Optional parts

Additional display unit (sold separately)

Example: C7D-400D00

Main unit					Other					Description
Basic model No.				Installa-tion	Option 1	Option 2	Add'l proc.	Add'l spec.	Special support	
1	2	3	4	5	6	7	8	9	10	
C	7	D	–							Additional display unit for multi-loop controller with multifunction display
				3						Integrated mounting*1
				4						Standard (separate) mounting
					0					English, Japanese
						0				None
							0			None
							D			With inspection report
								0		CE, KC, UKCA–compliant
									0	No special support

*1. A integrated mounting bracket is included.

Parts (sold separately)

Part name	Model No.
SLP-C7 Smart Loader Package (free version)*1	SLP-C7FJ91
SLP-C7 Smart Loader Package (paid version)	SLP-C7-J91
Power terminal cover (10 covers included)	81447704-001
C7 (display unit) mounting method change kit*2	84503167-001
microSD card (for replacement)	84502552-001

Part name	Model No.
CLOCK block (for replacement)*3	84501420-001
MOTOR block (for replacement)*3	84501421-001
Current transformer (dia. 5.8 mm)	QN206A
Current transformer (dia. 12 mm)	QN212A
Voltage transformer (200 V AC)	81406725-003

*1. Downloadable from our website

  https://www.azbil.com/products/factory/factory-product/controller-recorder-communication-gateway/controller/index.html

*2. A integrated mounting bracket, a dedicated cable for connecting the display unit, and standard gasket,gasket with 92×92 mm hole are included with the product.

*3. Mounting bracket for replacement is included.

Accessories

Applicable model No.	Part name	Quantity	Remarks
C7G_4	Standard gasket	1	For the display unit
	Display unit mounting screw (6 mm)	5	
	Display unit mounting screws (10 mm)	5	
	Setscrews (for securing temporarily)	2	
C7G_3	Gasket with 92×92 mm hole	1	
	Integrated-mounting bracket	1	
	Display unit mounting screws (6 mm)	5	
	Integrated-mounting cable	1	

Please read "Terms and Conditions" from the following URL before ordering and use.
https://www.azbil.com/products/factory/order.html

Azbil Corporation
Advanced Automation Company

1-12-2 Kawana, Fujisawa
Kanagawa 251-8522 Japan
URL: https://www.azbil.com

azbil

Multi-loop Controller
with Multifunction Display
Model C7G

CE KC UKCA UL CERTIFIED

The next stage in controller evolution

Azbil Corporation

A Significantly Enhanced Role for Digital Indicating Controllers

This PID controller handles up to four loops with a top sampling cycle of 10 ms at an accuracy of 0.1% F.S. In addition, its separable structure, compact data storage, and health index* function make it useful in ways that conventional controllers cannot match.

Multi-loop Controller with Multifunction Display

Model C7G

Meets a variety of needs !

[NEED A]	**High-level waterproofing** for moist environments	P **04**
[NEED B]	**Easy-to-read** settings and alarms with no difficult codes	P **05**
[NEED C]	**Flexible installation** in small spaces	P **06**
[NEED D]	A device **powered from the PC** during setup	P **07**
[NEED E]	**High-speed, smart** Ethernet connection	P **10**
[NEED F]	**Data saved** even if a problem occurs	P **12**
[NEED G]	**Prediction of equipment faults** to prevent sudden problems	P **13**
[NEED H]	Easy selection of model No. and specifications	P **14~**

Excellent usability

We developed the hardware from the user's viewpoint in order to achieve a high level of usability.

- Better usability and readability of display
- Separable structure
- Screwless-clamp terminal block

FEATURE 01

Seamless coordination with other equipment maximizes value

Ethernet as a standard interface provides high-speed communication with a variety of devices. RS-485 is also a standard feature, allowing improved flexibility in network construction. A PLC link function, which provides an easy Ethernet connection with Mitsubishi Electric's PLC, is also available.

Ethernet

RS-485
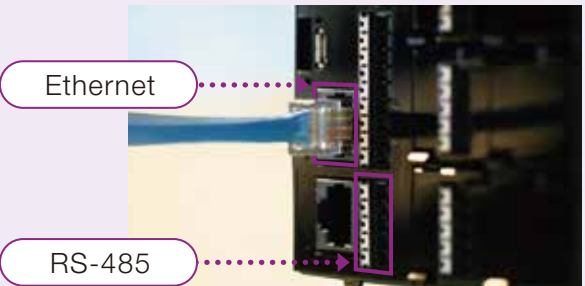
FEATURE 02

Diagnostic and management information for problem-solving

The advanced C7G, in addition to faster and more reliable process control, is capable of detecting warning signs of trouble with connected equipment through the use of its data-processing technology.

- Faster speed
- Compact data storage
- Data processing

Advance warning of problems

Advance-warning zone

Previous warning zone
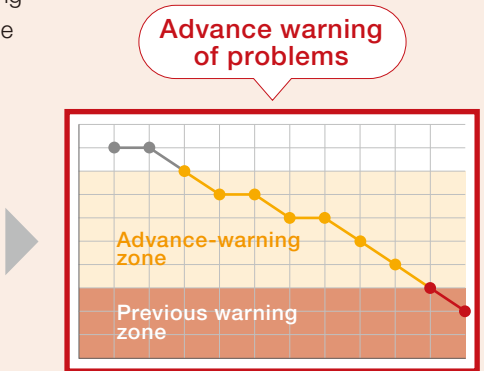
Health index function

FEATURE 03

Excellent usability

Excellent usability and readability

- 3.5-inch full dot matrix LCD offers crystal-clear display of values and graphs during control operation.
- Touch panel provides user-friendly operability. If lost, just press the home button.

Withstands a variety of environments

- Display unit features an IP67 protection rating. Resistance to dust and water drops allows use in a range of environments.
- Resistive touch-panel is easy to operate in cleanrooms, etc., where gloves are worn.

Vivid LCD display

Touch operation

Resistance to water drops

IP67 rating

Gloves are no problem

Selectable home screen

One controller handles up to 4 loops. The C7G breaks the single-loop controller mold by allowing users to select the required number of loops. The loops that are displayed on the screen can also be changed through home screen settings.

	2-loop display	3-loop display	4-loop display
Normal	100.1 200.2	100.1 200.2	100.1 200.2 300.3 400.4
Vertical display	100.1 200.2	100.1 200.2 300.3	

Displayed loops can be **switched between right and left**

Users can **freely choose** which loops to show on the home screen.

Clarity at a glance— set for full name display of C7G alarms and settings

Parameter settings and gauge alarms can be displayed by name rather than by code number, reducing the need to refer to the manual during setup and alarm handling. Both English and Japanese are available and can be seamlessly switched during operation.

- Sample display 1 -

English
(Controller alarm indication)

- Sample display 2 -

Japanese
(Parameter settings indication)

Easily identify the cause of alarms

The hierarchical design of the alarm screen allows easy identification of the location and cause of generated alarms.

[Example: sensor input error]

Alarm!

Problem in this function!

Cause identified!

Problem in this block!

Graphs are helpful in trial-run adjustments

Control status can be conveniently checked on a graph while making trial-run adjustments.

1-loop graph

Multi-loop graph

FEATURE 01
FEATURE 02
FEATURE 03

Excellent usability

Separable display allows for flexible positioning.

Display unit

Since power is supplied from the main unit, separate power wiring is not needed for displays installed less than 30 meters from the main unit. (A separate power supply is required for distances from 30 to 100 meters.)

LAN cable

Additional display unit block

Unlike conventional controllers, a second display can be added. The home screen of each display unit can be customized as desired.

Display unit   Second display

150.0

100.1
200.2
300.3

Main unit

Main unit

Easy DIN-rail mounting.
In addition to reducing the wiring to the panel, this structure greatly improves installation flexibility.

POINT 01

Simplified panel cutout mounting holes

Panel mounting requires only round holes. The tools previously required to make panel cutouts are not needed, allowing much simpler mounting.

Only round holes needed

POINT 02

Conventional panel cutouts also OK

As with conventional controllers, integrated mounting of the display unit attached to the main unit is also fine.

Conventional panel cutout

Insert wire. Spring-type terminals are that easy !

Spring-type terminals simplify wiring and improve reliability. They can be connected by simply inserting the bootlace ferrules. The spring clamp method achieves reliable electric contacts.

● **Much simpler** than conventional wiring methods.
● **No more hassles** after inserting the wire.

Bootlace ferrule

Configuration without a power supply

Parameters can be loaded and stored with the Smart Loader Package when the main unit is connected to a PC with a MicroUSB cable.

MicroUSB cable
(data transfer)

PC with PC loader software

The free version* of the Smart Loader Package can **be downloaded** from our webpage.

Smart Loader Package*

https://www.azbil.com/products/factory/factory-product/controller-recorder-communication-gateway/controller/index.html

* Configuration and monitoring software tool

● Free version (model SLP-C7FJ91) Includes configuration, monitoring, and Health Index functions.
● Paid version (model SLP-C7-J91) Includes additional functions not available in the free version (advanced monitoring function and Health Index screen).

Note: Diagrams are for illustrative purposes. The actual product may differ.

Basic functions of model C7G

Basic Functions

High-speed control

Up to 4 loops can be controlled at speeds of up to 10 ms. Ideal for heater control and other high-gain processes that require high-speed control.

A diversity of built-in functions

Various Functions

Cascade control

Compatible with internal cascade control functions. Especially effective for large-scale process control with slow dynamics.

Broken-line approximation

Equipped **with broken-line approximation function for input and output.** Controllability is improved by utilizing this feature for functions such as non-linear sensor output and output to high-gain actuators.

Parameter lock (with password)

With the lock level setting, **display and setting of parameters using the device's display** and **reading/writing parameters by the PC loader** can be prohibited.

Power supply voltage compensation

The heater power supply voltage can be monitored for fluctuations in order to **calculate corrections to the manipulated variable (MV) output.**

Display unit settings

The display can show, separately for each loop, **the units of measurement desired for the application.**

Pattern operation

The C7G is equipped with **pattern operation.** The same pattern operation can be used for up to 4 loops, or individual patterns operations can be executed. Functions that are needed for pattern operations, like PV start and Guarantee soak, are of course available.
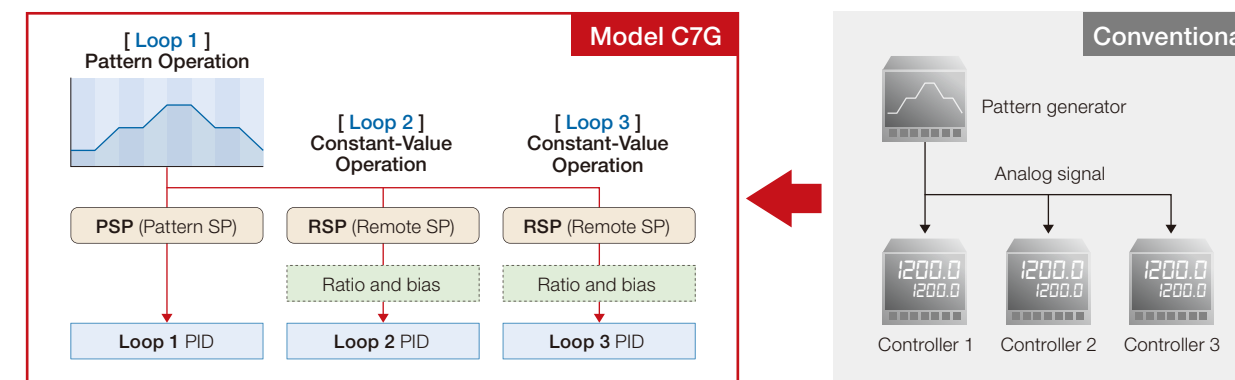
Overview of pattern operation specifications

Item	Function
Number of patterns and segments	16 patterns, 32 segments per pattern
Time units	0.01 s, 0.1 s, 1 s, 1 min
Operation modes	Pattern operation (Pattern SP) ↔ Constant-value operation (LSP/RSP)
Pattern operation functions	HOLD, Guarantee soak (start and end points), PV start, Advance, Cyclic operation, Pattern link, Operation end state (READY, END, constant-value operation), Pattern SP change limits (high and low limits)
Event functions	Segment events 1 to 32
Host communication	Pattern settings and segment settings can be read and write.

Case example

Multi-loop pattern operation

Multiple loops (up to four) can be controlled simultaneously with just one C7G unit, instead of using a group of conventional controllers receiving analog signal outputs from a pattern generator as remote set point (SP) inputs.

Model C7G

[Loop 1] Pattern Operation

[Loop 2] Constant-Value Operation

[Loop 3] Constant-Value Operation

PSP (Pattern SP)　RSP (Remote SP)　RSP (Remote SP)

Ratio and bias　Ratio and bias

Loop 1 PID　Loop 2 PID　Loop 3 PID

Conventional

Pattern generator

Analog signal

Controller 1　Controller 2　Controller 3

Numerical operation

Various **(up to 32) numeric data items** in the device **can be processed numerically,** and the results can be **monitored** and **recorded (to CDS),** or used for **status checking using event functions** or for **control by changing the sensor input.**

■ Signal flow

Input processing

Numerical operations 1–16

PID computation

Numerical operations 17–32

Output processing
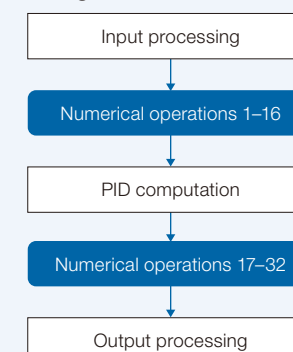
■ 24 types of calculation function (typical functions only are shown)

aX+bY	Division	Switch selector	High selector
Low selector	Soft switch selector	High/low limiter	Change rate limiter
Lead/lag	Absolute value	Linearization table	Hold
One-shot timer	Timer	Dead Time	Moving Average

Sample uses
● Sensor input changeover
● 2-input/1-output control (switchable by control output selection)
● Control by average of 2 inputs ● Override control ● Sample hold

FEATURE 01

FEATURE 02

FEATURE 03

08

09

Note: Diagrams are for illustrative purposes. The actual product may differ.

Value is maximized by seamless coordination with other equipment

Comes standard with two communication ports

Both Ethernet and RS-485 support is a standard feature. With high-speed (Ethernet) communication and serial (RS-485) communication, a high degree of flexibility is ensured for equipment-internal instrumentation networks and controller-controller instrumentation networks.

PC

Any company's PLC

Can connect to PCs and any manufactures' PLCs

Switching hub
(Azbil's model NX-SWA is pictured)

(1) Ethernet
Modbus™/TCP

(2) RS-485
Modbus/RTU

PLC link function

Utilizing Ethernet, model C7G can exchange data with a PLC without a communication converter (gateway) or dedicated program. (It uses Mitsubishi MC protocol/SLMP (3E).)

PLC

Easy data link

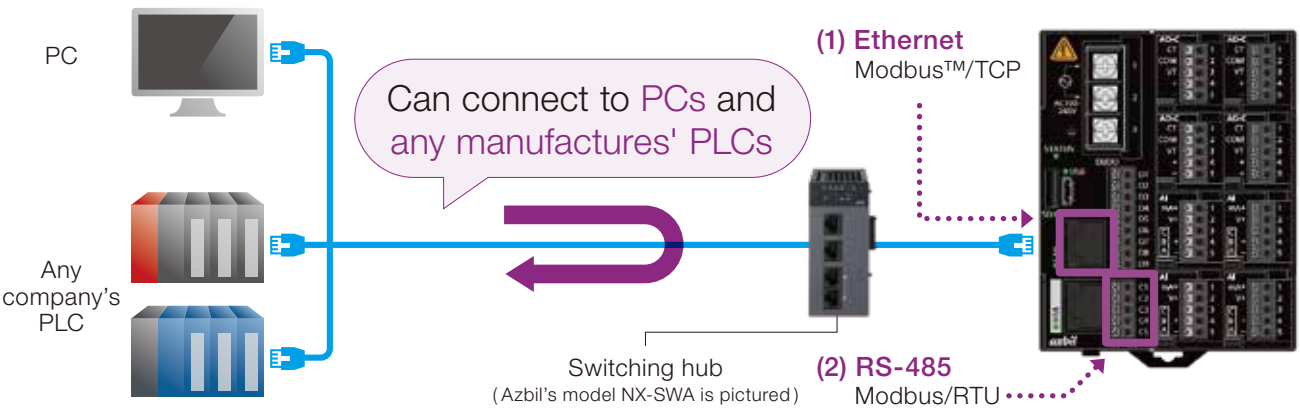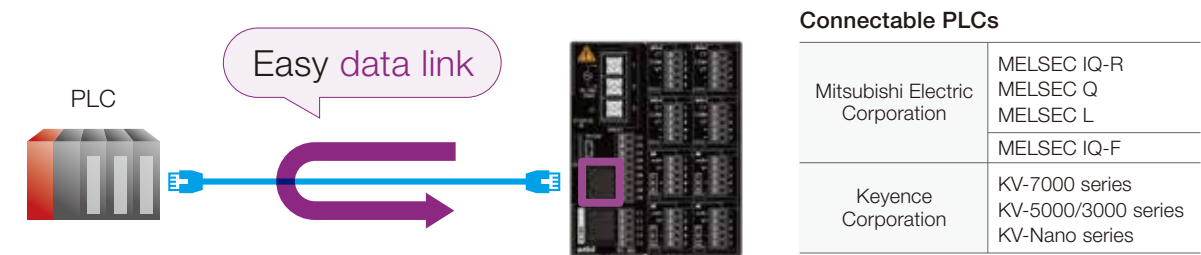| Connectable PLCs	
Mitsubishi Electric Corporation	MELSEC IQ-R MELSEC Q MELSEC L
	MELSEC IQ-F
Keyence Corporation	KV-7000 series KV-5000/3000 series KV-Nano series

Even easier instrumentation with a Network instrumentation module smart device gateway* model NX-SVG

Our model NX-SVG allows easy instrumentation using Ethernet.

Any manufactures' PLC — Ethernet — Model NX-SVG — Ethernet
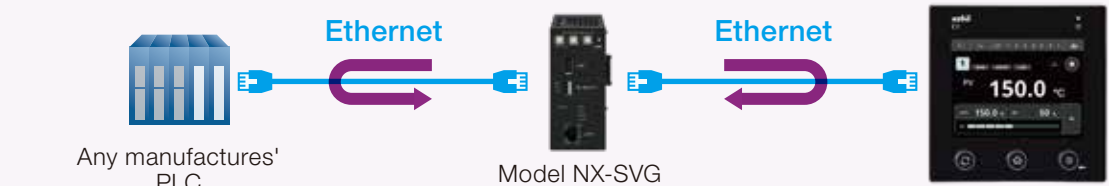
Data transfer can be easily configured by simply setting the source and target devices. Easy setup of data transmission is achieved without requiring communication programs by PLC ladder programming.

*A communication gateway that allows the interchange of information between various kinds of control device without programming, enabling smarter development work.

Diagnostic and management information for problem-solving

The controller displays and records changes in heater resistance to show the heater's condition.

Heater voltage and current is measurable from the voltage transformer (VT) input and current transformer (CT) input and is displayed as RMS values. Based on the values measured for VT input and CT input, heater resistance can be calculated, monitored (displayed/transmitted), and recorded.* The state of a heater whose resistance characteristics vary depending on the temperature environment is easier to know by recording* the resistance together with the temperature control status.

*The controller's CDS (compact data storage) function is used for recording.

Heater resistance / Heater deterioration / Time
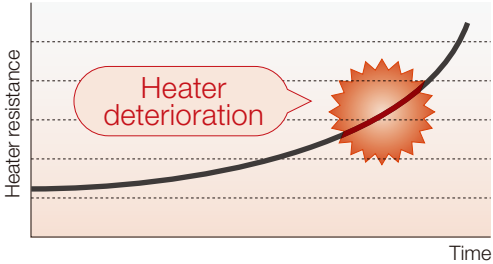
Sample display of RMS current and RMS voltage

RUN AUTO LSP
PV **150.0**
LSP1 150.0   MV 70.0 %
CT 20.0 A VT 200.0 V A2

Sample display of resistance

RUN AUTO LSP
PV **150.0**
LSP1 150.0   MV 70.0 %
Resistance 10.00 Ω A2

Display of RMS current, RMS voltage, and resistance measurements

Example of instrumentation

CT input

VT input → RMS voltage (V)
CT input → RMS current (A)

$$R = \text{RMS voltage} \div \text{RMS current}$$

Resistance (Ω)

MV output

VT input

Power controller

Voltage transformer
(model No. 81406725-003)

Current transformer
(model No. QN212A)

Heater

Note: Diagrams are for illustrative purposes. The actual product may differ.
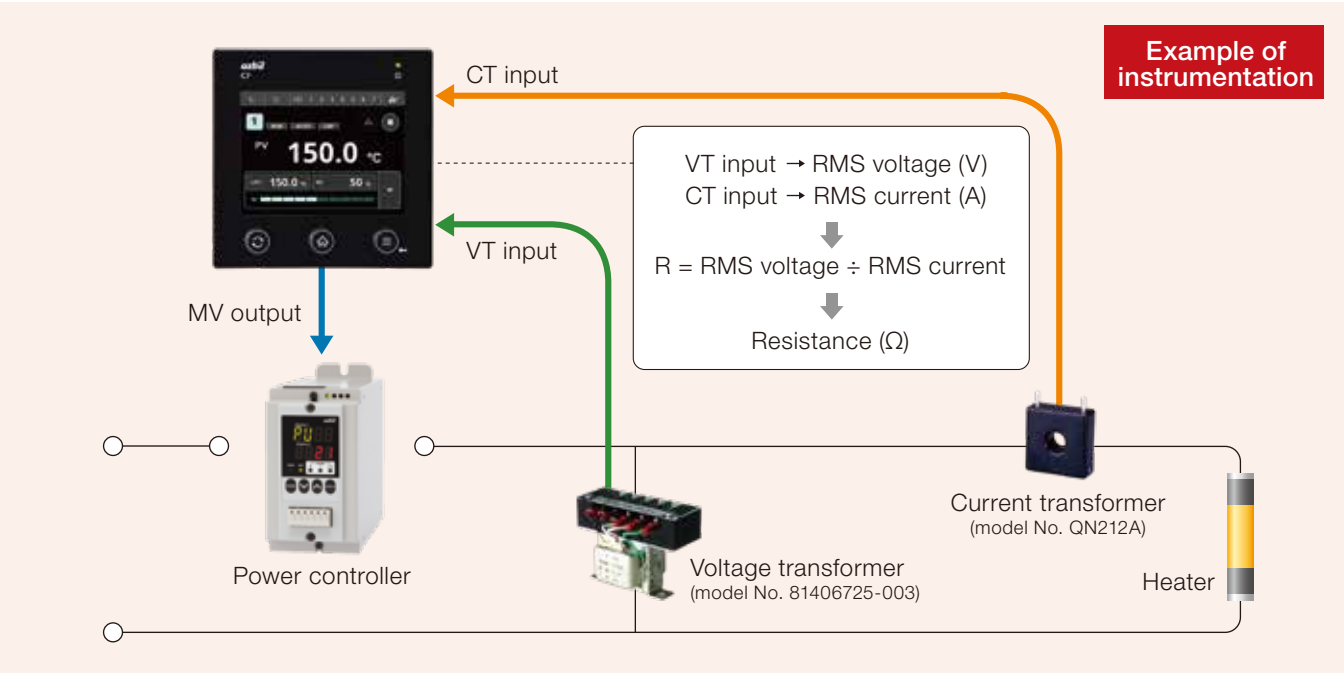
Diagnostic and management information for problem-solving

Compact data storage (CDS)

Compact data storage is Azbil's new technology for effective data recording. It can record necessary data at fixed intervals and also record just the required pieces of data, thus allowing controllers to achieve data processing and management at FA control layer.

microSD

Input of current values
(temperature, voltage, flow rate, etc.)

For example, data storage in batches

1100.0
1000.0
100.0

Batch #1
Batch #2
Batch #n

Control output
(to control valves, power controllers, etc.)

Power controller

Temperature sensor   Pressure sensor   Flow rate sensor   Control valve

PV(C°), Voltage (V), Current × 10 (A)

Elapsed time (s)

PV(C°) Voltage (V) Current (A)

Data storage in 10 ms (fastest mode)

Control output and process data such as temperature, pressure, flow rate, and resistance are extracted at speeds of up to 10 ms and stored. When data is collected through network communication, rapid variations can occur that cause some data to be lost, but the model C7G saves data to an SD card so that nothing is lost.

Recording method	Custom

This is a simplified data recording method that allows users to register and record up to 40 pieces of data as desired. CUSTUM or RING mode can be selected for data accumulation. Here, data in CSV file format is accumulated in microSD memory cards.

Recording method	Standard

This method is used with our proprietary primary data processing technology, "health index." Recorded data cannot be used by controllers of other models. Data is recorded in batches or during temperature rises (step change) and processed by way of the "health index."

Clock function block (with battery)

Recorded timestamp data is backed up by a battery.

Process diagnosis (Health index function)

Loop characteristics are quantified using process data for control. Loop soundness is monitored to detect status changes. Quantified data is provided for edge computing that in turn contributes to promotion of IoT services.

■ Kp/Tp calculation block diagram

Process model (for comparison)

SP → PID → MV → $\frac{Km}{1+Tms}$ → PVm → MAX (ΔPVm)

P → PV → MAX (ΔPV)

Actual process

$\frac{Km}{Tm}$ $\frac{\Delta PV}{\Delta PVm}$ → Kp/Tp

Kp/Tp = Normalized Response

■ ΔPV_max, ΔPVm_max, and TD

Temperature (°C)

SP
TD
PV
PVm
△PVm_max
△PV_max

Transfer function
Heating control can be expressed by the following approximation formula:

$P = Kp \exp(-Lp\ s)/(1+Tp\ s)$

Kp: Process gain Tp: Time constant Lp: Waste time

Normalized responsiveness is calculated with the following formula:

$Kp/Tp = (Km/Tm)(\Delta PV\_max/\Delta PVm\_max)$ $Lp \doteq TD$

By comparing the maximum amount of process change in a transient response (ΔPV_max) and the same value for the model installed in the controller (ΔPVm_max), the value of "Process gain (Kp) ÷ time constant (Tp)" is calculated as the Health Index (control loop quality). The health index is calculated while CDS is activated, and is then stored on the microSD memory card. (Depending on processing conditions, calculation may sometimes not be possible.)

How to use

The health index is an approximation of control loop condition. By storing data in batches and comparing it with initial values, equipment status changes can be detected **before a failure occurs.**

Index calculation for each batch

Kp/Tp=0.050   Kp/Tp=0.048   Kp/Tp=0.046   Kp/Tp=0.044

[Sample display]

LOOP1

0.050
0.048
0.046
0.044
0.042

Failure advance warning zone

Previous warning zone

Data collection and extraction

Data pro cessing

The health ind ex is based on our proprietary data-p rocessing technology.

Advance warning

FEATURE 01
FEATURE 02
FEATURE 03

Specification

<table>
<tr><td rowspan="6">Display unit (included)
Additional display unit
(model C7D-_ _ _ _ _)</td><td>Screen specifications</td><td colspan="2">3.5-inch QVGA LCD</td></tr>
<tr><td>Operation buttons</td><td colspan="2">Touch panel (resistive) and 3 hardware buttons</td></tr>
<tr><td>Display power source</td><td colspan="2">Main unit (if distance from connector on the main unit or connector on the additional display unit block to the display unit is less than 30 m)
5 V DC external power supply (if distance from connector on the main unit or connector on the additional display unit block to the display unit is 30 to 100 m)</td></tr>
<tr><td>Protective rating</td><td colspan="2">IP67 (front of display unit only)</td></tr>
<tr><td>Interface language</td><td colspan="2">English/Japanese (switchable by setting)</td></tr>
<tr><td>Service life of LCD</td><td colspan="2">5 years (at ambient temperature of 25 °C and brightness setting 4, for half-life of backlight brightness)</td></tr>

<tr><td rowspan="7">DI (Digital Input)/
DO (Digital Output) block</td><td>No. of I/Os</td><td colspan="2">7 max. (select DI/DO/TP by setting), shared common
Note: TP (time proportioning output) can be selected for DI/DO terminals 4 to 7.</td></tr>
<tr><td rowspan="2">Digital input</td><td>Compatible output type</td><td>Non-voltage contacts or open collector (sink type)</td></tr>
<tr><td>Function assignment</td><td>RUN/READY mode selection, AUTO/MANUAL mode selection, LSP/RSP mode selection, SP group selection, CDS stop/start, etc.</td></tr>
<tr><td rowspan="2">Digital output</td><td>Output method</td><td>Open collector</td></tr>
<tr><td>Function assignment</td><td>Select an event status or a standard bit code</td></tr>
<tr><td rowspan="3">Time proportional output</td><td>Output method</td><td>Same as digital output</td></tr>
<tr><td>Number of outputs</td><td>4 max. (DI/DO terminals 4 to 7)</td></tr>
</table>

	Time proportional output	Min. OFF time / ON time	1 ms when time proportional cycle is less than 10 s. 250 ms when time proportional cycle is 10 s or more.

<table>
<tr><td rowspan="12">AI (Analog Input) block</td><td colspan="2">Input type</td><td>Full multi-range for thermocouple, resistance temperature detector (RTD), DC current, and DC voltage</td></tr>
<tr><td colspan="2">No. of control loops</td><td>4 loops max. (configurable by the loop type setting)</td></tr>
<tr><td colspan="2">Range type</td><td>See Table of input types and ranges.</td></tr>
<tr><td colspan="2">Sampling cycle</td><td>10 ms, 50 ms, 100 ms (factory default: 50 ms)</td></tr>
<tr><td colspan="2">Decimal point position</td><td>0 to 4 digits after the decimal point are displayed. Values are displayed so that the entire value does not exceed 5 digits. (Note: Effective resolution depends on the range.)</td></tr>
<tr><td rowspan="2">Thermocouple</td><td>Reference junction compensation accuracy</td><td>±0.5 °C (ambient temperature 21 to 27 °C, under standard conditions)
±1.5 °C (ambient temperature 0 to 50 °C, under standard conditions except for ambient temperature)</td></tr>
<tr><td>Reference contact compensation method</td><td>Compensation within the model C7G</td></tr>
<tr><td rowspan="2">Resistance temperature detector (RTD)</td><td>Measuring current</td><td>1.0 mA (typical, current from terminals A and B; under standard conditions)</td></tr>
<tr><td>Allowable wiring resistance</td><td>85 Ω max. (per wire)</td></tr>
<tr><td rowspan="3">DC voltage
DC current</td><td>Input bias current</td><td>0 to 10 V range: 10 µA max. (under standard conditions)
1 to 5 V or 0 to 5 V range: 5 µA max. (under standard conditions)</td></tr>
<tr><td>Allowable input voltage</td><td>DC voltage input: −15 to +15 V
DC current input: −1.5 to +1.5 V</td></tr>
<tr><td>Scaling</td><td>−32000 to +32000 U
(Max. 5 digits within the above range, max. 4 digits after the decimal point, reverse scaling possible)</td></tr>

<tr><td rowspan="7">AO-C (Analog current output) block</td><td rowspan="4">Current output (1)</td><td>Type</td><td>4 to 20 mA DC / 0 to 20 mA DC</td></tr>
<tr><td>Output type</td><td>Control output (MV), process value (PV), set value (SP), standard numerical code, etc.</td></tr>
<tr><td>Allowable load resistance</td><td>600 Ω max.</td></tr>
<tr><td>Output resolution</td><td>1/16000 min.</td></tr>
<tr><td rowspan="2">CT (current) input (1)</td><td>Recommended current transformer</td><td>QN206A (hole diameter: 5.8 mm, 800 turns), QN212A (hole diameter: 12 mm, 800 turns). Note: Not UL-certified</td></tr>
<tr><td>Current measurement range</td><td>0.4 to 50.0 A AC, 50/60 Hz (peak current: 71 A, 800 turns, 1 power wire loop)</td></tr>
<tr><td rowspan="1">VT (voltage) input (1)</td><td>Recommended voltage transformer</td><td>81406725-003 Note: Not UL-certified.</td></tr>
</table>

	VT (voltage) input (1)	Voltage measurement range	24 to 240 V AC, 50/60 Hz (peak voltage: 339 V max.; recommended voltage: transformer primary side: 200 V, secondary side: 10 V)

<table>
<tr><td rowspan="3">V-P (Voltage pulse output) block</td><td rowspan="2">Voltage pulse output (1)</td><td>Output voltage</td><td>12 V DC +15/−10 % (under standard conditions)</td></tr>
<tr><td>Allowable current</td><td>25 mA max.</td></tr>
<tr><td>CT (current) input (2)</td><td>Specifications</td><td>Same as the CT (current) input for the AO-C block</td></tr>

<tr><td rowspan="4">MOTOR (Motor drive output) block</td><td rowspan="3">Motor drive output relay</td><td>Contact configuration</td><td>Switching between OPEN output and CLOSE output (with function for turning both outputs OFF at the same time)</td></tr>
<tr><td>Contact rating</td><td>250 V AC 2 A (cos Ø = 0.4); 24 V DC 2.5 A (L/R = 0.7 ms)</td></tr>
<tr><td>Contact voltage</td><td>250 V AC max. / 125 V DC max.</td></tr>
<tr><td>MFB (Motor feedback) input</td><td>Allowable potentiometer</td><td>100 to 2500 Ω (wiring resistance included)</td></tr>

<tr><td rowspan="3">DI (Digital input) block</td><td colspan="2">Number of inputs</td><td>4 (common)</td></tr>
<tr><td colspan="2">Compatible output type</td><td>Non-voltage contacts or open collector</td></tr>
<tr><td colspan="2">Function assignment</td><td>RUN/READY mode selection, LSP/RSP mode selection, SP group selection, PID group selection, CDS stop/start, etc.</td></tr>

<tr><td rowspan="3">DO (Digital output) block</td><td colspan="2">Number of outputs</td><td>4 (common)</td></tr>
<tr><td colspan="2">Output type</td><td>Open collector (sink type)</td></tr>
<tr><td colspan="2">Function assignment</td><td>Select an event status or a standard bit code</td></tr>

<tr><td rowspan="3">CLOCK (Clock function) block (with battery)</td><td colspan="2">Clock function</td><td>Hours, minutes, seconds, calendar (years 2000 to 2099, supports leap years)</td></tr>
<tr><td colspan="2">Clock accuracy</td><td>Monthly error: less than ±65 s (under standard conditions)</td></tr>
<tr><td colspan="2">Service life</td><td>10 years (battery life when not energized; under standard conditions)</td></tr>

<tr><td rowspan="2">HIMI2 (Additional display unit) block</td><td colspan="2">No. of connectable units</td><td>1</td></tr>
<tr><td colspan="2">Connector</td><td>RJ-45</td></tr>
</table>

<table>
<tr><td rowspan="8">Control unit</td><td colspan="2">Control operation</td><td colspan="2">PID control (reverse action, direct action, heating and cooling action), ON/OFF control (reverse action, direct action)</td></tr>
<tr><td rowspan="6">PID Control</td><td>Proportional band (P)</td><td colspan="2">0.1 to 3200 % (5 digits max. within the range at the left, 4 digits max. after the decimal point)</td></tr>
<tr><td>Integral time (I)</td><td colspan="2">0 to 32000 s (5 digits max. within the range at the left, 4 digits max. after the decimal point);
No integral calculation if the setting is 0.</td></tr>
<tr><td>Derivative time (D)</td><td colspan="2">0 to 32000 s (5 digits max. within the range at the left, 4 digits max. after the decimal point);
No derivative calculation if the setting is 0.</td></tr>
<tr><td>Number of PID groups</td><td colspan="2">8 groups per loop</td></tr>
<tr><td>Auto-tuning</td><td colspan="2">PID automatic setting using the limit cycle method</td></tr>
<tr><td>SP (LSP: Local SP)</td><td>Number of LSP groups</td><td colspan="2">8 groups per loop</td></tr>

<tr><td rowspan="3">Analog input processing unit</td><td colspan="2">Filter</td><td colspan="2">0.0000 to 120.00 s</td></tr>
<tr><td colspan="2">Ratio</td><td colspan="2">0.0010 to 10.000</td></tr>
<tr><td colspan="2">Bias</td><td colspan="2">−32000 to +32000 (5 digits within this range, 4 digits max. after the decimal point)</td></tr>

<tr><td rowspan="2">Linear approximation functions</td><td colspan="2">Number of groups, breakpoints per group</td><td colspan="2">8 groups, 20 breakpoints</td></tr>
<tr><td colspan="2">Available functions</td><td colspan="2">Analog input, analog output, etc.</td></tr>

<tr><td rowspan="2">Event functions</td><td colspan="2">Operation types</td><td colspan="2">PV high limit, PV low limit, PV high and low limits, Deviation high limit, Deviation low limit, Deviation high and low limits, Deviation high limit (final SP basis), Deviation low limit (final SP basis), Deviation high and low limits (final SP basis), SP high limit, SP low limit, SP high and low limits, MV high limit, MV low limit, MV high and low limits, MFB high and low limits, Standard numerical code high limit, Standard numerical code low limit, Standard numerical code high and low limits, PV change rate, PV change rate high limit, PV change rate low limit, Standard numerical code change rate high limit, Standard numerical code change rate low limit, Alarm (status), READY (status), MANUAL (status), RSP (status), AT running (status), SP ramp running (status), Control direct action (status), MFB (status), Timer (status)</td></tr>
<tr><td colspan="2">Number of events</td><td colspan="2">16</td></tr>

<tr><td rowspan="5">Pattern operation functions</td><td colspan="2">Number of patterns and segments</td><td colspan="2">16 patterns, 32 segments per pattern</td></tr>
<tr><td colspan="2">Segment setting method</td><td colspan="2">Set with set point (SP) and time</td></tr>
<tr><td colspan="2">Time units</td><td colspan="2">0.01 s, 0.1 s, 1 s, 1 min</td></tr>
<tr><td colspan="2">Function</td><td colspan="2">HOLD, Guarantee soak (start and end points), PV start, Advance, Cyclic operation, Pattern link, etc.</td></tr>
<tr><td colspan="2">Operation end state</td><td colspan="2">READY, END, constant-value operation</td></tr>
</table>

Pattern operation functions	Event		Segment events 1 to 32

<table>
<tr><td rowspan="2">Numeric calculation section</td><td colspan="2">Number of units</td><td colspan="2">32</td></tr>
<tr><td colspan="2">Calculation types</td><td colspan="2">aX+bY, Division, Switch selector, High selector, Low selector, Soft switch selector, High/low limiter, Change rate limiter, Lead/lag, Absolute value, Linearization table, Hold, One-shot timer, NOP (No Operation), Timer, Square-root extraction, Deviation monitor, Integration pulse output I, Integration pulse output II, Log, Exponent, Integral, Derivative, Dead time, Moving average</td></tr>

<tr><td rowspan="16">External communication</td><td rowspan="5">Ethernet</td><td>Transmission line type</td><td colspan="2">Compliant with IEEE 802.3u 100BASE-TX (FastEthernet)</td></tr>
<tr><td>No. of connections</td><td colspan="2">4 (The total number of connections for Modbus/TCP and loader communications via Ethernet is 1 to 3, and the number of connections for PLC link communication is fixed at 1.)</td></tr>
<tr><td>No. of physical ports (connectors)</td><td colspan="2">1 (RJ-45)</td></tr>
<tr><td>Cable</td><td colspan="2">UTP cable (4P) Cat 5e min. (straight) (ANSI/TIA/EIA-568-B both ends)</td></tr>
<tr><td>Protocol</td><td colspan="2">Modbus/TCP, Mitsubishi Electric SLMP (3E) (for PLC link communication), Loder Communications via Ethernet</td></tr>
<tr><td rowspan="5">RS-485 communication</td><td>Signal level</td><td colspan="2">RS-485 compliant</td></tr>
<tr><td>Network</td><td colspan="2">Multidrop (up to 31 slave stations for 1 host station)</td></tr>
<tr><td>No. of communication wires</td><td colspan="2">3-wire system</td></tr>
<tr><td>Transmission speed</td><td colspan="2">9600, 19200, 38400, 57600, 115200 bps</td></tr>
<tr><td>Protocol</td><td colspan="2">Modbus/RTU</td></tr>
<tr><td rowspan="4">Loader communication</td><td>Dedicated PC loader</td><td colspan="2">SLP-C7FJ91 (free version), SLP-C7-J91 (paid version)</td></tr>
<tr><td>Cable</td><td colspan="2">USB-to-Micro-USB (Type A/B) cable (USB 2.0 supported, 5 m max.) or Ethernet cable</td></tr>
<tr><td>Power supply</td><td colspan="2">When connected with a USB cable, the device can be powered by the PC and parameters can be changed.</td></tr>

<tr><td rowspan="1">Data storage</td><td colspan="2">SD</td><td colspan="2">microSD/SDHC-compliant (4 GB) (for the compact data storage and health index functions)</td></tr>

<tr><td rowspan="16">General specifications</td><td colspan="2">Memory backup</td><td colspan="2">EEPROM (durability: 1 million erase-write cycles min.), for parameters settings</td></tr>
<tr><td colspan="2">Power consumption</td><td colspan="2">AC models: 25 VA 10 W max. DC models: 12 W max.</td></tr>
<tr><td colspan="2">Case material</td><td colspan="2">Main unit: Modified PPE (case), polycarbonate (board holder, front mask)
Display unit: Modified PPE (case), polycarbonate (back cover), PET film (decorative sheet)</td></tr>
<tr><td colspan="2">Case color</td><td colspan="2">Black</td></tr>
<tr><td colspan="2">Applicable standards</td><td colspan="2">EN 61010-1, EN 61326-1 (for use in industrial locations)
Note: During EMC testing, the reading or output may fluctuate by the equivalent of ±10 % FS.
UL 61010-1, CAN/CSA C22.2 No. 61010-1 (applicable model needs to be selected)</td></tr>
<tr><td colspan="2">Overvoltage category</td><td colspan="2">Category II (IEC 60364-4-443, IEC 60664-1)</td></tr>
<tr><td colspan="2">Installation</td><td colspan="2">Main unit: Mounting on a DIN rail (standard) or on the display unit using the mounting bracket
Display unit: Mounting using φ3 screws (standard) or the mounting bracket (mount in a 92 × 92 mm hole)</td></tr>
<tr><td colspan="2">Built-in clock accuracy</td><td colspan="2">Monthly error: less than ±140 s (less than ±65 s if the CLOCK block with battery is used)
Note: The time is reset to 00:00:00 1/1/2000 (default) at power-on (including power restoration).
Note: For a firmware version of the MAIN block 3.*.* or earlier (* represents any number), the time is reset to 00:00:00 1/1/2014 (default).</td></tr>
<tr><td rowspan="4">Standard conditions</td><td>Ambient temperature</td><td colspan="2">23 °C −2/+5 °C</td></tr>
<tr><td>Ambient humidity</td><td colspan="2">60 ± 5 % RH</td></tr>
<tr><td>Power voltage</td><td colspan="2">AC models: 105 V AC ±10 %. DC models:, 24 V DC ±5 %</td></tr>
<tr><td>Ambient temperature</td><td colspan="2">0 to 50 °C (0 to 40 °C if 2 or more main units are gang-mounted), 0 to 50 °C (display unit)</td></tr>
<tr><td rowspan="3">Operating conditions</td><td>Ambient humidity</td><td colspan="2">10 to 90 % RH (without condensation)</td></tr>
<tr><td>Rated power voltage</td><td colspan="2">AC models: 100 to 240 V AC (operating input voltage: 85 to 264 V AC) DC models: 24 V DC (operating input voltage: 20.4 to 28.8 V DC)</td></tr>
<tr><td>Mounting angle</td><td colspan="2">Reference plane ±10 ° (main unit, and main unit and display unit in integrated mounting), no restriction for display unit in standard mounting</td></tr>
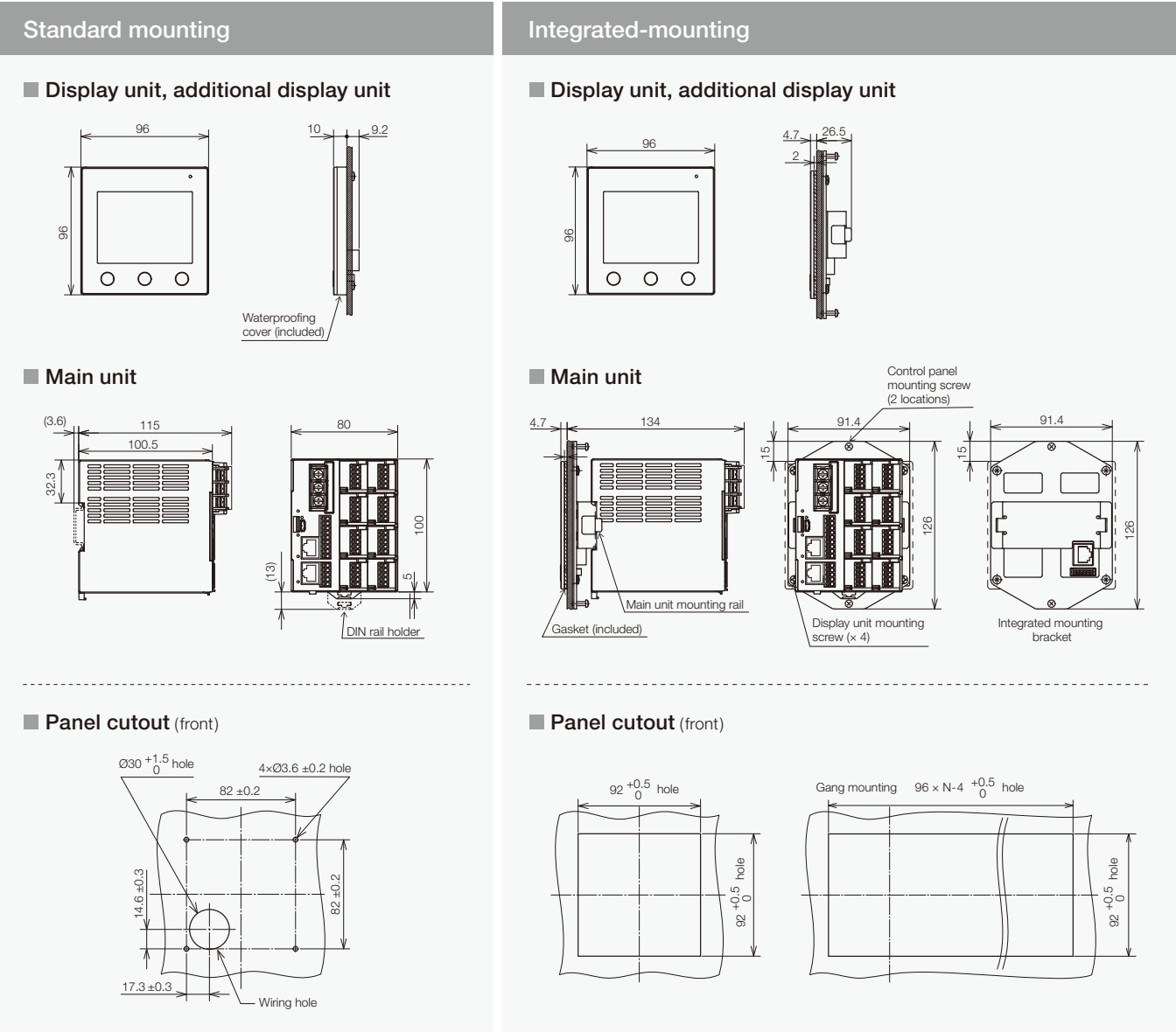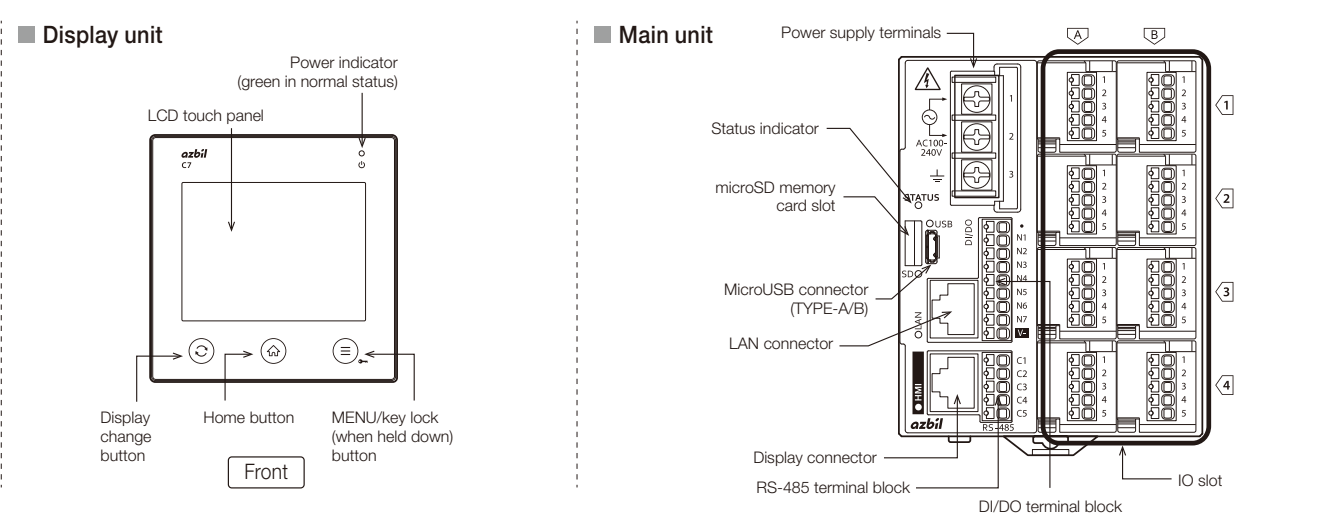</table>

14

15

Note: For details, refer to specification sheet No. CP-SS-1911E.

Specification

Input types and ranges

Input type	Range type Nos.	Sensor	Range	Accuracy	Effective resolution
Thermocouple	1	K	-200 to +1,200°C	± 0.1 % FS ± 1digit [*1]	0.1°C
	2	K	0 to 1,200°C	± 0.1 % FS ± 1digit	0.1°C
	3	K	0 to 800°C	± 0.1 % FS ± 1digit	0.1°C
	4	K	0 to 600°C	± 0.1 % FS ± 1digit	0.1°C
	5	K	0 to 400°C	± 0.1 % FS ± 1digit	0.1°C
	6	K	-200 to +400°C	± 0.1 % FS ± 1digit [*1]	0.1°C
	7	K	-200 to +200°C	± 0.1 % FS ± 1digit [*1]	0.1°C
	8	J	0 to 1,200°C	± 0.1 % FS ± 1digit	0.1°C
	9	J	0 to 800°C	± 0.1 % FS ± 1digit	0.1°C
	10	J	0 to 600°C	± 0.1 % FS ± 1digit	0.1°C
	11	J	-200 to +400°C	± 0.1 % FS ± 1digit [*1]	0.1°C
	12	E	0 to 800°C	± 0.1 % FS ± 1digit	0.1°C
	13	E	0 to 600°C	± 0.1 % FS ± 1digit	0.1°C
	14	T	-200 to +400°C	± 0.1 % FS ± 1digit [*1]	0.1°C
	15	R	0 to 1,600°C	± 0.1 % FS ± 1digit [*2]	0.1°C
	16	S	0 to 1,600°C	± 0.1 % FS ± 1digit [*2]	0.1°C
	17	B	0 to 1,800°C	± 0.2 % FS ± 1digit [*3]	0.1°C
	18	N	0 to 1,300°C	± 0.1 % FS ± 1digit	0.1°C
	19	PLII	0 to 1,300°C	± 0.1 % FS ± 1digit	0.1°C
	20	WRe5-26	0 to 1,400°C	± 0.1 % FS ± 1digit	0.1°C
	21	WRe5-26	0 to 2,300°C	± 0.1 % FS ± 1digit	0.1°C
	23	PR40-20	0 to 1,900°C	± 0.5 % FS ± 1digit [*4]	0.1°C
Resistance temperature detector (RTD)	41	Pt100	-200 to +500°C	± 0.1 % FS ± 1digit	0.1°C
	43	Pt100	-200 to +200°C	± 0.1 % FS ± 1digit	0.01°C
	45	Pt100	-100 to +300°C	± 0.1 % FS ± 1digit	0.01°C
	47	Pt100	-100 to +200°C	± 0.1 % FS ± 1digit	0.01°C
	49	Pt100	-100 to +150°C	± 0.1 % FS ± 1digit	0.01°C
	51	Pt100	-50 to +200°C	± 0.1 % FS ± 1digit	0.01°C
	53	Pt100	-50 to +100°C	± 0.1 % FS ± 1digit	0.01°C
	55	Pt100	-60 to +40°C	± 0.1 % FS ± 1digit	0.01°C
	57	Pt100	-40 to +60°C	± 0.1 % FS ± 1digit	0.01°C
	59	Pt100	-10 to +60°C	± 0.1 % FS ± 1digit	0.01°C
	61	Pt100	0 to 100°C	± 0.1 % FS ± 1digit	0.01°C
	63	Pt100	0 to 200°C	± 0.1 % FS ± 1digit	0.01°C
	65	Pt100	0 to 300°C	± 0.1 % FS ± 1digit	0.01°C
	67	Pt100	0 to 500°C	± 0.1 % FS ± 1digit	0.1°C
	69	Pt100	-200 to +850°C	± 0.1 % FS ± 1digit	0.1°C
Linear	86	Voltage (V)	1 to 5V	± 0.1 % FS ± 1digit	1/90000 or better
	87	Voltage (V)	0 to 5V	± 0.1 % FS ± 1digit	
	88	Voltage (V)	0 to 10V	± 0.1 % FS ± 1digit	
	89	Current (mA)	0 to 20mA	± 0.1 % FS ± 1digit	
	90	Current (mA)	4 to 20mA	± 0.1 % FS ± 1digit	
	92	Voltage (V)	-10 to +10V	± 0.1 % FS ± 1digit	

*1. For –200 to 0 °C, ±0.2 % FS ± 1 digit
*2. For 0 to 100 °C, ±0.2 % FS ± 1 digit
*3. For 0 to 260 °C, ±4 % FS ± 1 digit; for 260 to 800 °C, ±0.4 % FS ± 1 digit
*4. For 0 to 300 °C, ±2.5 % FS ± 1 digit; for 300 to 800 °C, ±1.5 % FS ± 1 digit

External dimensions and mounting (Unit: mm)

Standard mounting

■ Display unit, additional display unit

Waterproofing cover (included)

■ Main unit

DIN rail holder

■ Panel cutout (front)

Ø30 +1.5/0 hole
4×Ø3.6 ±0.2 hole
82 ±0.2
82 ±0.2
14.6 ±0.3
17.3 ±0.3
Wiring hole

Integrated-mounting

■ Display unit, additional display unit

■ Main unit

Control panel mounting screw (2 locations)
Main unit mounting rail
Gasket (included)
Display unit mounting screw (× 4)
Integrated mounting bracket

■ Panel cutout (front)

92 +0.5/0 hole
Gang mounting 96 × N-4 +0.5/0 hole
92 +0.5/0 hole
92 +0.5/0 hole

Part names and functions

■ Display unit

Power indicator (green in normal status)
LCD touch panel
Display change button
Home button
MENU/key lock (when held down) button
Front

■ Main unit

Power supply terminals
Status indicator
microSD memory card slot
MicroUSB connector (TYPE-A/B)
LAN connector
Display connector
RS-485 terminal block
DI/DO terminal block
IO slot

Specification

Model selection

Example: C7GA411CC0D00

Main unit			Commu-nication	Size	Slots A3, A4	Slots B3, B4	Slots A1, A2	Slots B1, B2	Option	Add'l proc.	Add'l spec.	Special support	Description
Basic model No.					I/O slot				Other				
1	2	3	4	5	6	7	8	9	10	11	12	13	
C	7	G											Multi-loop controller with multifunction display
			A										Communications (Ethernet, RS-485, USB), DI/DO (sink output, source input) × 7
				3									Integrated mounting*1
				4									Standard (separate) mounting

		Slot A3	Slot A4
1	PV1 (full-multi) × 1		AI
2	PV1 (full-multi) + RSP1 (full-multi)*2	AI	AI
A	PV1 (full-multi) + DI × 4	DI	AI

Condition

The model No. selections indicated below are available if the specified conditions are satisfied.

		Slot B3	Slot B4
If the 6th digit (slots A3, A4) is 2 →	0	None	
	1	PV2 (full-multi) × 1	AI
If the 6th digit (slots A3, A4) is 2 or A →	2	PV2 (full-multi) + RSP2 (full-multi)*3	AI	AI
If the 9th digit (slots B1, B2) is 0, C, V, F, W, N, G, H, 1, or 2 →	A	PV2 (full-multi) + DI × 4	DI	AI
	B	PV2 (full-multi) + clock (with battery)	CLOCK	AI

		Slot A1	Slot A2
C	Current output (CT and VT inputs, 1 each) × 1		AO-C
V	Voltage pulse output (2 CT inputs) × 1		V-P
F	Current output (CT and VT inputs, 1 each) × 2	AO-C	AO-C
W	Voltage pulse output (2 CT inputs) × 2	V-P	V-P
N	Current output (CT and VT inputs, 1 each) + voltage pulse output (2 CT inputs)	V-P	AO-C
1	Current output (CT and VT inputs, 1 each) + DO (sink output) × 4	DO	AO-C
2	Voltage pulse output (2 CT inputs) + DO (sink output) × 4	DO	V-P

		Slot B1	Slot B2
If the 8th digit (slots A1, A2) is C, V, F, 1, or 2 →	0	None	
If the 8th digit (slots A1, A2) is C, F, N, or 1 →	C	Current output (CT and VT inputs, 1 each) × 1		AO-C
If the 8th digit (slots A1, A2) is C, V, W, N, 1, or 2 →	V	Voltage pulse output (2 CT inputs) × 1		V-P
If the 8th digit (slots A1, A2) is F →	F	Current output (CT and VT inputs, 1 each) × 2	AO-C	AO-C
If the 8th digit (slots A1, A2) is W or N →	W	Voltage pulse output (2 CT inputs) × 2	V-P	V-P
If the 8th digit (slots A1, A2) is F or N →	N	Current output (CT and VT inputs, 1 each) + voltage pulse output (2 CT inputs)	V-P	AO-C
If the 8th digit (slots A1, A2) is C, F, N, or 1 →	G	Current output (CT and VT inputs, 1 each) + additional display unit	HMI2	AO-C
If the 8th digit (slots A1, A2) is C, V, W, N, 1, or 2 →	H	Voltage pulse output (2 CT inputs) + additional display unit	HMI2	V-P
If the 8th digit (slots A1, A2) is C, F, N, or 1 →	L	Current output (CT and VT inputs, 1 each) + clock (with battery)	CLOCK	AO-C
If the 8th digit (slots A1, A2) is C, V, W, N, 1, or 2 →	P	Voltage pulse output (2 CT inputs) + clock (with battery)	CLOCK	V-P
If the 8th digit (slots A1, A2) is F, N, or 1 →	1	Current output (CT and VT inputs, 1 each) + DO (sink output) × 4	DO	AO-C
If the 8th digit (slots A1, A2) is W, N, 1, or 2 →	2	Voltage pulse output (2 CT inputs) + DO (sink output) × 4	DO	V-P

				Description
0				None
	0			None
	D			With inspection report
	Y			With traceability certificate
		0		AC power. CE, KC, UKCA–compliant
		D		DC power. CE, KC, UKCA–compliant
		A		AC power. CE, KC, UKCA, UL–compliant
		B		DC power. CE, KC, UKCA, UL–compliant
			0	No special support
			F	F in Fahrenheit

Symbol	Block name	Description
AI	Analog input	Full-multi range (thermocouple, RTD, DC current, DC voltage) input × 1
V-P	Voltage pulse output	Voltage pulse output (12 V DC) × 1 Input terminals for the current transformer (CT) for detecting heater burnout, overcurrent, and short circuit are included × 2.*4
AO-C	Analog current output	Current output (4–20 mA DC / 0–20 mA DC) × 1 Input terminals for the current transformer (CT) for measuring current and the voltage transformer (VT) for measuring voltage are included (1 each).*4
HMI2	Additional display unit	Additional connector for the second display unit *5
CLOCK	Clock function	Clock (available for CDS and health index) with a battery
DI	Digital input	4 digital inputs (external power required)
DO	Digital output	4 digital outputs (sink output)

■ Recommended models

Current output

Digits 8 & 9	If 1 output: C0 →	If 2 outputs: CC →	If 3 outputs: FC →	If 4 outputs: FF

Analog input

Digits 6 & 7	If 1 input: 10 →	If 2 inputs: 11 →	If 3 inputs: 21 →	If 4 inputs: 22

● Block layout example

*1. A integrated mounting bracket and a dedicated cable for connecting the display unit are included with the product.

*2. RSP1 can be switched for use as PV3.

*3. RSP2 can be switched for use as PV4.

*4. Current transformer (CT) and voltage transformer (VT) are sold separately.

*5. Additional display unit is sold separately.

Model selection (models with motor output)

Example: C7GA410M00D00

Main unit			Commu-nication	Size	A4	B4	A2–3, B2–3	A1, B1	Option	Add'l proc.	Add'l spec.	Special support	Description
Basic model No.					I/O slot				Other				
1	2	3	4	5	6	7	8	9	10	11	12	13	
C	7	G											Multi-loop controller with multifunction display
			A										Communications (Ethernet, RS-485, USB), DI/DO (sink output, source input) × 7
				3									Integrated mounting*1
				4									Standard (separate) mounting

		Slot A4
1	PV1 (full-multi) × 1	AI

		Slot B4
0	None	
1	PV2 (full-multi) × 1*2	AI

		Slots A2-3, B2-3
M	Motor drive output (with MFB input)	MOTOR

		Slot A1	Slot B1
0	None		
C	Current output (CT and VT inputs, 1 each) × 1	AO-C	
V	Voltage pulse output (2 CT inputs) × 1	V-P	
N	Current output (CT and VT inputs, 1 each) + voltage pulse output (2 CT inputs)	AO-C	V-P
G	Current output (CT and VT inputs, 1 each) + additional display unit	AO-C	HMI2
L	Current output (CT and VT inputs, 1 each) + clock (with battery)	AO-C	CLOCK
1	Current output (CT and VT inputs, 1 each) + DO (sink output) × 4	AO-C	DO
4	DO (sink output) × 4 + clock (with battery)	DO	CLOCK

				Description
0				None
	0			None
	D			With inspection report
	Y			With traceability certificate
		0		AC power. CE, KC, UKCA–compliant
		D		DC power. CE, KC, UKCA–compliant
		A		AC power. CE, KC, UKCA, UL–compliant
		B		DC power. CE, KC, UKCA, UL–compliant
			0	No special support

Symbol	Block name	Description
AI	Analog input	Full-multi range (thermocouple, RTD, DC current, DC voltage) input × 1
V-P	Voltage pulse output	Voltage pulse output (12 V DC) × 1 Input terminals for the current transformer (CT) for detecting heater burnout, overcurrent, and short circuit are included × 2. *3
AO-C	Analog current output	Current output (4–20 mA DC / 0–20 mA DC) × 1 Input terminals for the current transformer (CT) for measuring current and the voltage transformer (VT) for measuring voltage are included (1 each). *3
MOTOR	Motor drive output	Motor drive output (100/200 V AC) forward (OPEN) output, reverse (CLOSE) output with MFB (motor feedback) input
HMI2	Additional display unit	Additional connector for the second display unit *4
CLOCK	Clock function	Clock (available for CDS and health index) with a battery
DO	Digital output	4 digital outputs (sink output)

*1. A integrated mounting bracket and a dedicated cable for connecting the display unit are included with the product.

*2. PV2 can be switched for use as RSP1.

*3. Current transformer (CT) and voltage transformer (VT) are sold separately.

*4. Additional display unit is sold separately.

● Block layout example