Single Loop Controller Series

MULTI-FUNCTION PID CONTROLLER
(color LCD with touch-panel, MV output backup, Modbus/NestBus communication)

144 (5.67)
72 (2.83)
mm (inch)
*Selectable with option code

MODEL: SC210-[1][2][3][4]

ORDERING INFORMATION
• Code number: SC210-[1][2]-[3][4]
Specify a code from below for each of [1] through [4].
(e.g. SC210-11-M2/M2/E/1/T/Q)
• Specify the specification for option code /Q
(e.g. /C01/S01)

[1] DISCRETE OUTPUT
1: Relay contact
2: Photo MOSFET relay

[2] MODBUS
1: Modbus-RTU
2: Modbus/TCP

[3] POWER INPUT
AC Power
M2: 100 – 240 V AC (Operational voltage range 85 – 264 V, 50/60 Hz)
DC Power
R: 24 V DC (Operational voltage range 24 V ±10 %, ripple 10 %p-p max.)

[4] OPTIONS (multiple selections)
Housing Depth (must be specified)
/300: 300 mm (Discontinued, select /3)
/400: 400 mm (Discontinued, select /4)
/3: 300 mm
/4: 400 mm
Backup Module Power Supply
blank: Single supply
/M2: 100 – 240 V AC (dual supply)
(Operational voltage range 85 – 264 V AC; 50/60 Hz)
/R: 24 V DC (dual supply)
(Operational voltage range 24 V DC ±10 %; ripple 10 %p-p max.)
Control/Backup modules are powered from common terminals with 'single' supply type; powered from independent terminals with 'dual' supply type.
Language
blank: Japanese
/E: English
(Language (Japanese or English) can be chosen by front panel setting.)
Configurator Interface
blank: Infrared
/1: Stereo jack
(If external noise interference is a concern, stereo jack type is recommended.)
Terminal block
blank: One block terminal
/T: Separable terminal
Other Options
blank: none
/Q: Option other than the above (specify the specification)

SPECIFICATIONS OF OPTION: Q (multiple selections)
COATING (For the detail, refer to M-System’s web site.)
/C01: Silicone coating
/C02: Polyurethane coating
/C03: Rubber coating
TERMINAL SCREW MATERIAL
/S01: Stainless steel

FUNCTIONS & FEATURES
Functions & Features
• Color LCD with touch panel
• Five Operation views (digital display, bargraph, dual-loop bargraph, short trend and user's parameter table views)
• Enhanced screen functions for engineering (configuration, programming and tuning views)
• Universal input x 2 points, analog input x 4 points, discrete input x 6 points, pulse input x 5 points, high speed pulse input x 1 point
• Current output (4-20 mA) x 2 points, voltage output (1-5 V) x 2 points, relay or photo-MOSFET relay output x 5 points
• RUN contact output (relay) x 1 point
• I/O signals can be added with remote I/O modules connected via NestBus peer-to-peer communication
• Computation cycle selectable between 50 msec. and 3 sec. (control cycle selectable between 1 and 64 times of the computation cycle)
• Two PID function blocks
• Advanced computation and sequence control functions
• Auto-tuning function
• Parameter input and changing with touch panel
• Function parameter setting, list printing and data downloading/uploading available with Loop Configuration Builder Software (model: SFEW3E)
• Short trend export (CSV), display parameter setting, saving and transfer with PC Configurator Software (model: SCCFG)
• Control and supervision by SCADA software via Modbus TCP/IP or RTU communication
• Backup module power supply terminal (option /M2, /R): Euro terminal block (applicable wire size: dia. 2.4 max., 0.5 – 2.5 mm², stripped length 10 mm)
• Ethernet: RJ-45 Modular Jack
• Screw terminal
• Terminal screws: Nickel-plated steel (standard) or stainless steel
• Terminal fixing screws: Chrome-plated steel
• Housing material: Flame-resistant resin (gray), steel
• Isolation: Pv1 to Pv2 to supply output to Ai1 or Ai2 or Ai3 or Ai4 to Di1 or Di2 or Di3 or Di4 or Di5 or Pi1 or Pi2 or Pi3 or Pi4 or Pi5 to Di6 or Pi6 to Mv1 to Mv2 or Mv2B to Ao1 or Ao2 to Do1 to Do2 to Do3 to Do4 to Do5 to Do6 to NestBus to Modbus-RTU to Modbus/TCP to power to backup module power to FG
• PID control: Single loop, cascade, advanced
• Proportional band (P): 1 to 1000 %
• Integral time (I): 0.01 to 100 minutes
• Derivative time (D): 0.01 to 10 minutes
• Auto-tuning: Limit cycle method
• Alarm: PV high & low, deviation, rate of change
• Computation: 48 functions blocks available for arithmetic operations, time functions, signal selection, limit, alarm and other functions
• Sequence operation: Logic sequence and step sequence (max. 1068 commands)

**GENERAL SPECIFICATIONS**

Construction: Panel flush mounting
Degree of protection: IP55; ensured for the front panel of the unit independently mounted to a panel
Connection
• Terminal screws: M3.5 screw terminals (torque 1.0 N·m)
• Terminal fixing screws: M4 screw terminals (torque 1.2 N·m)
• Backup module power supply terminal (option /M2, /R): Euro terminal block (applicable wire size: dia. 2.4 max., 0.5 – 2.5 mm², stripped length 10 mm)
• Ethernet: RJ-45 Modular Jack

Typical Applications
• Replacement of conventional controllers
• Panel operation for small-scale instrumentation

**RELATIVE PRODUCTS**

• PC Configurator cable (model: COP-US)
• Loop configuration builder software (model: SFEW3E Ver. 1.40 or later)
• Infrared communication adaptor (model: COP-IRDA)
• PC configurator software (model: SCCFG Ver.1.50 or later)
Builder software and configurator software are downloadable at M-System’s web site.

**ACCESSORIES**

• Precision resistor module (model: REM4): 2
• Cold junction sensor: 2
• Mounting brackets: 2
• Connector adapter: 1
included in Stereo jack type. The jack on the unit and the plug of PC Configurator cable (not included in the product) are different in size.)
Display colors: 256
Resolution: 480 × 272 pixels
Pixel pitch: 0.198 × 0.198 mm (128 × 128 DPI)
Backlight: LED
Backlight life: Approx. 50 000 hours (at 50 % brightness)
Note: The backlight can be replaced in M-System factory. The LCD must be replaced at the same time.
Screen saver standby time: 1 to 99 minutes
Scaling range: -32000 to +32000
Decimal point position: 10^1, 10^0, 10^-1, 10^-2 or none
Scale divisions: 2 to 10
Engineering unit indication: Max. 8 characters
Auto/Man indicator: Green/Amber LED
Backup mode MV output setting indicator: Blue LED

FACTORY DEFAULT

■ LOOP 1

1 – 5 V DC
1 – 5 V DC
4 – 20 mA DC

■ LOOP 2

1 – 5 V DC
1 – 5 V DC
4 – 20 mA DC

SUPPLY OUTPUT

Output voltage:
24 V DC ±10 % with no load
18 V DC min. at 20 mA
Current rating: ≤ 22 mA DC
Shortcircuit protection
Current limited: Approx. 30 mA

INPUT SPECIFICATIONS

■ Pv1, Pv2 (universal input)
  - Current input: 4 – 20 mA DC with input resistance 250 Ω (REM4)
  - Voltage input: -10 – +10 V DC
  - -1 – +1 V DC
  - 0 – 10 V DC
  - 1 – 5 V DC
  - 0 – 1 V DC
  Input resistance: ≥ 1 MΩ
  Thermocouple input: K, E, J, T, B, R, S, C, N, U, L, P, PR (See Table 1)
  - Input resistance: ≥ 30 kΩ
  Burnout sensing: ≤ 0.3 µA
  Burnout indication: 115 % of the measuring range (upscale)
  RTD input: Pt100 (JIS '97, IEC), Pt100 (JIS '89), JPt100 (JIS '89), Pt50Ω (JIS '81), Ni100 (See Table 2)
Maximum lead wire resistance: 100 Ω per wire
Burnout indication: 115 % of the measuring range (upscale)
Sensing current: ≤ 1 mA
• Potentiometer input: Total resistance 100 Ω to 10 kΩ
Minimum span: 50 % of total resistance
Excitation: ≤ 0.6 V DC
■ Ai1, Ai2, Ai3, Ai4
• Voltage input: 1 - 5 V DC
Input resistance: ≥ 1 MΩ
■ Pi1, Pi2, Pi3, Pi4, Pi5: Dry contact
(Di1 through Di5 are assigned to the same terminals respectively.)
Maximum frequency: 20 Hz
Minimum pulse width: 25 msec.
Common: Negative common per 5 points
Sensing: Approx. 12 V DC, 6 mA
ON voltage/resistance: ≤ 2.25 V, ≤ 1.5 kΩ
OFF voltage/resistance: ≥ 11.25 V ≥ 15 kΩ
■ Pi6: Dry contact
(Di6 is assigned to the same terminal.)
Maximum frequency: 10 kHz
Minimum pulse width: 0.05 msec.
Common: Negative common
Sensing: Approx. 12 V DC, 12 mA
ON voltage/resistance: ≤ 2 V, ≤ 1.5 kΩ
OFF voltage/resistance: ≥ 11 V, ≥ 15 kΩ
Excitation: 12 V DC ±10%, 15 mA
Current limiting circuit: Approx. 30 mA
■ Di1, Di2, Di3, Di4, Di5: Dry contact
(Pi1 through Pi5 are assigned to the same terminals respectively.)
Common: Negative common per 5 points
Sensing: Approx. 12 V DC, 6 mA
ON voltage/resistance: ≤ 2.25 V, ≤ 1.5 kΩ
OFF voltage/resistance: ≥ 11.25 V ≥ 15 kΩ
■ Di6: Dry contact
(Pi6 is assigned to the same terminal.)
Common: Negative common
Sensing: Approx. 12 V DC, 12 mA
ON voltage/resistance: ≤ 2 V, ≤ 1.5 kΩ
OFF voltage/resistance: ≥ 11 V, ≥ 15 kΩ

[Table 1 (Thermocouple input)]

<table>
<thead>
<tr>
<th>T/C</th>
<th>USABLE RANGE (°C)</th>
<th>CONFORMANCE RANGE (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K (CA)</td>
<td>-272 to +1472</td>
<td>-150 to +1370</td>
</tr>
<tr>
<td>E (CRC)</td>
<td>-272 to +1100</td>
<td>-170 to +1000</td>
</tr>
<tr>
<td>J (IC)</td>
<td>-260 to +1300</td>
<td>-180 to +1200</td>
</tr>
<tr>
<td>T (CC)</td>
<td>-272 to +500</td>
<td>-170 to +400</td>
</tr>
<tr>
<td>B (RH)</td>
<td>24 to 1920</td>
<td>1000 to 1760</td>
</tr>
<tr>
<td>R</td>
<td>-100 to +1860</td>
<td>380 to 1760</td>
</tr>
<tr>
<td>S</td>
<td>-100 to +1860</td>
<td>400 to 1760</td>
</tr>
<tr>
<td>C (WRe 5-26)</td>
<td>-52 to +2416</td>
<td>100 to 2315</td>
</tr>
<tr>
<td>N</td>
<td>-272 to +1400</td>
<td>-130 to +1300</td>
</tr>
<tr>
<td>U</td>
<td>-252 to +700</td>
<td>-200 to +600</td>
</tr>
<tr>
<td>L</td>
<td>-252 to +1000</td>
<td>-200 to +900</td>
</tr>
<tr>
<td>P (Platinel II) (PR)</td>
<td>-52 to +1496</td>
<td>0 to 1395</td>
</tr>
<tr>
<td></td>
<td>-52 to +1860</td>
<td>300 to 1760</td>
</tr>
</tbody>
</table>

Overrange input (out of the usable range) is handled as burnout.

[Table 2 (RTD input)]

<table>
<thead>
<tr>
<th>RTD</th>
<th>USABLE RANGE (°C)</th>
<th>CONFORMANCE RANGE (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt 100 (JIS '97, IEC)</td>
<td>-240 to +900</td>
<td>-200 to +850</td>
</tr>
<tr>
<td>Pt 100 (JIS '89)</td>
<td>-240 to +900</td>
<td>-200 to +660</td>
</tr>
<tr>
<td>JPt 100 (JIS '89)</td>
<td>-236 to +560</td>
<td>-200 to +510</td>
</tr>
<tr>
<td>Pt 500 (JIS ‘81)</td>
<td>-236 to +700</td>
<td>-200 to +649</td>
</tr>
<tr>
<td>Ni 100</td>
<td>-100 to +252</td>
<td>-80 to +250</td>
</tr>
</tbody>
</table>

Overrange input (out of the usable range) is handled as burnout.

OUTPUT SPECIFICATIONS

■ Mv1, Mv2, Mv2B
• Current output: 4 - 20 mA DC
Load resistance: ≤ 600 Ω
(Mv2B is the output from backup unit.)
■ Ao1, Ao2
• Voltage output: 1 - 5 V DC
Load resistance: ≥ 10 kΩ
■ Discrete Output
• Do1, Do2, Do3, Do4, Do5, RUN contact (Do6): Relay contact
Rated load: 250 V AC @1 A (cos φ = 1)
30 V DC @1 A (resistive load)
Maximum switching voltage: 250 V AC or 30 V DC
Maximum switching power: 250 VA or 60 W
Minimum load: 5 V DC @10 mA
Mechanical life: 2 × 10^7 cycles
• Do1, Do2, Do3, Do4, Do5: Photo MOSFET relay
Rating: 200 V AC/DC @0.5 A (resistive load)
ON resistance: 2.1 Ω
Maximum frequency: 4 Hz @24 V, 10 mA
ON delay time: ≤ 5.0 msec.
OFF delay time: ≤ 3.0 msec.
INSTALLATION

**Power input**

- **AC:**
  - Control module: \(\leq 25\) VA at 100 V AC
  - Control module: \(\leq 40\) VA at 240 V AC
  - Backup module: \(\leq 10\) VA at 100 V AC
  - Backup module: \(\leq 15\) VA at 240 V AC
- **DC**
  - Control module: \(\leq 650\) mA
  - Backup module: \(\leq 150\) mA

**Operating temperature:** -5 to +55°C (23 to 131°F)

**Operating humidity:** 5 to 90 %RH (non-condensing)

**Mounting:** Panel flush mounting (high-density mounting in horizontal direction)

**Weight:**
- Approx. 2.0 kg (4.41 lb) for 300 mm depth type
- Approx. 2.5 kg (5.51 lb) for 400 mm depth type

PERFORMANCE

**Accuracy**

- **DC input:** ±0.1 % ±1 digit
- **Thermocouple input:** ±1°C ±1 digit
- ±2°C ±1 digit for B, R, S, C and PR
- **RTD input:** ±1°C ±1 digit
- **Potentiometer input:** ±0.2 % ±1 digit
- **DC output:** ±0.1 %

**Precision resistor module (REM4):** ±0.1 %

**Cold junction compensation:**
- ±2°C at 25°C ±10°C
- ±4°C for S, R and PR

**Temp. coefficient:** ±0.015 %/°C (±0.008 %/°F)
- **DC input:** ±0.015 %/°C (±0.008 %/°F)
- **Thermocouple input:** ±0.015 %/°C (±0.008 %/°F)
- **RTD input:** ±0.015 %/°C (±0.008 %/°F)
- **Potentiometer input:** ±0.015 %/°C (±0.008 %/°F)
- **DC output:** ±0.015 %/°C (±0.008 %/°F)
- **Precision resistor module (REM4):** ±0.015 %/°C (±0.008 %/°F)

**Line voltage effect:** ±0.1 % over voltage range

**Calendar clock accuracy:** Monthly deviation 3 minutes at 25°C

**RAM memory duration in power failure for hot start:**
- 10 minutes assured

**Insulation resistance:** ≥ 100 MΩ with 500 V DC

**Dielectric strength:**
- 1500 V AC @ 1 minute
- (Pv1 or supply output to Pv2 or Ai1 or Ai2 or Ai3 or Ai4 to Di1 or Di2 or Di3 or Di4 or Di5 or Pi1 or Pi2 or Pi3 or Pi4 or Pi5 to Di6 or Pi6 to Mv1 to Mv2 or Mv2B or Ao1 or Ao2 to Do1 to Do2 or Do3 or Do4 or Do5 or Do6 to NestBus to Modbus-RTU to Modbus/TCP to power to backup module power to FG)
- 500 V AC @ 1 minute (Pv2 to Ai1 or Ai2 or Ai3 or Ai4)
- 500 V AC @ 1 minute (Mv2 or Mv2B to Ao1 or Ao2)
- 500 V AC @ 1 minute (Do2 to Do3 to Do4 to Do5 to Do6)
- 500 V AC @ 1 minute (Pv1 to supply output)

STANDARDS & APPROVALS

**EU conformity:**
- EMC Directive
  - EMI EN 61000-6-4
  - EMS EN 61000-6-2
- Low Voltage Directive
  - EN 61010-1
  - Measurement Category II (contact output)
  - Installation Category II (power)
  - Pollution degree 2
  - Input or output to contact output - Basic insulation (300 V)
  - Input or output to power - Reinforced insulation (300 V)
- RoHS Directive
  - EN 50581

**Protection against access to the terminal blocks:**
- Finger protection (VDE 0660-514)
## EXTERNAL VIEW

### CONTROL MODULE FRONT VIEW
- **Infrared communication type**
- **Stereo jack type**

1. TFT Color LCD with touch panel
   - Provides operation and engineering views to facilitate monitoring and setting
2. MV output setting indicator LEDs for the backup mode
3. Infrared communication port
   - Used to communicate with PC via IRDA Communication Adaptor (model: COP-IRDA) to program and change parameters using Loop Configuration Builder Software (model: SFEW3E) or PC Configurator Software (model: SCCFG)
4. MV value (DOWN) button
5. Acceleration button
   - (Accelerates MV signal's changing speed by pressing simultaneously with MV value button)
6. MV value (UP) button
7. Auto / Man selector (changes the control mode for MV output)
8. Configurator jack and cap
   - Connects with a PC where Loop Configuration Builder Software (model: SFEW3E) or PC configurator software (model: SCCFG) is installed via a PC configurator cable (model: COP-US) and enables programming and parameter setting

### BACKUP MODULE

9. MV output setting indicators
10. Configurator jack
11. MV value (UP) button
12. Acceleration button
   - (Accelerates MV signal's changing speed by pressing simultaneously with MV value button)
13. MV value (DOWN) button
COMMUNICATION CABLE CONNECTIONS

■ NestBus

![NestBus diagram]

■ Modbus-RTU

![Modbus-RTU diagram]

*1. Internal terminating resistor is used when the device is at the end of a transmission line.
*2. Install shield cables to all sections and ground them at single point.
EXTERNAL DIMENSIONS & TERMINAL ASSIGNMENTS unit: mm (inch)

<table>
<thead>
<tr>
<th>144 (5.67)</th>
<th>164 (6.46)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MOUNTING BRACKETS</td>
<td>BACKUP MODULE POWER INPUT TERMINAL</td>
</tr>
</tbody>
</table>

**TERMINAL COVER**

- **ONE BLOCK TERMINAL** (without option /T)
- **SEPARABLE TERMINAL** (with option /T)

**RJ-45 CONNECTOR**

- Option /3: 300 mm (11.81"")
- Option /4: 400 mm (15.75"")

*1. Option /M2, /R only
*2. For Modbus/TCP only
*3. Option /3: 300 mm (11.81")
   Option /4: 400 mm (15.75")

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MODEL: SC210

M-SYSTEM CO., LTD.
http://www.m-system.co.jp/

SC210 SPECIFICATIONS

ES-6340 Rev.18  Page 8/14
■ STEREO JACK TYPE

*1. Option /M2, /R only
*2. For Modbus/TCP only
*3. Option /3: 300 mm (11.81")
   Option /4: 400 mm (15.75")

MOUNTING BRACKETS
BACKUP MODULE POWER INPUT TERMINAL
TERMINAL COVER

• ONE BLOCK TERMINAL
  (without option /T)

• SEPARABLE TERMINAL
  (with option /T)

RJ-45 CONNECTOR

52-M3.5 SCREW

4-M4 SCREW FOR FIXING TERMINAL

Jack cap
MOUNTING REQUIREMENTS unit: mm

■ PANEL CUTOUT unit: mm

- Single mounting

- Clustered mounting

\[
\begin{align*}
&68^{+0.7} \\
&[68 + 72\times(n - 1)]^{+0.7} \\
&138 \ (n = \text{number of units}) \\
&\text{Panel thickness 2.3 – 20 mm}
\end{align*}
\]

■ Caution

- IP55 is ensured for the front panel of the unit mounted independently to according to a panel. Test the sealing at the mounting surface once the device is installed.
- Set the unit on a vertical surface with its operation buttons at the lower side. Mounting in other directions may cause heat built up inside the unit and shorten its life span or degrade its performance.
- Ensure that there is sufficient space for ventilation inside a panel. Do not install above the devices that generate high heat such as heaters, transformers or resistors. Leave at least 30 mm (1.2 inch) space above, below and behind the unit for maintenance purpose (e.g. wiring, removing or installing).
Note: In order to improve EMC performance, bond the FG terminal to ground.

Caution: FG terminal is NOT a protective conductor terminal.

*1. Close across the terminals 27 – 28 when the unit is located at the end of a transmission line (= no cross-wiring).
*2. Close across the terminals 14 – 15 when the unit is located at the end of a transmission line (= no cross-wiring).
*3. Backup is applicable to Mv 2 only. Mv 2B is output of the backup module.

**UNIVERSAL INPUT CONNECTION E.G.**

*4. Connect input resistor module (model: REM4) for current input.
*5. Connect CJC sensor for thermocouple input.

**DISCRETE INPUT PULSE INPUT CONNECTION E.G.:**

*7. Connect 2-Wire transmitter to 12V or 2kΩ.

*8. Connect Mv 2, Mv 2B.
**Backup Module Power Supply: Dual Supply**

- **Di 1 / Pi 1**
- **Di 2 / Pi 2**
- **Di 3 / Pi 3**
- **Di 4 / Pi 4**
- **Di 5 / Pi 5**
- **Di 6 / Pi 6**

**Sensor Excitation Input Circuit**

- **A/D Converter**
- **Discrete Input Circuit**

**Display / Setting**

- **Isolation**
- **Backup Module Power Circuit**

**Backup Module**

- **Shaded Twisted-pair Cable**
- **Modbus/TCP**

**Universal Input Connection E.G.**

- **RTD**
- **POTENTIOMETER**
- **2-Wire XMTTR**

**Numbered Points**

1. Close across the terminals 27 – 28 when the unit is located at the end of a transmission line (= no cross-wiring).
2. Close across the terminals 14 – 15 when the unit is located at the end of a transmission line (= no cross-wiring).
3. Backup is applicable to Mv 2 only. Mv 2B is output of the backup module.

**Discrete Input Pulse Input Connection E.G.**

- **Dry contact**
- **2-Wire**

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*4. Connect input resistor module (model: REM4) for current input.
5. Connect CJC sensor for thermocouple input.
SYSTEM CONFIGURATION EXAMPLES

■ SINGLE LOOP CONTROL

Multi-Function PID Controller
Model: SC210

PV
MV

■ CASCADE CONTROL

Multi-Function PID Controller
Model: SC210

PV
MV

■ I/O EXPANDED VIA NESTBUS

NestBus

PV
MV

PV
MV

■ CONTROL / SUPERVISION VIA MODBUS/TCP

SCADA System

PV
MV

PV
MV

Multi-Function PID Controller
Model: SC210

Ethernet Communication Adaptor
Model: 72EM2-M4

PV
MV

PV
MV

Multi-Function PID Controller
Model: SC210

Multi-Function PID Controller
Model: SC210

Multi-Function PID Controller
Model: SC210

Multi-Function PID Controller
Model: SC210
■ CONTROL / SUPERVISION VIA MODUBS-RTU

![Diagram of SCADA System with Multi-Function PID Controllers]

Specifications are subject to change without notice.