# TLV®

# MULTI-CONTROLLER

## MODEL SP-F70

**PROGRAMMABLE MULTI-PURPOSE CONTROLLER WITH MC-COS CONTROL FEATURE**

## Benefits

**Programmable multi-purpose controller for a wide range of operations. Ideal for equipment automation and systems creation in many fields.**
Allows pressure or temperature control when combined with automatic control valve [MC-COS(R)].
Allows PID action with auto-tuning when combined with pneumatic control valve.
Allows dual position (ON-OFF) control when combined with ON-OFF valve.

1. High measurement accuracy of 0.1% F.S.
2. Large memory allows programming of fifteen 14-segment patterns.
3. Quick and easy to determine PID setting using auto-tune function for excellent stability and responsiveness. Overshoot prevention function.
4. Up to 4 alarm outputs and 3 transmission outputs.
5. Measurement input area can accommodate various input signals.
6. Voltage: 100V - 240V AC.
7. Conforms with CE marking.



## Dimensions

(in)



● Panel Cutout and Spacing
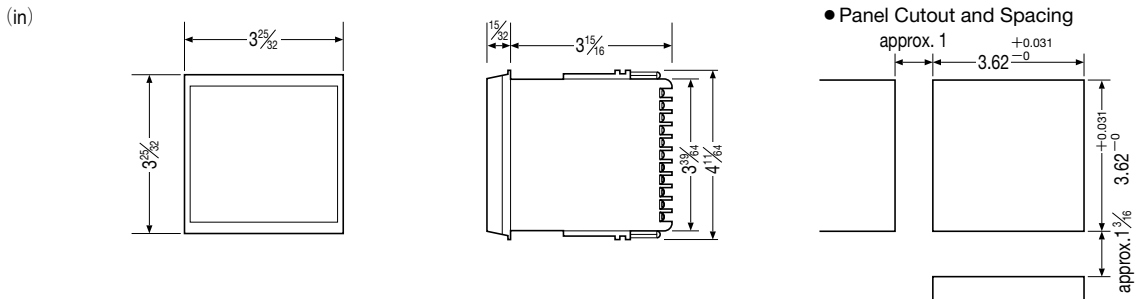
## Wiring Terminals

| No. | Function | No. | Function | No. | Function | No. | Function |
|---|---|---|---|---|---|---|---|
| 1 | Ground terminal | 33 | R(A) | Communications terminals | 22 | MAN/AUT | Contact input terminals | 12 | 8 | Contact input terminals |
| 2 | Power terminals | 34 | R(B) | | 23 | RUN | | 13 | 4 | |
| 3 | 100-240V AC | 35 | T(A) / T/R(A) / SD | | 24 | RESET | | 14 | 2 / PTN | |
| 4 | AL1 | Alarm 1/Alarm 2 output terminals | 36 | T(B) / T/R(B) / RD | | 25 | HOLD | | 15 | 1 | |
| 5 | AL2 | | 37 | SG / SG / SG | | 26 | ADVANCE | | 16 | COM(−) | |
| 6 | | 38 | AO1 + | Transmission output 1 terminals | 27 | COM(−) | | 17 | Input terminals ①Thermocouple input ②RTD input ③Voltage input (LOW) ④Voltage input (HIGH) or Current input ⑤Current input and sensor power Output terminals ⑥Sensor power |
| 7 | OUT1/AL3 NO / NC | Control output 1 or alarm output 3 terminals | 39 | 4-20mA − | | 28 | TE 1 | Time event output terminals | 18 | |
| 8 | | 40 | OUT2/AL4 NO | Control output 2 or alarm output 4 terminals | 29 | TE 2 | | 19 | |
| 9 | | 41 | | 30 | TE 3 | | 20 | |
| 10 | OUT1/AO3 + | Control output 1 or transmission output 3 terminals | 42 | OUT2/AO2 + | Control output 2 or transmission output 2 terminals | 31 | TE 4 | | 21 | |
| 11 | 4-20mA − | | 43 | 4-20mA − | | 32 | COM(−) | | | |

## Specifications

| | | | Thermocouple | RTD | DC Voltage (LOW) | DC Voltage (HIGH) | DC Current |
|---|---|---|---|---|---|---|---|
| Measurement Input | Measurement Input Types *1 | | ● K ● J<br>● E ● T<br>● U ● L | ● Pt100<br>● JPt100 | ● 0 - 10mV<br>● 0 - 100mV<br>● 0 - 1V | ● 0 - 5V<br>● 1 - 5V<br>● 0 - 10V | ● 0 - 20mA<br>● 4 - 20mA |
| | Effects of Signal Resistance | | approx. 0.2 $\mu$V/$\Omega$ | — | — | — | — |
| | Allowable Input Line Resistance | | — | maximum 10$\Omega$ | — | — | — |
| | Allowable Input Voltage | | — | — | within ± 4V | within ± 12V | — |
| | Input Impedance | | 1M$\Omega$ minimum | — | approx. 1M$\Omega$ | approx. 1M$\Omega$ | approx. 250$\Omega$ |
| | Display during Input Disconnection | | Upscale | Upscale | — | — | — |
| | Display during Input Short-Circuit | | — | Downscale | — | — | — |
| | Measurement Accuracy | | ± (0.1% F.S. ＋ 1 digit) | | | | |
| | Cold Junction Compensation Error | | approx. ± 1.0 ℃ ［℉］ within range of 32 ℉ - 122 ℉ | | | | |
| | Sampling Period | | 0.25 second | | | | |
| Settings Displays | Set and Measurement Values Display | | 4 digit 7 segment LED (orange) | | | | |
| | Symbol Display | | 3 digit 7 segment LED (orange) | | | | |
| | Operation Display | | 18 LED's indicate operating mode | | | | |
| | Setting Range (SV) | | Same as measurement input ranges | | | | |
| | Setting Resolution | | 0.1℃ ［℉］ | 0.1℃ ［℉］ | Depends on measurement input scaling | | |
| | Setting Programs | | 15 Patterns, 14 segments each | | | | |
| Control | Control Action Types | | ● PID action with auto-tuning<br>● Heating/cooling PID action<br>● Pressure control [MC-COS(R) / MC-VCOS(R)]<br>● Temperature control [MC-COS(R) / MC-VCOS(R)] | | | | |
| Control Output | Heating (OUT 1) *2 | Current Output | Output: 4 - 20mA; Load resistance: 600$\Omega$ maximum; Output accuracy: ± 0.1% of span<br>* Selecting relay output for the heating control output sets it to transmission output 3 (AO3). | | | | |
| | | Relay Output | Contact: 1c contact 250V AC, 3A (resistance load)<br>* Selecting current output for the heating control output sets it to alarm output 3 (AL3). | | | | |
| | Cooling (OUT 2) *3 | Current Output | Output: 4 - 20mA; Load resistance: 600$\Omega$ maximum; Output accuracy: ± 0.1% of span<br>* Selecting relay output for the cooling control output sets it to transmission output 2 (AO2). | | | | |
| | | Relay Output | Contact: 1a contact 250V AC, 3A (resistance load)<br>* Selecting current output for the cooling control output sets it to alarm output 4 (AL4). | | | | |
| Alarm Output | Number of Alarm Contacts | | ● PID action with auto-tuning: When heating control output is set to current output: 4 contacts<br>　　　　　　　When heating control output is set to relay output: 3 contacts<br>● Heating/cooling PID action: When both heating and cooling control output are set to current output: 4 contacts<br>　　　　　　　When both heating and cooling control output are set to relay output: 2 contacts<br>　　　　　　　When heating control output is set to current output and cooling control output is<br>　　　　　　　set to relay output: 3 contacts<br>● Pressure control: 4 contacts<br>● Temperature control: 4 contacts | | | | |
| | Alarm Types | | No alarm, measurement upper limit, measurement lower limit, deviation upper limit, deviation lower limit, deviation upper & lower limits, within deviation range, measurement upper limit with standby, measurement lower limit with standby, deviation upper limit with standby, deviation lower limit with standby, deviation upper/lower limits with standby, input error, FAIL status, end of pattern, control error (for pressure control only) | | | | |
| | Output *4 | | Relay contact output 1a contact 250V AC, 1A (resistance load) | | | | |
| | Alarm Displays | | Red surface emitting LEDs (AL1/AL2/AL3/AL4) | | | | |
| Transmission Output | Number of Output Contacts | | ● PID action with auto-tuning: When heating control output is set to current output: 2 contacts<br>　　　　　　　When heating control output is set to relay output: 3 contacts<br>● Heating/cooling PID action: When both heating and cooling control output are set to current output: 1 contact<br>　　　　　　　When both heating and cooling control output are set to relay output: 3 contacts<br>　　　　　　　When heating control output is set to current output and cooling control output is<br>　　　　　　　set to relay output: 2 contacts<br>● Pressure control: 2 contacts<br>● Temperature control: 2 contacts | | | | |
| | Output Types | | Measured values, set values, deviation values, heating control output values, cooling control output values (for heating/cooling PID action only) | | | | |
| | Output Signals | | 4 - 20mA DC | | | | |
| | Load Resistance | | 600$\Omega$ maximum | | | | |
| | Output Accuracy | | 0.1% of span | | | | |
| Contact Input | No of Input Contacts | | 9 | | | | |
| | Input Method | | No voltage contact, Line resistance OPEN: minimum 500k$\Omega$, CLOSED maximum 10$\Omega$ | | | | |
| | OPEN Voltage of Contacts | | 5V DC | | | | |
| | Contact Function | | Pattern 1 - 15 selection (4 contacts), MAN/AUT selection, RUN, RESET, HOLD, ADVANCE | | | | |

*1 Types changeable with jumper switches and PARAMETERS.
*2 Either current output or relay contact output can be specified for heating control output (but set to current output for pressure control or temperature control).
*3 Either current output or relay contact output can be specified for cooling control output; cooling control output only set for heating/cooling PID action.
*4 Specifications shown are for Alarms 1 and 2. Alarm 3 is for heating control output; Alarm 4 is used when relay output has been set for cooling control output.

## Specifications

| | | |
|---|---|---|
| Contact Output | No of Output Contacts | 4 |
| | Output Method | Transistor open collector output, load maximum 24V DC, 50mA |
| | Contact Function | Time event output TE1-TE4 |
| Communi-cations | Communications Method | RS-422A: 4-wire type; RS-485: 2-wire type; RS-232C |
| | Communications Code | JIS (ASCII) 7-bit code |
| Self-Diagnostic Function | Check Items | ROM/RAM check, input value check, CPU power monitoring, watchdog timer |
| | Error Displays | FAIL lamp lights up (except during input error) |
| | Error Output | When FAIL lamp lights up: all output OFF |
| | | During input error: action selectable |
| Ambient Conditions | Ambient Temperature | 32 ℉ - 122 ℉ |
| | Ambient Humidity | 20 - 85% RH |
| | Line Voltage Fluctuations | Rated voltage ± 10% |
| | Power Frequency Fluctuations | Rated value ± 5% |
| General Specifications | Insulation Resistance | Between measurement terminal and ground: 500V DC/20MΩ minimum |
| | | Between power terminal and ground: 500V DC/20MΩ minimum |
| | Maximum Allowed Votage | Between measurement terminal and ground: 1000V AC for 1 minute |
| | | Between power terminal and ground: 1500V AC for 1 minute |
| | Line Voltage | 100 - 240V AC,  50/60Hz |
| | Power Consumption | 16VA at 240V・12VA at 100V |
| | Effect of Power Outage | No effect for power outage of 50 msec or less |
| | Memory Backup | Setting data backed up by lithium battery. Service life approximately 10 years * |
| | Weight | Approximately 1 lb. 5 oz. maximum |
| | Accessories | 1 set of fittings (2) |

\* Will depend on product storage time, storage environment, operating conditions, etc.
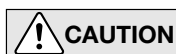
⚠ **CAUTION** To avoid abnormal operation, accidents or serious injury, DO NOT use this product outside of the specification range. Local regulations may restrict the use of this product to below the conditions quoted.

## Measurement Input Types & Ranges

| | Input Type | Input Range [℃] | Code | Input Range [℉] | Code |
|---|---|---|---|---|---|
| Thermocouple (TC) | Type K (EX-: CA) [JIS/IEC] | 0.0 - 400.0 | 0 | 0.0 - 800.0 | 200 |
| | | 0.0 - 800.0 | 1 | | |
| | Type J (EX-: IC) [JIS/IEC] | 0.0 - 400.0 | 10 | 0.0 - 700.0 | 210 |
| | | 0.0 - 800.0 | 11 | | |
| | Type E (EX-: CRC) [JIS/IEC] | 0.0 - 700.0 | 20 | 0.0 - 999.9 | 220 |
| | Type T (EX-: CC) [JIS/IEC] | 0.0 - 400.0 | 30 | 0.0 - 700.0 | 230 |
| | Type U [DIN] | 0.0 - 600.0 | 40 | 0.0 - 999.0 | 240 |
| | Type L [DIN] | 0.0 - 400.0 | 50 | 0.0 - 700.0 | 250 |
| RTD | JPt 100 [JIS] | 0.0 - 300.0 | 400 | 0.0 - 600.0 | 500 |
| | | 0.0 - 500.0 | 401 | 0.0 - 900.0 | 501 |
| | Pt 100 [JIS/IEC] | ○ 0.0 - 300.0 | 410 | 0.0 - 600.0 | 510 |
| | | 0.0 - 600.0 | 411 | 0.0 - 999.9 | 511 |
| Voltage (LOW) | 0 - 10mV | Arbitrary scaling possible | 600 | | |
| | 0 - 100mV | | 601 | | |
| | 0 - 1V | | 602 | | |
| Voltage (HIGH) | 0 - 5V | Arbitrary scaling possible | 610 | | |
| | 1 - 5V | | 611 | | |
| | 0 - 10V | | 612 | | |
| Current | 0 - 20mA | Arbitrary scaling possible | 700 | | |
| | ● 4 - 20mA | | 701 | | |

●: Factory default for pressure control
○: Factory default for all control types other than pressure control

## Specifications Checksheet

| | | Code | | | | Remarks |
|---|---|---|---|---|---|---|
| **Model** | | SP-F70 | ☐ | * D | ☐ | For boxes in the "code" section at left, enter the appropriate code from among the specification items below each box. |

| | | | | Code | |
|---|---|---|---|---|---|
| **Basic Specifications** | Control Operation Type | ● PID action with auto-tuning | 0 | | Select to match the valve that will be used with the controller. |
| | | ● Heating / cooling PID action | 1 | | |
| | | ● Pressure control operation ［MC-COS(R)-3］ | 2 | | |
| | | ● Pressure control operation ［MC-COS(R)-16, ½″ - 2″］ | 3 | | |
| | | ● Pressure control operation ［MC-COS(R)-16, 2½″ - 6″］ | 4 | | |
| | | ● Pressure control operation ［MC-COS-21］ | 5 | | |
| | | ● Pressure control operation ［MC-VCOS(R)］ | 6 | | |
| | | ● Temperature control operation ［MC-COS(R)-16］ | 7 | | |
| | | ● Temperature control operation ［MC-VCOS(R)］ | 8 | | |

| | | | Code | | Remarks |
|---|---|---|---|---|---|
| **Additional Specifications** | Remote External Input | ● Contact input and time event ouput | D | | |
| | Communications Function | ● None | | N | Select to match the computer to be connected. |
| | | ● RS-232C | | 1 | |
| | | ● RS-422A (4-wire type) | | 4 | |
| | | ● RS-485 (2-wire type) | | 5 | |

| | | | | Remarks |
|---|---|---|---|---|
| **Initial Settings\*** | Measurement Input Types & Ranges | ☐ RTD<br>☐ Thermocouple (TC)<br>☐ Voltage (low) input<br>☐ Voltage (high) input<br>☐ Current input | Range code ☐ ☐ | - Select the type and range code from "Table of Measurement Input Types and Ranges".<br>- Values can be changed after the controller has been shipped by changing jumper switches and PARAMETERS. |
| | Pressure Sensor Range | ☐ 0 - 2000 kPaG    ☐ 0.00 - 20.40 kg/cm²G<br>☐ 0 - 1000 kPaG    ☐ 0.00 - 10.20 kg/cm²G<br>☐ 0 - 500 kPaG    ☐ 0.00 - 5.10 kg/cm²G<br>☐ -101.3 - 298.7 kPaG    ☐ -760 - 2240 mmHg G<br>☐ 0 - 400 kPaG abs    ☐ 0 - 3000 Torr (mmHg)<br>☐ 0.00 - 20.00 barg    ☐ 0.0 - 290.1 psig<br>☐ 0.00 - 10.00 barg    ☐ 0.0 - 145.0 psig<br>☐ 0.00 - 05.00 barg    ☐ 0.0 - 72.5 psig<br>☐ -1013 - 2987 mbarg    ☐ -14.70 - 43.32 psig<br>☐ 0 - 4000 mbar abs    ☐ 0.00 - 58.02 psi abs<br>☐ Other: range (   -   ) unit (   ) | | Specify the range of the pressure sensor to be connected (when pressure control has been selected). |

\* Initial settings can be changed after the controller has been shipped from the factory. When not specified in advance, items are set to their default values before shipment.