A1	40.00	648	1	99.999	HFC-B024
7	HFT-060M80-A	60.0	446	1	99.999	HFC-B024
19	HFT-080M80-A	80.0	330	1	999.99	HFC-B024
8	HFT-130M80-A	130.0	203	1	999.99	HFC-B024
14	HFT-015M80-S1	15.00	1600	1	99.999	HFC-B024
18	HFT-040M80-S	40.00	694	1	99.999	HFC-B024
11	HFT-040M80-T	40.00	694	1	99.999	HFC-B024
27	HFT-015M50-P1	15.00	1190	1	99.999	HFC-B024
30	HFT-035M80-P1	35.00	778	1	99.999	HFC-B024
21	HFT-010M50-S1	10.00	1800	1	99.999	HFC-B024
22	HFT-025M80-S1	25.00	1000	1	99.999	HFC-B024
29	HFT-055M80-S	55.00	508	1	99.999	HFC-B024
26	HFT-080M80-S	80.0	303	1	999.99	HFC-B024
20	HFT-015M50-P	15.00	1000	1	99.999	HFC-B024
3	HFT-060M80-T	60.0	420	1	99.999	HFC-B024
25	HFT-060M81-P	60.0	500	1	99.999	HFC-B024
17	HFT-015M80-A	15.00	1215	1	99.999	HFC-B024
10	HFT-040M80-L	40.00	805	1	99.999	HFC-B024
31	HFT-030M80-P1D	30.00	980	1	99.999	HFC-B024
32	HFT-060M80-P1	60.0	461	1	99.999	HFC-B024
33	HFT-030M80-D	30.00	980	1	99.999	HFC-B024
34	HFT-200M80-A	200.0	117	1	999.99	HFC-B024

*The decimal point for the torque is the decimal point of the "Maximum Torque."

Revision History

Revision date	Manual No.	Content of revision	Page
Aug, 2015	S0140185A	1st Edition(Supporting V1.000)	
Jan 2016	S0140185B	Added explanation of various FB. Updated the photograph of the base	Chapter 9 P3-3, 4-4
May 2016	S0140185C	Fixed a description of the RS232C	P4-20

● **Technical Problems**

Dai-ichi Dentsu Ltd.

Technical Group

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